FARRAGUT NORTH AND FARRAGUT WEST PEDESTRIAN PASSAGEWAY TUNNEL STUDY

Washington Metropolitan Area Transit Authority

DEPARTMENT OF PLANNING AND STRATEGIC PROGRAMS
OFFICE OF BUSINESS PLANNING AND PROJECT DEVELOPMENT (BPPD)

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Prepared By:
Parsons
KGP Design Studio
Basile Baumann Prost & Associates

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I. INTRODUCTION AND DESCRIPTION OF PROJECT

The Pedestrian Connection between Farragut North and Farragut West is conceived as a paid area (free passage for patrons) that will shorten the travel time going from Virginia toward NW Washington and vise versa by eliminating the need to go to Metro Center to transfer. This connection will not only save time but will free up space in Metro Center during rush hours. The connection is anticipated to carry approximately 37,000 patrons a day by 2030 with increases as ridership continues to grow.

The passageway is designed for ADA accessibility at both stations. New elevators are added at Farragut North from the passageway to the platform and new elevators at Farragut West from the existing mezzanine to the platform and to the street. The passage has a continuous slope of approximately 3% to travel from the Farragut West, east mezzanine, down to the Farragut North new mezzanine level at the south end of the station. All elevators are WMATA standard elevators except the two elevators at Farragut North. These elevators meet ADA requirements but are minimal in size to accommodate the existing required ductwork in the station. This will require a variance from WMATA criteria for these two elevators to be built. One full size elevator can be used as alternative if required by WMATA.

The tunnel has roll down fire doors at each end to be able to isolate each station. This prevents a disturbance in one station from affecting the other station. Next to each of these doors are emergency exits accessed from either side of the door that lead to an area of rescue and an emergency exit stair to the surface. Each stair comes out a “pedestrian hatch” located flush with the sidewalk along Farragut Square. This is a standard escape hatch used in many WMATA stations in the system that can be walked on similar to other grills or grates along the streets.

An allowance has been made for the future Transitway along K Street. If this is developed the vent shaft at the north edge of Farragut Park will need to be located within the final sidewalk location. The Transitway affects no other areas.

There are four station information panels with two toward each end of the tunnel to relate train arrival times, directions and other important information as you approach each station.

The pedestrian connection is examined as three options: 1), pedestrian tunnel, 2), pedestrian tunnel with moving walkways in both directions and 3), pedestrian tunnel with commercial space. The three tunnel options all connect with the existing stations using exactly the same configurations, only the tunnel sections change.

Prior to the final solutions, many options were studied. This was all part of the process to create the best and most cost effective solutions. The background and decision process will be discussed in Section IV.

II. PEDESTRIAN CONNECTION OPTIONS

The final solutions have evolved with common elements in each option. The circulation elements and egress as well as the general architectural character are similar in all the options, while only the tunnel section and service areas change.

The architectural section of the tunnel options was studied. The standard passageway ceiling is flat and 11' high. This ceiling was considered visually too confining for a tunnel that is 320' long. The tunnel length is about 50% of a station and the width of is similar to Forest Glen and Wheaton Station rooms. It was decided to create a higher ceiling to provide a more comfortable walk and use the existing architecture of these stations as the model for the design. The standard cove base and bronze railings are used except in the retail option where the wall surface is needed for storage.

The following outlines first the connections at each station then the tunnel options between the connections.

A. Connections at Farragut West

The tunnel connection at Farragut West is through an existing knockout panel in the station wall on the north side of the East Mezzanine paid area. This requires some modifications to the existing mezzanine parapet and railing. No modifications are needed to the fare gate arrangement to accommodate this new passageway.

The connection to the tunnel is through a short, 10 foot, passageway where doors are located to the elevator machine room and to the emergency exit stair and area of rescue. This short passage reflects the typical metro entrance passage with curved concrete base and bronze railings up to the fire door where a portal leads into the pedestrian tunnel. An AC mechanical room is located just off this passage and serves approximately half the pedestrian tunnel. This same system can be used for smoke exhaust during an emergency. Vent shafts go up to the sidewalk from this area.

Two new elevators are added, one to each platform, from the mezzanine paid area. These elevators would be built outside the station vault with openings punctured into the vault for access to the elevator cabs. These are small openings approximately the size of an elevator door, 3 feet by 7 feet at each level. The parapet and railings at the mezzanine and platform will need to be modified to allow access to the elevators. The elevator machine rooms are located at the mezzanine level, one off the existing station entrance passageway and one off the new pedestrian passageway.

Two new surface elevators are added next to the escalator entrance from street level in the existing right-of-way under the Club Quarters Building. Space is created in the mezzanine passageway by taking approximately 8

feet from the Traction Power Substation at that level. Some additional space may be required from the Club Quarters Building that must be worked out in the future. A new elevator machine room is created in the right-of-way area accessed at street level.

