WHITE FLINT METRORAIL STATION NORTH ENTRANCE FEASIBILITY STUDY

Final Report

Montgomery County, Maryland
November 2019

Washington Metropolitan Area Transit Authority

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White Flint Metrorail Station North Entrance Feasibility Study

Final Report

November 2019

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Table of Contents

Executive Summary ES-1

1. Introduction 1
   - 1.1 Study Purpose and Overview 1
   - 1.2 Background 1
   - 1.3 Study and Design Process 3
   - 1.4 Report Organization 3
2. Station Profile 4
   - 2.1 Project Location and Description 4
   - 2.2 Station Area Planning and Development Context 5
   - 2.3 Previous Station Planning Studies 7
   - 2.4 Site Visit and Existing Conditions 9
3. Demand Assessment 15
   - 3.1 Ridership Forecasting 15
   - 3.2 Pedestrian Activity (Rockville Pike & Old Georgetown Road Intersection) 17
4. Engineering Feasibility 19
   - 4.1 Design Criteria 19
   - 4.2 Architecture 19
   - 4.3 Elevator Evaluation 26
   - 4.4 Geotechnical 29
   - 4.5 Structure 30
   - 4.6 Mechanical 40
   - 4.7 Electrical 43
   - 4.8 Plumbing 46
   - 4.9 Utilities 49
   - 4.10 Egress Analysis 50
5. Environmental Scan 52
   - 5.1 Environmental Considerations 52
   - 5.2 Environmental Resources 53
6. Constructability and Risk Assessment 59

6.1 Constructability Review ... 60
6.2 Risk Assessment ... 65
7. Rough Order of Magnitude (ROM) Capital Cost Estimates ... 66
7.1 Soft Cost Assumptions ... 66
7.2 Estimating Assumptions ... 66
8. Preferred Alternative ... 67
8.1 Preliminary Design Approach ... 68
8.2 ROM Capital Cost Estimate ... 73
8.3 Design Considerations for Preliminary Engineering (PE) ... 73

List of Figures

Figure 1-1 | White Flint Metrorail Station Location ... 2
Figure 1-2 | Study Process ... 3
Figure 2-1 | Future bridge across WMATA tracks and station platform ... 7
Figure 2-2 | Improvement 2A – 2010 White Flint Station Access Plan ... 8
Figure 2-3 | Existing North Service Rooms – Platform Level ... 10
Figure 2-4 | Cross Section – Platform North End Wall ... 11
Figure 2-5 | Cross Section – North Service Rooms & Adjacent Train Tunnels ... 12
Figure 2-6 | Longitudinal Section – North Service Rooms ... 13
Figure 2-7 | Photo of Existing Tunnel Structure at North End of Station ... 14
Figure 2-8 | Photo of Existing South Station Entrance ... 14
Figure 4-1 | Revised North Entrance Configuration ... 22
Figure 4-2 | Roof Plans ... 24
Figure 4-3 | Mezzanine Structural Approaches ... 25
Figure 4-4 | Geotechnical Subsurface Profile ... 30
Figure 4-5 | Cross Section of Existing South Mezzanine – Slab on Grade ... 31
Figure 4-6 | Cross Section of Existing Platform – Canopy Columns Supported on Invert ... 32
Figure 4-7 | Site Visit Photo – Platform Manhole Removed with Standpipe Visible ... 33
Figure 4-8 | Long Section of Existing Cut-and-Cover Tunnel – Finished Grade Depth of 1.5' ... 33
Figure 4-9 | Site Visit Photo – Additional Soil Cover Over Existing Tunnel: Looking North ... 34
Figure 4-10 | Site Visit Photo – Additional Soil Cover Over Existing Tunnel: Looking South ... 34

Figure 4-11 | Cross Section of Existing Cut-and-Cover Tunnel 36
Figure 4-12 | Cross Section – Platform North End Wall Local Demolition 37
Figure 4-13 | Ventilation Fan Units – North End Service Rooms 41
Figure 4-14 | North End Sanitary Drainage Below Inbound Track 49
Figure 5-1 | Project Location and Environmental Scan Study Area Map 54
Figure 6-1 | Potential Construction Storage, Staging and Material Lay Down Areas 63
Figure 8-1 | Preferred Alternative Longitudinal Section 69
Figure 8-2 | Preferred Alternative Platform Level 70
Figure 8-3 | Preferred Alternative Mezzanine Level 71

List of Tables

Table 2-1 | Forecasted Station-Level Daily Boardings 4
Table 2-2 | Existing and Projected Operations 4
Table 2-3 | Development Pipeline 5
Table 2-4 | WMATA Transit Asset Inventory and Condition Assessment (TAICA) Database 9
Table 3-1 | Forecasted Station-Level Daily Boardings 17
Table 3-2 | Pedestrian Activity at Each Corner of Rockville Pike & Old Georgetown Road Intersection 18
Table 4-1 | Minimum Queues 21
Table 4-2 | Existing Onsite Utilities and Owners 50
Table 4-3 | Summary Table of Spreadsheet Calculations Results 51
Table 5-1 | Known Hazardous Waste Sites 57
Table 6-1 | Preliminary Risk Register 65
Table 7-1 | Summary of ROM Cost Estimates 67
Table 8-1 | Summary of ROM Cost Estimates (Preferred Alternative 3) 73

Appendices

Appendix A: *Architectural Design Drawings*
- Alternatives 1, 2, 3

Appendix B: *Rough Order-of-Magnitude (ROM) Cost Estimates*
- Alternatives 1, 2, 3

Appendix C: *Technical Memoranda*
- Egress Analysis
  - Egress Calculations
  - Egress Diagrams
- Demand Assessment

Appendix E: *Reference Documents*
- Station As-Built Drawings
- Auxiliary Power Load Calculations
- Risk Register
- Environmental Scan
  - Hazardous Materials Report
  - USFWS IPaC Report
  - Historic Resource

Executive Summary

Introduction and Background

The primary objective of this study was to evaluate the feasibility and advance the planning of the White Flint North Entrance through the Development and Evaluation (D&E) phase of Metro's capital planning program. The D&E phase includes identification and evaluation of needs leading to the selection of a preferred solution; and conducting sufficient design and engineering to determine technical feasibility and Rough Order of Magnitude (ROM) Capital Costs, in addition to identifying project risks and operating impacts.

The White Flint Metrorail Station is in Montgomery County, Maryland and is served by Metro's Red Line. Montgomery County's vision for the area surrounding the station is detailed in their *White Flint Sector Plan*, calling for the development of walkable, vibrant, and appropriately dense development in the 430 acres surrounding the station. The plan specifically recommends a north entrance to the White Flint Station to support the anticipated increased levels of development; currently the south entrance is the station's only entrance. Several development plans have either been completed, are under construction, or are planned for the area surrounding the existing station.

Demand Assessment

A Demand Assessment was completed to: 1) determine the growth in 2040 ridership that a new entry would result in; and 2) determine the levels of pedestrian activity at each corner of the Rockville Pike and Old Georgetown Road intersection to inform the location of a potential grade-separated crossing.

The 2040 ridership demand assessment shows that ridership at White Flint is expected to grow through 2040, however that growth is from anticipated development in the surrounding area and not from a potential new entry. Due to White Flint station's proximity to Twinbrook station to the north, a new north entrance at White Flint is not expected to capture a large increase of new riders entering the system; however, the new entrance is expected to result in many existing riders entering the system through the new entrance. Additional daily boardings due to the new entrance are forecasted to range between a low of 158 and a high of 895, with an average of 526.

Walkshed and land use analyses were also performed to determine levels of pedestrian activity at each corner of the Rockville Pike and Old Georgetown Road intersection in order to inform decision making regarding a grade-separated pedestrian crossing. Much like the ridership demand analysis, the pedestrian activity levels varied depending on the forecast method used; however, in all scenarios the NW corner of the intersection showed the greatest level of pedestrian activity. The intent of this exercise was not to choose an alignment for the potential crossing, but to provide the data and analysis needed to support further discussion in the decision-making process. For the purposes of this feasibility study, the proposed north station entrance design does not include nor preclude the potential grade-separated pedestrian crossing.

Alternatives Development

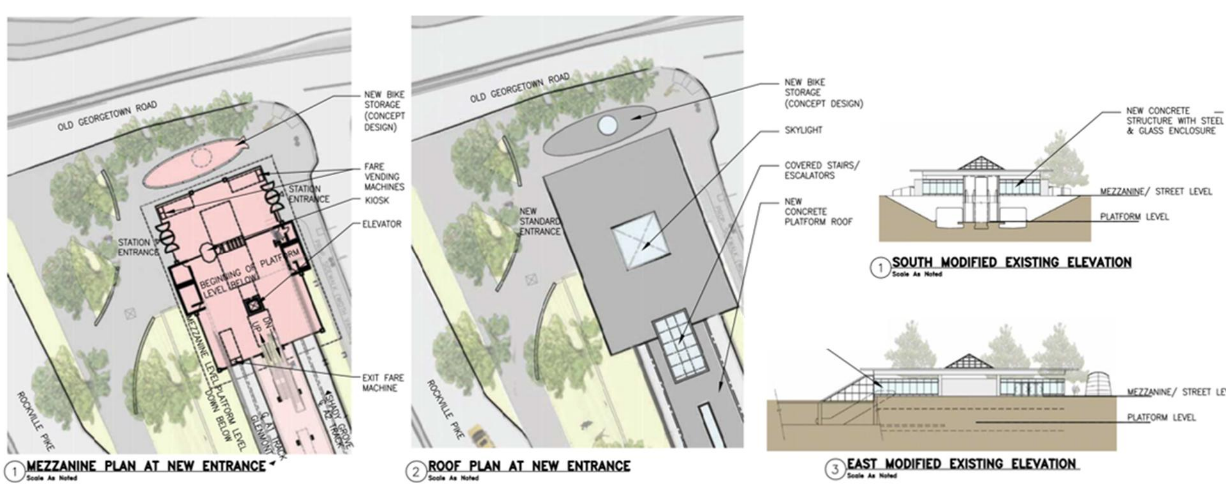
The design team adopted the entrance concept developed under Metro's *2010 White Flint Station Access Plan* and evaluated two separate structural approaches to support the over-platform mezzanine area: 1) columns located within the boarding platform, and 2) locating structural columns on the outside edge of both trainways. The two structural approaches that were developed for Alternatives 1 and 2 result in different structural expressions and different opportunities for locating the entry skylight.

In addition, the previous design was refined to comply with WMATA Design Criteria as well as closely mimic the south entry aesthetic. The revised layout included the following design refinements:

- Align the new at-grade north entrance roofline with the existing south entry roofline and align the above-platform mezzanine with the existing platform canopy.
- Reconfigure the at-grade north entrance footprint to take the shape of a square and the above-platform mezzanine portion becoming more rectangular, mimicking the south entry configuration.
- Replace the paired escalator-stair configuration with a double-wide 10' stair with center handrail, improving the station's emergency egress capacity.
- Replace the single elevator with two elevators to comply with WMATA Design Criteria; relocate the elevator pair within the boarding platform so as not to impact the existing underground service rooms to the north.

Once the design refinements were made and two structural alternatives were developed, the alternatives were evaluated for engineering feasibility. The engineering feasibility was done to provide points of comparison so that conclusions could be drawn, and a preferred approach could be identified.

Figure ES-1 | 2010 White Flint Station Access Plan – Improvement 2A



Alternative 1

In Alternative 1, the mezzanine area is supported by new columns located within the boarding platform with cantilevered beams that taper as they extend over the adjacent trainways. The structural expression of Alternative 1 closely mimics the look of the existing south entrance with concrete columns and tapered beams, however the location and alignment of structural members results in a linear skylight over the main entry.

Alternative 1 consists of two parallel longitudinal concrete frames in the north-south direction of the station and three transverse concrete frames in the east-west direction of the station. The transverse frames are designed with tapered beams that cantilever over a portion of the existing trainway. Support for these frames is provided by concrete columns that penetrate the existing concrete platform slab and rest on transfer beams above the invert slab that are supported by micropiles that pass through the invert slab and terminate in the bedrock below the station. Additional concrete or steel frame reinforcement will be needed in the areas where the platform slab is penetrated, and additional footings will be required at the invert slab level.

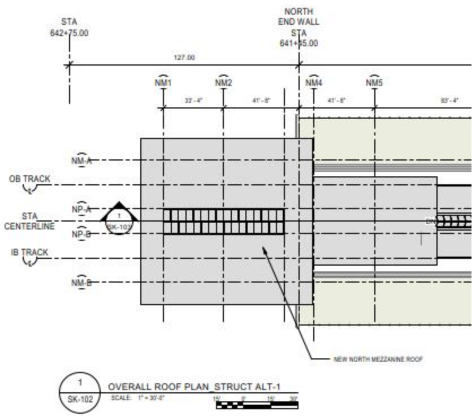
Alternative 2

In Alternative 2, the mezzanine area is supported by deep long-span beams which span over the boarding platform and both adjacent trainways. These beams rest on deep structural piers located on the outside edge of each trainway. Alternative 2 introduces a new aesthetic to the station with deep long-span beams located over the boarding platform, however the location and alignment of structural members results in a pyramidal skylight over the main entry, like that found in the south entrance.

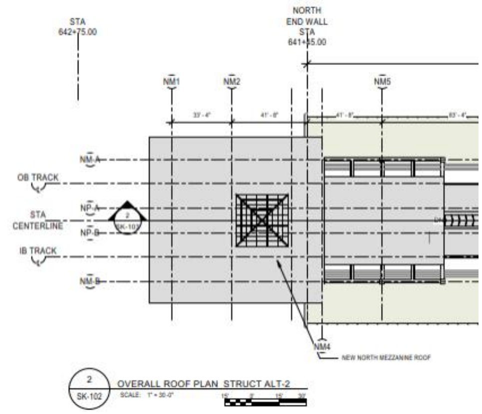
Alternative 2 proposes to avoid resting the additional load of the new mezzanine in the area below the boarding platform. Under Alternative 2, support to the frames in the short direction of the station is provided by piers located outside the track limits that are supported on drilled shafts. In this alternative, deep long-span reinforced concrete beams are required to span across both tracks and the boarding platform. In the longitudinal direction, transfer beams support a cast in place concrete slab that is required between the concrete frames running in the short direction.

Figure ES-3 | Roof Plans

Alternative 1



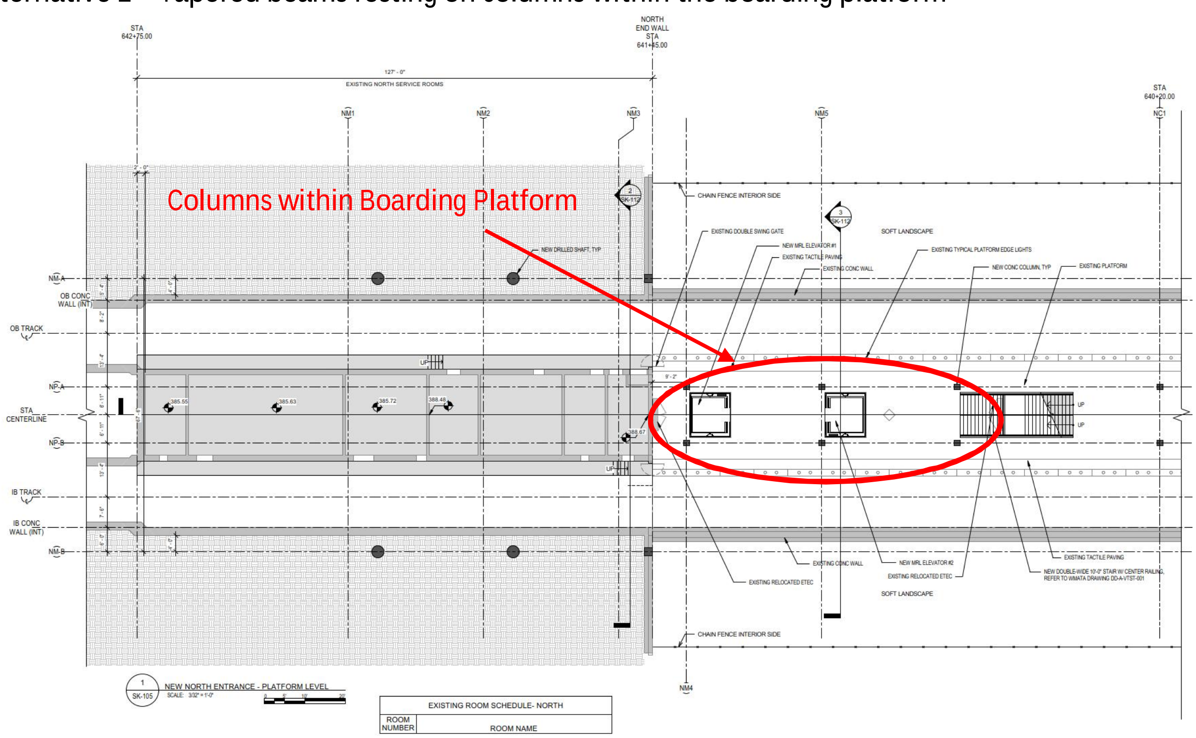
Alternative 2



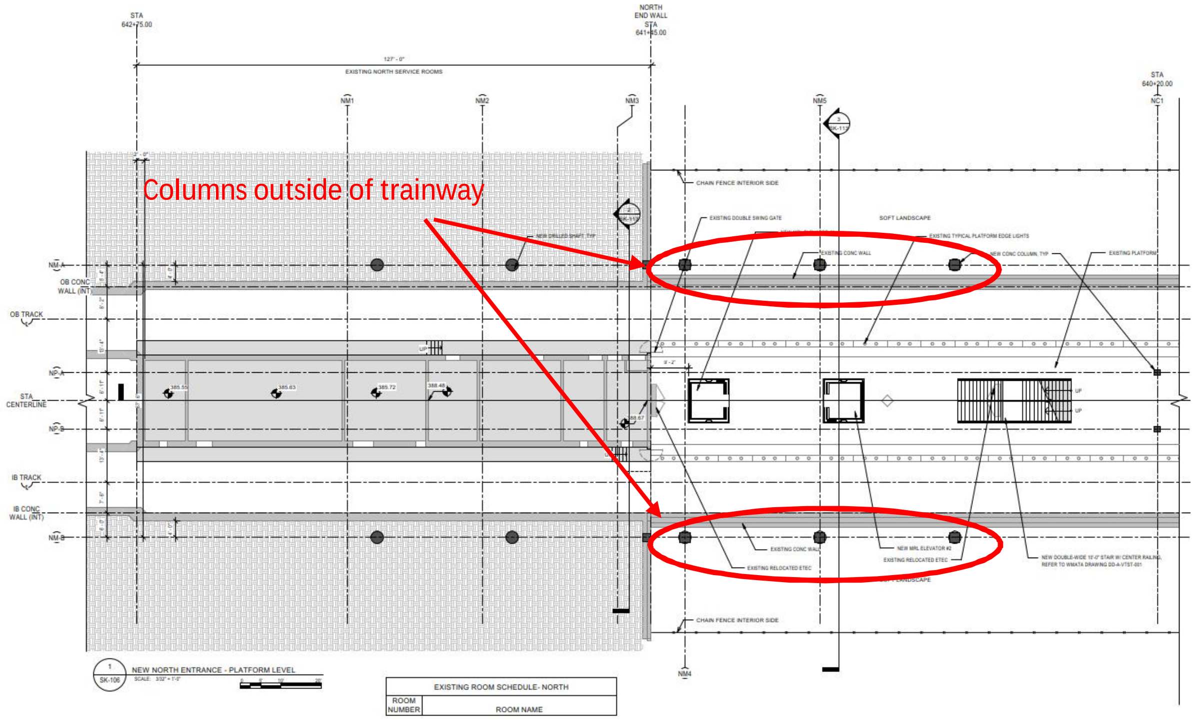
Source: KGP Design Studio

Figure ES-4 | Mezzanine Structural Approaches

Alternative 1 – Tapered beams resting on columns within the boarding platform



Alternative 2 – Long-span beams resting on piers located just outside of each trainway



Source: KGP Design Studio

Engineering Feasibility

The Engineering Feasibility assessed the overall technical viability of the two alternatives and provided a comparison to assist in identifying a preferred design approach. The following table presents a summary of the assessment by technical discipline.

Table ES-1 | Engineering Assessment Summary

Engineering Discipline	Assessment	Considerations for PE
Architectural	• Alt 1 support columns within boarding platform closely mimics existing south entrance aesthetic. • Alt 2 pyramidal skylight and roof plan closely mimics existing south entrance aesthetic • Design can accommodate holeless hydraulic or machine room-less traction (MRL) elevator types	• Determine type of elevators chosen for the project • Perform a detailed survey of the under-platform space to confirm available clear height for the elevators and to identify all impacts on existing under-platform facilities
Geotechnical	• 3' to 7' of loose fill soils are present at the ground surface. • Medium dense to compact sandy silt soils are present to a depth of about 35' to 45',	• Drilled shafts or micropiles are feasible foundation alternatives • Ground supported floor slabs are feasible and can be supported directly

Engineering Discipline	Assessment	Considerations for PE
	followed by very dense disintegrated rock/decomposed rock. • Bedrock is expected to consist of Schistose Gneiss at a depth of about 80' to 110' below existing ground surface grades	on existing fill soils, new compacted fill soils, or natural soils • Ground water is expected at depths of about 11' to 13' below existing grades, dewatering of excavations will be needed • Support of excavation (SOE) systems may be needed if sufficient space is not available for sloped excavations
Utilities	• No potential conflicts identified in the general vicinity of the new entrance	• The general area has available utility services for station tie-in
Structural	• Existing cut-and-cover tunnel designed for a significant surcharge load that can support a slab-on-grade • Alt 1 support provided by concrete columns which penetrate the existing concrete platform slab and rest on transfer beams above the invert slab that are supported by micropiles that pass below the invert slab. • Alt 2 support is provided by piers located outside the trainway that are supported on drilled shafts • Columns for the canopy extension penetrate through the platform and tie into the invert slab below with minimal interference	• A portion of the existing end-wall to be demolished to accommodate the new slab-on-grade • Additional concrete or steel frame reinforcement required for areas where the platform slab is penetrated for elevators and support columns. • Additional footings required at the invert slab level • Invert slab may need to be thickened to help spread loads
Mechanical Systems	• Existing mechanical systems located on the south end of the station are not connected to the north end of the station; the two ends are mechanically isolated • Existing mechanical system does not have any active cooling or heating elements • Station is open to the environment requiring no additional active cooling, heating, or ventilation	• New entrance layout and configuration will be able to accommodate the mechanical needs of either hydraulic or MRL type elevators • Restrooms and electrical room both require a fresh air intake and exhaust • Station manager's kiosk and the communication rooms require both active cooling and heating
Electrical Systems	• Existing electrical services have enough spare capacity to serve the anticipated future loads	• The existing empty space in the north AC switchboard can be fitted with a new 3-pole 400A circuit breaker to serve the new electric cabinet room which will be located on the mezzanine of the new north station entrance • Spare circuit breakers in the essential panelboards, backed up by battery/uninterrupted power supply (UPS), in the north AC switchgear room

Engineering Discipline	Assessment	Considerations for PE
		can be utilized to serve elevators and emergency egress lighting • One-line diagram and electrical layouts for switchgear rooms should be reviewed and confirmed during PE
Plumbing	• At the north end of the station a sanitary sewer is located near the inbound track and a domestic water line is located underground just outside of the fence line to the east	• Plumbing systems would independently support the new north entrance and required service rooms • Restrooms would be tied into the existing underground domestic water service outside of the fence line • The new elevator pits drain to the existing sanitary sewer main on the north end
Egress Analysis	• Additional entrance and platform stairs greatly improve the performance of the evacuation performance of the station • Meets evacuation timed-egress criteria • Complies with NFPA 130 maximum travel distance of 325 feet to nearest egress point on the platforms • Does not meet the NFPA 130 maximum platform common path travel distance of 82 feet, however provides substantial improvement over the existing condition	• All new construction elements, components, systems, and spaces are designed to comply with the requirements of the Virginia Construction Code, except where NFPA 130 criteria apply

Egress Analysis

The design team performed an egress analysis to determine the impacts that a new entrance would have on the ability for customers to evacuate the station during an emergency. To establish a baseline to improve upon, the egress performance of the existing station configuration was determined and then compared to the egress performance of the proposed station configuration with a new north entrance. The findings from these two evaluations are summarized below:

Table ES-2 | Summary Table of Spreadsheet Calculations Results

	AM Peak Hour 8:00-9:00		PM Peak Hour 17:00-18:00	
	Platform Evacuation Time (Minutes)	Evacuation Time to a Point of Safety (minutes)	Platform Evacuation Time (minutes)	Evacuation Time to a Point of Safety (minutes)
2023 No-Build	32.12	32.83	26.70	27.41
2023 Build	9.21	10.29	7.63	8.71

- The analyzed build alternative shows significant improvements to the evacuation performance of the existing station, both for the platform evacuation time and the evacuation time to a point of safety. Therefore, the build alternative meets the evacuation timed-egress criteria as applicable to an existing station. See Section 7 of the Egress Analyses Technical Memorandum that is included in Appendix C.
- The existing station does not comply with the *NFPA 130* maximum travel distance of 325‘ to the nearest egress point on the platform. Under the build alternative, the longest travel distance is reduced and meets this requirement.
- The existing station configuration does not comply with the *NFPA 130* requirement for a minimum of two remote means of egress from the platform, nor with the limitation of common path travel distance to a maximum of 82’. The Build Alternative adds a second remote means of egress, with a common path travel distance of 104’, a substantial improvement over the existing common path of 708’.

Environmental Scan

The following environmental considerations should be considered during subsequent engineering and planning:

- Land Use and Zoning: Zoning requirements, such as minimum façade transparency and maximum setbacks, apply to the property. Above-ground improvements should consider these regulations;
- Environmental Justice: The proposed north entrance is located within a block group with a slightly higher proportion of low-income population than Montgomery County as a whole. Subsequent planning should consider how the project may interact with these populations;
- Known Hazardous Waste Sites: Three automotive businesses and one dry cleaning business located between one- and two-tenths of a mile from the proposed north entrance. No Environmental Protection Agency (EPA) Superfund sites or other remediation sites were identified. As planning for the project progresses, more detailed and updated information should be reviewed to determine the potential for disturbing unknown hazardous waste sites;
- Protected Species/Critical Habitats: As planning for the project progresses, more detailed and updated information should be reviewed. Potential impacts to birds of concern or bald eagles should be considered, minimized, and mitigated;
- Historic Properties and Cultural Resources: The White Flint Metrorail Station is identified as a potential historic property in Maryland’s cultural resources information system, pending further documentation. The result of this evaluation will determine whether the station is eligible for listing in the National Register of Historic Places (NRHP). Medusa, the Maryland Historical Trust's online database of architectural and archeological sites and standing structures, should be monitored regularly to track the status of the station’s potential designation as a historic property. If the station is determined to be eligible for the NRHP, Section 106 consultation should be initiated; and

- Construction Impacts: Construction activities may result in temporary disruptions or alterations to transportation and utility services; increased noise and vibration; or discharge into the nearby storm water retention pond. Best management practices should be utilized to minimize and mitigate these impacts, and all necessary permits should be obtained. Coordination with local, state, and federal agencies should consider these issues.

