

SOUTH ENTRANCE TO BETHESDA METRO STATION

BASIS OF DESIGN REPORT

Draft, October 2013



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1 Introduction

The Bethesda South Entrance will provide a vertical access connection between Elm Street, the Purple Line Bethesda Terminal Station and the southern end of the existing WMATA Bethesda Metro Station which is part of the Metrorail Red Line in Bethesda, MD. The connection includes the following elements:

- Four (4) high-speed elevators between the Purple Line Station Lobby and the Red Line Mezzanine Level
- Two (2) high-speed elevators between Elm Street, the Purple Line Station Lobby and the Red Line Mezzanine Level
- Emergency stairs from the Red Line Mezzanine Level to Elm Street
- Service rooms at the Red Line Machine Room and Mezzanine Levels
- Service rooms at the Purple Line Level
- Pedestrian passageway between the existing Red Line Station and high-speed elevators located at the Red Line Mezzanine Station Lobby
- Addition of a steel-framed mezzanine at the southern end of the Red Line Station
- Modifications to the existing Red Line Station platform to accommodate a new escalator, stairs and two (2) elevators between the new mezzanine and existing platform
- Stairs between Purple Line Station Lobby and Elm Street
- Vent shaft
- Paving, barriers, sidewalk modification and restoration of Elm Street
- Maintenance of Traffic
- Utility coordination and design
- Landscape design
- Erosion and sediment control design

The existing Bethesda Metro Station is located between the East West Highway and Elm Street and was constructed under Contract A11b in the late 1970s/early 1980s. The Bethesda Metro Station currently has one entrance at the north end, near the East West Highway.

The Bethesda Metro Station is approximately 744 feet long with a platform length of 600 feet. For reference, the platform limits are Stations 389+07 at the south end near Elm Street and 395+07 at the north end near the East West Highway. The mezzanine at the north end of the platform is approximately 110 feet long and 37 feet wide.

As part of the Apex Building construction contract, knock-out panels for future WMATA elevators were constructed at the plaza floor level. To accommodate the knock-out panels, grade beams and caissons outside the limits of the column lines of the Apex Building were constructed. The caissons are used to support column loads from columns A-9, A-10 and A-11. Due to alignment changes to the Purple Line Transitway and the number of elevators required per the vertical circulation analysis, these knock-out panels will not be utilized. Also, the Apex Building as-built plans indicate the drilled shaft foundations supporting the Apex Building columns are unreinforced.

The Purple Line Level is approximately 25 feet below Elm Street Level and the Red Line is approximately 100 feet below Purple Line Level.

Design and construction shall be in conformance with the WMATA Manual of Design Criteria for Maintaining and Continued Operation of Facilities and Systems, WMATA Standard Technical Specifications, WMATA Directive and Standard Drawings and the WMATA Adjacent Construction Manual.

2 Architecture

The Elm Street At-Grade structures at the elevators will utilize stainless steel framing components with point-supported laminated safety glazing to present a “transparent” feel at the street level. This will minimize the potential for a clash of architectural styles and materials with the surrounding buildings and potential future redevelopment. The roof profiles at the elevator waiting area and the stair are vaulted to acknowledge the distinctive WMATA rooflines at other locations but are scaled back to meet site constraints.

The vent shaft structure at Elm Street will be topped with a structural deck slab to support the condenser units. The parapet surrounding the condensers will be stainless steel louvers to provide the required air flow and will be continuous around the top of the elevator shafts.

The below grade spaces are to be finished in compliance with the requirements of the WMATA Design Criteria to the greatest extent possible to ensure visual continuity with the entire WMATA system. The Elevator Lobby at the Purple Line Level is designed to allow separation from the Purple Line station area by means of a fixed-in-place Fire Rated glazed screen and Fire Rated glazed doors on electric hold open linked to the fire alarm system. The main opening is to be protected by means of an overhead-coiling fire shutter (see Section 10: Fire and Life Safety). To achieve adequate overhead clearance for the four elevators under Elm Street the pedestrian route from the track crossing to the Lobby shall slope at less than 5%.

The new south mezzanine above the existing platform shall resemble in appearance the WMATA standard mezzanine located at the north end of the platform with the exception of the wider than standard stair and should be coordinated with any planned WMATA station upgrades for the north mezzanine.

To minimize the risk of additional water being directed to the existing station the new pedestrian tunnel between the Mezzanine and the Elevator Lobby will have a 1% slope back toward the Elevator Lobby.

3 Roadway and Traffic

Maintenance of Traffic Plans

Under existing conditions, Elm Street operates with two-way traffic. It is anticipated that a system consisting of soldier piles and lagging with struts for the support of excavation will be employed at the beginning of construction. The excavation will likely be covered with a deck-over system consisting of timber mats to allow for truck traffic and material storage. Initial concepts indicate that Elm Street between Woodmont Avenue and MD 355 (Wisconsin Avenue) will need to be temporarily closed during this construction stage and traffic will be detoured. A detour plan will be developed for this scenario. A designated detour route has yet to be identified.