B. Connections at Farragut North

The tunnel connection at Farragut North is through the end wall of the station into a new passageway above the existing mechanical rooms and tracks. The mechanical equipment is modified and relocated further back and in areas of the existing vent shaft that is relocated. The new vent shaft is on the north sidewalk of Farragut Square, similar to the existing vent shaft on the south sidewalk. See Section VI Mechanical Section for more details.

At platform level the mechanical room modification allows room for an elevator lobby located beyond the end of the platform and access through the end wall of the station. A new 12 foot wide stair leads up to the new passageway from the platform. The elevators are set back in the passageway approximately 30 feet from the stair. An enlarged area at the top of the stair provides additional space for circulation. Two new pylons with up lights and AC are placed at the top of the stairs and replace a platform pylon that is removed. A bench is also removed from the platform to allow room for the stair.

The passageway takes the form of a typical entrance passage with concrete curved base and bronze handrails. This esthetic continues to the fire door where a portal leads to the pedestrian tunnel. An AC mechanical room is located off this passage that supplies approximately half the tunnel and can be reversed to remove smoke, (see Section VI Mechanical Section for more detail).

All the options require the relocation of the Farragut North vent shaft that is presently located in the middle of 17th Street, (see Section VI Mechanical Section for more details). The vent shaft is relocated to the north sidewalk of Farragut Square, similar to the existing vent shaft from Farragut West on the south sidewalk.

C. Pedestrian Tunnel Options

All the tunnel options follow the same general esthetic of the existing Metro System with concrete walls and quarry tile floors. The intent is to make this feel like another “room” within the system.

1. Option 1 – Pedestrian Tunnel

   This tunnel is a simple concrete tunnel in a vault shape that reflects the esthetics of the "shot gun" stations at Forest Glen and Wheaton. The width is 27 feet and the length is approximately 300 feet long. The tunnel begins and ends at the two fire doors where a standard metro portal frames the entry. The ceiling is approximately 20 feet high in the center and tapers down on the sides. There is a cove base along the walls and a bronze railing that keeps people from touching the walls. The 2' – 6" cove base creates an open walkway area 22 feet wide. The floor is quarry tile and matches the rest of the system. There are up lights along the edge of the walkway flush with the floor behind the railings. Grills are located to direct the light onto the ceiling. Additional down lights are located in every other coffer section over the center of the passage which form a grid 16' x 8" square. These lights are recessed into acoustic panels that are in the upper coffers.

   Air-conditioning ducts come up next to the walls and have backlit advertising panels attached similar to Forest Glen. Behind several of the ceiling acoustic panels are the AC return grills that will be used as exhaust in emergencies.

2. Option 2 – Pedestrian Tunnel with Moving Walkway

   This tunnel is similar to Option 1 but has a bigger section and two moving walkways, one in each direction. The tunnel is 39 feet wide and the 2 walkways are 12 feet. With the same base cove there is an open walkway of 11 feet on each side of the walkway. The walkway is centered rather than on the side to prevent cross circulation problems at the two ends. The height of the tunnel is approximately 25 feet in the center.

   Additional lighting is required in the ceiling with two more light fixture added near the center of the coffers.

3. Option 3 – Pedestrian Tunnel with Commercial Space

   The Commercial tunnel is similar to the other options but is limited to the central 150 feet. The two ends of the tunnel are the standard passageway esthetics that occurs as the passage comes out of each station with a flat ceiling and acoustic panels with recessed lights. The passage has a curved cove base and ceiling with a bronze railing along the edge.

   The commercial space is similar to Options 1 and 2 with a concrete vault 43-foot width. There is no cove base in this section to allow

commercial kiosk to be attached to the walls. The walls come directly to the floor. Lighting is located along the wall about half way up the vault that provides both up and down light. Lights are provided in the ceiling similar to Option 2.

Air ducts are located in the wall in this case using the "j tube" method, which puts the grills in each coffer just above head height. Electrical outlets are placed in the floor and along the walls as well as telecommunications access points for the use of the commercial venders.

The size of the vending carts may vary, but the general space allowed is 10 feet by 16 feet. These spaces will alternate along the two sides of the passage creating a meandering path for the patrons giving maximum exposure to the retail kiosks.

Additional service rooms are required and will be located at the south end of the tunnel.

III. CODES AND DATA

The Codes that were analyzed included NFPA 130, (see Appendix D) and the District of Columbia International Building Code, 2000 Addition. Once the decisions were made about the alternatives it was determined that NFPA 130 would apply to the pedestrian tunnel in all cases and not the International Building Code. This was determined due to the use of the tunnel as a passage between the stations. Even in the case of the commercial in the tunnel, the amount of commercial and the nature of the commercial is allowed in the NFPA regulations. This tunnel is part of the Metro System and is not considered to fall into another use category.

The emergency stairs that are added improve egress from the stations. There are two stairs each 48 inches wide as prescribed in the WMATA criteria. The minimum size for NFPA 130 is 44 inches. This stair width works with the standard WMATA surface emergency hatch that is provided in the sidewalk.