Constructability and Risk Assessment

Protection of the existing station is paramount during construction to ensure the structural integrity and operation of the tunnels, station platform, and underground service rooms to the north are maintained. Additionally, maintaining station facility operations during construction is required with minimal train and station operational impacts. To support these objectives, the following should be considered for the project:

- Developing a Maintenance of Operations Plan (MOP) to address elements such as advanced coordination of station closures with a train bypass;
- Limiting mezzanine construction work to non-revenue hours and selected weekends; and
- Utilizing adjacent roadways to bring in equipment and materials; minimize reliance on work trains.

Construction impacts will, for the best-case scenario, minimize impacts on traffic and pedestrian activity through off-peak delivery, acquiring the ideal project staging location, and traffic mitigation strategies. Ideal staging would take place in the adjacent vacant private property; this will require coordination with the owner. The project will avoid major utility impacts, pending more detailed Preliminary Engineering investigation.

Risk Assessment

A preliminary list and potential mitigations of project risks that have been identified for assessment. This list should be modified and carried through into Preliminary Engineering as the project progresses.

Table ES-3 | Preliminary Risk Register

Risk ID	Risk Identification and Description	Mitigation Plan
1	Unknown utility impacts or relocations required	Preliminary engineering will include in depth review of existing utilities and including subsurface investigation to identify utilities
2	Integration with the existing Metro system	Preliminary engineering will include in depth review of the existing systems and conditions
3	Environmental permitting	Metro to determine impacts based on 30% design.

Risk ID	Risk Identification and Description	Mitigation Plan
4	Noise mitigation	Confirm work hours for MOT design such that project complies with local regulations
5	Hazardous materials – contaminated soil encountered	Team will generate a Hazmat report as part of the final deliverables. Hazmat report will be created per the contract and will define what will be considered additional unforeseen hazardous materials, the process for detecting them, and costs and procedures for removal if additional hazardous materials are found.
6	Project phasing with other Montgomery Co. priorities at this location include 1) a bridge over the station and 2) new BRT along MD 355	Metro coordinates early in design process with Montgomery Co. to agree on design interface constraints.
7	Community may request additional amenities at station entrance	Metro and design team will coordinate early and often with Montgomery Co. and other stakeholders to agree on amenities.
8	New storm drain at the Metro platform level cannot be tied into existing track drainage system.	Preliminary design phase will need to research a connection to MD 355 via pumping
9	Existing sanitary has capacity to support additional sanitary needs (water closets, elevator pumps, etc.)	Preliminary design phase will need to research a connection to MD 355 via pumping
10	Elevators (machine room-less versus hydraulic)	Multiple implications in final design (logistics and approvals)
11	NFPA 130 Interpretation versus individual Authority Having Jurisdiction (AHJ). AHJs approving code applications	Metro and design team will coordinate and establish parameters with the AHJ for this improvement during the preliminary design phase
12	Property to the east of the site redevelops or otherwise are unable to obtain for staging (site logistics)	During preliminary engineering, Metro will coordinate with adjacent property owner to begin discussion for temporary construction easement/access. Should property not be available, alternative laydown/staging area will be utilized.
13	Scheduling conflicts with other Metro projects (track time)	Metro to begin coordination with design team and other planned project as project moves towards advertisement to ensure minimal conflict
14	Adjacent construction - project coordination necessary for lane closures, public occupancy permits and site access	As project nears final design and project approval, Metro will need to coordinate with Montgomery Co. and Maryland State Highway for permits
15	Public events preventing needed maintenance of traffic (MOT) or material delivery	Contractor will have to monitor and plan accordingly in construction schedule.

Risk ID	Risk Identification and Description	Mitigation Plan
16	Impacts to existing Metro facilities from construction (train control, communications, traction power, etc.)	Plan will be developed by the contractor prior to construction to monitor and maintain existing systems during construction.
17	Passenger safety incidents in station	Safety plan to be developed by contractor prior to construction

Preferred Alternative

The preferred alternative was developed in response to the findings of the Engineering Feasibility Assessment and a strong desire to match the existing south entrance conditions as closely as possible. Discussions concluded with a clear need for the development of a hybrid approach that combined some portions of Alternative 1 with those of Alternative 2 to arrive at the preferred Alternative 3, where:

- The structural columns supporting the over-platform portion of the new entry are located within the boarding platform, as shown in Alternative 1;
- The entrance skylight is pyramidal in shape, as shown in Alternative 2; and
- The entry layout is revised to accommodate either a hydraulic or MRL type elevator.

The process of developing the Alternative 3 hybrid began by adopting and combining the desired design elements of the two previously developed alternatives. Combining the desired elements of Alternatives 1 and 2 resulted in the structural roof beams of the new entrance and over-platform roof to be misaligned. To address this, the two portions of roof were separated by height with the entrance roof located at a higher elevation than the roof located over the platform, new elevators and stair. By having the separation in height, the misaligned roof beams are less visually incongruent as they no longer share the same horizontal plane. The third and final step was to revise the entrance layout configuration to provide a new room with a minimum area of 240 square feet; large enough to accommodate the equipment for either two hydraulic elevators or two MRL elevators.

Rough Order of Magnitude (ROM) Capital Cost Estimates

The table below presents a summary of the preferred Alternative 3.

Table ES-4 | Summary of ROM Cost Estimates – Alternative 3

	2019 ($)
Construction Total + Allocated Contingency (30%)	$18,000,000
Professional Services Costs (30%)	$5,400,000
Unallocated Contingency (30%)	$7,025,000
Mid-Point Escalation (4%/year)	$4,375,000
Total Project Cost	$34,800,000

Note: Figures above rounded for clarity, see Appendix for detailed cost estimates.

Figure ES-5 | Preferred Alternative Longitudinal Section

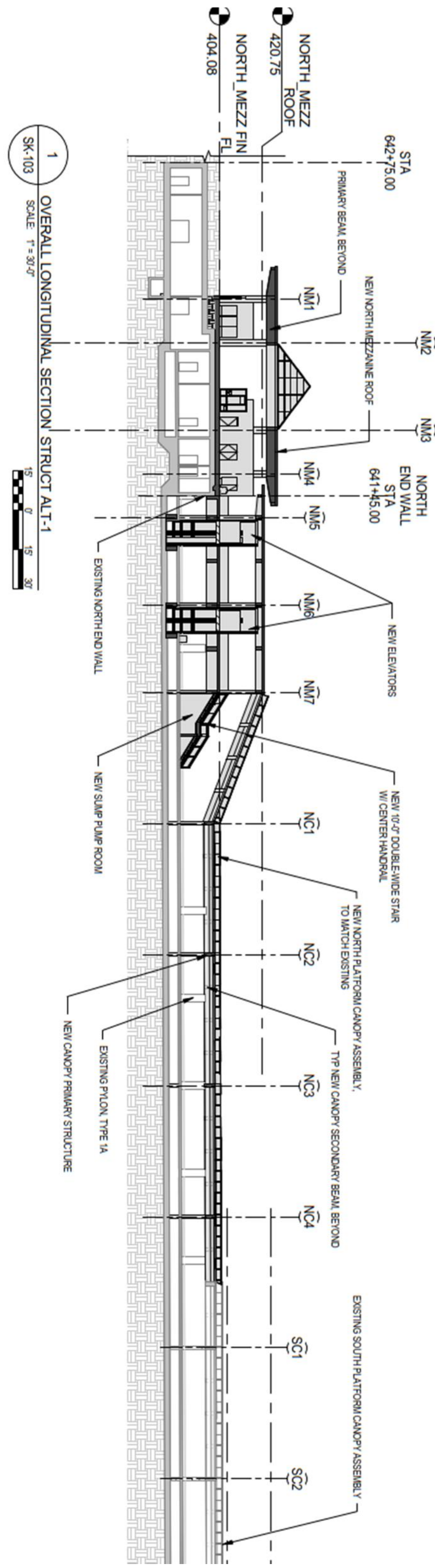


Figure ES-6 | Preferred Alternative Platform Level

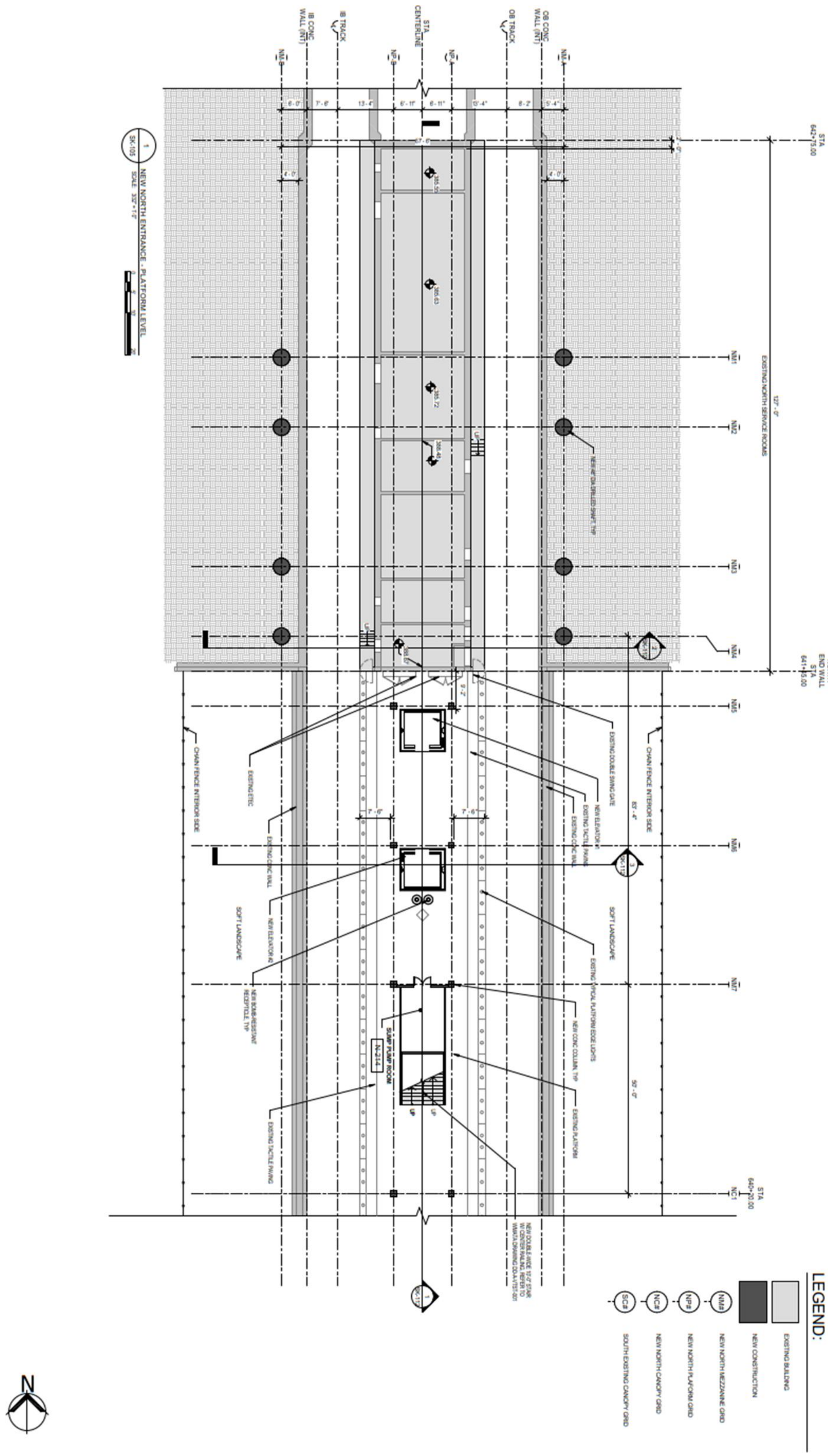
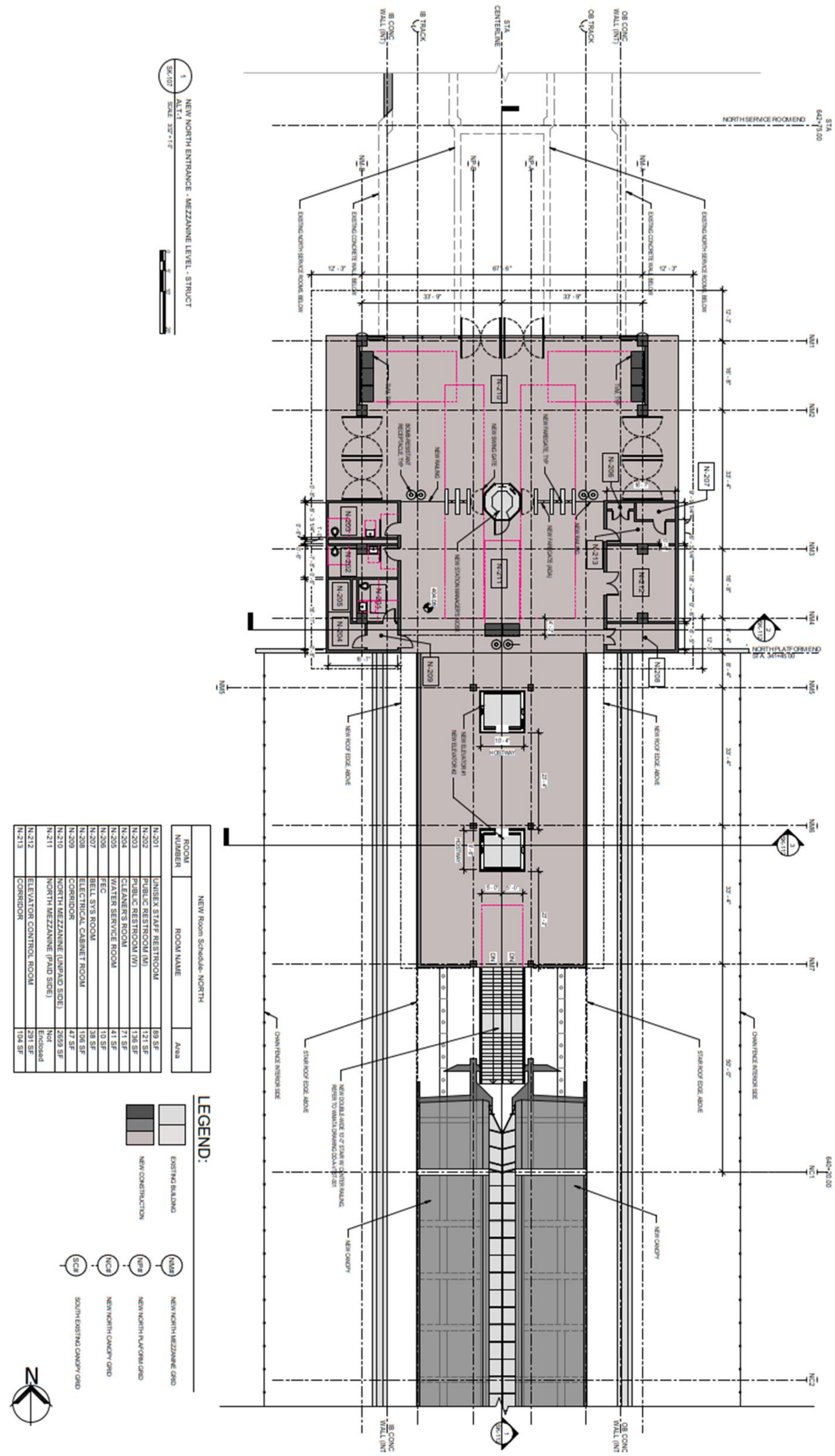


Figure ES-7 | Preferred Alternative Mezzanine Level



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1. Introduction

This report summarizes the findings and conclusions of the White Flint North Entrance Feasibility Study ("the study") conducted by the Washington Metropolitan Area Transit Authority (WMATA or "Metro").

1.1 Study Purpose and Overview

The primary objective of this study was to evaluate the feasibility and advance planning for the White Flint North Entrance in Montgomery County, Maryland (see Figure 1-1Error! Reference source not found.) through the Development and Evaluation (D&E) phase of Metro's capital planning program. The D&E phase includes identification and evaluation of needs leading to the selection of a preferred solution; and conducting sufficient design and engineering to determine technical feasibility and Rough Order of Magnitude (ROM) Capital costs, in addition to identifying project risks and operating impacts.

1.2 Background

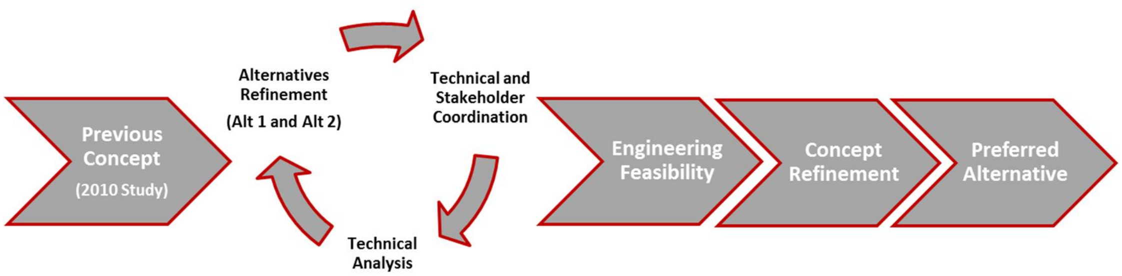
The White Flint Metrorail Station is located in Montgomery County, Maryland and is served by Metro's Red Line. The station's only entrance is located at the south end of the boarding platform at the intersection of Rockville Pike and Marinelli Road. Montgomery County has a vision for the surrounding area as a vibrant, walkable, and transit-oriented community. In 2010, the county adopted the *White Flint Sector Plan*, which focused on land use, appropriate density, and mobility for 430 acres around the Station. The plan specifically recommended the construction of a second entrance at the north end of the boarding platform near the intersection of Rockville Pike and Old Georgetown Road, which would support planned development in the immediate vicinity to the north of the existing station. Additionally, Metro's *2010 White Flint Station Access Plan* recommended modifications to the existing south entrance and developed two design concepts for a new entrance to the north.

Figure 1-1 | White Flint Metrorail Station Location

1.3 Study and Design Process

The approach to the study was iterative in nature with the design team working through various engineering and architectural challenges to develop two entrance alternatives. As a starting point, the design team adopted the entrance concept developed under Metro's *2010 White Flint Station Access Plan* and advanced its design to comply with WMATA's Design Criteria requirements. Once revised floor plans had been developed and agreed, two separate structural approaches were evaluated. The first structural approach supported the over-platform mezzanine with columns located within the boarding platform, and the second took the approach of supporting the same area by locating the structural columns on the outside edge of both trainways. Once the two structural alternatives had been developed, they were evaluated for engineering feasibility to provide points of comparison so that conclusions could be drawn, and a preferred approach identified. The study also examined the existing site conditions in order to inform the new entrance design. Additionally, the design team coordinated with Montgomery County stakeholders and internal Metro technical disciplines to address specific engineering and architectural design challenges and issues. Technical disciplines included Metro staff from Architecture, Structural, Electrical, Mechanical, Elevators/Escalators, ADA, and the Fire Marshall.

Figure 1-2 | Study Process



1.4 Report Organization

This report has been organized to reflect the sequential order and methodology that was taken to develop the north entrance alternatives and to deliver this study. Documentation and analysis developed in support of this study are presented in the following sequence and sections:

- Station Profile: documents the existing conditions within and surrounding the station;
- Demand Assessment: provides an analysis of the 2040 ridership demand forecasts conducted by WMATA and evaluation of the corners of the Rockville Pike and Old Georgetown Road intersection for ridership demand;
- Engineering Feasibility: summarizes the overall technical viability by discipline of a new north entrance at White Flint Metrorail Station;
- Environmental Scan: identifies the environmental resources present within 0.25 mile of the station site as well as key considerations for subsequent engineering and planning;

- Constructability, Risk Assessment, and ROM Cost Estimates: provides a preliminary constructability review, risk assessment and ROM cost estimate for construction focusing on major construction elements associated with the new entrance; and
- Preferred Alternative: presents the preferred alternative for the new North Entrance including design assumptions and refinements gleaned from the Engineering Feasibility analysis.

2. Station Profile

2.1 Project Location and Description

A new north entrance would improve access to the station by expanding the quarter-mile walkshed radius around the station increasing the convenience of transit to existing and new residents, workers, and shoppers in the area, and supporting the long-term growth planned in the immediate vicinity. The new entrance would also increase the station's capacity to move customers in and out of the station and would reduce the time for riders to exit the station during an emergency. Table 2-1 presents station-level ridership from the present and future timelines. To accommodate the increase in ridership, it is assumed trains will operate on a more frequent basis and all trains will operate with eight cars as shown in Table 2-2.

Table 2-1 | Forecasted Station-Level Daily Boardings

	Daily Boardings		
	Lower Bound	Upper Bound	Average
2017: Existing			
2017 (Mezzanine Data*)	3,504		3,504
2017 (Actuals** from Integrated Forecasts)	3,788	3,798	3,793
2040: Without New Entrance			
2040 No-Build (Integrated Forecasts)	5,725	7,754	6,739

Note: * corresponding to average weekday from July to August 2017
** corresponding to average weekday from May to July 2017

Table 2-2 | Existing and Projected Operations

Operation	2017	2040
Peak Headway – Red Line	4-minutes	3-minutes/4-minutes[2]
Railcar Consists 6-car/ 8-car (%)[1]	52/48	0/100

Sources: WMATA Line Load 2018/2025/2040 data.
Notes: [1]Railcar 6/8 car ratio is calculated based on FY 2016 data.
[2]Two variations of effective red-line headways; called FY2016 & FY2018 service plans; future service plans are currently unknown

2.2 Station Area Planning and Development Context

Montgomery County has a vision for the surrounding area as a vibrant, walkable, and transit-oriented community. In 2010, the county adopted the *White Flint Sector Plan*, which focuses on land use, appropriate density, and mobility for 430 acres around the White Flint Metrorail Station. The plan makes recommendations for zoning, urban design, the transportation network including transit, streets and bikeways, and public facilities. Specific recommendations related to the Metrorail station included the construction of a new northern entrance located in the southeast quadrant of the Rockville Pike and Old Georgetown Road intersection. The plan also noted that east of Rockville Pike has a greater potential for the creation of new neighborhoods. Known constraints in this area include a large water main, an 80-foot wide safety zone underneath Nicholson Lane, and a 50-foot Metro tunnel easement under Rockville Pike.

In 2017, the County adopted the *White Flint 2 Sector Plan*, which focused on land use, appropriate density, and mobility options for 460 acres located between the City of Rockville, the 2009 Twinbrook Sector Plan area, and the 2010 White Flint Sector Plan area. Recommendations were made for zoning, urban design, public facilities, and streets. Although the White Flint Metrorail Station is not included within the White Flint 2 Sector Plan boundary, areas within the sector plan boundary are within a half-mile of the station, which is a traditional threshold of how far an employee, or a resident is typically willing to walk from their office or home to transit. Therefore, the plan includes the second entrance to the White Flint Metrorail Station in the plan's proposed staging (i.e., within Phase 2) and in the proposed capital improvements program at an estimated cost of $13.5 to $35 million. Improvements at the station are needed to support new development within the White Flint 2 Sector Plan boundary as well as the area studied in the 2010 White Flint Sector Plan area.

Several development plans have either been completed, are under construction, or are planned for the area surrounding the existing station.
Table 2-3 summarizes the projects that have been completed or are in the development pipeline.

Table 2-3 | Development Pipeline

Project (Status)	Details	Approx. Distance to Station
North Bethesda Town Center (Planned)	The 32-acre North Bethesda Center is situated adjacent to the White Flint Metrorail Station. The transit-oriented development will have 1,275 residential units and 1.3 million sqft of non-residential development.	<0.25 mile
Saul Centers (Planned)	Up to 1.43 million sqft of residential development and up to 205,000 sqft of non-residential development on 9.42 gross acres located adjacent to the White Flint Metrorail Station.	<0.25 mile

Project (Status)	Details	Approx. Distance to Station
Pike and Rose Phase 1 (Complete)	24 acres Phase I: 493 residential dwelling units and 341,800 sqft of non-residential development.	0.25 mile
Pike and Rose Phase 2 (Underway)	Up to 645,976 sqft of residential development and up to 1,122,960 sqft of non-residential development on approximately 13.21 gross acres	0.25 mile
Gables White Flint (Planned)	Up to 476 residential dwelling units and 31,000 sqft of non-residential development on approximately 5.14 gross acres	0.25 mile
White Flint View (Planned)	183 residential dwelling units and 18,000 sqft for retail.	0.25 mile
North Bethesda Market II (Planned)	Up to 470 residential dwelling units and 175,260 sqft of non-residential development.	0.25 mile
North Bethesda Gateway (Planned)	739,198 sqft residential and 884,960 sqft non-residential	0.25 mile
East Village at North Bethesda Gateway (Planned)	614 residential dwelling units and 34,000 sqft of non-residential	0.25 - 0.50 mile
North Bethesda Center (Built)	653 residential dwelling units (Wentworth and Aurora), 61,246 sqft of retail, and 352,662 sqft of office	0.3 mile
North Bethesda Center (Underway)	294 multifamily residential dwelling units	0.3 mile
White Flint Mall (Planned)	3 million sqft of residential development and 2.5 million sqft of non-residential	0.5-0.6 mile
6000 Executive Blvd (Planned)	364 residential dwelling units and 302,143 sqft of non-residential development	0.6 mile
VOB Development	Mixed use development with approximately 1 million sqft of gross floor area including: up to 1,000 multi-family dwelling units and 110,169 square feet of commercial development	0.6 mile
Wilgus Property	Mixed use development with up to 1.2 million sqft of total development including: up to 1 million sqft of multi-family and townhouse residential uses and up to 248,709 sqft commercial	0.8 mile

Source: Montgomery County Planning Department Pipeline of Approved Development

2.3 Previous Station Planning Studies

This study adopts and advances some of the design elements developed in Metro's *2010 White Flint Station Access Plan*. The 2010 study recommended modifications to the existing south entrance and developed two design concepts for a new north entrance and three design concepts for a grade-separated pedestrian crossing at the intersection of Rockville Pike and Old Georgetown: two tunnel options and one bridge option. The plan also proposes a future bridge over the existing Metro platform and right-of-way – on future MacGrath Boulevard between Rockville Pike and the development area to the east of the station (see Figure 2-1 below).