During previous meetings, Montgomery County Department of Transportation (MCDOT) requested that the Design Team review options for maintaining one lane of eastbound traffic along Elm Street during all phases of construction. A conceptual design of the construction area, including equipment, material storage, etc., will be developed in order to evaluate if maintaining one lane eastbound on Elm Street is feasible. If it is determined that this is feasible, maintenance of traffic plans will be developed to allow for a partial roadway closure, while maintaining a single lane for eastbound traffic.

Pedestrian traffic along the north side of Elm Street will be maintained during construction, while pedestrian traffic on the south side of Elm Street may require the use of a covered walkway in order to maintain access during construction.

MOT plans will adhere to the standards set by the Maryland State Highway Administration (SHA) and Montgomery County Department of Public Works & Transportation (DPW&T).

Signing and Marking Plans

The location of the elevators, vent shafts and stairwell will require narrowing Elm Street; however, based on meetings with Montgomery County Traffic and DOT, Elm Street

shall remain a two-way street with a minimum clear width of 22 feet and if possible, a desirable clear width of 24 feet. The signing on Elm Street, from MD 355 to Woodmont Avenue, will account for two-way traffic in the ultimate condition, and will include concepts for the metro station vehicular wayfinding signing in the vicinity of the project, but will not include any WMATA pedestrian signing within the metro station for the proposed vertical access connection from Elm Street to the south end of the existing WMATA Bethesda Metro Station. Proper signage will be required to restrict parking along the south side of Elm Street since the final roadway width will be insufficient to allow curbside parking as is allowed currently.

Traffic Signal Plans

There are no major traffic signal design modifications proposed under this project, but it is anticipated that pedestrian signals/devices will need to be modified at the intersection of Elm Street and MD 355 (Wisconsin Avenue). Plans will be prepared in accordance with the Maryland SHA standards and guidelines.

Lighting Plans

The project will likely impact several existing decorative pedestrian light poles and associated underground circuitry. Lighting design for the project will include photometric design and detailing electrical designs to replace, in-kind, the existing light poles impacted by construction of the project. Pedestrian lighting design shall be coordinated with any architectural lighting being installed by the project, to ensure a uniform distribution of lighting in the project area.

4 Utilities

Multiple utilities are present within Elm Street; therefore, there are substantial impacts. The major utility companies with facilities located within Elm Street include the following:

- Verizon, a private utility providing telecommunication services – underground impacts
- Potomac Electric Power Company (PEPCo), a private electric utility – underground impacts
- Washington Gas (WG), a private utility providing natural gas service – underground impacts

PEPCo

A meeting was held on April 4, 2013 with PEPCO where the following items were discussed:

- Based on the age of the system and the Korduct asbestos conduit ductbanks built in the 1960s, the asbestos conduit ductbanks would require replacement as part of the relocation activities
- The pull hole at the east end of Elm Street at its intersection with Wisconsin Avenue (outside the proposed connection footprint) will require replacement as part of the relocation activities as it does not meet current PEPCo design standards
- The three (3) 13kv power feeders entering the pull manhole east end are routed south on Wisconsin Avenue from a PEPCo substation. The 3-feeders exit the west end and enter another pull manhole within the proposed connection footprint. The 2-feeders are routed to the spot network bus manhole which serves 7316 Wisconsin Avenue on the north side of Elm Street. The remaining feeder is routed to a manhole (773418-0639) and hereafter routed to the spot network bus manhole, which serves 7272 Wisconsin Avenue (Apex Building) on the south side of Elm Street. The three feeders and spot network bus and 2-transformer manholes serving 7316 Wisconsin Avenue will need to be permanently relocated to accommodate the proposed construction
- The 2-spot network bus and 2-transformer manholes are currently sized to exclusively provide power to the two buildings noted above
- Since the spot networks are designated for the buildings only, project construction activities would likely need to be served by temporary generators
- The spot network and 3-feeders will need to be permanently relocated first and new feeder cables installed and reconnected to minimize and/or avoid power disruption to the two buildings
- Due to the current location of the spot network, a bypass system needs to be constructed first to minimize and/or avoid powers outages to customers served by the spot network to be relocated
- The time to design and relocate electrical facilities is estimated at 18 to 24 months

Verizon

A meeting was held with Verizon on May 8, 2013. Similar to PEPCo it is anticipated their facilities will need to be relocated before construction of the South Entrance connection commences. The following items were discussed at the meeting:

- The feeds along Elm Street are designated primarily for the customers on this street
- There are three (3) feeds serving the north side of Elm Street and one serving the south side. Manhole (MH1385) would require relocation being that it is within the proposed station footprint
- The question was raised whether or not Verizon's facilities could be relocated beneath the sidewalk. However, Verizon's personnel confirmed that this is not Verizon's standard practice and the utilities would need to be relocated within the roadway
- Verizon noted that the services enter the buildings along Elm Street through the walls and not directly into a mechanical room. Verizon will not perform work activities on private property. Activities will need to be performed "By Others" to make the connections
- The availability of duct space within the network was also raised being that the system was sized primarily for the existing buildings. With the proposed improvements, additional ducts may be required to adequately serve the new station. However, Verizon will determine if available duct space exists which could serve the proposed development
- Verizon's manhole (MH62) at the intersection of Wisconsin Avenue and Elm Street would need to be enlarged in order to construct a redundant feed prior to relocating the existing utilities in the impact zone
- The two (2) existing tile ducts built in 1957 at the intersection of Elm Street and Wisconsin Avenue would need to be rebuilt as part of the relocation efforts
- Verizon suggested that a utility corridor be established for all the utilities to be relocated given the limited space
- In regards to the proposed relocation activities, Verizon is interested in ascertaining whether or not the closure of Elm Street during utility construction would be possible. From their standpoint and also potential the other utility providers within the impact zone, the relocation efforts would significantly benefit from said closure to allow ample room to work within the very limited space

- Verizon raised the question whether or not it was possible for the Design Team to consider shifting the curblineline of the proposed improvements to the south to facilitate additional space for the utilities to be relocated in. Both PEPCo and Verizon have a significant amount of utilities within the proposed impacted area and there is limited room to relocate them
- Verizon noted that the relocation activities would need to be funded by the project and not absorbed by Verizon. A list of approved design firms and Contractors that are allowed to work on Verizon's network was provided to the Consultant
- Verizon's has a minimum 5-foot horizontal separation requirement for its utilities.
- The time to design and relocate telecommunication facilities is estimated at 12 to 18 months

Washington Gas

A meeting with Washington Gas' personnel is pending. The Consultant has obtained a copy of the Utility Provider's known utilities within the project area. Based on the grid map (F-7-NW), it is evident that the 3-inch gas line within Elm's Street will require relocation. Gate valve number 11 (GV 11) at the eastern end of Elm Street on approach to Wisconsin Avenue will likely be impacted. Depending on the limits of the construction of the elevator shaft, the 12-inch gas main running along Wisconsin Avenue may also be impacted. A determination on this item will be made upon finalizing the limits of the construction shaft.

5 Structural

One elevator lobby will be provided to serve the Purple Line approximately 25 feet below street level. A second lobby will be provided approximately 125 feet below street level to access the Metrorail Red Line. Based on the A11b Contract boring logs and borings taken during the planning phase, rock is expected to be encountered approximately 60 feet below the existing ground surface. As part of the Bethesda Metro Station A11b Contract, knock-out arch tunnel panels were installed on the west side of the track in the direction of the Glenmont Station, near the south end of the platform, at Station 389+48.67, to access a future passageway and mezzanine. Also as part of the A11b Contract, support of excavation and a portion of the future passageway at the south end were provided. The excavation extends approximately 50 feet behind the knock-out panels. An additional passageway extension, elevator lobby, walkway, and mezzanine will be provided to connect the Bethesda Metro Station platform to the high-

speed elevators. A horizontal connection between the elevators and passageway in rock will be required based on surveyed information. Provisions in the station platform for a future escalator and mezzanine were made as part of the A11b Contract. However, no provisions for an elevator or staircase from the future mezzanine to the platform were made at that time. Modifications to the existing platform to accommodate two (2) elevators from the new mezzanine to the platform, as well as a staircase will need to be made.

As part of the A11b Contract, three (3) foundations, integral to the Red Line Station platform, with anchor bolts for future mezzanine support columns were constructed at Stations 389+48.67, 389+86.17 and 390+22.17. A recent condition inspection of the platform and plenum indicated the station suffers from water infiltration and leaking resulting in the anchor bolts being corroded and insufficient for supporting applied loads. Prior to setting the proposed columns, the anchor bolts must either be replaced at all three foundation locations or abandoned. It is anticipated a large, oversized base plate will be used to anchor the columns to the existing foundation. Holes, located to avoid interference with existing reinforcing steel, will be core-drilled through the existing foundation and into rock at an adequate distance to resist applied loads. Waterproofing will be installed and the holes will be filled with a polyester resin and threaded rods inserted to anchor the base plate.

The superstructure of the mezzanine is proposed to be composed of a reinforced-concrete deck supported by built-up and rolled structural steel members. Finish tiling and the parapet will have similar aesthetics and details as that of the existing north mezzanine.

It is anticipated construction of the pedestrian passageway and service rooms will consist of multiple drifts utilizing rock anchors, shotcrete, waterproofing and steel arch ribs. Design of the passageway and lobby at Red Line Mezzanine Level will need to account for foundation loads from the buildings above. The typical passageway section will be larger than the area excavated as part of the original A11b Contract. The existing steel arch ribs, shotcrete and rock anchors will be removed and new ones installed to accommodate the proposed passageway section.

If one lane of traffic on Elm Street is to be maintained during construction, and also to aid in staging for construction, it is anticipated a deck-over system would be constructed as part of the support of excavation system for the vertical shafts. It is anticipated the support of excavation system would be very stiff and consist of soldier piles with beams/struts between piles to provide lateral stability and support the deck-over system. Due to the presence of adjacent structures, the use of tie-backs or soil nails is not expected. The support of excavation design and shaft geometry will need to

account for the existing adjacent building foundations. The connection was located accounting for the drilled shafts at Apex Building Columns Lines 9 and 11 that are present approximately 15'-3 ½" north of Column Line A under the existing curb and sidewalk and also for the existing drilled shafts that support the building on the north side of Elm Street, 7316 Wisconsin Avenue. Once the excavation extends below the rock line, a grid of rock bolts and shotcrete will be used to progress the construction.