IV. BACKGROUND ANALYSIS AND DECISION PROCESS

A. Initial Scope and Alternatives

There were two alternative tunnel connections considered between Farragut North and West. Alternative 1 is a tunnel connection from mezzanine to mezzanine through existing knock out panels as either a paid or free area leading directly to fare gates and a kiosk at each end. Alternative 2 is a tunnel connection from existing mezzanine at Farragut West via knockout panel to a new mezzanine at the south end of Farragut North, also free or

paid. There are no fare gates at this location at Farragut North. See Drawing Appendix for Alternative Drawings.

If Alternative 2 became a free area connection a new mezzanine would be required at Farragut North. Patrons would need to leave the paid area to access the free area tunnel. This would require fare gates and a kiosk. The free tunnel also requires fare gates at the new entrance along the tunnel. All the variations considered both options of free or paid.

There were the three options, 1), tunnel only, 2), tunnel with moving walkway and 3), tunnel with commercial. For each of these schemes additional variations were looked at for entrance locations in Farragut Square.
Alternative Descriptions:

1. Alternative 1: Pedestrian Tunnel to existing Mezzanines in North and West

1A: Pedestrian Tunnel, 22' wide 520' long with entrances along 17th Street. The elevators must be placed in an existing building due to sidewalk width.

1B: Pedestrian Tunnel, 34' wide and 520' long with two moving walkways split into two sections. Entrance conditions are the same as A1.

1C: Pedestrian Tunnel with Commercial Space on one side, 60' wide for approximate 400' with a continuation of the Pedestrian Tunnel for 120'. This created a commercial area of approximately 7,600 SF. Entrances have 2 possibilities, one along 17th Street or an entrance in Farragut Park.

2. Alternative 2: Pedestrian Tunnel to South end of Farragut North and Existing Mezzanine at Farragut West

2A: Pedestrian Tunnel, 22' wide 370' long with entrances along 17th Street. The elevators must be placed in an existing building due to sidewalk width.

2B: Pedestrian Tunnel, 34' wide and 370' long with two moving walkways split into two sections. Entrance Conditions the same as A1.

2C: Pedestrian Tunnel with Commercial Space on both sides, 60' wide, 370 feet long. This created a commercial area of approximately 6,800 SF. Entrances have two possibilities, one along 17th Street or an entrance in Farragut Park.

B. Entrances To the Tunnel

Entrances were required into the tunnel along 17th Street both for safety and convenience of the patrons. Elevators were also required to meet proper accessibility. The width of the 17th Street sidewalk along the west side of the street is 18', which limits the entrance width and limits elevators from being placed on the sidewalk. At most this could allow a single escalator or a stair. At least 2 of these entrances were necessary to provide in and out pedestrian flow for the tunnel area. With little room for elevators on the sidewalk, they needed to be located in the basement and storefront area of an existing building, similar to the elevator at Farragut North. In all cases new elevators were added to the Farragut West Station at the east mezzanine down to the platforms.

An entrance was studied in Farragut Square that could accommodate escalators, stairs and elevators. This solution would require an escalator canopy and 2 elevator head houses in the park.

C. Farragut North - South Entrance to Platform Options, Alternative 2 and All Options

At Farragut North Alternative 2 several elevator, stair and escalator options were studied. To enter the new pedestrian passageway the patrons have to go up to the mezzanine level to cross over the tracks. With the entrance at the south end of the station new vertical circulation was required. Four options were studied:

1. A 6' stair and elevator at the end of the platform. This is the maximum area that can be used due to the platform width.
2. A 12' stair with a single full size elevator beyond the platform was studied. This is the maximum size stair to keep the platform clear for 9' feet next to the trains (WMATA criteria). There is not enough space to place 2 full size WMATA elevators on or beyond the platform due to train clearance and mechanical ductwork.
3. A stair / escalator combination with no elevator.
4. A 7' wide stair and a 10' wide bridge from the new passageway to the existing mezzanine to make use of the existing elevator.

Any escalators or stairs in the platform required lowering the ac and under platform exhaust ducts. New escalators do not count as part of the egress requirements under NFPA 130. The decision was made to make the largest stair possible and located two elevators off the platform, meeting the elevator requirement. These elevators need to be reduced size but meeting ADA requirements. These are standard hospital elevators with 4500 lb limit, 30/26 passenger load with a 5'-8" x 7'-11" cab.

D. Farragut West - Station Entrance and Platform Elevators, All Alternatives and Options

At Farragut West Station elevators to the street were studied in several locations. The limitation was on the station size and the relationship to the surrounding buildings and sidewalks. The only place were elevators could be placed was within existing buildings. With this in mind the decision was made to locate the elevators within the existing WMATA right of way under the Club Quarters Building. By removing the public access from 17th Street to the station escalators 2 new elevators could be added. Some space will be required from the Club Quarters Building that will have to be negotiated. The elevator machine room would be located in the remainder of the WMATA space at the surface next to escalators.