Figure 2-1 | Future bridge across WMATA tracks and station platform

Source: Montgomery County

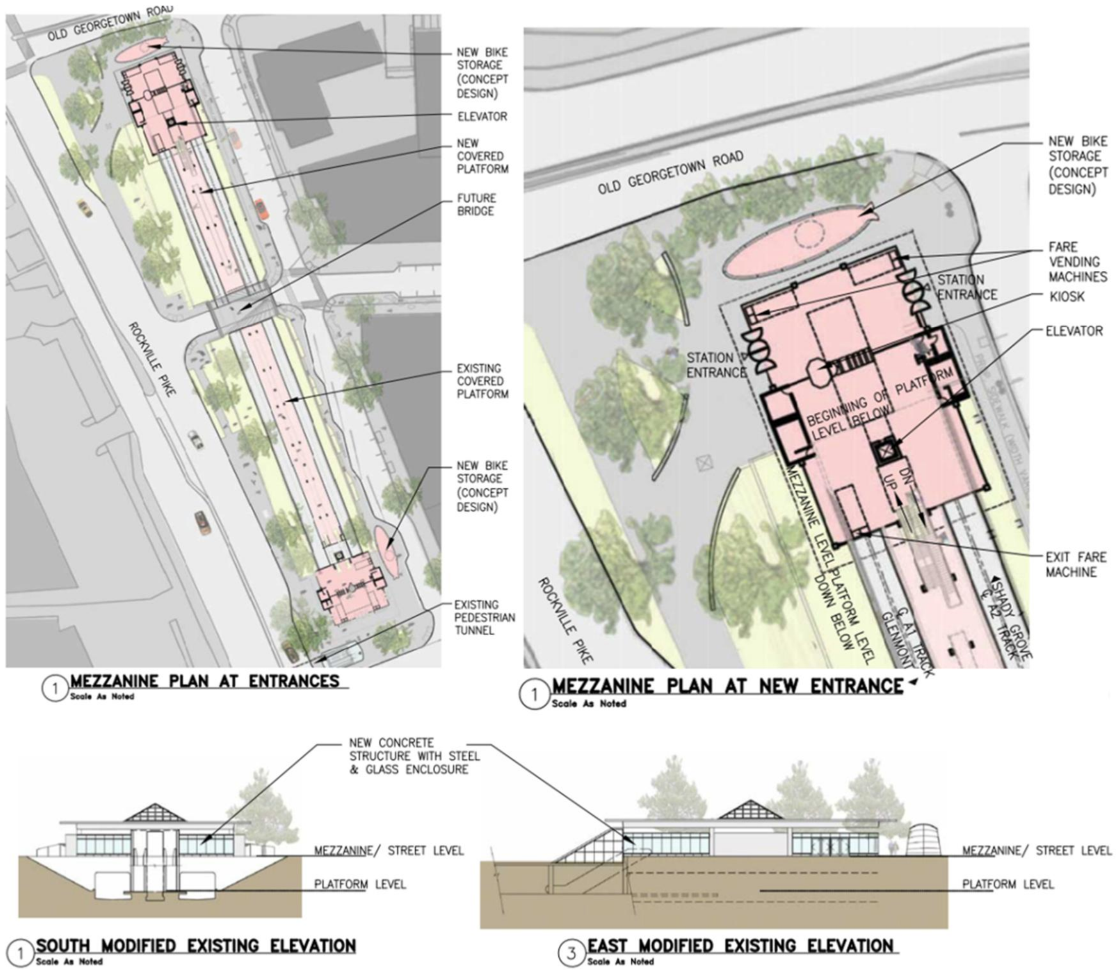
In 2017, one of the proposed north entrance options in the 2010 study (Improvement 2A) was chosen for further evaluation by Federal Realty, a private real estate investment trust, with the goal of developing a phased approach for implementing a new north entrance. Under this study, Metro has further advanced the same entrance option (Improvement 2A) from the 2010 study in order to satisfy Metro D&E requirements of assessing engineering feasibility, evaluating constructability, and estimating project costs.

Under Improvement 2A (see Figure 2-2), the new north entrance mezzanine was proposed to be constructed directly over the existing north service rooms and tunnel structures. The new entrance included the following elements:

- Six new faregates, a station manager kiosk, four fare machines, two add-fare machines, and new service rooms;
- An escalator paired with a stair, and a single, dual-sided mezzanine-to-platform elevator for new vertical circulation;

- An extended mezzanine over the boarding platform to accommodate the new vertical circulation elements (VCEs); and
- An entrance configured to maintain natural ventilation, like the existing south entrance, making mechanical ventilation of the entrance unnecessary.

Figure 2-2 | Improvement 2A – 2010 White Flint Station Access Plan



Source: 2010 White Flint Station Access Plan

In 2017, Federal Realty undertook a planning exercise to evaluate a phased implementation approach for the north entrance. The design focused primarily on the programmatic needs and geometric constraints of the new entrance, however constructability and feasibility assessments were not performed. Concepts developed were presented to Metro, however no formal technical reviews were conducted, and no concept design approvals were granted.

Work under this study included refinements and advancements to the 2010 study's Improvement 2A entrance concept that was previously developed. Refinements and advancements were made to align the new design with WMATA's Design Criteria and to explore two different structural approaches to support the new entrance over the existing station infrastructure. Additionally, this study performed a pedestrian demand assessment at the Rockville Pike and Old Georgetown Road intersection to determine the most effective alignment for a potential grade-separated pedestrian crossing.

The modifications to the existing south entrance and the grade-separated crossing that were proposed in the 2010 study were not included under this study, however those improvements would benefit the customer experience and are assumed to be part of a future phase of work.

2.4 Site Visit and Existing Conditions

After reviewing station as-built documents for the station, the project team visited the White Flint Metrorail Station on Wednesday, January 16th, 2019 from 1:30 to 3:00 PM to perform a site visit. The purpose of the site visit was to observe, document, and more fully understand the existing conditions so that new entrance concepts could be developed. The project team included technical leads from the architectural, structural, mechanical, plumbing, electrical, and constructability disciplines. Drawings of the existing conditions were developed by the team and are shown in Figure 2-3 through Figure 2-6. Figure 2-7 and Figure 2-8 are photos that were taken during the site visit.

State of Good Repair (SOGR)

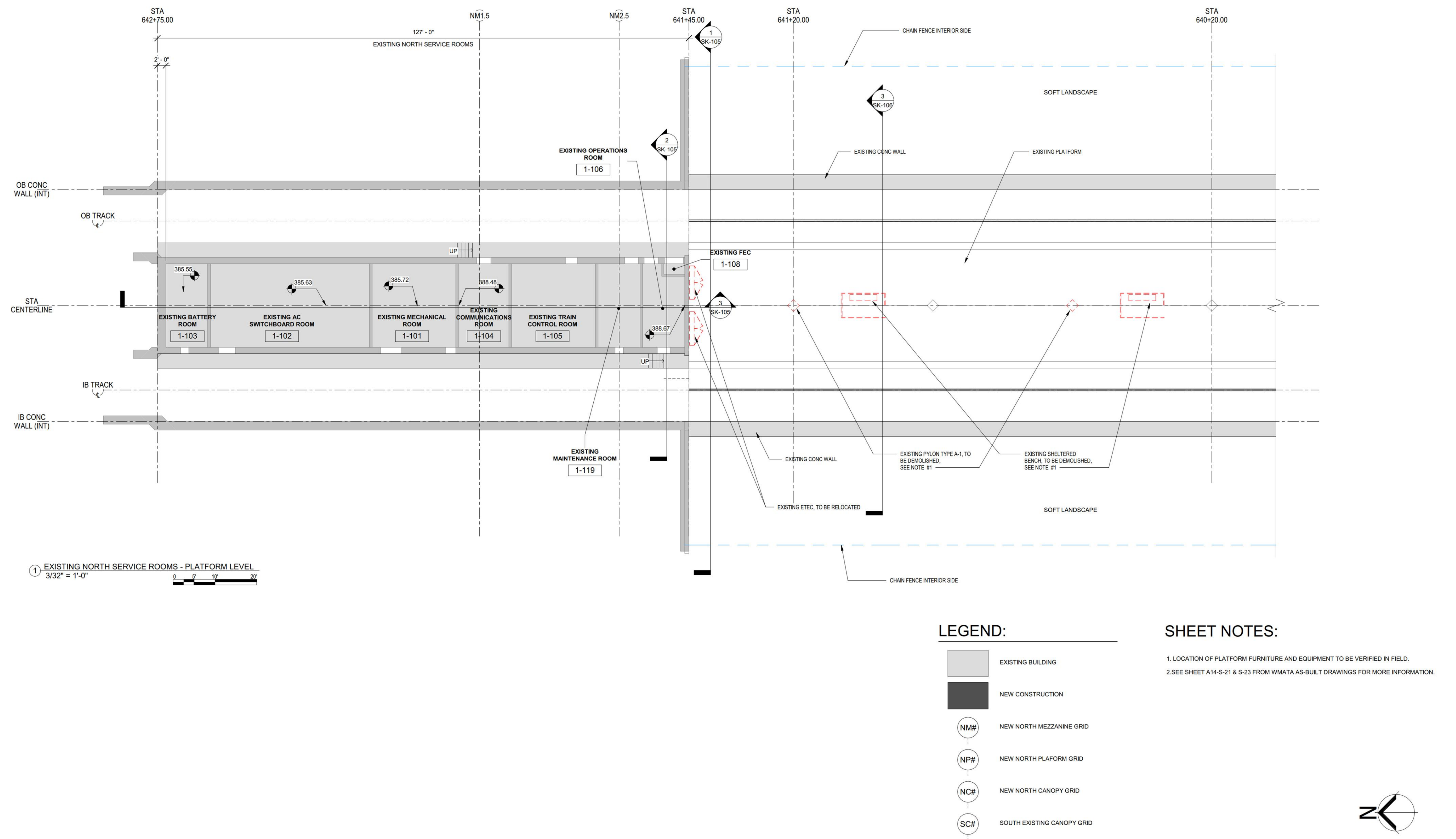
Beginning in 2016 Metro undertook a Transit Asset Inventory and Condition Assessment (TAICA) effort where facility asset data was obtained, and assessments of the existing condition were made. The TAICA data provided a "snapshot" of the current physical condition of Metro facilities. Facilities were assessed using a five-point scale with "5.00" indicating excellent (near new condition) and "1.00" indicating poor (in need of immediate repair/well past useful life). According to the TAICA database, the existing Metrorail facilities at the White Flint Metrorail Station all score between Fair (3.00) to Good (4.00) and are not prioritized for repair or replacement at this time (see Table 2-4).

Table 2-4 | WMATA Transit Asset Inventory and Condition Assessment (TAICA) Database

Location ID	Location	Asset Type	Subsystem Description	Inventory	Average of SOGR Score
A12	Platform	Building Structure	Revenue Areas Floor Slab	G6103123 – Revenue Areas Floor Slab	4.00
A12	Level 1 N Platform	Building Structure	Non-Revenue Areas Floor Slab	G6103122 – Non-revenue Areas Floor Slab	4.00
A12	Platform	Building Structure	Floors	G6103120 – Floors	3.00
A12	Platform	Building Structure	Platform Canopy	G6103117 – Platform Canopy – Structural	3.50

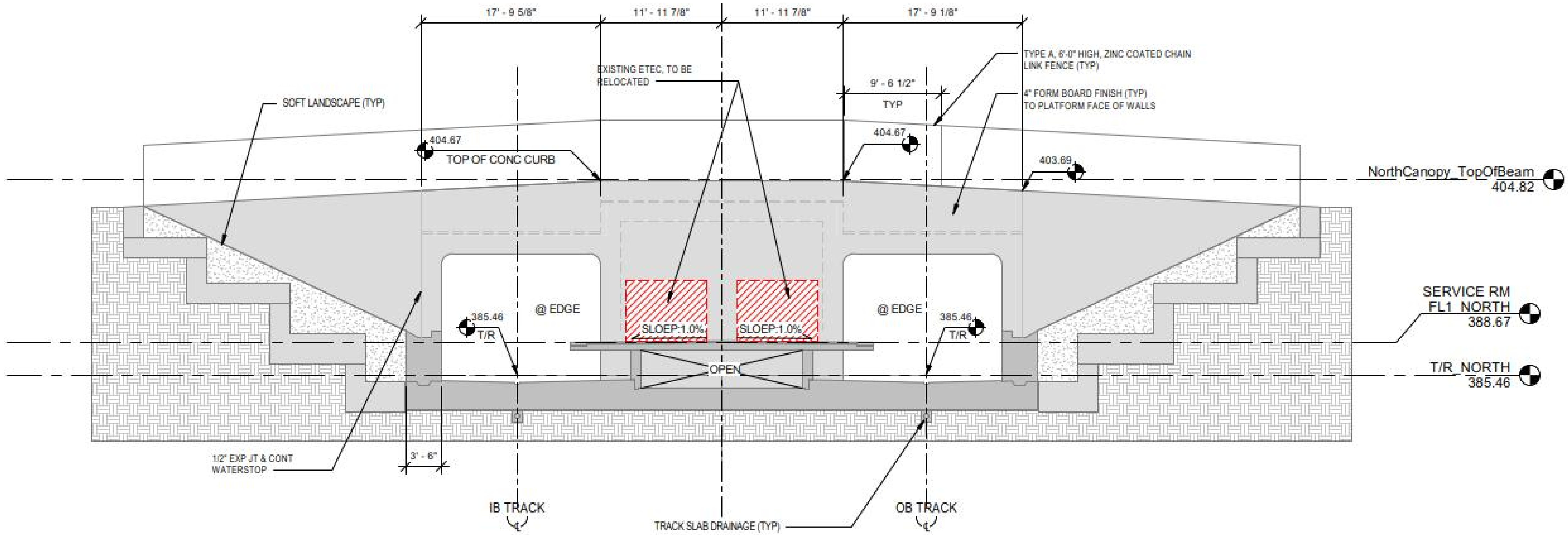
Source: WMATA Transit Asset Inventory and Condition Assessment
Note: Elevators, escalators, mechanical/electrical/comms systems were not included in the TAICA Database

Figure 2-3 | Existing North Service Rooms – Platform Level



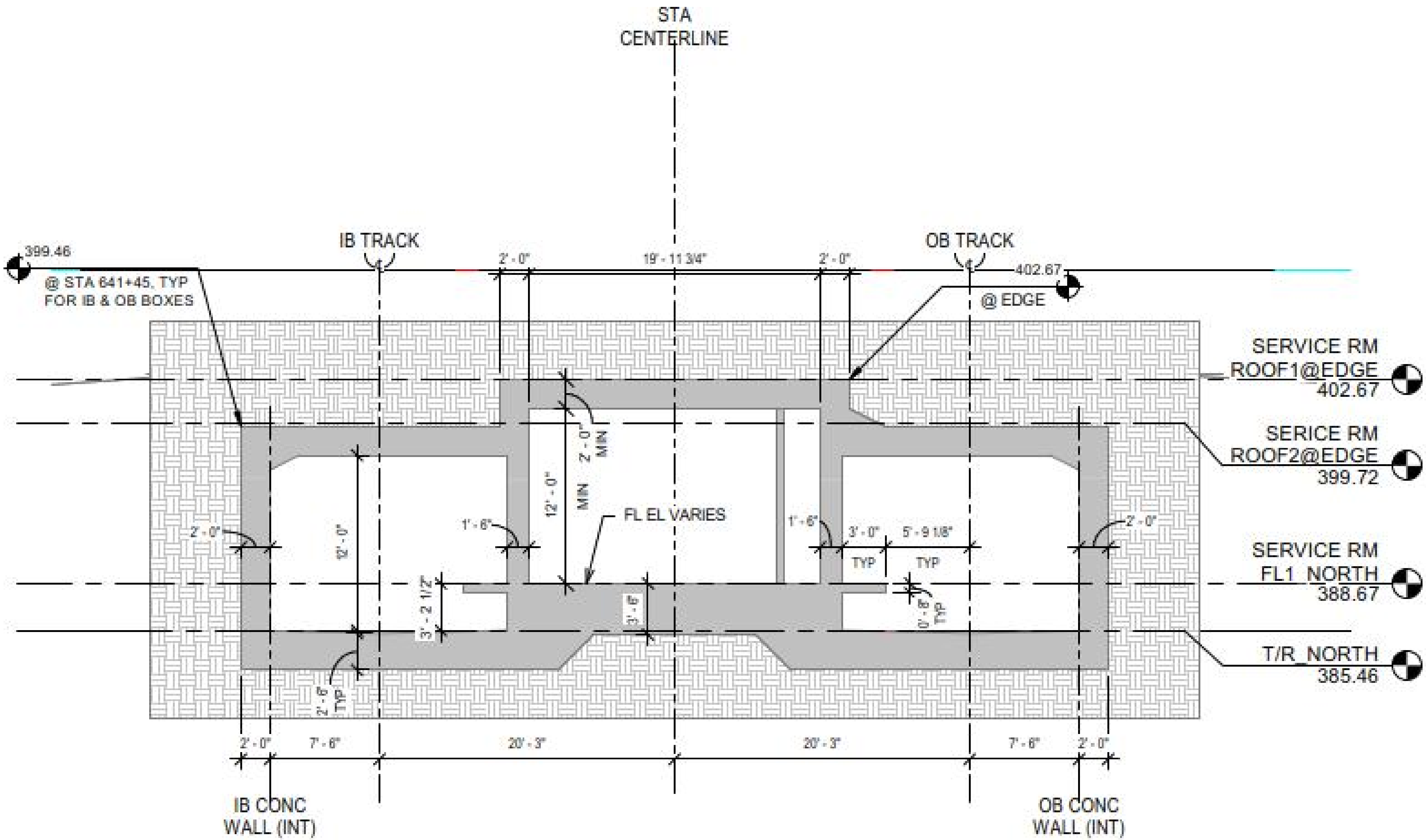
Source: WMATA As-Builts, KGP Design Studio

Figure 2-4 | Cross Section – Platform North End Wall



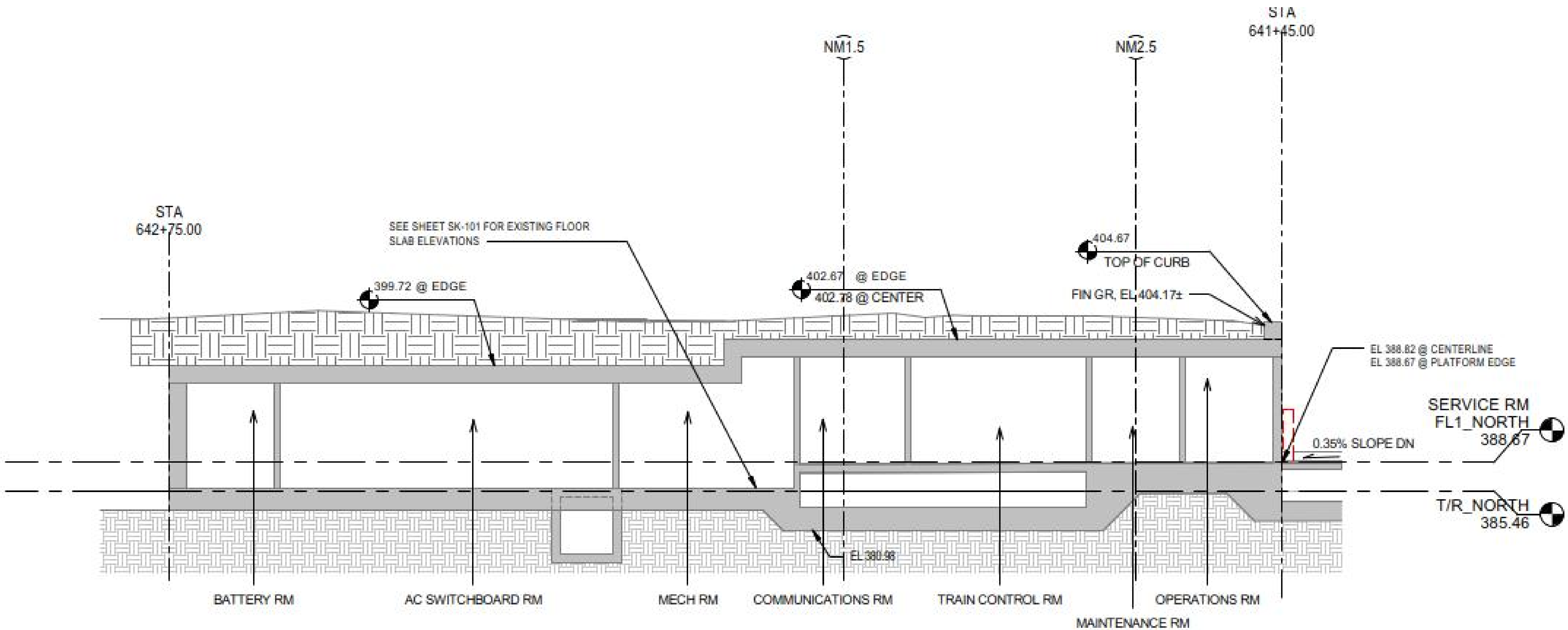
Source: WMATA As-Builts, KGP Design Studio

Figure 2-5 | Cross Section – North Service Rooms & Adjacent Train Tunnels



Source: WMATA As-Builts, KGP Design Studio

Figure 2-6 | Longitudinal Section – North Service Rooms



Source: WMATA As-Builts, KGP Design Studio

Figure 2-7 | Photo of Existing Tunnel Structure at North End of Station

Source: January 17th, 2019 Site Visit

Figure 2-8 | Photo of Existing South Station Entrance

Source: January 17th, 2019 Site Visit

3. Demand Assessment

The primary objective of the Demand Assessment was to forecast 2040 ridership and to determine the levels of pedestrian activity at each corner of the Rockville Pike and Old Georgetown Road intersection after implementation of a new north entrance. The 2040 ridership data was developed to support the evaluation and decision-making process by providing a metric that allows the cost of a new entry to be weighed against the growth in future ridership that the new entry would result in.

In addition to the ridership demand, this assessment also evaluated the pedestrian activity at each corner of the Rockville Pike and Old Georgetown Road intersection to determine where a future grade-separated crossing would make the most sense to connect to.

This section summarizes the findings of the Demand Assessment, which can be found in its entirety in Appendix C.

3.1 Ridership Forecasting

Metro produces annual Integrated Metrorail Ridership Forecasts ("Integrated Forecasts") in a spreadsheet that combines the results from a short-term (direct-ridership) model and a long-term forecast (National Capital Region Transportation Planning Board (NC-TPB) / Metropolitan Washington Council of Governments (MWCOG)'s regional travel forecasting) model to provide a range of station-level boardings. This range has a lower-bound and an upper-bound. According to its documentation the lower bound represents the continuation of the trend wherein the challenges to the Metro brand, volatility in the mobility space, and, increasing telework, continue as they have been. On the other hand, the upper bound represents an assumption that the trend is saturated – that is, the Metro brand and public opinion is getting better, the mobility options are maxed out and we've reached peak-Uber, and that those who can telework already do. This spreadsheet forms a key input to the Line Load application, a dynamic Metrorail train loading estimation tool. It may note that the 2018 version of the Integrated Forecasts included observed boardings by station for 2017 and forecasted boardings by station for 2019 to 2040. The forecasts for 2019 to 2023 were based on the short-term methodology, and the forecasts for 2024 to 2040 were based on long-term methodology that essentially applied a compounded annual growth rate derived from the ridership forecasts in the NC-TPB/MWCOG model.

At the request of Metro, the ridership demand forecasting under this study was performed using available data instead of running any travel models. The key input to the forecast was the *2018 Integrated Metrorail Ridership Forecast* spreadsheet, which was provided by Metro. The forecast for 2040, which is based on the long-term methodology as mentioned earlier, in the 2018 Integrated Forecasts is based on Version 2.3.70 of the NC-TPB/MWCOG model and which in turn is based on the MWCOG Round 9.0 Cooperative Land Use Forecast ("Land Use Round 9.0"). Since the release of the 2018 Integrated Metrorail Ridership Forecast, a newer version of the regional co-operative land use forecast ("Land Use Round 9.1") has become available. Another data source used in this analysis was the

Line Load application that was built on the 2017 Integrated Forecasts, with the base year for the analysis as 2017 and the forecast year as 2040.

To provide a more comprehensive evaluation of the ridership forecast at the White Flint station, two different methods were developed and applied to estimate the boardings with the new entrance (or build conditions):

- Method I: Land Use Activity – Ridership computed by applying a growth percentage to the no-build ridership. Growth percentage determined by isolating the catchment area of the new entrance and determining the projected growth in land use within the catchment area to arrive at a growth percentage. This method was repeated with the Land Use Round 9.1 and 9.0 to generate two sets of data points.

- Method II: Development Parcels - Ridership computed by applying a growth percentage to the no-build ridership. Growth percentage determined by isolating the catchment area of the new entrance and determining the projected development growth within the catchment area to arrive at a growth percentage. This method was repeated with the Land Use Round 9.1 and 9.0 to generate two sets of data points.

3.1.1 Ridership Conclusion

Table 3-1 presents station-level daily boardings for the White Flint station from various sources. The observed data are shown with a single value, while the forecasts are presented ranging from a lower bound to upper bound. In summary:

- The Method 1 application with Land Use Round 9.1 represented a growth of about 7.4 percent increase in daily boardings, and about 6.8 percent increase in daily boardings with Land Use Round 9.0.
- The application of Method 2 with Land use Round 9.1 represented a growth of about 11.5 percent increase in daily boardings, and about 2.8 percent increase in daily boardings with Land Use Round 9.0

The proposed second entrance would not result in many new riders entering the system, however it would result in many current riders entering the system through the new entrance which would relieve demand at the existing entrance.

Table 3-1 | Forecasted Station-Level Daily Boardings

	Daily Boardings		
	Lower Bound	Upper Bound	Average
2017: Existing			
2017 (Mezzanine Data*)	3,504		3,504
2017 (Actuals** from Integrated Forecasts)	3,788	3,798	3,793
2040: Without New Entrance			
2040 No-Build (Integrated Forecasts)	5,725	7,754	6,739
2040: With New Entrance (Method 1: Land Use Activity)			
2040 Build (Growth using Land Use Round 9.1)	6,149	8,329	7,239
2040 Build (Growth using Land Use Round 9.0)	6,116	8,284	7,200
2040: With New Entrance (Method 2: Development Parcels)			
2040 Build (Growth using Land Use Round 9.1 & Parcels)	6,386	8,649	7,517
2040 Build (Growth using Land Use Round 9.0 & Parcels)	5,883	7,968	6,925
2040: Additional Daily Boardings			
Estimated Additional Daily Boardings from New Entrance	158	895	526

Note: * corresponding to average weekday from July to August 2017
** corresponding to average weekday from May to July 2017

3.2 Pedestrian Activity (Rockville Pike & Old Georgetown Road Intersection)

To determine the direction of approach for the riders using the new entrance, half-mile walkshed buffers were prepared in GIS and analyzed against the Transportation Analysis Zones (TAZ) based land use data from the NC-TPB travel demand model. These quarter-mile walksheds were also analyzed in conjunction with the White Flint Sector plans. After reviewing the 2010 and 2017 White Flint Sector Plans, the density and building height near the southeast and northwest corners of the Old Georgetown Rd and Rockville Pike intersection is relatively high (recommended building heights range from 190 feet to 300 feet in the latest adopted master plan and Floor to Area Ratio (FAR) is near 4.0). Parcel data for Montgomery County was sourced from the website of Maryland Department of Planning and when overlaid with quarter-mile walkshed for all four potential locations of the new entrance, the overall square footage of buildings in commercial use and number of housing units are compared. Table 3-2 below shows the score of initial evaluation based on the existing land use data at Transportation Analysis Zones (TAZ) and parcel level.