6 Communications

At multiple discipline-specific meetings with WMATA technical personnel, the following design items were conveyed to the design team:

- All new communications systems are to be linked to, and be compatible with, the existing WMATA communications systems at this station.
- All new communications systems are to have UPS and emergency generator back-up.
- The new communications system shall incorporate 'First Responder' radio coverage plus 'Hot Spot' coverage for patrons.
- WMATA communications shall be kept independent from any adjoining Purple Line communications but the two systems should have direct communications access to each other at the operational level to assist in coordination in the event of an emergency affecting either or both stations.
- The new communications room should be sized so that it has the potential to be upgraded to serve as either the new main communications room or as an interim should the existing main communications room need to be taken 'off-line' during repairs or upgrades.
- Emergency call systems shall be located within the new Area of Rescue Assistance at the mezzanine level, the new Emergency Egress Stair and within the new elevators.
- Location of security cameras will require ongoing coordination with WMATA personnel but will be required in all public spaces plus full coverage of the interior of the emergency stair.
- Communications will require ongoing coordination with: Fire and Life Safety, Mechanical, Electrical and WMATA.

7 Mechanical

At a coordination meeting with representatives of WMATA's technical divisions, the design team was asked to investigate the feasibility of upgrading/replacing the existing chiller unit that serves the WMATA Bethesda Station. During investigations it became apparent that the existing chiller was of insufficient size to service the additional load. It was also considered to be technically and financially infeasible to replace the existing unit with a larger unit as the existing unit is located on the roof of the adjacent hotel and all associated piping, which would need to be upgraded, passes vertically through the hotel.

Therefore, the current design is based on conditioning only the new spaces at the south of the station using split system units with the four condensers mounted on top of the vent shaft that terminates at Elm Street. These spaces are to include; Elevator Machine Rooms, Elevator Cabs and Elevator Lobby at the Mezzanine Level.

All air handling equipment is to be located adjacent to the full-height vent shaft to the WMATA Mezzanine Level, which would provide all outside air and could provide a route for any required exhaust ducts while also providing a convenient vertical chase for condensate lines. The air handling equipment will be sized to keep the following areas at a positive air pressure in the event of an emergency: Mezzanine Level Area of Rescue Assistance, Emergency Egress Stairs, Purple Line Level Elevator Lobby.

8 Electrical

At a coordination meeting with representatives of WMATA's technical divisions, the design team received the following clarifications on design direction:

- The lighting at the new South Mezzanine should be 'similar' to that used at the Judiciary Square station and not that at the North Mezzanine.
- Lighting levels in elevator cabs to be a minimum of 10 foot candles.
- The electrical requirements of the new South Entrance should be provided by a new service (plus a duplicate second if available) and should not tap in to the existing station service.
- The panels for the new incoming electrical service should be located adjacent to the WMATA Generator Room at the Purple Line level.

- A new emergency generator should be provide with a capacity to maintain all emergency systems (lighting, elevators, air handlers, communications, sump pumps etc.) for a time period to be determined by WMATA and, if necessary, the Fire Marshall.

9 Elevators and Escalators

Meetings have been held with WMATA to establish the requirements for all elevators and escalators associated with the project. The following outline the most current understanding:

- An 11'-6" wide, double escalator with reversing capability at each landing will be provided between the existing platform and the new south mezzanine.
- Two new hydraulic elevators will be provided between the existing platform and the new south mezzanine. One elevator will be powered from a new machine room located at the mezzanine level behind the existing south head wall, the other will be powered from a new machine room located on the existing platform below the new stair. Each elevator will be rated at 4500 lb. and will have a rated speed of 200 feet per minute.
- Four new high speed electric traction elevators will be provided between the WMATA Mezzanine Level and the Purple Line Station Lobby, and two new high speed electric traction elevators will be provided between the WMATA Red Line Mezzanine Level and Elm Street Level at the surface with a stop at the intermediate Purple Line Station Lobby. All six electric traction elevators will be rated 4500 lb. and will have a fully loaded minimum rated speed of 300 feet per minute and a fully loaded maximum rated speed of 400 feet per minute. Machine rooms will be located below the Mezzanine Level and will incorporate sumps and sump pumps that will be capable of operating under normal power and under emergency generator back-up power.
- The two new high speed elevators that stop at all three levels (WMATA Mezzanine Level, Purple Line Level and Elm Street Level) will have a Fire Department operated intermediate stop with the egress stair to assist with evacuation of the station.

10 Fire and Life Safety

- See attached Memorandum 'Bethesda Metro Station Occupant Load and Egress Time' for egress calculations prepared following discussions with

WMATA and Montgomery County as well as the Egress Sketches for the north and south entrances.