To allow patrons access to the platform from the new pedestrian passageway, new elevators are required at the east end of Farragut West. Elevators were examined in the station at the far east end of the platform. The elevators could be placed in the station vault, but this prevented required clearance of 9' from the train on the platform when an 8 car train is in operation. Elevators beyond the platform were examined but the mechanical and ductwork prevented elevators in this location. The only available option was to locate the elevators outside the station vault on both sides of the station where access could be obtained to both tracks and the mezzanine.

E. Decision Process

The WMATA staff, consultants and other participants including National Park Service, National Capitol Planning Commission, DC Office of Planning and DC Department of Transportation, agreed to the decisions. Several meetings took place at WMATA that

1. The decision was made to use Alternative 2, the shorter tunnel between the stations connecting to the south end of Farragut North. This was chosen because it was shorter and did not disrupt K Street during construction and also provided additional egress from the Farragut North Platform.

    a) The entrance in Farragut Square was dropped as an alternative at the insistence of the National Park Service. The NPS sees Farragut and McPherson Squares as symmetrical parks that needed to remain in the same configuration. The new entrance in the park would have overpowered the park plan.

    b) The decision was made to make the tunnel in the paid area for patrons. There were multiple reasons for this decision. If the tunnel had been free for the public to enter there were questions

about who would patrol and provide security in the tunnel. The retail analysis showed that few people would come underground simply to shop where there were shops at street level in the surrounding area. The DC Planning Department did not want to pull people off the street into an underground shopping center.

c) The location of the street elevators and the need for fare gates into the tunnel at the entrances were the deciding factors to locate the elevators at the existing Farragut West Station, east entrance. This works well in the big picture placing elevators to the surface in the three most distance corners of the area covered by the stations. These elevators also bring people into the free area of the mezzanine and allow normal circulation through the fare gates. This was the only place where the elevators could be placed without taking or negotiating space in an existing storefront. The sidewalks were too narrow or not accessible from the tunnel or station areas below.

d) Due to the decision to place the elevators at the existing entrance the requirement for additional entrances was dropped. This was done to eliminate to solve the problem of remote gates and/or a new Kiosk in the tunnel. Egress was accomplished with emergency stairs that were necessary anyway to protect each station during an emergency.

e) The retail space was limited to 2,700 SF and the use of carts rather than a large mall type retail space. This decision was made due to the prohibition of food in the system and a reflection of the market that would be available within the transit system. See Section IX.B for more details.

V. STRUCTURAL FEATURES

A. Modification of Farragut North Station

A proposed stair with railings extending from the existing platform level to the proposed mezzanine level will be constructed at the south end of the station. The proposed mezzanine area will be approximately twenty (20) feet by six (6) feet. Concrete slab on structural steel framing will be used to support pedestrian load and dead loads including the precast concrete railing along the perimeter of the mezzanine. Columns extended to the 3’-6” station concrete invert slab will be constructed to support the stair and the mezzanine entrance at the south end of the station. The construction will be performed inside the station, the work area will be enclosed to control dust from the construction activities.

Two openings will be provided at the 2-foot thick south end wall of the station. A 14-foot wide opening will be provided at the platform level. The proposed opening is located between the existing inbound and outbound tunnels. The distance between the inbound/outbound tunnel openings and the proposed opening at the platform is approximately five feet. The walls between the openings will be strengthened to become columns by increasing the concrete wall thickness and providing additional reinforcement. The existing mechanical equipment room will be converted to an elevator lobby. The existing 4'-6" roof slab of the mechanical equipment room outside the station will become the floor slab of the new passageway. A 20-foot wide opening will be provided at the mezzanine level of the station end wall above the proposed opening at the platform level. The portion of wall between the two proposed openings will be strengthened as concrete beam to support and transfer the loads form the mezzanine to the proposed columns. The 2' thick north wall and roof slab of the existing 3-foot wide fresh air shaft will be demolished to make room for the passageway at the mezzanine level. Concrete roof slab spanning from the end wall to the south wall of the existing fresh airshaft will be constructed to create a proposed 27 feet wide passageway. Two proposed 7'-4" by 5'-9" elevators from the platform level to the mezzanine level will be furnished. Openings will be provided at the 4'-6" slab for the elevators. An exterior east wall will be constructed above the existing mechanical equipment room for the proposed storage room and electrical/mechanical room at the east side of the proposed elevators.

There are some utilities in the area of the new tunnel that must be dealt with for construction. The smaller utility lines can be relocated to the sides of the tunnel during construction. The 20" water line can shift to the park side of the tunnel until it crosses over the construction near 17th and K Streets. At this point the line will need to be supported during the construction. The 30" storm sewer line crosses over Farragut North Station at the far south end where the new entrance is planned over the mechanical rooms. During construction this line will need to be moved or supported depending on the detailed design. There is a Pepco power distribution line that runs along the west side of 17th Street. A 6" gas line runs along the west side of 17th Street. This gas line becomes an 8" line in the area of the intersection of 17th Street and Eye Street. There is also a 24" gas line that runs along the south side of K Street. The power distribution line and gas lines will need to be supported or relocated during construction depending upon the detailed design.