Table 3-2 | Pedestrian Activity at Each Corner of Rockville Pike & Old Georgetown Road Intersection

PM Peak Hour	Passenger Movement	Parcel-level Land Use	% of the Total	Emp/HH Weights (Rnd 9.1)	Emp/HH Weights (Rnd 9.0)	Final Score (Rnd 9.1)	Final Score (Rnd 9.0)
SW Corner	Commercial and Industrial Building Structure (SQFT)	3,294,051	24.97%	84.49%	70.44%	0.250	0.250
	Apartment/Single-Family Building Units	547	25.01%	15.51%	29.56%		
SE Corner	Commercial and Industrial Building Structure (SQFT)	3,259,470	24.71%	80.36%	73.86%	0.248	0.248
	Apartment/Single-Family Building Units	547	25.01%	19.65%	26.14%		
NE Corner	Commercial and Industrial Building Structure (SQFT)	3,211,913	24.35%	80.35%	73.86%	0.245	0.245
	Apartment/Single-Family Building Units	546	25.01%	19.65%	26.14%		
NW Corner	Commercial and Industrial Building Structure (SQFT)	3,426,094	24.97%	84.49%	70.44%	0.258	0.257
	Apartment/Single-Family Building Units	547	25.01%	15.51%	29.56%		

Note: Department of Planning, Maryland. Digital Parcel Mapping Files. https://planning.maryland.gov/Pages/OurProducts/DownloadFiles.aspx. Accessed on 1/24/2018.

3.2.1 Pedestrian Activity Conclusion

The Pedestrian Activity assessment was developed as a method for evaluating which corners of the intersection a future grade-separated crossing should connect. This study assumes that one end of the pedestrian crossing would be at the SE corner near the location of the new entry. The other corner that the pedestrian crossing would connect to is determined by the Final Scores listed in Table 3-2 above. Under both Round 9.1 and Round 9.0, the NW corner has the most pedestrian activity. The intent of this exercise was not to choose a corner, but to provide the data and evaluation needed to support further discussion in the decision-making process.

With Rockville Pike having seven lanes of traffic and Old Georgetown Road having four lanes on the east, five lanes on the west, and slip lanes on all four corners, the Rockville Pike and Old Georgetown Road intersection is not pedestrian friendly. It creates a significant distance and time to cross as a pedestrian and mixes pedestrians with traffic at a busy intersection. Although the intersection is signalized and has pedestrian crossings, today's Metro customers must cross up to two wide roads to access the White Flint Metrorail station when approaching from the north. This could be improved with a grade-separated crossing directly from the SE corner, where the new entry will be located, to a second corner of the intersection with a high level of forecasted pedestrian activity.

4. Engineering Feasibility

This section summarizes the overall technical viability of a new north entrance at White Flint Metrorail Station. The following multi-disciplinary evaluation documents existing conditions, highlights technical approaches, and identifies known constraints for each design discipline. This detailed engineering feasibility assessment of the two alternatives was conducted to provide a comparison and identify a preferred approach and design.

4.1 Design Criteria

The following governing documents were used to develop each alternative under this study:

- WMATA Guidelines & Standards
  - Adjacent Construction Project Manual, Revision 5a, September 2015
  - Manual of Design Criteria, Release 9, Revision 3, November 2016
  - Standard Design Drawings & Specifications
- Department of Transportation (DOT), ADA Standards for Transportation Facilities, 2006
- International Building Code, 2015
- International Mechanical Code, 2015
- International Plumbing Code, 2015
- International Existing Building Code, 2012
- ICC International Building Code (IBC), Energy Conservation Code, 2015 edition
- National Fire Protection Association (NFPA) 70, National Electrical Code, 2014 edition
- National Fire Protection Association (NFPA) 130, Standard for Fixed Guideway Transit and Passenger Rail Systems, 2017 edition, and its referenced standards
- American Society of Mechanical Engineers (ASME) A17.1, Safety Code for Elevators and Escalators
- American Concrete Institute (AIC) Manual of Concrete Practice, including the Building Code Requirements for Structural Concrete (ACI-318) and Commentary (ACI 318R)
- American Institute of Steel Construction (AISC) Manual of Steel Construction, Allowable Stress Design

4.2 Architecture

This section documents the existing conditions, design approach, and assumptions taken by the architecture discipline in developing the alternatives under this study.

4.2.1 Existing Conditions

The White Flint Metrorail Station is located directly east of Rockville Pike, between Marinelli Road to the south and Old Georgetown Road to the north. The 600’ boarding platform is slightly sloped to the south. At street level, the existing onsite topography is inconsistent with the information shown in the as-built drawings, which is likely the result of the adjacent road construction after the station was constructed in the early 1980s. The station has several service rooms on the north end that are located underground, between the trainways, directly adjacent to the north end of the boarding platform. These service rooms accommodate several critical station functions and are filled with equipment, leaving little to no opportunity for repurposing or adding structural columns to support the new entrance above.

Beyond the north end of the boarding platform, and in the trainway tunnels, the underground service rooms are arrived at by way of a 40" wide maintenance walk on either side. Both service walks are separated from the public boarding platform area by swing gates. The distance between inside-face of concrete wall to inside-face of concrete wall of the trainway tunnels measured 59'-6".

The station's boarding platform width was measured at 29'-11 ¾" and has a slight downward slope from south to north of 0.35%. The boarding platform's existing condition includes platform canopy columns spaced every 50'-0", Type A-1 pylons, and sheltered benches.

Existing items located on the platform that will need to be removed or relocated due to the addition of the new entrance are: three Type A-1 pylons, two sheltered benches, and two Emergency Tunnel Evacuation Cart (ETEC) cabinets located against the platform end wall to the north.

4.2.2 Preliminary Design Approach

As a point of departure, this study first adopted the Improvement 2A entrance configuration that was developed under Metro's 2010 station access study. The 2010 design was then evaluated for compliance with WMATA Design Criteria to identify any non-compliant elements that would have to be addressed in a revised entrance configuration. In addition to compliance with the Design Criteria, a high priority was placed on maximizing emergency egress from the station, minimizing the required entrance footprint, and mimicking the form, aesthetic, and design language found in the existing south entrance.

The following assumptions were made in considering the architectural design of the new entrance and mezzanine:

- The as-built information provided by WMATA accurately represents the current built condition;
- The entrance mezzanine will adopt the number of fare vending machines and fare gates as included in Metro's 2010 study;
- The paired escalator-stair configuration found in Improvement 2A from the 2010 design will be replaced by a double-wide 10' stair with center handrail to maximize the egress capacity from the station and to reduce operating and maintenance costs associated with escalators;
- The single elevator found in Improvement 2A from the 2010 design will be replaced by two elevators as required by the WMATA Design Criteria;
- Existing platform pylons, sheltered benches, trash receptacles, and ETECs will be relocated to maintain a 5'-0" minimum clear distance from the new stair, elevators, and structural columns. If this clearance cannot be maintained by relocation, the existing element will be removed;
- Existing platform pylons, sheltered benches, and ETECs will be removed or relocated as needed to provide space for the new structure and VCEs being introduced to the boarding platform area;
- The entrance design will be based on the major 33'-4" WMATA module;

- The platform canopy extension will be designed based on the new module of the entrance and the existing module of the platform canopy;
- All new station and VCE finishes will comply with WMATA standards and match the existing station architecture;
- All new columns, piers, and beams will be aligned with the existing station's structural members and use the existing structural spacing and module, wherever possible;
- No new structure will be introduced inside the existing underground north service rooms. Any new structure required in the existing boarding area will maintain a minimum 7'-6" distance from the edge of platform; and
- Minimum queue requirements for fare vending machines, faregate array, elevators, and stairs will comply with WMATA Design Criteria. Minimum queues are included in Table 4-1 and are shown on the plan drawings.

Table 4-1 | Minimum Queues

Station Element/VCE	Minimum Queue (feet)
Fare Vending Machines	20
Faregate Array	25
Escalator	20
Elevator	10 Single / 13 Facing
Stair	10

4.2.3 Alternatives Development and Refinement

Using Metro's 2010 entrance design as a starting point, and working under the assumptions above, a single revised entrance configuration was created, and two alternative structural approaches were developed for supporting the new mezzanine area located over the boarding platform. In Alternative 1, this area is supported by tapered beams resting on columns located within the boarding platform. In Alternative 2, the new mezzanine is supported by long-span beams resting on piers located just outside of each trainway. While this effort did not advance the design or evaluate feasibility of the planned future bridge over Metro's boarding platform and right-of-way, the north entrance designs do not preclude the planned project at a future date. Concept drawings for each alternative are included in Appendix A.

Mezzanine Configuration

The revised mezzanine configuration and entrance layout was developed to be identical for both Alternatives 1 and 2. The revised mezzanine configuration is very similar to that of the 2010 study, however it differs from the Improvement 2A design in the following two ways:

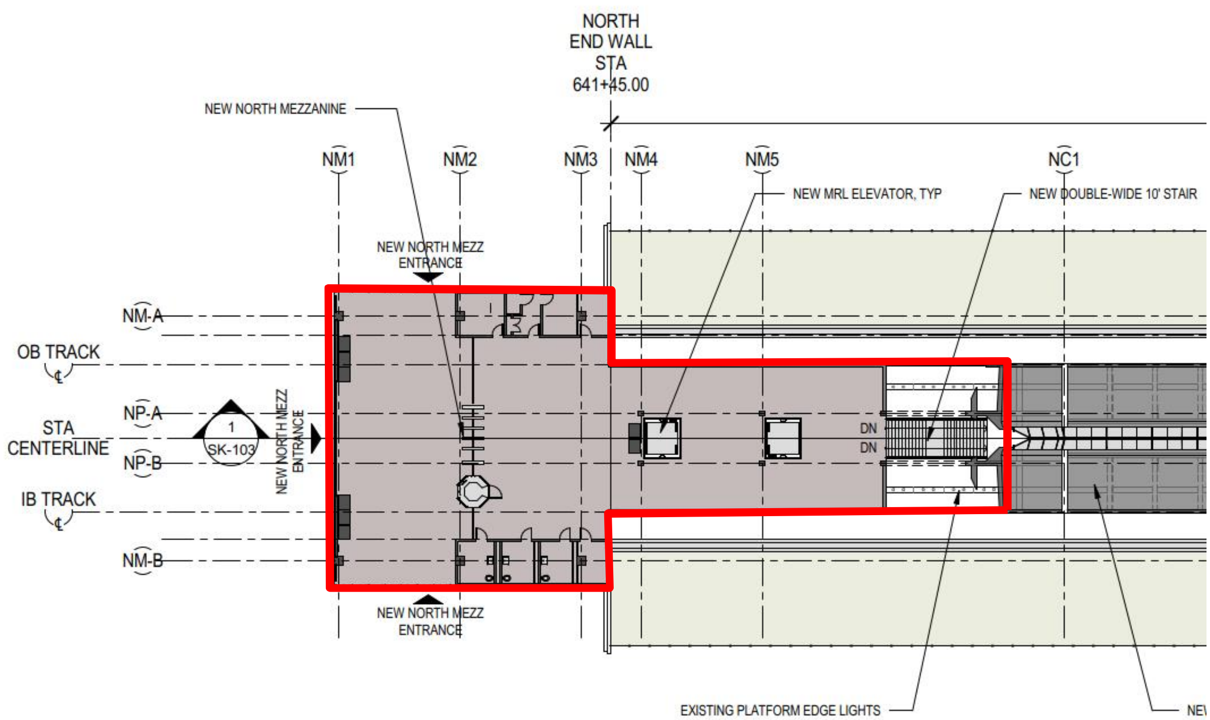
Vertical Circulation Elements

The paired escalator-stair configuration found in Improvement 2A from the 2010 design has been replaced by a double-wide 10' stair with center handrail. This helps to improve the station's emergency egress capacity by providing more stair width for riders to egress the station. Providing a stair rather than an escalator also helps to reduce the station's long-term operating and maintenance costs. Another difference from the 2010 design is that instead of one elevator, two are provided to comply with the WMATA Design Criteria. The two new elevators have been located within the boarding platform so as not to impact the existing underground service rooms to the north. Both machine room-less (MRL) type elevators and hydraulic were considered under this study. See Section 4.3 for an evaluation of the elevator options.

Shape of the Overall Footprint

The 2010 Improvement 2A design consisted of a single rectangular shape in plan, with the at-grade entrance portion connecting to the above-platform mezzanine portion at the same width. Under this study, the layout was revised to have the at-grade entrance portion align with the existing south entry roofline, and the above-platform mezzanine portion to align with the existing platform canopy. The revised configuration is more similar to the existing south entry with the at-grade entrance portion taking on the shape of a square and the above-platform mezzanine portion becoming more rectangular. Although the revised layout reads as two separate volumes, and includes a second elevator, the overall area of the station entry is only slightly larger than that of the 2010 study at 9,200 square feet.

Figure 4-1 | Revised North Entrance Configuration



Source: KGP Design Studio

Structural Expression & Mezzanine Skylight

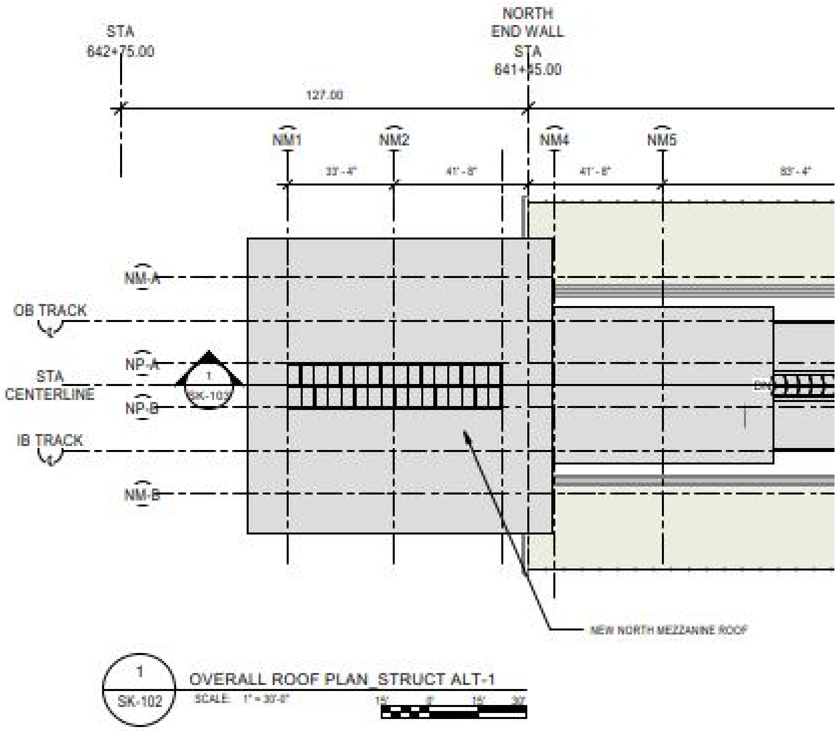
Although both alternatives developed under this study share identical entry configurations, the two structural approaches that were developed for Alternatives 1 and 2 result in different structural expressions and differ in opportunities for locating an entry skylight. Both structural approaches are the same in every way except how they support the portion of new entrance mezzanine that is located above the existing boarding platform (see Figure 4-3). In Alternative 1, this area is supported by new columns located within the boarding platform with cantilevered beams that taper as they extend over the adjacent trainways. In Alternative 2, the same mezzanine area is supported by deep long-span beams which span over the boarding platform and both adjacent trainways. These beams rest on deep structural piers located on the outside edge of each trainway.

The structural expression of Alternative 1 closely mimics the look of the existing south entrance with concrete columns and tapered beams, however the location and alignment of structural members results in a linear skylight over the main entry. Alternative 2 introduces a new aesthetic to the station with deep long-span beams located over the boarding platform, however the location and alignment of structural members results in a pyramidal skylight over the main entry, similar to that found in the south entrance.

Figure 4-2 below illustrates these differences in the skylight aesthetic and the overall roof plan. See Section 4.5 for more information on the structural approach.

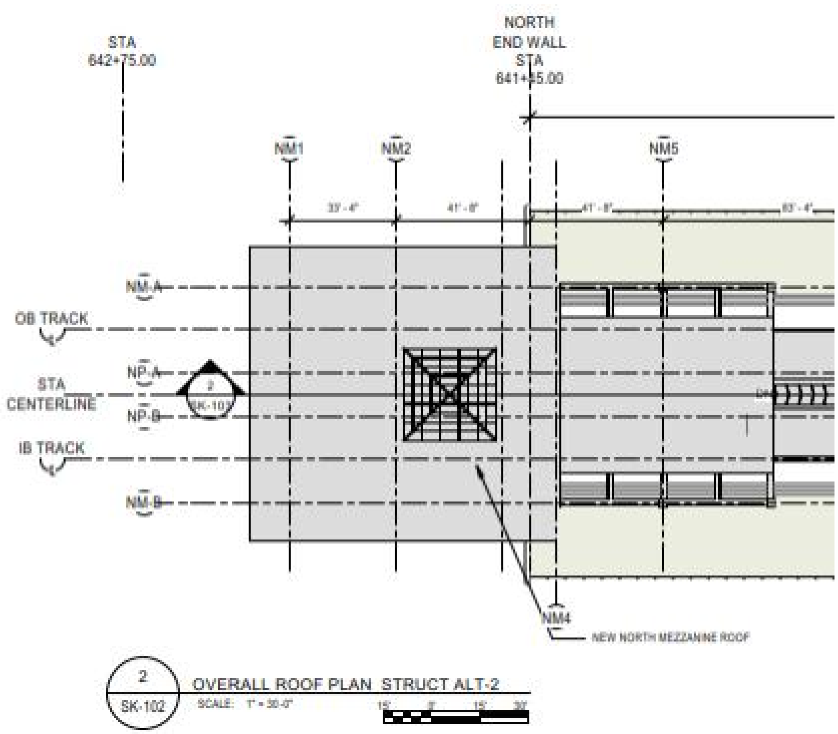
Figure 4-2 | Roof Plans

Alternative 1



Source: KGP Design Studio

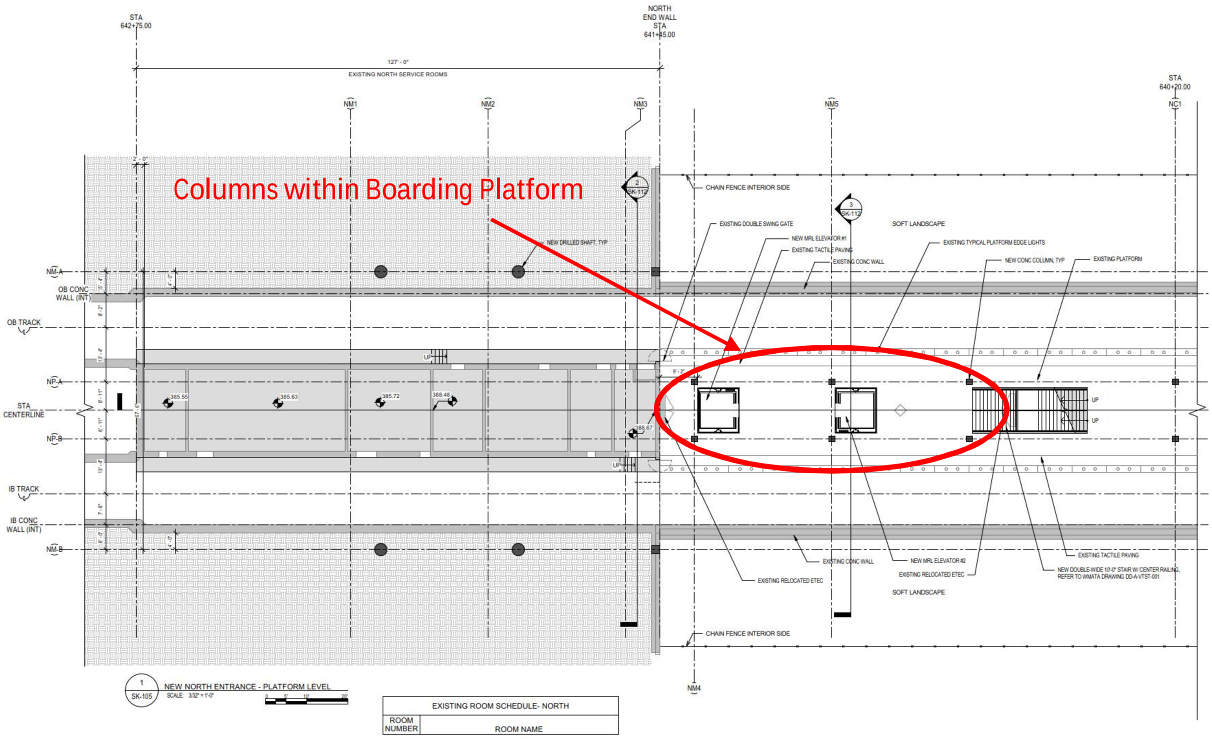
Alternative 2



Source: KGP Design Studio

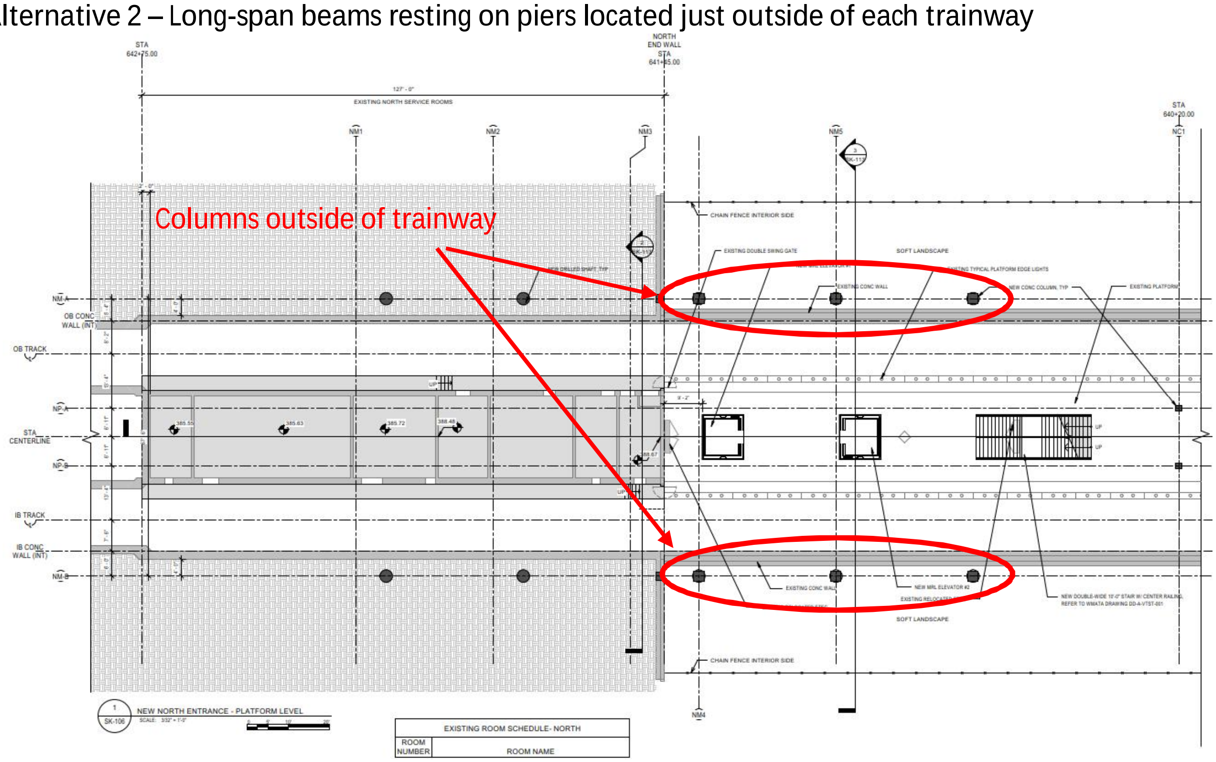
Figure 4-3 | Mezzanine Structural Approaches

Alternative 1 – Tapered beams resting on columns within the boarding platform



Source: KGP Design Studio

Alternative 2 – Long-span beams resting on piers located just outside of each trainway



Source: KGP Design Studio

Height Differential: Existing Sidewalk to New Entry Finished Floor

Both Alternatives 1 and 2 take the approach of providing the lowest possible finished floor elevation for the new entrance. This approach was adopted early on by the design team with the intent of eliminating the need for ADA ramps or elevators having to be provided along the approach to the new entrance. After reviewing Old Georgetown Road as-builts, in combination with the station as-builts and proposed design, the design team confirmed that no ADA ramps or elevators will be required, however inclined sidewalks will be needed as the new entrance will sit at a slightly higher elevation than the existing adjacent sidewalks.

4.3 Elevator Evaluation

The improvements proposed under this project include the installation of two new elevators which would serve the platform level. The invert slab of the existing White Flint Metrorail Station is 4'-10" below the platform's finished floor level and the travel distance for these two elevators is approximately 15' from the existing boarding platform to the proposed new entrance mezzanine.

Metro has provided two options to consider for these elevators: holeless hydraulic and machine room-less traction. This section summarizes the characteristics and challenges of each type of elevator.

4.3.1 Overview: Holeless Hydraulic Elevators

Holeless hydraulic elevators consist of an elevator cab and platform suspended by one or two hydraulic pistons installed within the elevator hoistway. These hydraulic pistons are connected to a pump unit in an elevator machine room which provides the motive force to move the car. As the pump increases hydraulic pressure in the piston, the elevator will rise, while a decrease in pressure causes the elevator to descend.

A holeless hydraulic elevator has a maximum travel distance of about 20-0" with single-stage jacks and 40'-0" with the use of multi-stage jacks. [1] The maximum speed of holeless hydraulic elevators is approximately 150 feet/minute, however, most are designed to travel at a standard 100 feet/minute. These elevators typically require 4'-0" clear pit depths, but may require up to 4'-6" when traveling at 150 ft/min.