- A Fire Control Room, as requested by WMATA, has been located in direct line-of-sight of the mezzanine entrance.
- The closing time of the Fire Rated Shutter at the mezzanine entry is to be coordinated with WMATA personnel and, if required, the State Fire Marshall.
- The closing time of the Fire Rated Shutter at the Purple Line Lobby entry is to be coordinated with WMATA personnel and, if required, the State Fire Marshall.
- A Fire Department annunciator panel for the south entry is to be located adjacent to the Elm Street stair at the Purple Line level.
- The new emergency egress stair from the WMATA Mezzanine Level to Elm Street will be 10'-0" wide and will incorporate a central handrail and an intermediate 'rest level' coinciding with the Fire Department elevator intermediate stop level and will contain an emergency communications device.

M-E-M-O-R-A-N-D-U-M

DATE: September 27, 2013

TO: Michael Henry
Whitman Requardt & Associates, LLP

FROM: Erik Anderson, P.E.
Licensed in DE, FL, MD, PA, VA

SUBJECT: FINAL - Bethesda Metro Station Occupant Load and Egress Time

KA PROJECT: W003-14

The following calculations and presumptions were used to determine the final occupant load for the Bethesda Metro Station South Entrance project. This approach was agreed upon by the project design team members, WMATA, and MCDPS at a meeting held on August 27, 2013. The presumptions are consistent with: the requirements of NFPA 130, the second entrance demand analysis for the Foggy Bottom-GWU station, and other WMATA standard practices. These figures are used in the timed egress calculations, which are also included in this memo, and will be used in the computer egress modeling for the Bethesda Metro South Entrance project.

OCCUPANT LOAD

1. NFPA 130 requires the occupant load in a train station to be based on the occupants on the trains entering the station simultaneously (*train load*) plus the occupants on the platform waiting for the train (*entraining load*) [NFPA 130, 5.5.5.1].
2. Based on an email dated June 2, 2010, from John A. Magarelli, P.E., of the WMATA Office of Station Area Planning & Asset Management, the occupant load of a typical train is 120 people per car. However, at the August 27, 2013 meeting at the MCDPS, it was agreed upon to use a more conservative occupant load of 175 people per car to capture peak ridership conditions.
3. The maximum length of a train is typically eight cars. Therefore, 8 cars x 175 people/car = 1,400 people per train. As required by NFPA 130, we assume there are 2 trains in the station simultaneously. One train is assumed full. A 0.8 direction factor is applied to the other train. Thus the *train load* is $1.8 \times 1,400 = 2,520$ people.
4. The *entraining load* is required to be based on the projected peak ridership numbers [NFPA 130, 5.5.5.2.1].
5. A ridership analysis for the Bethesda Metro has been completed by Parsons in conjunction with Gallop Corporation. The original report is dated May 2005 and is

entitled *Bi-County Transitway/Bethesda Station Access Demand Analysis*.

The report includes a table summarizing the year 2030 projected ridership numbers. A revised report was issued in 2010. Ridership numbers were derived from a table in the 2010 report and adjusted for 2013. The table indicates the following:

- The projected 2030 AM Peak period boardings of the Bethesda Metro Station via the North and South Metro Station entrances is 4,900 people.
 - The projected 2030 AM peak period transfers from the Purple Line to the Bethesda Metro Station is 2,559 people.
 - Therefore, the total 2030 AM peak period Bethesda Metro access is 4,900 + 2,559 people = 7,459 people total in the AM.
6. The *entraining load* is based on the train headway, factored to account for service disruptions and system reaction time [NFPA 130, 5.5.5.6.2.1]. The 30-minute peak factor is 0.2453. Therefore, the 30-minute peak period *entraining load* is $0.2453 \times 7,459$ people = 1,830 people. The 15-minute peak factor is 0.67 times the 30-minute peak factor. The 15-minute peak period is $0.67 \times 1,830$ people = 1,226 people.
 7. The train headway is 2.5 minutes. Assume headway of 2.5 minutes is delayed to be 5 minutes between trains.
 8. The *entraining load* is 1/3 of the 15-minute peak or $1/3 \times 1,226 = 409$ people entering the station at peak time during the headway period.
 9. The total calculated occupant load for the Bethesda Metro station to be used in the egress modeling is 2,520 people (*train load*) plus 409 people (*entraining load*) for a total station occupant load of 2,929 people.
 10. The total station occupant load of 2,929 people will be assumed to be on the platform for calculation of the *platform evacuation time*, due to the fact that all means of egress components from the platform to the mezzanine level (both new and existing) will be considered in the calculation of *platform evacuation time*.
 11. It will be assumed that half of the Bethesda Metro station occupant load will utilize the new Metro south entrance for egress. The other half of the occupants will utilize the existing Metro north entrance. The occupant load that will be utilized for calculation of the *evacuation time from the most remote point on the platform to a point of safety* will be $2,929/2 = 1,465$ people. This is due to the fact that only the new South entrance will be considered in the calculation of the *evacuation time from the most remote point on the platform to a point of safety*.