The construction will be performed from the street level at the corner of K Street and 17th Street within Farragut Square, a National Park Service (NPS) property. Provisions will be specified for the working area at the NPS property to be restored to its original condition after construction.

The existing 30-inch storm sewer at the south end of the station may require relocation prior to construction. The existing 20-inch water line may remain and temporary support will be provided during the construction.

B. Modification of Farragut West Station

Proposed elevators will be provided at both platforms of the station to mezzanine at approximately 70 feet from the east end of the station. The proposed elevator shafts will be located at both sides of the 50-foot unit adjacent to the entrance and knock out panel unit. The proposed shafts will consist of thick and heavily reinforced concrete walls and slabs. The shaft walls will extend from the top of the station vault to the invert slab. The shafts will provide additional structural strength for the existing vault elevator openings. The construction of the elevator shafts will be performed from the street level at both sidewalks of the Eye Street and 17th Street intersection. Openings will be provided at both the platform level and mezzanine level for the elevators. The elevator openings will be constructed inside the station, the work area will be enclosed to control dust from the construction activities. Displacement of the existing vault will be monitored for the duration of the construction to ensure the safety of the structure.

Two proposed elevators from the street level to the mezzanine will be constructed at the southeast corner of the station adjacent to the existing escalator at the east entrance. The proposed elevator will be located between the existing traction power substation and the Club Quarters Building basement. The construction will be performed at the street level. Additional beams and walls will be constructed around the shaft to support the elevator openings. Walls and slabs will also be built for the proposed elevator lobby at the mezzanine.

The utilities near Farragut West Station appear to be minor and can be relocated along the side of the construction. Only the emergency exit stair passes under 20” water line, that will need to be supported during construction.

C. Relocation of Vent Shaft at 17th Street

The existing vent shaft at the 17th Street roadway will be demolished and relocated to the sidewalk along K Street sidewalk adjacent to the Farragut Square. The area of the proposed vent shaft opening will be approximately the same size as the existing shaft opening. The proposed structure will be extended from the east side of the existing air plenum. The new box structure will have about 16 feet of soil overburden beneath the park. Cut and cover type of construction will be performed and one existing tree may be affected during construction. Provisions will be specified for the working area at the NPS property to be restored to its original condition after construction. Work

areas in NPS lands will be surrounded by fences, as determined by NPS officials, to minimize the impact on park activities. Wood slat fence with metal post will be used for protection of existing trees and shrubs. Trees within the work areas will be protected by tree boxes of substantial construction. The portion of the existing vent shaft that interferes with the passageway construction will be demolished.

The existing 20-inch water line may remain and temporary support will be provided during the construction. The 30-inch storm sewer may require relocation prior to construction.

D. Tunnel Construction Method

Three (3) different options of passageway are presented in the report. Option 1 is a 28 foot wide by 14 foot high pedestrian walkway. Option 2 has a 40 foot wide by 18 foot wide passageway with a moving walkway at the center. Option 3 has a 38 foot wide by 17'-6" high passageway with a commercial/retail option at both sides of the walkway.

The passageway for all three options will be connecting the south end wall of the Farragut North Station to the mezzanine knock out panel at the north side of the Farragut West Station. The vertical clearance of the entrance at the knock out panel is approximately eight (8) feet high.

Based on existing available soil boring information, the passageway will pass through various layers of soil strata mainly composed of medium to coarse sand and silty sand. The soil overburden above the passageway varies from approximately 8 feet to 16 feet beneath the roadway for the three options. Cut and cover type of construction method is recommended. Temporary support of the excavation such as soldier piles and lagging or slurry walls can be used. Concrete or timber decking can be utilized to minimize the impact to the 17th Street traffic during construction of the passageway.

The water table is in general twenty to thirty feet below grade. Dewatering may be performed during construction. Possible displacement of the adjacent buildings should be monitored for the entire duration of construction**.**

E. Emergency Egress of Passageway

Emergency egress and mechanical/electrical rooms will be constructed at both ends of the passageway. The northern emergency egress will be extended to the NPS property. Provisions will be specified for the working area at the NPS property to be restored to its original condition after construction.

VI. MECHANICAL FEATURES

A. General Mechanical Issues Common to All Options

1. Passageway Air Conditioning

All three passageway options will be air conditioned. Heating is typically not provided for WMATA station public areas and will be used only for Option 3 where the potential exists for people to spend significant amounts of time in the passageway. Options for a suitable air conditioning system consist of the following:

- An air conditioning system utilizing the existing station chilled water system. The components involved would consist of the additional chilled water piping and fan coil units. Unless the capacity of the chiller plants serving the stations were increased, this option would divert chilled water from the stations into the passageway and would result in a loss cooling capacity in each of the stations. Maintaining the current chilled water capacity would require an upgrade to chiller plants serving both Farragut North and Farragut West Stations. WMATA underground stations are typically provided with 350 tons of air conditioning capacity. Farragut North is currently served by a 700 ton chiller plant located between Farragut North and DuPont Circle Stations. Farragut West is served by a 1050 ton capacity central chiller plant that is located in the vicinity of Farragut West and also serves McPherson Square and Foggy Bottom stations.
- An air conditioning system utilizing chilled water provided by a dedicated air-cooled liquid chiller. This system would be sized to provide the required cooling for the passageway and would operate independently of the station chilled water systems. The components involved would consist of the chiller, associated chilled water piping, chilled pump and fan coil units spaced throughout the passageway. The air cooled chiller would preferably be located on the roof of a nearby building. In addition, mounting a chiller on a building roof would also require a pipe chase within the building for routing chilled supply and return piping. While it is possible to mount a chiller in an open areaway, this option would complicate maintenance and could also adversely impact performance as a result of short circuiting of condenser intake and discharge air.
- An air conditioning system utilizing a split system type air conditioner that consists of a fan coil unit and a remotely located condensing unit. Air distribution would utilize supply and return air ductwork routed through the length of the passageway. As is the case with an air cooled chiller, the condenser unit would preferably be located on the roof of a nearby building. The building would also require a pipe chase for routing refrigerant piping. Due to

restrictions on refrigerant piping lengths, the condenser would have to be mounted relatively close to the fan coil unit.

- An air conditioning system utilizing a self contained type air conditioner that can be completely installed within a mechanical equipment room. Air distribution would utilize supply and return air ductwork routed through the length of the passageway. Condenser air intake and condenser air discharge shafts to the surface are required.

Of the four options listed above, the self contained air conditioning system option is preferred for all three passageway options and is included in the cost estimate. This option does not require space within an adjacent building and does not impact the existing station chilled water systems.

Ventilation, cooling and heating will be provided for the service spaces connected to the passageway in accordance with the WMATA design criteria. Air conditioning and heating will be provided for the elevator machine rooms associated with each of the three options. Per WMATA criteria, underground mechanical and electrical rooms do not require ventilation or heating with the exception that ventilation is required if the electrical room space contains heat producing equipment. Requirements for the Cleaner's, Men's and Women's rooms contained in Option 3 are exhaust ventilation at the rate of 2.5 cubic feet per minute (cfm) per square foot and sufficient heating to maintain a room temperature of 70 degrees Fahrenheit.

2. Vent Shaft Relocation

   The vent shaft serving the south end of Farragut North station currently terminates in a grating located in 17th Street. The design for this station was completed in the early 1970's before NFPA 130 existed. However, this grating location violates the current version of NFPA 130 (reference: NFPA 2003 paragraph 6.2.8.2) and is undesirable in any case since this location may allow flammable liquids to enter the subway system in the event of a fuel spill on the surface. All three passageway options include the relocation of the vent shaft to the sidewalk on the south side of K Street. Due to its location on the sidewalk, an ADA compliant grating is required.

   The existing underplatform exhaust shaft serving the south end of Farragut North station terminates in a grating located in the sidewalk on the west side of Farragut Square. This grating will remain in its current location.

3. Station Mechanical Room Modifications

   Required modifications to existing Farragut North station south platform level mechanical room consist of the following:

- Relocate the existing station platform air conditioning unit serving the south platform (ACU-2) and reconfigure the ductwork. Due to the apparent age and condition of this equipment item, a new unit equipped with bag filters should be provided per current WMATA criteria.
- Replace existing air handling unit AHU-2 serving as the south platform underplatform exhaust system with an axial fan sized to deliver 30,000 cfm. Replacing the existing unit with a fan of the same capacity requires a variance to the design criteria. The existing underplatform exhaust system utilizes two non-reversible air handling units, each of which serve half the platform and are sized to exhaust 30,000 cfm each. Current WMATA criteria require two reversible, 60,000 cfm axial fans. Compliance with these criteria requires replacement of both existing air handling units with new fans and the provision of significantly larger ductwork.

Accommodation of the pedestrian passageway does not require any modifications to existing mechanical rooms in the Farragut West Station.

4. Fire Protection

Due to the length of the pedestrian passageway, a dry standpipe system will be provided in the passageway with angle hose valves located in the vicinity of each exit stairway and an additional angle hose valve located at the approximate center of the walkway. Options for this system consist of either extending the existing standpipe systems serving Farragut North and Farragut West stations or the provision of an entirely separate dry standpipe system. Per NFPA 130 (reference NFPA 130 2003, paragraph 5.7.4.4), cross connections are necessary where stations involve more than one platform. While NFPA 130 does not directly address two stations connected by a passageway, it is assumed that the local jurisdiction would find it desirable to extend the existing standpipe systems into the passageway such that the passageway can be served from either the Farragut North or Farragut West station.

In any case, the existing standpipe system serving the south end of Farragut North station needs to be extended to provide an additional angle hose valve serving the new mezzanine.

NFPA 130 (reference NFPA 130 2003, paragraph 5.7.3.1) requires provision of an automatic sprinkler system in station concession areas. In addition, WMATA criteria require the provision of sprinklers in washrooms. The sprinkler requirement applies to Option 3, which is the only option that contains commercial areas and washrooms. Sprinklers are not provided in Options 1 and 2.