WMATA Design Criteria requires one 224 square foot elevator machine room for each hydraulic type elevator. WMATA will consider a smaller footprint for an elevator machine room that accommodates

[1] A single stage jack is the most common elevator jack used for short travel distances. A single stage jack utilizes a piston that goes up and down and does not telescope when it reaches a certain height. A multi-stage or telescopic jack can have up to four pistons, each traveling inside each other.

multiple elevator machinery depending on verification of the adequacy of the equipment layout and required clearances.

4.3.2 Overview: Machine Room-Less (MRL) Elevators

MRLs are a unique variety of gearless traction elevator. All traction elevators are provided with a traction machine that powers a drive sheave which hoist ropes pass over (typically either steel wire rope or steel-lined polymer belts). These ropes are connected on one end to the elevator platform/cab and the other end to a counterweight, thus providing a more balanced load on the traction machine. As the drive sheave rotates, the elevator car is moved up or down.

The traction machine for an MRL is installed inside the hoistway instead of a separate machine room. There are many options for the location of the elevator controller and ancillary electrical equipment, including embedded in the elevator jamb. However, if implemented at the White Flint Metrorail station, Metro would require a remote-control room or closet to house this equipment to enhance maintainability and reliability of equipment. Therefore, the MRL moniker may be confusing; while an elevator machine room is not needed for an MRL because the machine is in the shaft, a control room or closet is recommended in all cases as requested by Metro. There are options for locating the control panel within the hoistway, however this is not recommended or permitted by Metro.

MRLs have many different models, so standard operating values will depend on the manufacturer and model selected. Metro has indicated that they are currently evaluating and would be willing to consider two models for MRL applications within the Metro system: KONE EcoSpace and Schindler 3300XL. These models have maximum travel distances of about 50'and 100', respectively, with travel speeds of either 150 ft/min or 200 ft/min. These elevators typically require 5'-0" deep pits but can be custom engineered for reduced pit depths if necessary.

Although MRLs are not currently included in WMATA's Design Criteria, the option to consider MRL elevators under this task has been approved by Metro. If MRLs are to be used, Metro has confirmed that a minimum of 168 square foot control room must be provided for each control panel. Metro will consider a smaller footprint for an elevator control room that accommodates multiple elevator control panels depending on verification of the adequacy of the equipment layout and required clearances.

4.3.3 Application at White Flint: Holeless vs. MRL

The following factors must be considered when evaluating a holeless or MRL application for the White Flint Metrorail Station:

- Non-Proprietary Equipment: Holeless hydraulic elevators can be easily procured utilizing non-proprietary, third-party equipment. This will allow all parties, including Metro staff, to easily obtain parts and equipment from the vendors without restriction. The MRL elevators under Metro's consideration use proprietary technology. Documentation is not shared without express authorization of that vendor.

- Environmental Factors: The holeless hydraulic elevator utilizes hydraulic fluid, while the MRL elevator does not, offering a “greener” option.
- Power Requirements: The holeless hydraulic elevator will typically require a motor two or three times larger than an equivalently sized MRL elevator.
- Durability: The durability of MRL equipment in a transit environment is different from that of hydraulic. Metro typically installs glass elevator cabs, while MRLs have cab weight restrictions which may not be able to accommodate glass cabs. Further discussions will also be necessary with the MRL vendors to ensure vandal-proof, urine-resistant, durable equipment can be provided at a reasonable cost. These concerns are not applicable to holeless hydraulic elevators.
- Outdoor Installation: The drive machines of MRLs consist of permanent magnets and other electrical equipment, which must be climate controlled – typically between 41ºF and 104ºF (5ºC and 40ºC) at all times with < 95% humidity, non-condensing. As such, when used outdoors, the top of an MRL hoistway typically requires small heaters and cooling equipment. Temperature can also affect hydraulic elevator performance but can be easily remedied with controller options and do not require providing HVAC equipment inside the hoistway.
- Machine/Control Room: Both elevator types will require remote rooms. The holeless hydraulic elevator will require a machine room and has few limitations on location or distance from the hoistway. The MRL will require a control room, which must be located no more than 150’ away from the top of the hoistway due to electrical signal concerns.
- Pit Depths: A standard holeless hydraulic elevator requires a pit depth of either 4’-0” or 4’-6”, while an MRL typically requires a 5’-0” pit depth. Depending on the existing condition of the station and the available clear height of the under-platform space, one type may be better suited than the other. Although vendors are able to customize their MRLs to use smaller pit depths, this custom engineering would likely increase cost significantly while removing the pre-engineered benefits of an MRL.
- Familiarity to Metro: As of October 11, 2018, Metro maintained over 150 hydraulic elevators of various capacities, while having zero MRLs installed and three under construction.

4.3.4 Elevator Pit Sump Pump/Drainage

Either elevator type selected will need to address hoistway sump pump/drainage concerns. The Elevator Code, ASME A17.1, requires elevators with Firefighters’ Emergency Operation (nearly all elevators) to be provided with a drain or sump to remove water from the pit. The Code also requires the pit floor to be level, thereby requiring any sump pumps to be installed in sump pits with level covers.

Due to the available height of the under-platform space at the White Flint Metrorail Station, a typical sump pump/pit installation in the hoistway would require modification to the invert slab to house the sump pump. Instead of a sump pump, a gravity drainage pipe may be provided which would empty onto the adjacent track slab. If the distances involved are acceptable to allow the drainage pipe pitch, this is the recommended option for drainage. Alternatively, a suction sump pump system may be provided. This scenario would permit the sump pump installation outside the hoistway, thus allowing the invert slab to remain untouched. Final approach to sump pump drainage to be developed during Preliminary Engineering and to be reviewed and approved by Metro.

4.4 Geotechnical

This section documents the geotechnical approach for the proposed improvements. Figure 4-4 on the following page illustrates the geologic subsurface profile. Previous soil borings drilled in the area of the new north entrance indicate that about 3’ to 7’ of loose fill soils are present at the ground surface. The upper fill soils are underlain by medium dense to compact sandy silt soils to a depth of about 35’ to 45’, which are in-turn underlain by very dense disintegrated rock/decomposed rock. The soil borings in the area did not encounter bedrock, but the bedrock is expected to consist of Schistose Gneiss at a depth of about 80’ to 110’ below existing ground surface grades, based on other soil borings drilled in the surrounding area. Previous soil borings by Metro did not extend to bedrock.

It is expected that new foundations required for the new entrance improvements can consist of drilled shafts (caissons). Drilled shafts can be designed for an allowable end bearing pressure of 25 ksf when supported on very compact Disintegrated Rock/Decomposed Rock. It is anticipated that drilled shafts can be terminated at a depth of about 70’ to 75’ below existing grades, or at about El. 335.

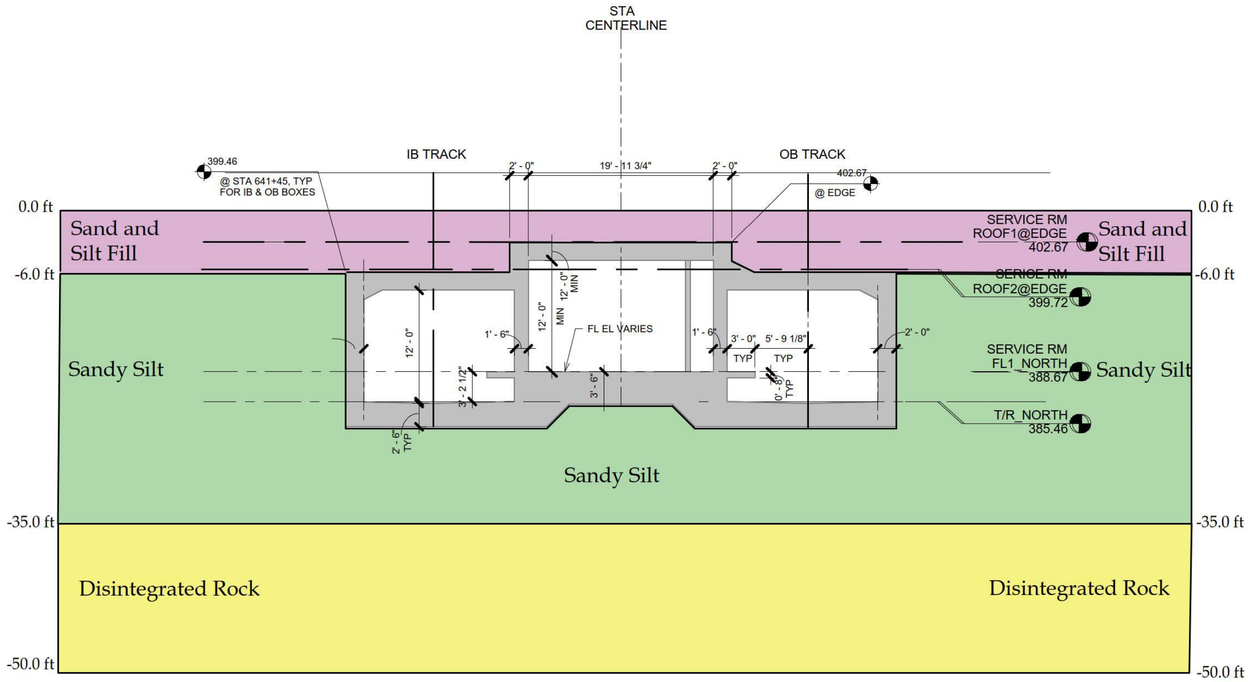
Micropiles terminated in bedrock are also considered a feasible foundation alternative if space restrictions preclude the use of drilled shafts. Micropiles would likely be about 7” or 9” in diameter, would be drilled into the bedrock, and would likely extend about 12’ to 20’ into the bedrock. Most of their load carrying capacity would be derived from skin friction in the bedrock. Micropiles have the advantage that they can be constructed using small, portable equipment in low headroom conditions. Also, micropiles would have less risk associated with ground water or changes in soil conditions. Micropiles have the disadvantage that they are more expensive than shallow foundations, drilled shafts, or auger-cast piles.

Ground supported floor slabs are feasible and can be supported directly on existing fill soils, new compacted fill soils, or natural soils. It is possible that existing fill soils may be soft in areas and some selective undercutting and replacement of loose existing fill soils may be required. Undercut soils can be replaced with new compacted fill.

Ground water is expected at depths of about 11’ to 13’ below existing grades (El. 385 to El. 392). Therefore, dewatering of excavations will be needed. Ground water flows are not expected to be significant and it should be feasible to control ground water with sumps and collector trenches.

Support of Excavation (SOE) systems may be needed if sufficient space is not available for sloped excavations. It should be feasible to install conventional steel H-pile and wood lagging SOE systems Rock excavation using hoe-ramming or blasting to reach the bottoms of the excavations is generally not expected to be needed.

Figure 4-4 | Geotechnical Subsurface Profile



Source: AECOM

4.5 Structure

To evaluate technical feasibility and to support the development of project costs, preliminary structural approaches were developed and assessed for three primary areas: the portion of the entry located on grade, the over-platform mezzanine under the Alternative 1 approach, and the same for the Alternative 2 approach. An initial review of as-built documents, in combination with the site visit, resulted in the identification of existing loads as well as candidate load paths for the proposed new entrance, mezzanine, and associated structures.

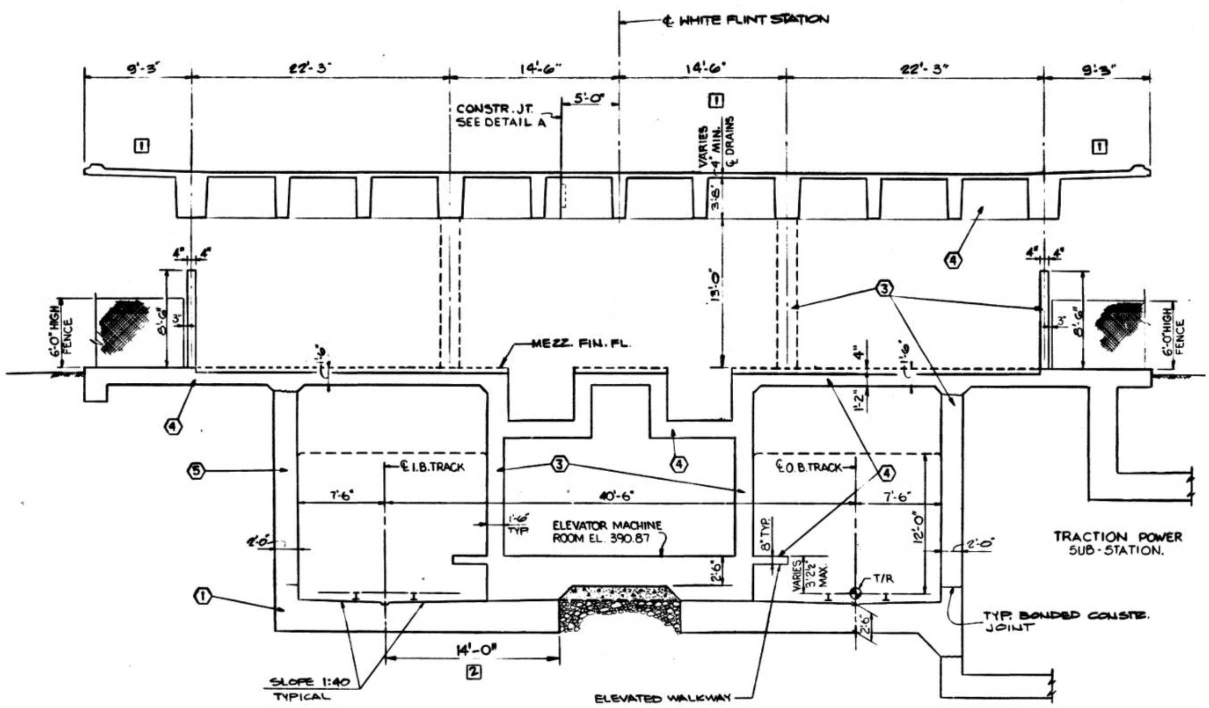
4.5.1 Existing Conditions

The existing White Flint Metrorail Station is configured with a south entrance at ground level, which is connected to the boarding platform below via two escalators and a single elevator. Roughly 300' of the 600' boarding platform is weather protected on the southern end by a canopy structure. The station has several underground service rooms to the north of the boarding platform that are located directly under the area where the new entrance is proposed. Site inspection confirmed that there is little to no room within these service rooms to accommodate any structural members for the new entry.

As-built drawings show the existing south mezzanine entrance employing a slab-on-grade approach with the roof-supporting columns bearing directly on the slab (A14-S-31 see Figure 4-5). Station as-builts also show the existing platform canopy supported by columns that penetrate the platform slab and rest on the existing invert slab below (A14-S-26 - see Figure 4-6). The distance between the underside of the platform slab and the top of the invert slab measures approximately 3'-9" high. During the January 17th, 2019 site visit, a platform manhole was opened by Metro staff (see Figure 4-7) to allow the team to visually inspect the existing conditions of the under-platform space. From what was observed, the under-platform area is empty except for a single standpipe. Due to the size of the manhole, line of sight was limited to a small area near the north end of the platform.

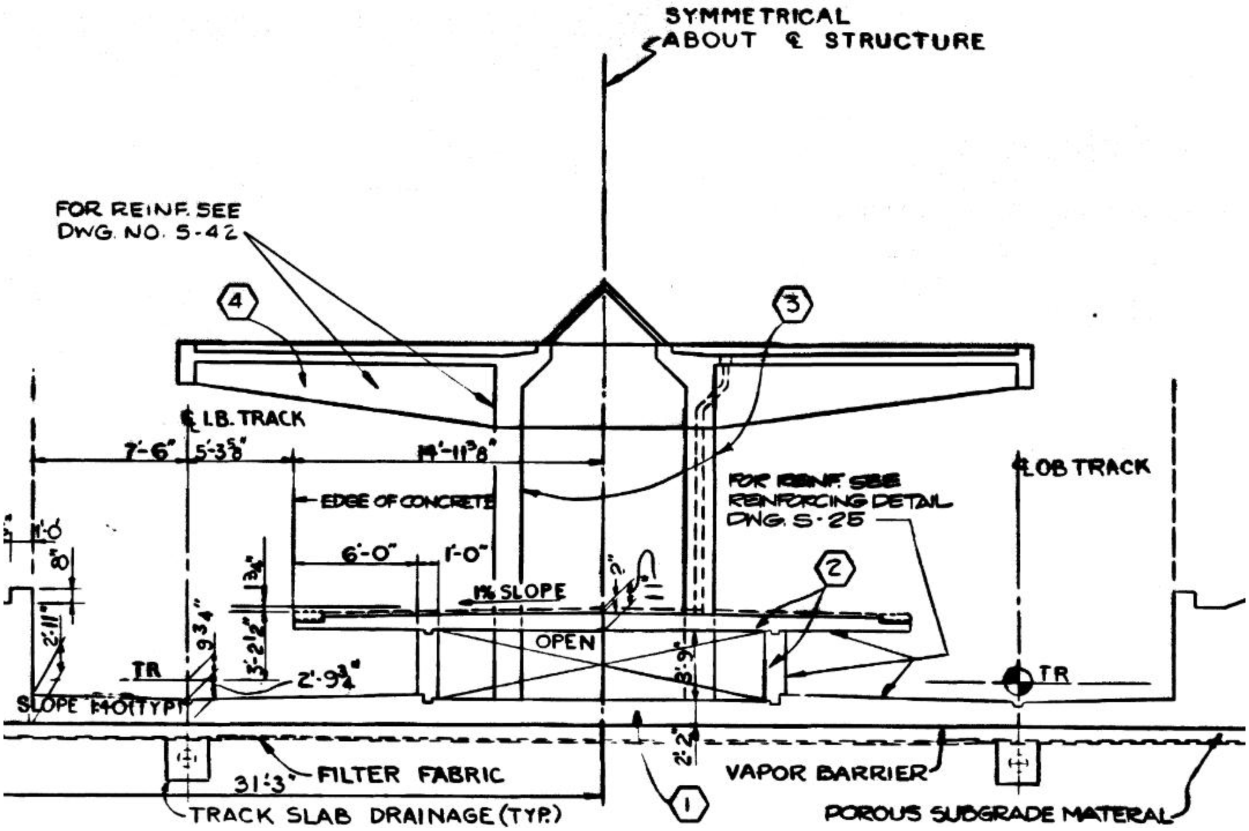
The existing cut-and-cover tunnel to the north of the station is currently supporting a significant amount of backfill. As-built drawings of this area (A14-S-21 - see Figure 4-8) show a finished grade depth of 1.5' at the southernmost edge, however observations during the site visit revealed that additional soil has been added since the station was originally constructed (see Figure 4-9 and Figure 4-10) which has raised the finished surface grade by several feet.

Figure 4-5 | Cross Section of Existing South Mezzanine – Slab on Grade



Source: WMATA As-Built Drawing A14-S-31

Figure 4-6 | Cross Section of Existing Platform – Canopy Columns Supported on Invert

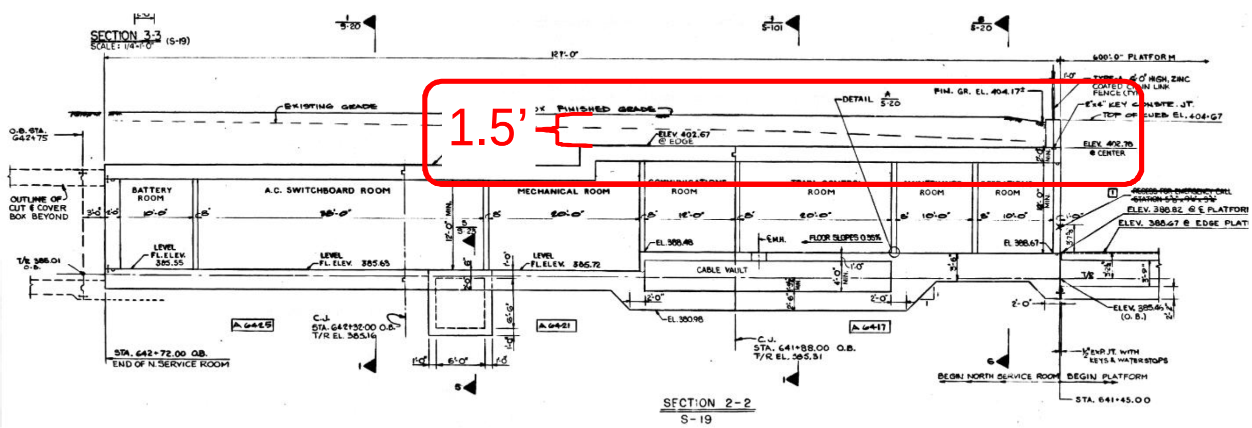


Source: WMATA As-Built Drawing A14-S-26

Figure 4-7 | Site Visit Photo – Platform Manhole Removed with Standpipe Visible

Source: January 17th, 2019 Site Visit

Figure 4-8 | Long Section of Existing Cut-and-Cover Tunnel – Finished Grade Depth of 1.5’



Source: WMATA As-Built Drawing A14-S-21

Figure 4-9 | Site Visit Photo – Additional Soil Cover Over Existing Tunnel: Looking North

Source: January 17th, 2019 Site Visit

Figure 4-10 | Site Visit Photo – Additional Soil Cover Over Existing Tunnel: Looking South

Source: January 17th, 2019 Site Visit

4.5.2 Preliminary Design Approach

The structural approach for all the station elements in both alternatives is the same, with the exception of the support structure for the new mezzanine over the existing station platform. In developing structural concepts, a high priority was placed on minimizing the new entrance's finished floor elevation and developing structural solutions that resulted in minimum impacts to the invert slab.

The following assumptions were made in considering the structural systems for the new entrance and associated structures:

- Evaluations are based on the as-built drawings received from WMATA, in addition to information gathered on the January 17th, 2019 site visit;
- Per WMATA Design Criteria, structural precast concrete was not to be considered as it is not permitted for stations;
- Per WMATA Design Criteria, the existing cut and cover tunnel was designed for an assumed future cover of 8' plus a uniform live load of 300 psf or it was designed for the actual depth of cover plus superimposed HS 20-44 wheel load whichever governs the design;
- An elevator type will be chosen that does not require penetrations through the invert slab; and
- Penetrations through the existing invert slab are limited to those required to accommodate micropiles.

4.5.3 Alternatives Development and Refinement

Using the revised entrance layout configuration as a starting point, and working under the assumptions above, structural approaches were developed for the entrance level, roof level, platform canopy extension, and elevators. For the area of the entrance that is located over the existing boarding platform, two separate approaches were developed: Alternative 1, with tapered beams resting on columns within the platform that rest on micropiles below the invert slab, and Alternative 2, with deep long-span beams spanning over the platform and resting on piers located just outside each of the trainways. Concept drawings for each of these alternatives are included in Appendix A.

Entrance Level

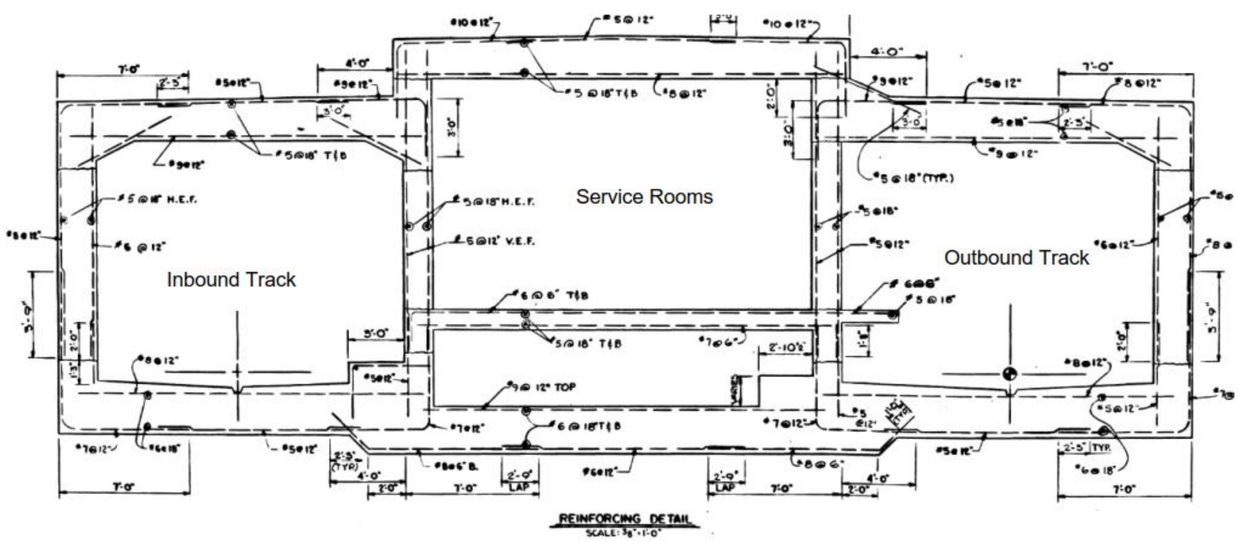
Located at street level, the new mezzanine consists of two distinct areas. The first area consists of an open area that comprises the proposed new entrance to the station, which is located above the existing north cut-and-cover tunnel structure. The second area consists of the structure located above the north end of the existing boarding platform. Due to the difference in geometry of the proposed areas and a resulting difference in structural behavior, an expansion joint between these two areas is required.

At Grade

For the portion of entrance located at grade, and over the existing tunnels to the north, an initial alternative was assessed. This alternative focused on supporting the new mezzanine over the existing tunnels with deep long-span grade beams supported on drilled shafts. Due to the long span and the heavy loads expected in this area, the structural members would have to be either prestressed concrete beams or very deep reinforced concrete spaced at 16’-10”. Because this option would have resulted in raising the elevation of the mezzanine’s finished floor by several feet, creating significant access challenges both to the street and to the platform below, other options were explored for supporting the area over the existing tunnels.