Summary:

1. Metro train headway = 2.5 minutes. Assume headway of 2.5 minutes is delayed to be 5 minutes between trains.
2. 15-minute peak = $.67 \times 30$ -minute peak load [$.67 \times 1,830 = 1,226$ people]
3. *Entraining Load* is 1/3 of 15-minute peak [$1/3 \times 1226 = 409$ people]
4. *Train load* at station = Full train in one direction, 0.8 factor for train in other direction.
 - a. 175 people per car

- b. $1.8 \times 175 \text{ people per car} \times 8 \text{ cars} = 2,520 \text{ people}$
5. Total *platform occupant load* = $2,520 + 409 = 2,929 \text{ people}$
6. Divide 2,929 by 2 for Metro North/South Entrance = 1,465 people exiting via South entrance.

PLATFORM EVACUATION TIME [NFPA 130, 5.5.6.1]

- NFPA 130 requires that sufficient capacity be provided to evacuate the platform occupant load, as calculated above, from the station platform in 4 minutes or less [NFPA 130, 5.5.6.1].
- The *platform evacuation time* is calculated by first computing the *total capacity* of the means of egress components (which lead from platform to mezzanine level) in people per minute. The *platform evacuation time* is then calculated by dividing the *platform occupant load* by the *total capacity* of the means of egress components.
- The capacity of an individual egress component is calculated by multiplying the capacity factor specified in NFPA 130 for that particular type of component by the width of the component [NFPA 130, 5.5.6.3].
- The *total capacity* of the means of egress components is calculated as the sum of the capacities of the individual means of egress components as follows:

Platform End	Component	Capacity Factor (ppl/in./min.)	Width (in.)	Calculated Capacity of Component (ppl/min.)	Notes
North	Mezz. Escalator***	1.41	40	56	Capacity Factor x Width = Calculated Capacity of Component
North	Mezz. Stair	1.41	60	84	
South	Mezz. Escalator***	1.41	40	56	
South	Mezz. Stair	1.41	120	169	
South	Tunnel Safety Walk Access Gates	N/A	N/A	120	Two Single Leaf Gates x 60 ppm [NFPA 130, 5.5.6.3.4.2]
South	Tunnel Safety Walks	2.08	36	74	Two 30" Walks - 24" for Sidewalls [NFPA 130, 5.5.6.3.1.2]*
South	Elm Street Vent Shaft Stair	1.41	49	69	Most Restrictive for Vent Shaft Stair Egress**
Total Calculated Capacity				434	<--- Sum of Calculated Capacities
Platform Occupant Load (O.L.)				2929	<--- Specified
Calculated Platform Egress Time (min.)				6.7	<--- Platform O.L./Total Capacity

*NFPA 130 §5.5.6.3.1.2 requires a deduction of 12 in. at each sidewall. The tunnel safety walks are each bounded by a tunnel sidewall on one side and railing at the other; therefore, 12 in. was deducted for each of the two tunnel safety walks.

**The Elm Street vent shaft stair is a more restrictive egress component than the tunnel safety walks or gates used to access them; therefore, the capacity of the vent shaft stair was used in the determination of the total egress capacity provided by that egress route.

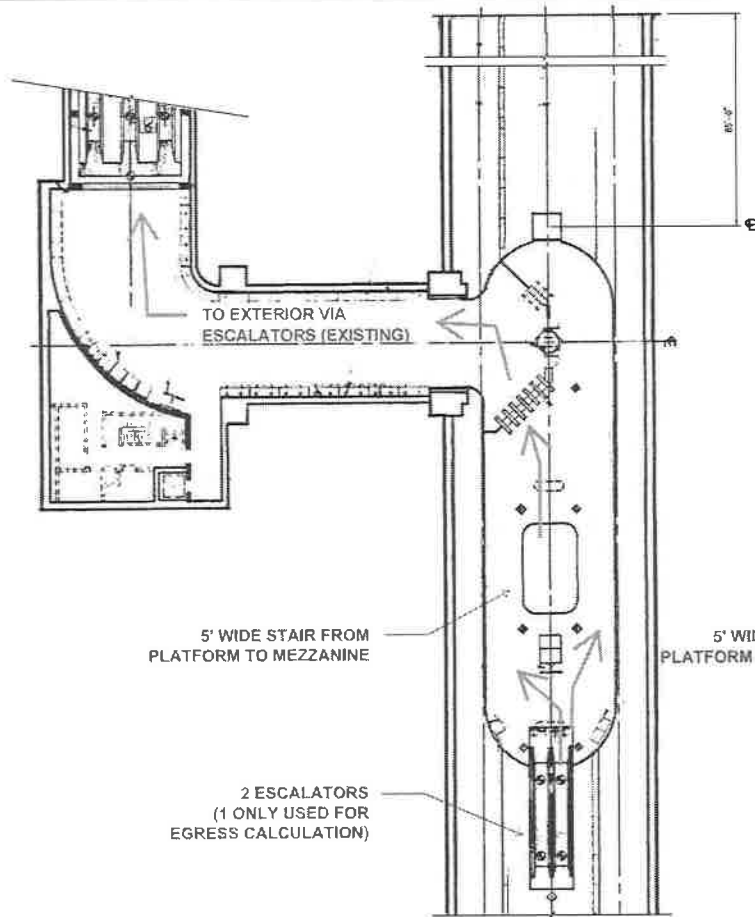
***NFPA 130 §5.5.6.3.2.6 required the calculation to assume one escalator is out of service.