NFPA 130 also contains requirements for emergency ventilation in the event of a fire. The addition of a return air fan to the self contained air conditioning system described above provides a means of providing smoke exhaust capability in the event of a fire within the passageway. If a fire occurs within either of the stations, the air conditioning system can be used to pressurize the passageway in the event the roll down fire door separating the passageway from the station is closed. With the roll down door open, the same unit will produce airflow into the station in a direction opposite to that of evacuating passengers.

5. Plumbing and Drainage

   In general, area drains will be provided in all shafts and the exit stairways. Due to problems associated with connecting to the existing station drainage systems, sump pumps will be provided and will discharge to the city sewer.

   Due to the presence of washrooms, a sewage ejector and a water service are required for Option 3. In addition to provision of domestic water, the water service will also need to supply the sprinkler system.

B. Mechanical Work Associated with Each Option

All three options require modification of the existing Farragut North vent shaft and south mechanical room. Specific mechanical work associated with each option is described below.

1. Option 1

   The mechanical, plumbing and fire protection features associated with this option consist of the following:

   - The pedestrian passage will be air conditioned with a two self contained air conditioning units. The estimated air conditioning requirement is approximately 24 tons with each unit having a nominal capacity of 12 tons. This is based on a floor area of approximately 8000 square feet, a passenger heat load of 1000 British Thermal Units per hour (Btuh) per person, a density of 40 square feet per person, and a miscellaneous electric and lighting load of 3 watts per square foot.
   - The air distribution system will utilize both supply and return air ductwork.
   - A mechanical room is required and associated air intake and exhaust shafts are required to house the air conditioning equipment and provide for condenser intake and discharge airflow, outside air for the passengers using the passageway.
   - Passageway heating will not be provided. This is consistent with existing station HVAC systems serving public areas and the design criteria.

- Area drains will be provided at each of the exit stairways and the mechanical room. Due to the subterranean location and problems associated with connecting to the existing station drainage systems, sump pumps will be provided to discharge the collected drainage water and condensate.
- A dry standpipe system will be provided in the passageway with angle hose valves located in the vicinity of each exit stairway and an additional angle hose valve located at the approximate center of the walkway.
- All elevator machine rooms will be provided with air conditioning and heating.

2. Option 2

   The mechanical, plumbing and fire protection features associated with this option are the same as Option 1 with the following exceptions:

   - The pedestrian passage will be air conditioned with two self contained air conditioning units. The estimated air conditioning requirement is approximately 35 tons with each unit having a nominal capacity of 18 tons. This based on a floor area of approximately 11,400 square feet, a passenger heat load of 1000 Btuh per person, a density of 40 square feet per person, and a miscellaneous electric and lighting load of 3 watts per square foot.
   - The air distribution system will utilize both supply and return air ductwork.
   - A mechanical room is required and associated air intake and exhaust shafts are required to house the air conditioning equipment and provide for condenser intake and discharge airflow, outside air for the passengers using the passageway.
   - Passageway heating will not be provided. This is consistent with existing station HVAC systems serving public areas and the design criteria.
   - Area drains will be provided at each of the exit stairways and the mechanical room. Due to the subterranean location and problems associated with connecting to the existing station drainage systems, sump pumps will be provided to discharge the collected drainage water and condensate.
   - A dry standpipe system will be provided in the passageway with angle hose valves located in the vicinity of each exit stairway and an additional angle hose valve located at the approximate center of the walkway.
   - All elevator machine rooms will be provided with air conditioning and heating.

3. Option 3

The mechanical, plumbing and fire protection features associated with this option consist of the following:

- The pedestrian passage will be air conditioned with two self contained air conditioning units. The estimated air conditioning requirement is approximately 30 tons with each unit having a nominal capacity of 15 tons. This is based on a floor area of approximately 10,250 square feet, a passenger heat load of 1000 Btuh per person, a density of 40 square feet per person, and a miscellaneous electric and lighting load of 3 watts per square foot.
- The air distribution system will utilize both supply and return air ductwork.
- A mechanical room is required and associated air intake and exhaust shafts are required to house the air conditioning equipment and provide for condenser intake and discharge airflow, outside air for the passengers using the passageway.
- Passageway heating will be provided in the vicinity of the commercial area.
- All elevator machine rooms will be provided with air conditioning and heating.
- The Cleaner's, Men's and Women's rooms will be provided with exhaust ventilation and heating.
- Area drains will be provided at each of the exit stairways and the mechanical room. Due to the subterranean location and problems associated with connecting to the existing station drainage systems, sump pumps will be provided to discharge the collected drainage water and condensate.
- A dry standpipe system will be provided in the passageway with angle hose valves located in the vicinity of each exit stairway and an additional angle hose valve located at the approximate center of the walkway.
- A dry sprinkler system will be provided to serve the passageway commercial areas and the washrooms.
- A sewage ejector per WMATA standards is required to serve the Men's and Women's rooms.
- Installation of air curtains should be considered during the detailed design stage. Air curtains positioned at each end of the passageway will help maintain comfort levels by containing conditioned air within the passageway. This is advantageous for the people working in the commercial area for extended periods.