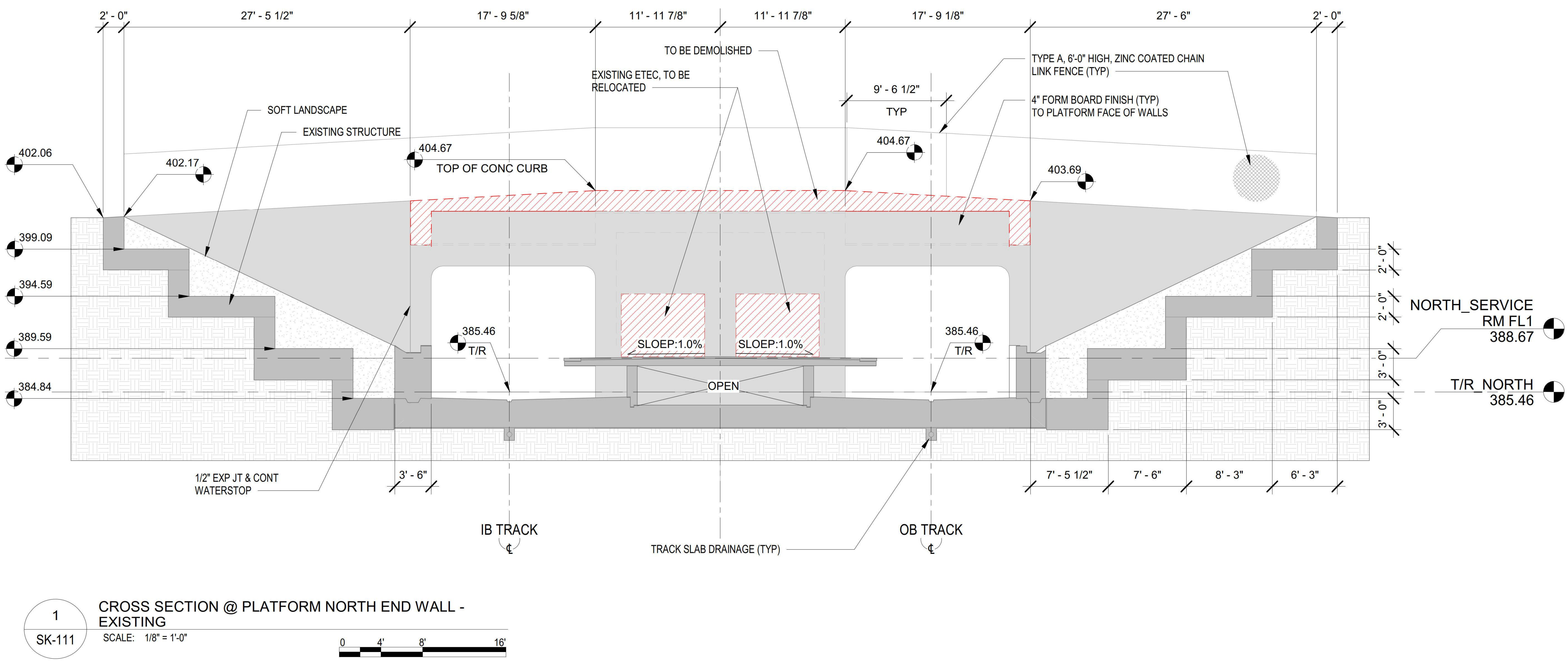
Further review of the station’s as-built drawings (A14-S-101 - see Figure 4-11), site visit observations, and further investigation of the original WMATA Design Criteria for the station, revealed that the cut-and-cover tunnel was designed for a significant surcharge load that could support the at-grade portion of the mezzanine. This resulted in a slab-on-grade approach being developed for the area over the existing tunnels. In order to further minimize the finished floor elevation of the new entrance, a portion of the existing end-wall to the north was proposed to be demolished to accommodate the new slab-on-grade of the new entrance (see Figure 4-12). This approach avoids the need for a long span structure over the tunnel, and results in a simpler, more constructible, less expensive structure, with the lowest possible entrance finished floor elevation.

Figure 4-11 | Cross Section of Existing Cut-and-Cover Tunnel



Source: WMATA As-built drawing A14-S-101

Figure 4-12 | Cross Section – Platform North End Wall Local Demolition



Source: KGP Design Studio

Over the Boarding Platform

For the area of new mezzanine located over the existing boarding platform, two alternatives were developed; Alternative 1 and Alternative 2.

Alternative 1 consists of two parallel longitudinal concrete frames in the north-south direction of the station and three transverse concrete frames in the east-west direction of the station. The transverse frames are designed with tapered beams that cantilever over a portion of the existing trainway. Support for these frames is provided by concrete columns, which penetrate the existing concrete platform slab and rest on beams above the invert slab that are supported by micropiles that pass through the invert slab and penetrate into the bedrock below the station. Additional concrete or steel frame reinforcement will be needed in the areas where the platform slab is penetrated, and additional footings will be required at the invert slab level.

Under Alternative 2, support to the frames in the short direction of the station is provided by piers located outside the track limits that are supported on drilled shafts. In this alternative, deep long-span reinforced concrete beams are required to span across both tracks and the boarding platform. In the longitudinal direction, transfer beams support a cast in place concrete slab that is required between the concrete frames running in the short direction.

Roof Level

The roof consists of two distinct areas: the roof of the new entrance which is located on grade and the roof of the new mezzanine which is located directly above the boarding platform.

At Grade

For the roof above the at-grade portion, deep long-span beams run in the east-west direction and are supported on concrete columns. These concrete columns, in turn, are supported on deep drilled shafts that are located directly adjacent to, and outside of, the existing cut-and-cover tunnels. This approach avoids having to place concentrated loads on the existing tunnel. Transfer, intermediate, and transverse beams are required between these long span beams. All beams have cantilevered end spans to support the desired architectural aesthetics of the roofline.

Over the Boarding Platform

Under Alternative 1, the roof area above the mezzanine area extending over the boarding platform is supported by a similar framing approach to that developed for the at-grade entrance portion of the entrance. In this area, the roof is supported by a structural frame where the longitudinal beams extend to the bay where the stairs are located and connect to the next frame in the short direction. This short direction frame is the first canopy roof frame and its support columns penetrate the existing concrete platform slab and rest on beams above the invert slab that are supported by micropiles that pass through the invert slab and penetrate into the bedrock below the station.

Under Alternative 2, the structural approach to the roof in this area is similar to the approach developed under Alternative 1. The difference under Alternative 2 is that the roof loads are supported on piers located outside of each trainway, rather than on columns located within the boarding platform.

Platform Canopy Extension

For the platform canopy extension, the new portion of canopy is supported in a similar way as the existing station canopy (A14-S-26 – see Figure 4-6) by locally penetrating the concrete boarding platform and installing columns that are supported on the existing invert slab below. Under this approach, the columns of the new station canopy penetrate through the platform and tie into the invert slab below with minimal interference. If obstructions, such as conduits, are encountered or discovered during Preliminary Engineering they would need to be shifted to avoid interference with the proposed columns. To support the weight of the new canopy, footings will be required, and the invert slab may need to be thickened to help spread the load.

An expansion joint is required where the new and existing platform canopies meet in order to keep the structures separate and to relieve stresses due to induced movement caused by thermal expansion.

Coordination of the canopy extension and the planned future bridge over Metro's boarding platform and right-of-way should occur as the two projects move forward into Preliminary Engineering. Accommodating the future bridge may require a portion of the canopy extension to be removed from the design.

Elevators

Openings are required in the existing boarding platform to install the two new elevators. This will require additional concrete or steel framing around the new openings for support. A key assumption under this study was that the existing invert slab would not need to be penetrated to accommodate elevators as an elevator type and configuration would be chosen to fit the existing condition.

Invert Slab Analysis

A structural analysis was performed to determine if the capacity of the invert slab was adequate to meet the additional loading from the proposed over-platform entrance structure. A strip section of the slab was modeled using SAP2000 (a finite element analysis program), with soil springs based on boring logs provided in the as-builts. Loads were developed and applicable load combinations were applied per WMATA Design Criteria and ASCE 7-16. Loads include Dead Load, Live Load (pedestrian and train), Roof Live Load, Snow Live Load, Elevator Live Load, Wind Load, and Horizontal Earth Pressure. Resulting forces were checked against the as-built details.

It was determined that the slab alone was not adequate for the new loading conditions. The proposed mezzanine and canopy loads exceed the capacity of the invert slab. A separate analysis was performed to determine if the slab was adequate for the elevator loading only. Results show that the slab does have enough capacity for the elevator loading. An option to support the mezzanine and roof canopy independently of the invert slab is to install two or more micropiles at each mezzanine column location with a grade beam between the series of micropiles. This will allow the load from the mezzanine columns to be transferred to the micropiles instead of the invert slab.

The use of micropiles is considered feasible for the support of the new loading. Micropiles would need to extend into bedrock and would derive their load carrying capacity primarily in skin friction between the micropile grout and the bedrock at the site. It is anticipated that 7” or 9” diameter micropiles can be designed for allowable vertical capacities of about 150 to 220 kips per micropile, and that micropiles would need to extend about 20 to 30 feet into bedrock. Bedrock is expected to be present at an average depth of about 90 feet below existing grades at the site or at about El. 310. Therefore, micropiles would terminate at a tip elevation of about El. 280 to El. 290. The actual location of bedrock should be verified by a subsurface exploration and sampling program.

For constructability of the micropiles there are two main considerations: equipment accessibility to the site and the weight of the equipment on the existing platform. Typical drill rigs are about 4’ wide by 12’ long and it is anticipated that they can be lifted by a crane onto the platform or transported via flatbed rail if needed. If the weight of the drill rig exceeds the capacity of the platform slab, temporary shoring can be installed between the platform slab and the invert slab to handle the loading from the rig. Additionally, because the ground water level is above the invert slab, pore water pressure is a concern. Once the slab is penetrated the water flow will have to be contained and a sealing system will be required after the micropiles are installed.

4.6 Mechanical

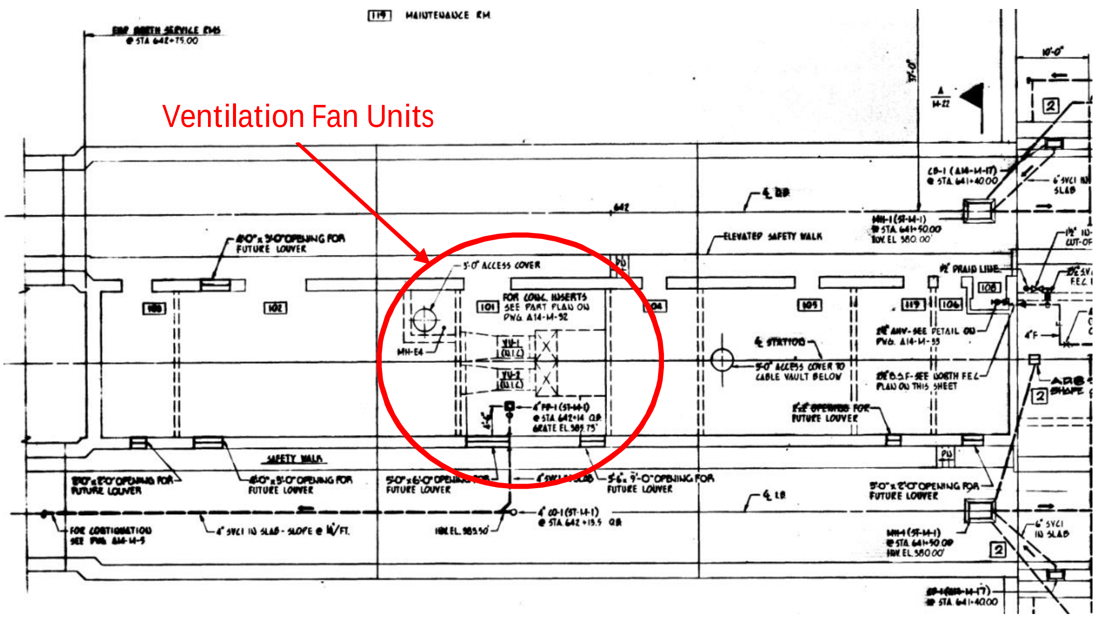
This section documents the existing conditions, design approach, and assumptions taken by the mechanical discipline in helping to develop and assess the alternatives under this study.

4.6.1 Existing Conditions

An understanding of the station’s existing condition was established through the review of available as-built documents and verified through the project site visit held on Wednesday, January 16th, 2019. As-built mechanical drawing A14-M-15 (Figure 4-13) shows the approximate locations of the ventilation fan units that are located within the underground service rooms at the north end of the station. These fans service the adjacent electrical and communication rooms. The existing mechanical system does not have any active cooling or heating elements, and therefore no hydronic services are available at the north end of the station. Additionally, it was found that the existing mechanical systems located on the south end of the station are not connected to the north end of the station. This suggests that the two ends of the station are mechanically isolated, however this should be verified by a thorough under-platform survey during Preliminary Engineering.

The project team surveyed underground service rooms located directly north of and adjacent to the boarding platform. In the mechanical room, the project team identified and confirmed the location of the two ventilation fan units that were found in the as-builts. The fan units' associated ductwork was visually traced to the adjacent electrical and communication rooms, confirming that the existing fan units serve these room. Out on the boarding platform, one of the manhole covers near the north end was opened by Metro staff so the project team could visually inspect the under-platform space. Only a single dry fire protection standpipe was observed in the space, however sightlines were limited to the area visible from the single manhole.

Figure 4-13 | Ventilation Fan Units – North End Service Rooms



4.6.2 Preliminary Design Approach

The design approach for mechanical systems is the same for both alternatives, which is to independently support the new north entrance and its required service rooms. The preliminary program for the new entrance calls for one public restroom, one employee restroom, electrical room, communications room, elevator control/machine room, water service room, and a station manager's kiosk. The new entrance layout for both Alternative 1 and 2 can accommodate either hydraulic or MRL type elevators, and depending on which is chosen, there will be different mechanical needs to accommodate the specific type. Irrespective, the proposed new entrance layout and configuration will be able to accommodate the mechanical needs of either.

The restrooms and electrical room both require a fresh air intake and exhaust of hot/polluted air along with heat during the winter months to maintain a minimum temperature setpoint. It is assumed the heat will be provided by electric unit heaters, and no active cooling is required for these spaces. For ventilation, the approach developed under this study is to utilize air exchange and louvers on the doors for fresh air in, and an exhaust fan to extract the hot/polluted air out. Alternatively, wall mounted transfer grills could be used to accommodate air exchange. Final approach to be proposed during Preliminary Engineering and to be reviewed and approved by Metro.

The station manager's kiosk and the communication rooms require both active cooling and heating as these spaces have normally occupied personnel and critical equipment. The design approach is to use a self-contained roof/ceiling mounted fan coil unit to regulate the air. The unit will be exposed to the environment to provide the code mandated fresh air. Also, the kiosk and communication rooms will have louvers for exhausting hot air to the environment and will be under slight positive pressure.

Similar to the existing south entrance, the remainder of the station is open to the environment requiring no additional active cooling, heating, or ventilation.

The following assumptions were made in considering the mechanical design and evaluation of the new entrance and its required rooms:

- The WMATA design drawings provided to the project team provide a reasonably accurate representation of the as-built conditions. The primary source of mechanical information for the evaluation is the WMATA drawing set titled "Rockville Route, Mechanical, 1A0141 M-0281, February 1977";
- The new mezzanine requires HVAC for non-public spaces in keeping with levels provided at other similar concourses/mezzanines that are open to the environment. Similar to the existing south entrance, the public spaces in the new north entrance will not require HVAC systems;
- The proposed HVAC design considers limitations in hydronic piping supply and therefore utilizes localized heating and cooling means for the individual rooms;
- The proposed design does not interrupt nor interconnect with the existing HVAC systems at the north end mechanical rooms; and
- If MRL type elevators are chosen, there are no additional HVAC systems needed. However, if a conventional hydraulic elevator machine room is required, then an active heating & ventilation system will be required to maintain temperature in accordance with the WMATA Design Criteria.

4.6.3 Alternatives Development and Refinement

To evaluate the technical feasibility of the proposed improvements, the new entrance layout was evaluated and refined to ensure critical dimensions and to ensure that clear distances from mechanical equipment were acceptable. Priorities for the HVAC system evaluation and design included:

1) Providing heating, cooling, and ventilation as required for each of the new entrance spaces:

- Water service room
- Electrical room
- Telecom systems room
- Corridor & Fire Emergency Cabinet (FEC)

- Cleaner's room
- Restrooms
- Station manager's kiosk
- Elevator control/machine room

2) Ensure that the required modifications to the HVAC system do not interfere with operation of any existing ventilation system and that all new HVAC control sequences are integrated and coordinated with existing and future sequences.

To accommodate these priorities, it is envisioned that the new entrance's HVAC systems will:

- Provide localized conditioning for remote spaces in the new mezzanine and avoid bulky crossover ducting;
- Provide electric unit heaters in each of the individual restrooms along with dedicated ventilation exhaust fans mounted on the exterior wall for direct exhaust;
- Provide electric unit heaters in the ancillary rooms, along with exterior wall mounted exhaust fans for direct ventilation, as required;
- Provide a ductless split system for the new communications room and station manager's kiosk; and
- All spaces shall utilize air exchange louvers on the door for fresh air intake.

The approach above assumes that the new north entrance will continue to be an open, non-enclosed space, and maintain natural ventilation. This approach is like the existing south entrance design.

4.7 Electrical

This section documents the existing conditions, design approach, and assumptions taken by the electrical discipline in helping to develop and assess the alternatives under this study.

4.7.1 Existing Conditions

An understanding of the station's existing condition was established through the review of available as-built documents and verified through the project site visit held on Wednesday, January 16th, 2019. The as-built electrical drawings[2] for the station show the approximate locations of conduits embedded in the invert slab located below the underground service rooms to the north, and those that are located within the void space of the under-platform area. It appears from the review of the drawings that most of these conduits are spare and terminate at the under-platform area. Some of the conduits which are not spare include the conduits between the north and south substation, the feeds to the platform edge

[2] Drawings of specific interest are A14-E-7, A14-E-8, A14-E-16 and A14-E-49. See attached red-line mark-ups in Appendix D.

lights and the feeds to the center platform pylons. The as-built electrical drawings reviewed by the design team did not include a one-line diagram or electrical equipment layouts for the switchgear rooms, however these may be included in other contract drawings. One-line diagram and electrical layouts for switchgear rooms should be reviewed and confirmed during Preliminary Engineering.

During the site visit, the project team surveyed underground service rooms located directly north of and adjacent to the boarding platform. The electrical switchgear room contains most of the electrical equipment which services the existing north end of the station, including the boarding platform, the underground service rooms to the north, and a stretch of tunnel further north of the underground service rooms. The electrical switchgear room contains a 1000KVA substation with a 1600A main circuit breaker disconnect. There is also a secondary tie breaker that backs up a second switchboard located in the south substation. Also, there is a circuit breaker for a temporary portable generator connection. The switchboard consists of four breaker sections with several spare circuit breakers and spaces for an additional breaker to be added.

An uninterruptible power supply (UPS) is also located in the electrical switchgear room, which is backed up by the bank of batteries located in the adjacent battery room. The UPS feeds the two “essential” power panels that are in the switchgear room. Also located in the electrical switchgear room are several 480/277V and 208/120V branch circuit panelboards, in addition to two small step-down transformers. Most of the useful wall space in the room is occupied by existing electrical equipment serving the station.

Electrical manhole, E4, is located below the slab with the manhole cover in front of the substation equipment. The battery room contains batteries, a battery disconnect, and a DC power panel. The electrical switchgear room contains a branch circuit panel dedicated to equipment within that room.

Out on the boarding platform, one of the manhole covers near the north end was opened by Metro staff so the project team could visually inspect the under-platform space. Only a single loose conduit was observed in the space, however sightlines were limited to the area visible from the single manhole.

4.7.2 Preliminary Design Approach

The design approach for electrical systems is the same for both alternatives. After receiving demand load data in the form of PEPCO bills from Metro, the project team performed a load calculation for the PEPCO services on the north and south substations using estimated loads for known equipment which will be included in the design of the new north entrance. Based on this calculation (see Appendix D), it was determined that the existing PEPCO services have enough spare capacity to serve the anticipated future loads.

The preliminary design approach for the electrical systems is to utilize the existing unused breaker space in the existing north substation to provide a new 400A/3P circuit breaker. This will feed a new 400A 480/277V panelboard located in the new electrical cabinet room. A 75 KVA step down transformer will be provided with a 200A 208/120V panelboard serving the kiosk, fare vending equipment, fare gates, and other 120V loads.

The elevators will be fed from existing spare fused disconnects in the existing essential power panel in the switchgear room. This essential panel will also serve the additional emergency lighting loads that will be required in the new entrance. This panel must be metered to ensure that there is sufficient spare capacity to serve these loads.

The following assumptions were made in considering the electrical design and evaluation of the new entrance and its required rooms:

- Conduits connecting the two tie breakers are installed in the under-platform plenum, below the return air duct opening, as shown on as-built drawings A14-E-7 and A14-E-49;
- A load calculation was performed based on 1 year of PEPCO electricity bills for both the north and south electrical services. It was determined based on this information and estimated values for the new electrical loads associated with the new north station entrance, that there is sufficient spare electrical capacity in the system for the new loads;
- The existing empty space in the north AC switchboard can be fitted with a new 3-pole 400A circuit breaker to serve the new electric cabinet room which will be located on the mezzanine of the new north station entrance; and
- Spare circuit breakers in the essential panelboards, backed up by battery/UPS, in the north AC switchgear room can be utilized to serve elevators and emergency egress lighting. These panels should be metered to ensure that there is sufficient spare capacity to serve these loads.

4.7.3 Alternatives Development and Refinement

To evaluate the technical feasibility of the proposed improvements, the new entrance layout was evaluated and refined to ensure critical dimensions and clear distances from electrical equipment were acceptable. Priorities for the electrical system evaluation and design included:

Power

Power will be needed for the two elevators that serve the new station entrance, in addition to the lighting, HVAC, fare vending, electrical outlets, and additional miscellaneous electrical loads that are included in the improvement. The design approach for providing power is the same for both alternatives, and includes the following:

- Emergency power at the station is served by an UPS which is backed up by batteries located in the battery room adjacent to the AC switchgear room. This UPS feeds the essential AC switchboard and serves emergency and egress lighting loads;
- A new 480Y/277V panelboard, fed from the north essential AC switchboard and located in the new north electrical cabinet room on the mezzanine level, will be added to serve the new elevators, egress lighting, and exit signs;

- New non-essential panelboards will be in the new electrical cabinet room to serve normal 120V power for convenience receptacle and normal 480/277V power for general lighting and HVAC equipment. A new 480/277V 225A panelboard will be in the new electrical cabinet room. It will feed a 208/120V 150A panelboard via a 45 KVA step-down transformer, also located in the electrical cabinet room. If a future grade-separated pedestrian crossing is expected to have power provided from the new north entrance, then consideration should be given to the expected loads so that the electrical panels can be properly sized to accommodate future elevators, escalators, lighting, etc.
- Conduits and conductors for power and controls for the elevators will be run below the platform to the elevator pits;
- If depressions or modifications to the invert slab are found to be necessary in accommodating the elevators, they should be strategically located away from the existing electrical duct bank that runs below the bottom of the return air duct;
- Any existing conduit in the under-platform plenums that will be in the way of the new elevator pits will need to be rerouted or relocated. The proposed elevator pit will occupy part of the platform. The conduit can avoid these pits by being re-routed adjacent to the trainways on either side of the platform. Any non-power conduits will also need to be re-routed similarly; and
- A survey should be done to identify any conduits that will interfere with the new elevator pits and new under-platform structural elements such as columns, strengthening struts or invert slab thickening.

Lighting at North Station Entrance

The design approach for providing lighting is the same for both alternatives, and includes the following:

- Platform lighting will be provided by LED fixtures chosen to match the style of the existing fixtures that are mounted under the canopy at the south end of the platform; and
- Lighting in the new entrance will also be provided by LED fixtures chosen to match the style of the existing fixtures within the south entrance.

4.8 Plumbing

This section documents the existing conditions, design approach, and assumptions taken by the plumbing discipline in helping to develop and assess the alternatives under this study.

4.8.1 Existing Conditions

An understanding of the station's existing conditions was established through the review of available as-built documents and verified through the project site visit held on Wednesday, January 16th, 2019. As-built drawing A14-M-18 shows the south station entrance as having domestic water for use in the public restrooms. The existing lavatories utilize local electrically generated hot water. Additionally, sanitary services such as sanitary sewer and storm water management are available at the south station entrance. The existing station entrance utilizes a sanitary pump system for below grade drainage back into the gravity sewer main as seen on sheet A14-M-13 and A14-M-25.

At the north end of the station, as-built drawing A14-M-15 shows a sanitary sewer near the inbound track. On as-built drawing A14-M-15, a domestic water line is shown to be located underground just outside of the fence line to the east. Available opportunities to tie into an existing storm water management system at the north end is not clearly indicated on the as-built drawings, however Old Georgetown Road was constructed after the station and likely has these facilities available for the new entry to tie into.

During the site visit, the project team was granted access to the underground service rooms located directly adjacent to the north of the boarding platform. In the mechanical room, a floor drain was found that likely lead to an underground sanitary sewer main. Other than the single dry fire protection standpipe that was visible in the underplatform space, no additional plumbing services were visible from the platform manhole that was opened. The existing restrooms at the south entrance were not surveyed as they would not be impacted by the new design.

4.8.2 Preliminary Design Approach

The design approach for plumbing systems is the same for both alternatives, which is to independently support the new north entrance and is required service rooms. The programmatic plan currently calls for new restrooms and elevators.

Restrooms would be tied into the existing underground domestic water service outside of the fence line. To provide hot water, new electric instant-hot water heaters are provided under the lavatories. New sanitary lines are tied into the existing sanitary sewer main under the in-bound track, providing gravity-flow to the existing.

The new elevator pits drain to the existing sanitary sewer main on the north end.

The new entrance and platform canopy will require stormwater mitigation. The preliminary design approach for stormwater assumes that a system of roof drains and rain leaders would collect and rout runoff to stormwater facilities. For the entrance, this will likely be to the adjacent Old Georgetown Road. For the platform canopy extension, this will likely be to the same place the existing platform canopy drains to. Although the existing platform canopy uses rain leaders located within concrete columns, Metro requires any future rain leaders to be located in an accessible area to accommodate maintenance concerns.

The new entrance floor is assumed to be higher than the adjacent grade and sloped to prevent water intrusion, making floor drains within this space unnecessary unless desired for cleaning purposes.