5. The *platform evacuation time* is thus calculated as $2,929/434 = \underline{6.7 \text{ minutes}}$. This is less than one-fourth of the existing *platform evacuation time* calculated using only the existing platform means of egress (vent shaft stair and north escalator) ($2,929 \text{ ppl}/[109 \text{ ppl/min. capacity}] = 26.9 \text{ minutes}$).

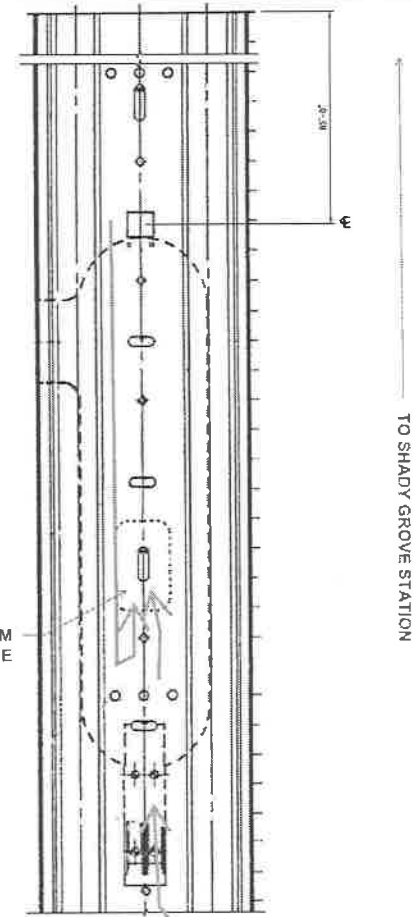
EVACUATION TIME TO A POINT OF SAFETY [NFPA 130, 5.5.6.2]

1. NFPA 130 also requires that a station be designed to permit evacuation from the most remote point on the platform to a point of safety in 6 minutes or less [NFPA 130, 5.5.6.2].
2. The point of safety for this calculation is the area of refuge at the mezzanine level. This area of refuge will be separated from the remainder of the station by a fire-resistance rated rolling shutter.
3. The *total evacuation time* is calculated as the sum of the walking travel time for the longest exit route plus the waiting times at the various circulation elements [NFPA 130, C.1.2].
4. The walking travel time is calculated using a travel speed of 124 ft per minute (fpm) along platforms, corridors, and ramps [NFPA 130, 5.5.6.3.1.4] and 48 ft per minute for the vertical component of travel speed for stairs and escalators.
5. The waiting time for platform exits is calculated by subtracting the walking travel time on the platform from the platform exits flow time. The waiting time for each of the remaining circulation elements is calculated by subtracting the maximum of all previous element flow times [NFPA 130, C.1.2].
6. The walking travel times and wait times are calculated as follows:
 - a. Travel time from remote point on platform to base of stair = $124 \text{ ft}/124 \text{ fpm} = 1 \text{ min}$.
 - b. Wait time at stair = *Platform evacuation time* – walking travel time on platform = $6.7 \text{ min.} - 1 \text{ min.} = 5.7 \text{ min.}$
 - c. Stair travel time = $24 \text{ ft}/48 \text{ fpm} = 0.5 \text{ min.}$
 - d. Travel time to fare barriers = $40 \text{ ft}/124 \text{ fpm} = 0.33 \text{ min.}$
 - e. Wait time at fare barriers = [*Concourse occupant load/Fare barrier egress capacity*] – *Platform evacuation time* = $[1465 \text{ ppl}/(50 \text{ people per minute per gate} \times 6 \text{ gates})] - 6.7 \text{ min.} = 0 \text{ min}$
 - f. Travel time from fare barriers to point of safety = $30 \text{ ft}/124 \text{ fpm} = 0.25 \text{ min.}$
7. The *total evacuation time* from the most remote point on the platform to a point of safety is thus $1+5.7+0.5+0.33+0+0.25 = \underline{7.8 \text{ minutes}}$.