The following assumptions were made in considering the plumbing design and evaluation of the new entrance and its required rooms:

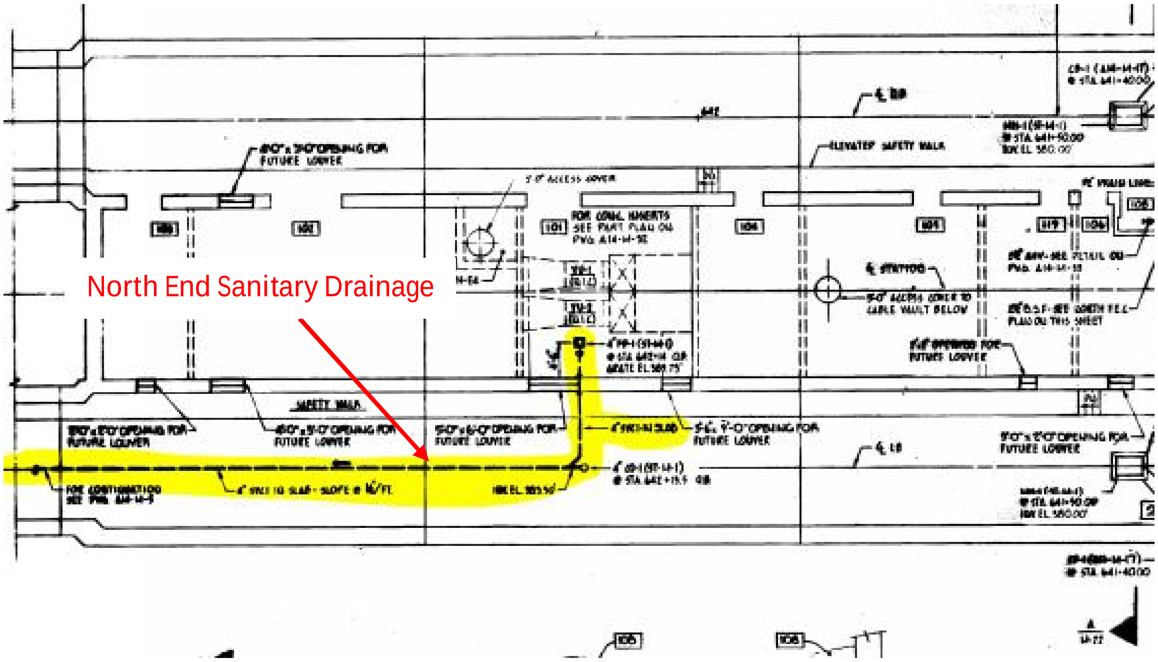
- As shown on as-built drawing A14-M-15, the existing sanitary sewer main below the inbound track is positively draining to the south end of the station;
- There are no obstacles in the under-platform space precluding this area from accommodating routing system mains as needed; and
- Elevator pit drainage will be required to accommodate necessary sprinklers located within the pit, which will need to pump a minimum of 50 gallons/minute per shaft.

4.8.3 Alternatives Development and Refinement

To evaluate the technical feasibility of the proposed improvements, the new entrance layout was evaluated to ensure critical dimensions and clear distances from plumbing equipment were acceptable. Priorities for the plumbing systems evaluation and design include:

- Provide new domestic water from the main located at the north end of the station, just outside of the fenceline to the east. New water service will be routed to the water service room, which will be provided with a backflow prevention assembly;
- Electric instant-hot water heaters will provide hot water to the individual rooms of the new entrance;
- Gravity drainage for the restrooms, and any floor drains within the new entrance, will terminate at the inbound sanitary main below the tracks via the existing mechanical room at the north end (see Figure 4-14);
- Stormwater management for the improvement will be routed to the adjacent Old Georgetown Road for the entrance portion, and to the same location that the existing platform canopy drains to for the extended platform canopy;
- Elevator pits will be interconnected, with a suction line connecting the pits to a pump room located at platform level under the new stairs. Drainage will be lifted from the pits and directed under the boarding platform to the gravity sewer main. The sump pump shall be capable of at least 50 GPM in order to satisfy ASME A17.1 code requirement for sprinklered elevator hoistways;
- If hydraulic elevators are adopted into the design, an oil water separator will be located under the platform in the discharge piping from the pumps to collect the oil, so it is not deposited into the combined sewer downstream. Access to the oil water separator will be required through the boarding platform with a new access door. Galvanized steel piping with mechanically grooved joint fittings and vacuum rated gaskets will be used for all piping in the system;
- The platform canopy extension will collect stormwater in the same manner and drain to the same location as the existing platform canopy. The only exception to this is that the new rain leaders will not be located within the structural columns to accommodate maintenance needs; and
- Heat tracing will not be used anywhere throughout the new entrance and its associated improvements.

Figure 4-14 | North End Sanitary Drainage Below Inbound Track



Source: WMATA As-Built Drawing A14-M-23

4.9 Utilities

This section documents the existing conditions and design approach for utilities in helping to develop and assess the alternatives under this study.

4.9.1 Existing Conditions

Existing utilities were assessed based on as-built information provided by Metro and supplemental information received from Montgomery County on construction at the intersection of Rockville Pike and Old Georgetown Road.

Review of existing utilities did not identify any potential conflicts in the general vicinity of the new entrance improvements. Most of the identified utilities are within the State of Maryland (MD SHA) and Montgomery County (Montgomery Co.) right-of-way along Rockville Pike and Old Georgetown Road. The identified utilities are listed in Table 4-2 below.

4.9.2 Preliminary Design Approach

The general area that the new entrance will be in has available utility services that can be tied into. Candidate locations include along Rockville Pike (MD 355) or Old Georgetown Road outside of the tunnel limits.

Table 4-2 | Existing Onsite Utilities and Owners

Name of Utility	Name of Owner
Storm Drain	MD SHA / Montgomery Co.
Sanitary Sewer	Washington Suburban Sanitary Commission (WSSC)
Electric (OH)	Pepco
Electric (UG)	Pepco/MD SHA
Communication (OH)	Telcom/MD SHA
Communication (UG)	Telcom/MD SHA
Gas	Washington Gas

4.10 Egress Analysis

This section summarizes the effect of the proposed second entrance on the White Flint Metrorail Station egress from the public areas of the station. See Appendix C for the full Egress Analysis Technical Memorandum, Spreadsheet Calculations and Egress Diagrams.

The applicable codes and standards for the analysis included the following:

- National Fire Protection Association: NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems, 2017 edition;
- Maryland Building Performance Standards (MBPS), which include the International Building Code (IBC) 2015, with Department of Housing and Community Development (DHCD) modifications; and
- Maryland Building Rehabilitation Code (MBRC) incorporating the International Existing Building Code (IEBC) 2015, with modifications

The approach to the application of life safety codes and standards for the design of the White Flint Metrorail Station improvements is based on the use of *NFPA 130* in conjunction with the *MBPS* as applicable to the alteration of an existing rail station. *NFPA 130* life safety criteria, specifically the *NFPA 130* criteria for the evaluation of the means of egress of the public areas of the station, supersede the corresponding criteria of the *MBPS*. All new construction elements, components, systems, and spaces are designed to comply with the requirements of the *MBPS*, except where *NFPA 130* criteria apply.

Based on the *MBRC* classification of the White Flint Metrorail Station proposed alternatives and the application of *NFPA 130* means of egress criteria to existing Metrorail stations, the Level 2 alterations require that the improvements do not compromise the existing means of egress features of the station. The new north mezzanine addition requires that the *NFPA 130* egress analyses demonstrate improvement to means of egress of the station as is achievable within the constraints of the existing station and station site, and as is acceptable to the Authority Having Jurisdiction (AHJ).

4.10.1 Conclusions

Based on platform occupant loads derived from the 2023 passenger demand forecasts and the train headways at White Flint Metrorail Station, the *NFPA 130* timed egress spreadsheet calculations shown in the summary results below indicate:

- The analyzed build alternative shows significant improvements to the evacuation performance of the existing station, both for the platform evacuation time and the evacuation time to a point of safety. Therefore, the build alternative meets the evacuation timed-egress criteria as applicable to an existing station. See Section 7 of the Egress Analyses Technical Memorandum that is included in Appendix C.
- The existing station does not comply with the *NFPA 130* maximum travel distance of 325' to the nearest egress point on the platform. Under the build alternative, the longest travel distance is reduced and meets this requirement.
- The existing station configuration does not comply with the *NFPA 130* requirement for a minimum of two remote means of egress from the platform, nor with the limitation of common path travel distance to a maximum of 82'. The Build Alternative adds a second remote means of egress, with a common path travel distance of 104', a substantial improvement over the existing common path of 708'.

Table 4-3 | Summary Table of Spreadsheet Calculations Results

	AM Peak Hour 8:00-9:00		PM Peak Hour 17:00-18:00	
	Platform Evacuation Time (minutes)	Evacuation Time to a Point of Safety (minutes)	Platform Evacuation Time (minutes)	Evacuation Time to a Point of Safety (minutes)
2023 No-Build	32.12	32.83	26.70	27.41
2023 Build	9.21	10.29	7.63	8.71

5. Environmental Scan

5.1 Environmental Considerations

The project would include both underground and above-ground additions to the existing station, such as concrete walls, platform canopy, station mezzanine, vertical circulation elements, and service rooms.

The following environmental considerations should be considered during subsequent engineering and planning:

- Land Use and Zoning: Zoning requirements, such as minimum façade transparency and maximum setbacks, apply to the property. Above-ground improvements should consider these regulations;
- Environmental Justice: The proposed north entrance is located within a block group with a slightly higher proportion of low-income population than Montgomery County as a whole. Subsequent planning should consider how the project may interact with these populations;
- Known Hazardous Waste Sites: Three automotive businesses and one dry cleaning business located between one- and two-tenths of a mile from the proposed north entrance. No Environmental Protection Agency (EPA) Superfund sites or other remediation sites were identified. As planning for the project progresses, more detailed and updated information should be reviewed to determine the potential for disturbing unknown hazardous waste sites;
- Protected Species/Critical Habitats: As planning for the project progresses, more detailed and updated information should be reviewed. Potential impacts to birds of concern or bald eagles should be considered, minimized, and mitigated;
- Historic Properties and Cultural Resources: The White Flint Metrorail Station is identified as a potential historic property in Maryland's cultural resources information system, pending further documentation. The result of this evaluation will determine whether or not the station is eligible for listing in the National Register of Historic Places (NRHP). Medusa, the Maryland Historical Trust's online database of architectural and archeological sites and standing structures, should be monitored regularly to track the status of the station's potential designation as a historic property. If the station is determined to be eligible for the NRHP, Section 106 consultation should be initiated; and
- Construction Impacts: Construction activities may result in temporary disruptions or alterations to transportation and utility services; increased noise and vibration; or discharge into the nearby storm water retention pond. Best management practices should be utilized to minimize and mitigate these impacts, and all necessary permits should be obtained. Coordination with local, state, and federal agencies should consider these issues.

A WMATA Compact public hearing will likely be held to obtain public comments on the project and to satisfy WMATA Compact requirements.

5.2 Environmental Resources

This section describes environmental resources within a 0.25 mile radius from the center of the proposed improvements (see Figure 5-1) and presents the methodology used to identify resources. For each resource present, the types and quantity of resources as well as key considerations for that resource is provided.

5.2.1 Methods

The project team reviewed environmental resources within a study area equivalent to a 0.25 mile radius from the center of the proposed improvements. Below is a list of the resources reviewed:

- Land use and zoning
- Community facilities
- Transportation facilities
- Air quality
- Environmental Justice (minority and low-income populations)
- Known hazardous waste sites (i.e., generators)
- Noise and vibration
- Ecological resources (water, habitat, species)
- Historic properties and cultural resources
- Parklands and recreation areas
- Farmland
- Wetlands
- Utilities

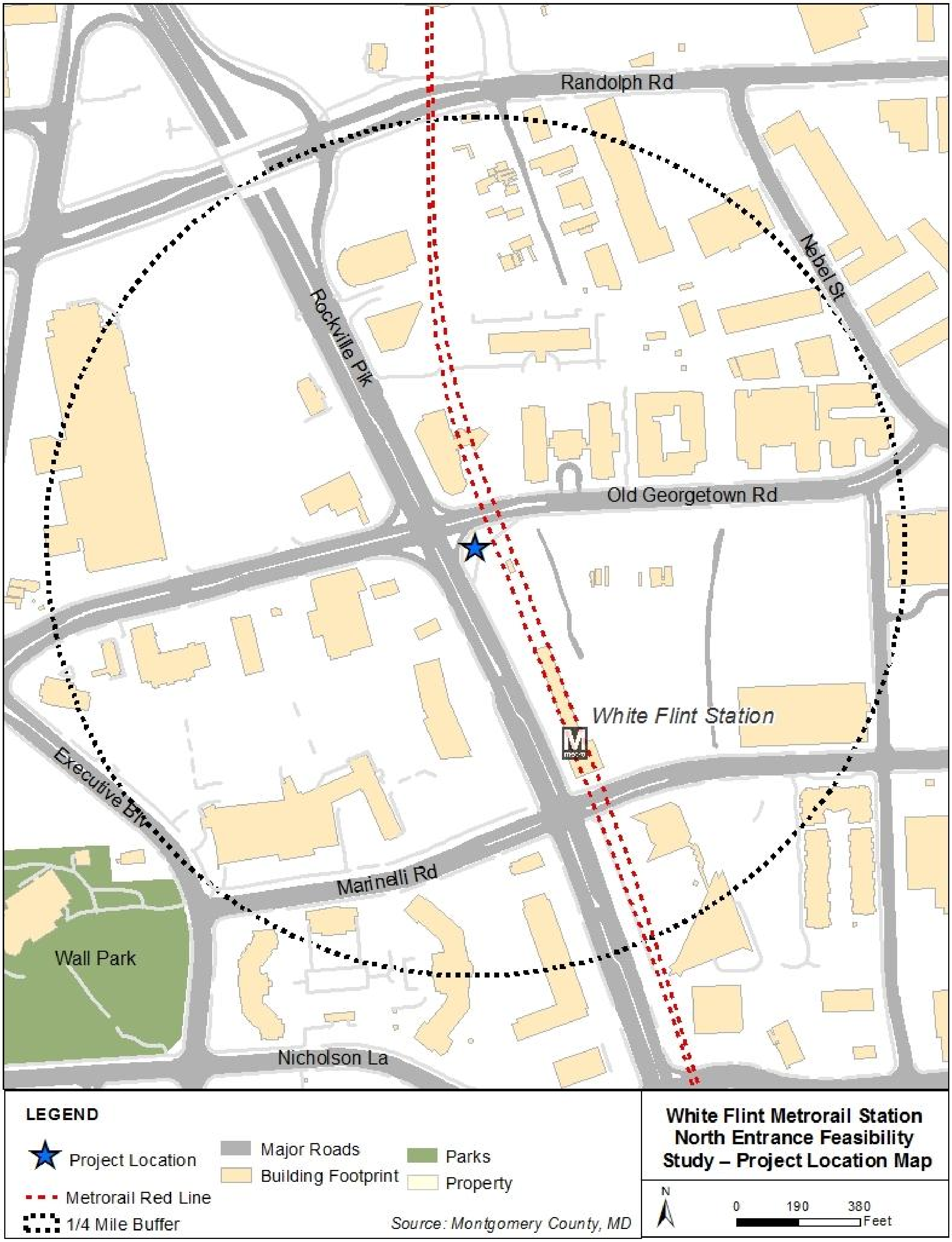
Resources in the study area were reviewed using a number of data sources, including Montgomery County Atlas (an online mapping tool maintained by Montgomery County at mcatlas.org), the National Register of Historic Places, Medusa (Maryland's cultural resource information system), the U.S. Census Bureau American Community Survey (ACS), EPA Envirofacts Enviromapper, and the U.S. Fish and Wildlife Service (USFWS) IPaC tool. GIS data was used to identify potential environmental concerns in the study area.

5.2.2 Resources Not Present

The following resources were not found in the study area:

- Prime soils or soils of statewide importance (farmlands)
- Navigable waterways, coastal zone, and floodplains

Figure 5-1 | Project Location and Environmental Scan Study Area Map



5.2.3 Identified Resources

The resources discussed below were found in the study area. The discussion also identifies key considerations for each resource and agency coordination needs with agencies that have jurisdiction over specified resources.

Land Use and Zoning

The Montgomery County Planning Department regulates land use and zoning in Montgomery County. Within the study area, the current land use consists of high-rise housing, hotel, and office developments; strip shopping centers; and surface and structured parking facilities. Parcels in the study area are primarily zoned as mixed-use commercial/residential (CR). These parcels have a maximum permitted floor area ratio (FAR) of between 3.0 and 4.0 with a maximum height between 200' and 300'. One parcel about one-tenth of a mile north of the proposed north entrance is designated as "employment office" with a maximum FAR of 1.5 and a maximum height of 75'.

According to the Montgomery County Zoning Ordinance, the CR zone is "intended for larger downtown, mixed-use, and pedestrian-oriented areas in close proximity to transit options such as Metro, light rail, and bus." It promotes economically, environmentally, and socially sustainable development patterns.

Key Considerations: Restrictions for the CR zone are focused on building uses and building specifications (e.g. set-backs, lot coverage, and façade transparency). A building in the CR zone is subject to the regulations in § 59.4.5.3. Most project improvements would occur below ground; however, any above-ground improvements should consider regulations in § 59.4.5.3, such as minimum façade transparency and maximum set-backs.

Community Facilities

Montgomery County Atlas identified the following place as a community facility: Georgetown Hill US Nuclear Regulatory Commission Child Care Campus for infant, pre-school, and kindergarten students.

Key Considerations: This resource is located about 0.10 miles from the existing south entrance and 0.25 miles from the proposed north entrance; therefore, it is unlikely that the project would have any adverse impact on this community facility.

Transportation Facilities

Existing transportation facilities include local roadways and sidewalks maintained by Montgomery County and Rockville Pike (MD 355) maintained by the State of Maryland. Transit facilities include the White Flint Metrorail Station, providing access to the Red Line. The station includes an existing station entrance at Rockville Pike and Marinelli Road; a six-story Metro-owned and operated Park and Ride garage; a Capital Bikeshare station; 32 bicycle rack and 20 bicycle locker spaces; and bus service/stops. Bus service includes Metrobus Route C8, which travels between the White Flint Metrorail Station and the College Park-U of MD station. Six Montgomery County Ride On routes provide service to Silver Spring, Glenmont, Wheaton, Westfield Montgomery Mall, Montgomery College, and nearby apartment buildings. The study area includes two Capital Bikeshare stations at Rockville Pike and Old Georgetown, across the street from the proposed north entrance, and at Citadel Avenue and McGrath Boulevard about 0.20 miles from the proposed north entrance. Bethesda Trolley Trail, located about 0.10 miles north of the proposed north entrance, serves bicyclists.

Key Considerations: Temporary disruptions (detours, service disruptions, restricted access, sidewalk closures) to these facilities and services during construction are key considerations for future planning and project development.

Air Quality

The Clean Air Act (CAA) requires compliance with established National Ambient Air Quality Standards (NAAQS) for certain criteria pollutants as determined by the EPA. The project is in the EPA-defined Metropolitan Washington Air Quality Designation Area. The greater metropolitan Washington area is currently designated as nonattainment for 8-hour ozone (O3) and a maintenance area (formerly nonattainment) for particulate matter smaller than 2.5 microns (PM2.5) and carbon monoxide (CO). The metropolitan Washington area is in attainment for all other criteria pollutants, including particulate matter less than 10 microns (PM10), nitrogen dioxide (NO2), sulfur dioxide (SO2), and lead (Pb).

Key Considerations: The CAA requires federal agencies (such as FTA) to ensure that their actions conform to a State Implementation Plan (SIP) in nonattainment or maintenance areas. Therefore, the project is subject to the transportation conformity rule for nonattainment or maintenance pollutants of O3, PM2.5, and CO on a project level. For specific transportation projects such as this one, the conformity determination must show that the individual project is consistent with the regional conformity determination and that potential localized emission impacts are addressed and are consistent with air quality goals found in the SIP. The state or local transportation agency is responsible for demonstrating that the project-level conformity determination requirements have been met.

Environmental Justice

The study area in Block Group 16, Census Tract 7012, which has a higher low-income population percentage (nine percent) than Montgomery County as a whole (seven percent). Minority populations comprise 46 percent of the block group's population, which is lower than the percentage of minority populations within Montgomery County (55 percent). Residential apartment buildings are located throughout the study area.

Key Considerations: Although potential Environmental Justice populations exist in Block Group 16, Census Tract 7012, no property acquisitions are likely to occur as a result of the project. However, subsequent planning should consider how the project interacts with these potential populations.

Known Hazardous Waste Sites

Four hazardous waste sites regulated by the EPA exist within the study area. These four sites are designated as hazardous waste handlers in the EPA's Resource Conservation and Recovery Act Information (RCRAInfo) management and inventory system. They include the three automotive businesses and one dry cleaning business located between one- and two-tenths of a mile from the proposed north entrance and listed in Table 5-1. EPA Superfund sites or other remediation sites were identified during the online database review. EPA Envirofacts reports for these sites are included in the Appendix D.

Key Considerations: As planning for the project progresses, more detailed and updated information should be reviewed to determine the potential for disturbing unknown hazardous waste sites.

Table 5-1 | Known Hazardous Waste Sites

Resource Name	Address	Handler ID
VOB Auto Sales	11605 Old Georgetown Road Rockville, MD 20852	MDR000005983
Dryclean Plus	11530 E Rockville Pike Rockville, MD 20852-0000	MDP000006048
Jaguar Bethesda – Land Rover Bethesda	11617 Old Georgetown Road North Bethesda, MD 20852	MDD024258154
Charles Toyota Specialists	12122 Nebel St Rockville, MD 20852	MDD985416403

Noise and Vibration

According to the FTA's *Transit Noise and Vibration Impact Assessment Manual*, noise- and/or vibration-sensitive receptors include special-use facilities that are very sensitive to noise and vibration (i.e., land where quiet is an essential element of its intended purpose, such as recording studios, concert halls, preserved land intended for serenity and quiet); residential land uses, and institutional land uses (e.g., schools, libraries, churches). Receptors also include buildings where vibration levels would interfere with operations (e.g., hospitals with vibration-sensitive equipment). Any historic sites and parks would require special consideration.

Key Considerations: Given the ambient conditions and existing land uses, it is unlikely that noise and vibration will be an issue for the project. Most of the land uses around the proposed project area are commercial and are not considered sensitive receptors. The project does not propose increased transit frequencies or new sources of noise or vibration over the ambient conditions. Temporary noise and vibration effects would likely result during construction but could be mitigated through best management practices.

Protected Species/Critical Habitats

The USFWS IPaC tool identified nine birds of concern known to be present within the study area at some point during the year. These birds are the bald eagle, blue-winged warbler, cerulean warbler, Kentucky warbler, prairie warbler, prothonotary warbler, red-headed woodpecker, rusty blackbird, and wood thrush. The Migratory Birds Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940 protect these birds. The IPaC tool did not identify any other endangered species expected to occur on the study area. Further information regarding these birds and their presence and/or breeding within the study area is included within the USFWS IPaC report in Appendix D.

Key Considerations: As planning for the project progresses, more detailed and updated information should be reviewed. Potential impacts to birds of concern or bald eagles should be considered, minimized, and mitigated.

Historic Properties and Cultural Resources

There are currently no listed or eligible NRHP resources within the study area. However, Medusa, Maryland's cultural resources information system, identified the White Flint Metrorail Station as a potential historic property, pending further documentation and review from Maryland Historical Trust, Maryland's SHPO. The result of this evaluation will determine whether the White Flint Metrorail Station is eligible for listing in the NRHP. A copy of the White Flint Metrorail Station documentation from Medusa is included in Appendix D.

Key Considerations: Medusa should be monitored regularly to track the status of the station's potential designation as a historic property. If the station is determined to be eligible for the NRHP, Section 106 consultation should be initiated under the direction of the FTA, the lead federal agency. Section 106 evaluations and coordination with the NPS and Maryland State Historic Preservation Officer (MD SHPO) would be required to determine effects on historic properties.

Parklands and Recreation Areas

At the edge of the study area (one-quarter mile from proposed north entrance), there is a neighborhood green in the McGrath Boulevard traffic circle. The property is owned by Metro and ground leased to LCOR, Inc.

Key Considerations: This resource is not immediately adjacent to the project site; therefore, it is unlikely that the project would have any adverse impact on this park facility.

Wetlands

The USFWS IPaC tool identified one wetland in the National Wetlands Inventory within the study area. The wetland is described as a freshwater pond with the classification code "PUBHh." This code indicates that the wetland is a man-made permanently flooded palustrine wetland with an unconsolidated bottom. This wetland is used as a storm water retention pond at the corner of Old Georgetown Road and Citadel Avenue less than 0.2 miles from the proposed north entrance. Further information regarding this wetland is included within the USFWS IPaC report in Appendix D.

Section 404 of the Clean Water Act established a permit program for the discharge of dredged or fill material into waters of the United States. The U.S. Army Corps of Engineers administers this permit program. Under Section 404, no discharge of dredged or fill material may be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. The 2015 Clean Water Rule excludes storm water retention ponds from the definition of "waters of the United States." The 2015 Clean Water Rule is currently in effect in the state of Maryland. Challenges to the 2015 Clean Water Rule are currently being litigated, and the future of the rule is uncertain.

Key Considerations: Given the distance of the storm water retention pond from the proposed north entrance, it is unlikely that discharge of dredged or fill material into the storm water retention pond will occur. Any potential for discharge could be mitigated through best management practices. In this case, coordination with the Army Corps of Engineers should occur to determine whether the retention pond would be considered a water of the United States subject to the federal permit program.

Utilities

Station as-built drawings did not identify any potential utility conflicts near the proposed north entrance. Utility tie-in locations will be further assessed during subsequent engineering and planning.

Key Considerations: Coordination with Montgomery County Department of Transportation (MCDOT), the Maryland Department of Transportation (MDOT), the Washington Suburban Sanitary Commission (WSSC), and the Potomac Electric Power Company (PEPCO) should occur to further consider how the project interacts with infrastructure under the purview of these agencies.

6. Constructability and Risk Assessment

This section summarizes the assumptions and preliminary findings for constructing the north entrance at the White Flint Metrorail Station and includes:

- Constructability review focused on high-profile elements of work including underground utilities, foundations, and mezzanine construction;
- Evaluation of each element's design practicality and economy to develop Rough Order-of-Magnitude (ROM) capital cost estimates, and potential construction considerations;
- Baseline sequence of construction for each major element;
- Identification of characteristics of the construction sequence or environment that will influence the project's ROM capital cost estimates, potential contractor pricing, and construction; and

- Implementation considerations, including project risks and recommended potential actions to facilitate construction.

6.1 Constructability Review

This section provides a preliminary constructability review for construction of the north entrance and focuses on major construction elements associated with the new entrance. Unless otherwise noted in the text, the observation applies to both alternatives identified in the study. Future environmental review and engineering analysis will refine the construction elements for a more detailed constructability review.

The review identifies zones where the project will impact adjacent uses and infrastructure. The project will need to consider and monitor these impact zones during the design and construction of the project which apply to both alternatives developed under this study.

The following is a description of each impact zone:

6.1.1 Site Access

Permits and/or agreements may be required prior to construction of the project. For example:

- Prior to start of construction, the project is required to have the Maintenance of Traffic (MOT) Plans in place with approval from MD SHA and/or Montgomery Co.;
- Due to site constraints, construction staging, laydown areas and crane placement may need to take place on the private property located directly adjacent to the east of the new entrance, just east of the Metro right-of-way. Early coordination during the design phase with the property owner is necessary to ensure access for construction staging, laydown areas and crane placement. Further discussion on this item can be found later in this section; and
- Access Permits from MD SHA or Montgomery Co. when building improvements on public property.

6.1.2 Street Level

Construction of the north entrance may disrupt sidewalk and street functions. The high vehicular and pedestrian traffic along Rockville Pike (MD 355), coupled with the pedestrian generators along Old Georgetown Road, make it necessary to only consider “off-peak” lane closures for delivery of material and equipment to the site. Closures of sidewalks should only be considered sparingly. Both lane closures and sidewalk closures will need to have MOT plans approved by the MD SHA or Montgomery Co. prior to each phase of construction.

6.1.3 Adjacent Underground Infrastructure

The project involves construction in an urban environment and needs to account for underground infrastructure that includes:

Utilities: Based on a review of the as-builts, record drawings, and site visit, the new north entrance will avoid major utility impacts. Preliminary Engineering (PE) will include further investigation and coordination to identify impacts to existing utilities, evaluate design solutions to minimize or avoid impacts, and define potential tie-ins required to support construction and operations of the new station entrance. A review of each alternative identified the following potential utility impacts:

Alternatives 1 and 2:

- The under-platform utilities (electrical conduit for platform pylon and edge lights and dry fire protection stand pipe) may be impacted by the canopy supports and elevators; and
- Existing Pepco Service Feed to the north service rooms may be impacted by the deep foundations that are needed for the new entrance's roof structure.

Alternative 1 only:

- The under-platform utilities (electrical conduit for platform pylon and edge lights and dry fire protection stand pipe) may be impacted by the structural columns that are needed to support the new entrance's mezzanine that is located directly above the existing boarding platform.

Existing Station: Protection of the existing station is paramount during construction to ensure the structural integrity and operation of the tunnels, station platform, and underground service rooms to the north are maintained. The condition of the existing structures should be re-visited once the project has moved into Preliminary Engineering. Each alternative includes the following considerations:

- Existing tunnel structures. The new entrance floor will be slab-on-grade, with a portion supported directly by the roof structure of the existing tunnels;
- Condition of the invert slab under the platform. This invert slab will be supporting the canopy structure under both alternatives, and under Alternative 1, penetrations will have to be made to accommodate the micropiles; and
- Underground service rooms – Rooms will remain in service during construction of the new entrance.

6.1.4 Train Operations

This constructability review assumes maintaining station facility operations during construction, with minimal train and station operational impacts.

- Construction of either alternative requires a MOP. This plan will address elements such as advanced coordination of station closures with a train bypass;
- This constructability analysis assumes limiting mezzanine construction work to non-revenue hours and selected weekends; and
- Equipment and materials are anticipated to be brought in via the highway systems (Rockville Pike and Old Georgetown Road) and work trains are not expected.

6.1.5 Sequence of Construction

This section describes a preliminary, baseline sequence of construction for the purposes of developing the conceptual project schedule and ROM cost estimates. This approach assumes a single full build-out with all construction activities occurring sequentially until the new north entrance is open for operations. A two-phase approach was considered but not recommended at this stage of the project due to costs and station operation impacts. A phased approach can be further investigated during Preliminary Engineering.

Assumptions and Approach

- Construction storage, staging, material lay down areas, and crane placement were reviewed and considered in the following locations (see Figure 6-1):

    1) West of the site between Rockville Pike and the Metro right-of-way: This location is feasible, but presents challenges related to the overhead utility lines running along Rockville Pike (MD 355). It could pose a safety risk to be offloading material and equipment from Rockville Pike with such low clearance under the utility lines.

    2) On top of the existing tunnel and underground service rooms: This location is feasible but would require phased construction as the north entrance is not able to be constructed entirely without additional lay down area and a second crane mobilization to construct the entry's slab-on-grade and roof structure.

    3) East of the Metro right-of-way on the adjacent private property: This location is feasible but would require an agreement with the owner of the adjacent property for access during construction. Out of the available areas, this is the preferred location for staging construction activities as it has the least disruption to vehicular and pedestrian traffic, in addition to Metro operations during construction. Additionally, this location has ample room for storage, staging, and material lay down with enough clearance from the overhead utility lines to maintain a safe distance for crane operation. Because of these advantages, this study assumes this location will be secured for construction activities. If this project moves forward, this proposed location needs to be revisited to confirm availability and to develop an agreement with the owner.

Figure 6-1 | Potential Construction Storage, Staging and Material Lay Down Areas

- Temporary lane closures and sidewalk closures will be permitted on Rockville Pike (MD 355) and Old Georgetown Road;
- Equipment and material will be delivered to the work site along the street network and not on work trains;
- Work will be completed using a combination of revenue and non-revenue service hours;
- Utilize stay in place forms (deck pans) for the cast in place mezzanine deck pour, eliminating the use of false work supported on the station platform; and
- Provide a column design that accommodates the installation of a construction barrier around the work area at the platform level in order to safely separate passengers from construction activities and also to contain dust and abate noise generated from construction activities and maintains the minimum walkway width of 7'-6".

Recommended Sequence of Work

1. Mobilize
2. Prepare selected construction staging area including clearing, providing a construction entrance, and delivering/staging of equipment and material
3. Coordinate with utility companies, protect existing utilities, and install new proposed utilities
4. Install temporary construction barrier on station platform and other construction site demising walls or barriers
5. Install temporary bracing under the boarding edge of the platform to support the platform during construction
6. Remove, store, and protect existing signage, pylons, and benches from the station platform to make way for the new improvements. Re-useable station elements to be stored off site for Metro's future use elsewhere in the Metrorail system.
7. Saw cut station platform and remove platform slab
8. Form, rebar, and pour (FRP) new canopy footings on top of invert slab
9. Drill shafts and install micropiles under invert slab
10. FRP support beams above the tunnel invert and on top of micropiles
11. FRP elevator sump pits and pit drainage for both elevators (Coordinate with selected elevator vendor).
12. Install all new under-platform pipe and conduit runs
13. FRP new mezzanine columns on top of new under-platform beams
14. Erect new mezzanine structure
15. Construct canopy extension structure over platform
16. Restore station platform
17. FRP new mezzanine deck and parapets
18. Install parapet railings
19. Install double-wide stair at the end of the new mezzanine
20. Install both elevators
21. Install mezzanine roof assembly over mezzanine extension and stairs
22. Install full-depth 48" diameter drilled shafts to support the north mezzanine roof assembly
23. Install full extents of the new mezzanine's slab-on-grade, inclusive of all embedded plumbing and conduit runs
24. Install Station Manager kiosk
25. Install fare vending machines
26. Install faregate array (5 faregates) and barriers separating paid and unpaid areas
27. Install two exit fare machines
28. Install metal entrance barriers and station gates
29. Construct Back-of-House (BOH) equipment rooms and facilities at mezzanine level
30. Install all mechanical, plumbing, and electrical systems necessary for Phase I
31. Install CCTV, fire alarm, communications, and intercom systems for Phase I
32. Complete all final finishes and installation of floor tiles

33. Remove the temporary construction barrier from the station platform
34. Open the new entrance for full-access operations

6.2 Risk Assessment

Table 6-1 below documents a preliminary list and potential mitigations of project risks that have been identified for assessment. This list will be refined as the project proceeds into Preliminary Engineering. The complete risk register is included in Appendix D.

Table 6-1 | Preliminary Risk Register

Risk ID	Risk Identification and Description	Mitigation Plan
1	Unknown utility impacts or relocations required	Preliminary engineering will include in depth review of existing utilities and including subsurface investigation to identify utilities
2	Integration with the existing Metro system	Preliminary engineering will include in depth review of the existing systems and conditions
3	Environmental Permitting	Metro to determine impacts based on 30% design.
4	Noise Mitigation	Confirm work hours for MOT design such that project complies with local regulations
5	Hazardous Materials – contaminated soil encountered	Team will generate a Hazmat report as part of the final deliverables. Hazmat report will be created per the contract and will define what will be considered additional unforeseen hazardous materials, the process for detecting them, and costs and procedures for removal if additional hazardous materials are found.
6	Project phasing and funding coordination with other Montgomery Co priorities - Project phasing with other Montgomery Co. priorities at this location including 1) a bridge over the station and 2) new BRT along MD 355	Metro coordinates early in design process with Montgomery Co. to agree on design interface constraints.
7	Additional community amenities - Community may request additional amenities at station entrance	Metro and design team will coordinate early and often with Montgomery Co. and other stakeholders to agree on amenities.
8	New Storm drain at the WMATA platform level cannot be tied into existing track drainage system.	Preliminary design phase will need to research a connection to MD 355 via pumping
9	Existing sanitary has capacity to support additional sanitary needs (water closets, elevator pumps, etc.)	Preliminary design phase will need to research a connection to MD 355 via pumping
10	Elevators (machine room-less versus hydraulic)	Multiple implications in final design (logistics and approvals)

Risk ID	Risk Identification and Description	Mitigation Plan
11	NFPA 130 Interpretation versus individual AHJs. AHJs approving code applications	Metro and design team will coordinate and establish parameters with the AHJ for this improvement during the preliminary design phase
12	Property to the east of the site redevelops or otherwise are unable to obtain for staging (site logistics)	During preliminary engineering, Metro will coordinate with adjacent property owner to begin discussion for temporary construction easement/access. Should property not be available, alternative laydown/staging area will be utilized.
13	Scheduling conflicts with other Metro projects (track time)	Metro to begin coordination with design team and other planned project as project moves towards advertisement to ensure minimal conflict
14	Adjacent Construction - project coordination necessary for lane closures, public occupancy permits and site access	As project nears final design and project approval, WMATA will need to coordinate with Montgomery Co. and Maryland State Highway for permits
15	Public Events preventing needed MOT or material delivery	Contractor will have to monitor and plan accordingly in construction schedule.
16	Impacts to existing WMATA facilities from construction (Train Control, Communications, Traction Power, etc.)	Plan will be developed by the contractor prior to construction to monitor and maintain existing systems during construction.
17	Passenger Safety Incidents in station	Safety plan to be developed by contractor prior to construction

7. Rough Order of Magnitude (ROM) Capital Cost Estimates

A summary of the ROM cost estimates for Alternatives 1 and 2 are included below. See Appendix B for the full breakdown of costs by line item. The estimate represents the costs of implementing the project and includes demolition, one new entrance, one new stair, and two new elevators. The ROM cost estimates were developed under the following assumptions:

7.1 Soft Cost Assumptions

1)	Contractor Mark-Up (General Construction)	30.68%
2)	Allocated Contingency (Applies only to Construction Costs)	30%
3)	Professional Services (SCC80 – Includes Systems Construction)	30%
4)	Unallocated Contingency	30%
5)	Annual Escalation	4%

7.2 Estimating Assumptions

1) Estimates are prepared using current dollars (2019)
2) Adequate experienced craft labor is available

3) Normal productivity rates as historically experienced are utilized
4) Compatible trade agreements exist in region
5) No strike impacts will be experienced by the project
6) There are sufficient experienced contractors available to perform said work
7) Normal Metro Washington D.C. area weather impacts to construction schedule
8) Existing state of the art construction technology will be utilized
9) Assumes cooperation between stakeholders
10) Estimate assumes a design-Bid-Build project delivery
11) Estimate assumes maintaining operation of the station facility during construction
12) Assumes construction duration of 28 months
13) Metro force account labor/equipment during track outages and/or adjacent active track work (included in Professional Services)
14) RRP (Railroad Protective Liability) insurance is included
15) ROW costs are assumed to be $0
16) Assume 12 months for Agreement, 12 months for Design, 3 months to bid
17) No hazardous or contaminated material mitigation is included
18) No articles of historic significance are expected to be discovered
19) Take-off and scope of work based on drawings dated 4.30.19
20) All estimates assume cast-in-place concrete and not steel or precast concrete
21) Appropriate fire protection and controls are included

Table 7-1 | Summary of ROM Cost Estimates

Alternative	Construction Total	Professional Services Cost	Unallocated Contingency	Mid-Point Escalation	Estimated Mid-Point of Construction	Total Project Cost
1	$17,500,000	$5,250,000	$6,800,000	$4,250,000	Aug-2022	$33,800,000
2	$17,000,000	$5,075,000	$6,575,000	$4,075,000	Aug-2022	$32,725,000

Note: Figures above rounded for clarity – see Appendix B for the full detailed ROM Estimate.

8. Preferred Alternative

Once Alternatives 1 and 2 had been reviewed by Metro, the project team gathered to discuss the pros and cons of each with the goal of determining a preferred alternative for the study. There was a very strong desire to match the existing conditions as closely as possible and discussions concluded with a clear need for the development of a 'hybrid' Alternative 3, where:

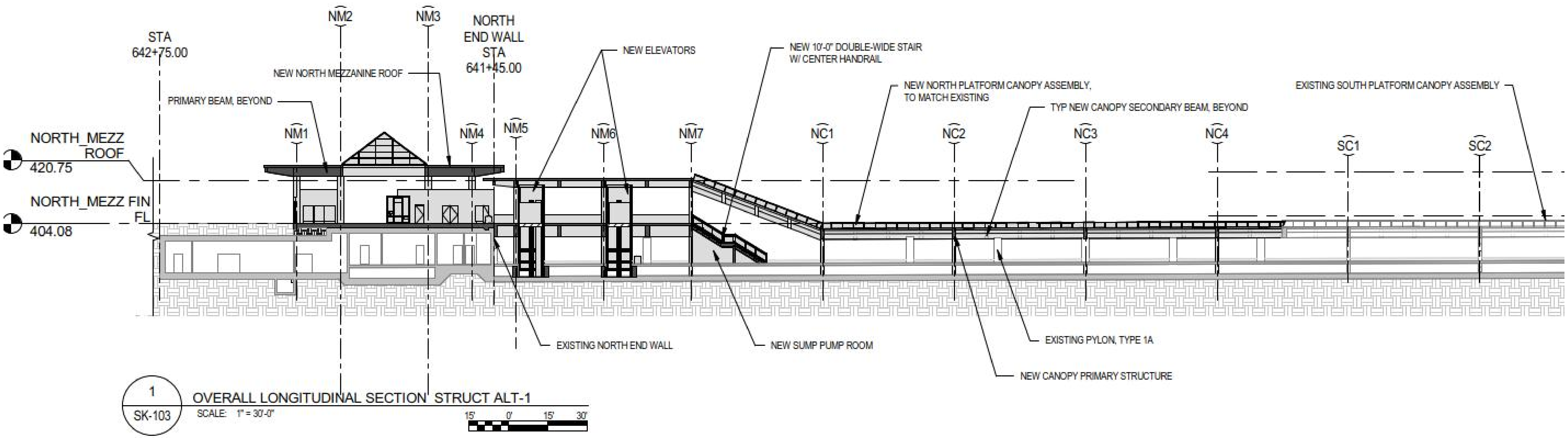
- The structural columns supporting the over-platform portion of the new entry are located within the boarding platform, as shown in Alternative 1;
- The entrance skylight is pyramidal in shape, as shown in Alternative 2; and
- The layout be revised to accommodate a hydraulic or MRL type elevator.

8.1 Preliminary Design Approach

The process of developing the hybrid Alternative 3 began by adopting and combining specific areas of the two previously developed alternatives. To begin, the over-platform area of Alternative 1 was adopted to locate the new structural columns within the boarding platform. The second step adopted the at-grade portion of the entry from Alternative 2 in order to accommodate a pyramidal skylight over the main entrance. Combining these two portions of Alternatives 1 and 2 resulted in misaligned structural roof beams between the two portions of roof. To address this misalignment, the two portions of roof were separated by height with the roof over the at-grade portion being higher than the roof located over the new elevators and stair. By having the separation in height, the mis-aligned roof beams are less visually incongruent as they no longer share the same horizontal plane. The third and final step was to revise the entrance layout configuration to provide a new room with a minimum area of 240 square feet; large enough to accommodate the equipment for either two hydraulic elevators or two MRL elevators. To accommodate the new room and the pyramidal skylight, the number and location of the structural columns in the at-grade portion of the entry were revised. Concept design drawings for Alternative 3 are included in Appendix A.

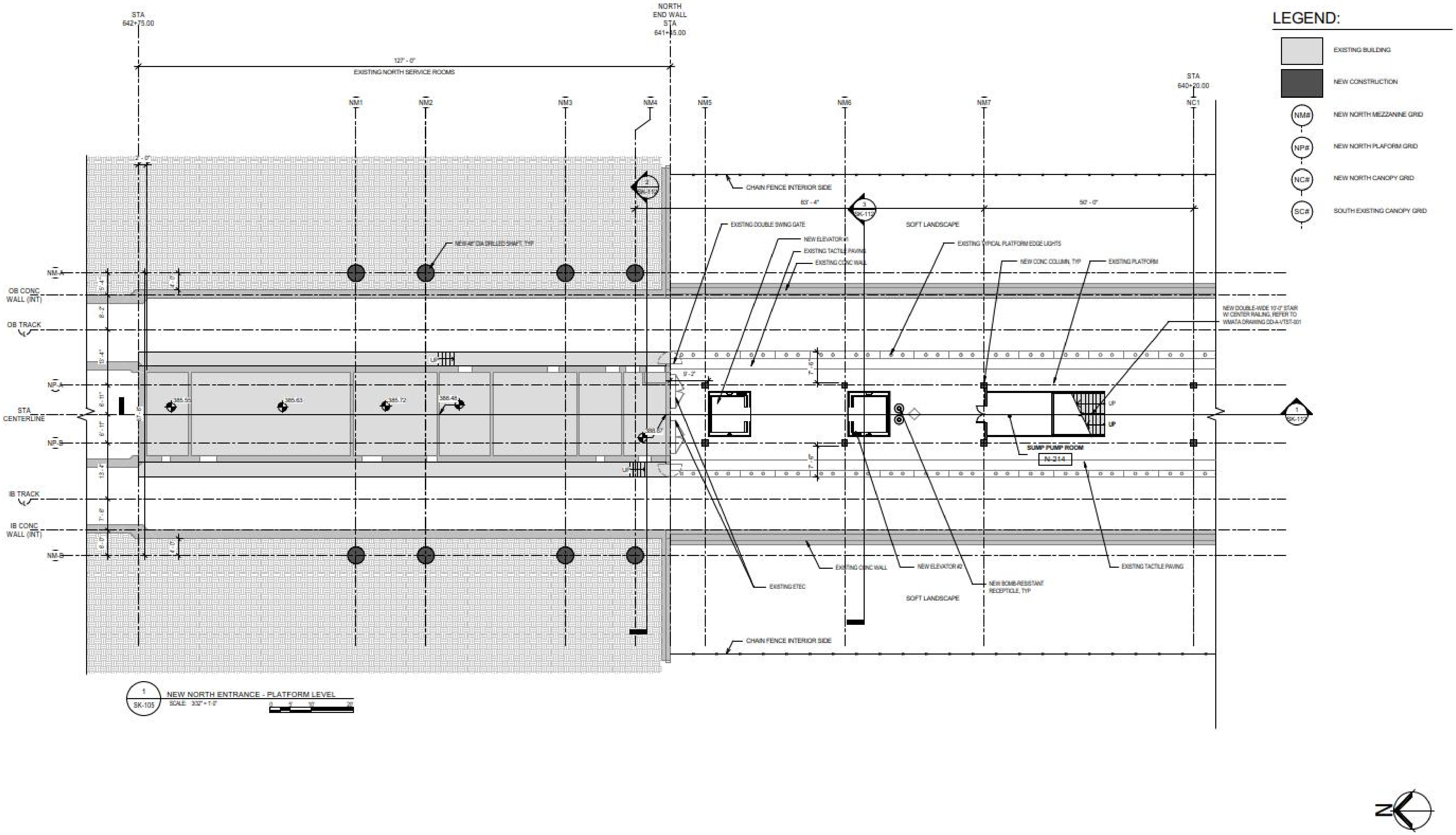
Other than the architectural and structural differences highlighted above, there were no further impacts to the preliminary design approaches as developed by the other disciplines included under this study. In other words, the revised layout and design developed for hybrid Alternative 3 only had impacts on the architecture and structure disciplines.

Figure 8-1 | Preferred Alternative Longitudinal Section



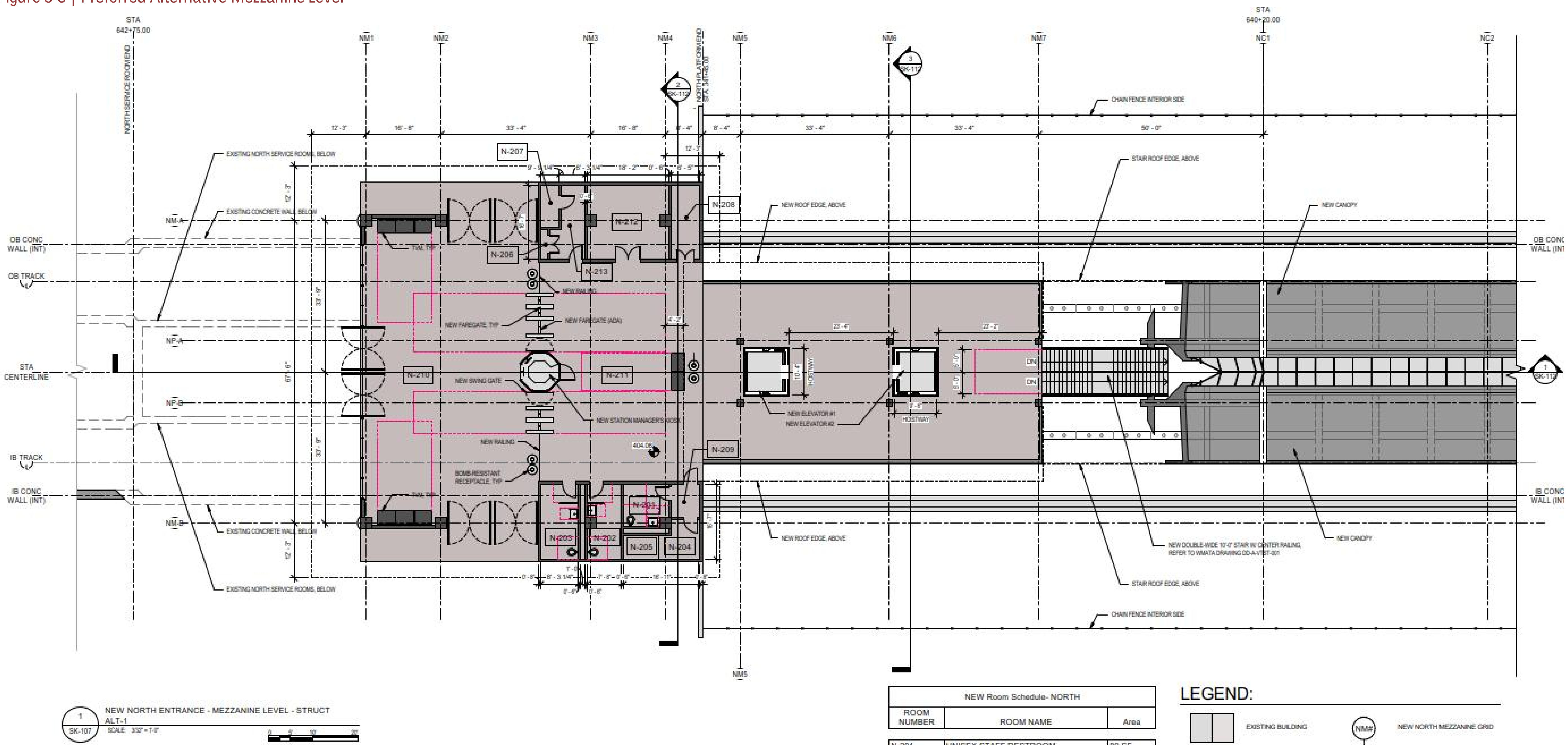
Source: KGP Design Studio

Figure 8-2 | Preferred Alternative Platform Level



Source: KGP Design Studio

Figure 8-3 | Preferred Alternative Mezzanine Level



ROOM NUMBER	ROOM NAME	Area
N-201	UNISEX STAFF RESTROOM	89 SF
N-202	PUBLIC RESTROOM (M)	121 SF
N-203	PUBLIC RESTROOM (W)	136 SF
N-204	CLEANER'S ROOM	71 SF
N-205	WATER SERVICE ROOM	41 SF
N-206	FEC	10 SF
N-207	BELL SYS ROOM	38 SF
N-208	ELECTRICAL CABINET ROOM	106 SF
N-209	CORRIDOR	47 SF
N-210	NORTH MEZZANINE (UNPAID SIDE)	2659 SF
N-211	NORTH MEZZANINE (PAID SIDE)	Not Enclosed
N-212	ELEVATOR CONTROL ROOM	291 SF
N-213	CORRIDOR	104 SF

NEW Room Schedule- NORTH

Source: KGP Design Studio

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8.2 ROM Capital Cost Estimate

The ROM Capital Cost Estimate for hybrid Alternative 3 was developed under the same assumptions as those developed for Alternatives 1 and 2.

Table 8-1 | Summary of ROM Cost Estimates (Preferred Alternative 3)

Alternative	Construction Total	Professional Services Cost	Unallocated Contingency	Mid-Point Escalation	Estimated Mid-Point of Construction	Total Project Cost
3	$18,000,000	$5,400,000	$7,025,000	$4,375,000	Aug-2022	$34,800,000

Note: Figures above rounded for clarity – see Appendix B for the full detailed ROM Estimate.

8.3 Design Considerations for Preliminary Engineering (PE)

Throughout the course of the study, the design team identified several items for the next design team to consider in PE if the White Flint north entrance improvements are to be implemented. These items are listed below, organized by discipline:

Architecture

- Assess any changes in WMATA Design Criteria since the completion of this report;
- If MRL type elevators are chosen for the project, confirm any custom application details needed;
- Perform a detailed survey of the under-platform space to confirm available clear height for the elevators and to identify all impacts on existing under-platform facilities; and
- Coordination of the canopy extension and the planned future bridge over Metro's boarding platform and right-of-way should occur if both projects advance to Preliminary Engineering within the same timeframe. Accommodating the future bridge may require a portion of the canopy extension to be removed from the design.

Structure

- Verify torsion requirements for the beam supports of the cantilever roof located above the stairs;
- Verify the need for additional support of the existing platform due to new openings;
- Select the elevator type to be used and confirm effects on the invert slab;
- Develop construction sequencing for the mezzanine slab-on-grade considering shrinkage, thermal and cantilever effects; and
- Confirm soil properties and effects on design parameters.

Mechanical

- Determine heating and ventilation loads for the enclosed public and non-public spaces of the new entrance; and

- Confirm which type of elevator is to be used and provide the HVAC needs per WMATA Design Criteria.

Electrical

- Verify that the available breaker space inside the north AC switchboard to serve the new branch circuit panelboard can be fitted with a new 225A circuit breaker;
- Meter the north essential AC switchboard to confirm that there is adequate available capacity to accommodate the new elevators; and
- Survey the area below the platform to identify any major conduits that will interfere with the new elevator pits, columns, strengthening struts, and any concrete thickening of the existing invert slab.

Plumbing

- All piping will be installed under the platform. The specific routing of the piping from the pumps to the manhole structure will need to be coordinated with existing conditions and proposed below-platform structural elements such as columns, strengthening struts and any invert slab thickening; and
- Heat tracing is not to be used in the final design.

Life Safety

- Include sprinklers, fire alarm, and communication systems design during Preliminary Engineering.