REVISED - 05/2008 (SHEET 1 OF 2) - 10/2008 (SHEET 2 OF 2) - 03/2009 (SHEET 3 OF 3) - 06/2009 (SHEET 4 OF 4) - 09/2009 (SHEET 5 OF 5) - 11/2009 (SHEET 6 OF 6) - 02/2010 (SHEET 7 OF 7) - 05/2010 (SHEET 8 OF 8) - 08/2010 (SHEET 9 OF 9) - 11/2010 (SHEET 10 OF 10) - 02/2011 (SHEET 11 OF 11) - 05/2011 (SHEET 12 OF 12) - 08/2011 (SHEET 13 OF 13) - 11/2011 (SHEET 14 OF 14) - 02/2012 (SHEET 15 OF 15) - 05/2012 (SHEET 16 OF 16) - 08/2012 (SHEET 17 OF 17) - 11/2012 (SHEET 18 OF 18) - 02/2013 (SHEET 19 OF 19) - 05/2013 (SHEET 20 OF 20) - 08/2013 (SHEET 21 OF 21) - 11/2013 (SHEET 22 OF 22) - 02/2014 (SHEET 23 OF 23) - 05/2014 (SHEET 24 OF 24) - 08/2014 (SHEET 25 OF 25) - 11/2014 (SHEET 26 OF 26) - 02/2015 (SHEET 27 OF 27) - 05/2015 (SHEET 28 OF 28) - 08/2015 (SHEET 29 OF 29) - 11/2015 (SHEET 30 OF 30) - 02/2016 (SHEET 31 OF 31) - 05/2016 (SHEET 32 OF 32) - 08/2016 (SHEET 33 OF 33) - 11/2016 (SHEET 34 OF 34) - 02/2017 (SHEET 35 OF 35) - 05/2017 (SHEET 36 OF 36) - 08/2017 (SHEET 37 OF 37) - 11/2017 (SHEET 38 OF 38) - 02/2018 (SHEET 39 OF 39) - 05/2018 (SHEET 40 OF 40) - 08/2018 (SHEET 41 OF 41) - 11/2018 (SHEET 42 OF 42) - 02/2019 (SHEET 43 OF 43) - 05/2019 (SHEET 44 OF 44) - 08/2019 (SHEET 45 OF 45) - 11/2019 (SHEET 46 OF 46) - 02/2020 (SHEET 47 OF 47) - 05/2020 (SHEET 48 OF 48) - 08/2020 (SHEET 49 OF 49) - 11/2020 (SHEET 50 OF 50) - 02/2021 (SHEET 51 OF 51) - 05/2021 (SHEET 52 OF 52) - 08/2021 (SHEET 53 OF 53) - 11/2021 (SHEET 54 OF 54) - 02/2022 (SHEET 55 OF 55) - 05/2022 (SHEET 56 OF 56) - 08/2022 (SHEET 57 OF 57) - 11/2022 (SHEET 58 OF 58) - 02/2023 (SHEET 59 OF 59) - 05/2023 (SHEET 60 OF 60) - 08/2023 (SHEET 61 OF 61) - 11/2023 (SHEET 62 OF 62) - 02/2024 (SHEET 63 OF 63) - 05/2024 (SHEET 64 OF 64) - 08/2024 (SHEET 65 OF 65) - 11/2024 (SHEET 66 OF 66) - 02/2025 (SHEET 67 OF 67) - 05/2025 (SHEET 68 OF 68) - 08/2025 (SHEET 69 OF 69) - 11/2025 (SHEET 70 OF 70) - 02/2026 (SHEET 71 OF 71) - 05/2026 (SHEET 72 OF 72) - 08/2026 (SHEET 73 OF 73) - 11/2026 (SHEET 74 OF 74) - 02/2027 (SHEET 75 OF 75) - 05/2027 (SHEET 76 OF 76) - 08/2027 (SHEET 77 OF 77) - 11/2027 (SHEET 78 OF 78) - 02/2028 (SHEET 79 OF 79) - 05/2028 (SHEET 80 OF 80) - 08/2028 (SHEET 81 OF 81) - 11/2028 (SHEET 82 OF 82) - 02/2029 (SHEET 83 OF 83) - 05/2029 (SHEET 84 OF 84) - 08/2029 (SHEET 85 OF 85) - 11/2029 (SHEET 86 OF 86) - 02/2030 (SHEET 87 OF 87) - 05/2030 (SHEET 88 OF 88) - 08/2030 (SHEET 89 OF 89) - 11/2030 (SHEET 90 OF 90) - 02/2031 (SHEET 91 OF 91) - 05/2031 (SHEET 92 OF 92) - 08/2031 (SHEET 93 OF 93) - 11/2031 (SHEET 94 OF 94) - 02/2032 (SHEET 95 OF 95) - 05/2032 (SHEET 96 OF 96) - 08/2032 (SHEET 97 OF 97) - 11/2032 (SHEET 98 OF 98) - 02/2033 (SHEET 99 OF 99) - 05/2033 (SHEET 100 OF 100)



1 RED LINE MEZZANINE LEVEL FLOOR PLAN (EXISTING)
 SCALE: APPROX. 1/16" = 1'-0"



2 RED LINE PLATFORM LEVEL FLOOR PLAN (EXISTING)
 SCALE: APPROX. 1/16" = 1'-0"

CONTRACT NO. XXXXXX

REVISIONS				
NO.	DATE	BY	DESCRIPTION	CHKD.
DESIGNED				
DRAWN				
CHECKED				
APPROVED				



WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
 DEPARTMENT OF OPERATIONS SERVICES
 OFFICE OF ENGINEERING SERVICE
 SUBMITTED BY: _____



BETHESDA STATION - SOUTH ENTRANCE
EGRESS SKETCH (NORTH)
 SCALE: AS NOTED DRAWING NO. A-2