However, there is also a possibility that some passengers using the passageway will consider air curtains a nuisance.

VII. ELECTRICAL/SYSTEMS FEATURES

A. General Electrical Issues Common to All Options

All three passageway options will require the following:

- New electrical equipment in a room near the walkway to provide power to lights, emergency lights and mechanical equipment. Electrical distribution equipment will be required in each of the elevator machine rooms and in the new electrical equipment room. Electrical circuits installed in conduit would run from the nearest source of power in the existing passenger station AC switchgear rooms. Some modifications will be required in the AC switchgear rooms such as adding new circuit breakers, evaluating the impact of adding new loads on the existing equipment and increasing the size of the UPS where necessary. Conduits would be concealed or embedded wherever feasible.
- Electric power to drive the new elevators plus additional power for associated elevator equipment requiring electricity. This would come from the passenger station where the new elevators are being installed.

At Farragut West passenger station mezzanine level, space needed for the two new mezzanine to surface elevators infringes into the traction power substation room. This area contains the traction power feeders that go down to the tracks. The ductbank that terminates in this area has 33 conduits that will have to relocated and the traction power cables will have to be replaced from the DC switchgear to the tracks. This will involve excavating below the substation floor and rerouting these conduits to a new location in the substation. Other items such as the existing cable tray and some wall mounting panel will also have to be relocated.

B. Electrical Work Associated with Each Option

1. Option 1

    - No additional electrical equipment is anticipated for this option.

2. Option 2

    - The moving walkway will required additional electrical equipment, either at the new service room or at the existing AC Switchgear

room. There will also be some additional lighting and mechanical equipment loads.

3. Option 3

   - The commercial area will require some additional electrical equipment within the service rooms. There will also be additional lighting and mechanical equipment loads specifically for the commercial areas.

C. General Systems Issues Common to all Options

All three passageway options will require the following system equipment:

- Closed-Circuit Television (CCTV) cameras to monitor elevator access and areas along the walkway. Conduits/cables will be required between these cameras and the corresponding communication room. Additional conduits/cable may be required to go from the communication room to the passenger station kiosk.

- Intrusion devices on all access doors. Conduits/cables will be required between these devices and the corresponding communication room. Additional conduits/cable may be required to go from the communication room to the passenger station kiosk.

- Fire alarm devices in station service rooms and with elevator equipment. Conduits/cables will be required between these devices and the corresponding communication room. Additional conduits/cable may be required to go from the communication room to the passenger station kiosk.

- Passenger Information Display System (PIDS). Conduits/cables will be required between these displays and the corresponding communication room.

- Public address speakers. Conduits/cables will be required between the speakers and the corresponding communication room.

- 2-way communication system in the Area of Rescue. Conduits/cables will be required between this system and the corresponding communication room. Additional conduits/cable may be required to go from the communication room to the passenger station kiosk.

- Modifications to kiosks in both passenger stations to accommodate additional elevators, CCTV camera, intrusion, fire and communication equipment.

Location of equipment will be based on WMATA's latest Design Criteria.

D. Systems Work Associated With Each Option

1. Option 1

   - No additional system equipment is anticipated for this option.

2. Option 2

   - The moving walkway will require additional CCTV cameras and modifications to both passenger station kiosks. Fire alarm devices associated with the moving walkway would require additional conduits and modifications to the fire alarm system.

3. Option 3

   - The commercial area will require additional CCTV cameras, intrusion and communication equipment. Additional conduits and modifications to the passenger station system will be required. Telephone service for commercial venders will require a dedicated telephone closet.

VIII. RIDERSHIP ANALYSIS

A. Market Definitions

All Metrorail trips were assigned to one of six "markets" based on their origin and destination stations. Trips in the same market are expected to have similar likelihood of using the Farragut pedestrian tunnel. The six markets were defined as follows:

- **Market 0 (non-users)** consists of riders whose routes do not pass near Farragut Square and riders who do not transfer between the Orange or Blue and Red lines. Most Metrorail trips fall into this market.

- **Market 1 (primary transfers)** includes riders who transfer between the west branch of the Orange or Blue Lines and the west branch of the Red Line. These riders could avoid changing trains at Metro Center and could shorten their trips by two stations. (Example trip: Rosslyn to Dupont Circle.)

- **Market 2 (secondary transfers)** includes riders who transfer between the Orange or Blue Lines and the Red Line, and who could choose to change

trains using the Farragut connection instead of at Metro Center, but who would still need to pass through the Metro Center station. The Farragut connection would be unlikely to shorten trips of riders in Market 2. (Example trip: Rosslyn to Union Station.)

- **Market 3 (primary local traffic)** consists of riders who enter or exit the system at Farragut North or Farragut West and whose trips could be significantly shortened by using the Farragut connection instead of changing trains at Metro Center. (Example trip: Rosslyn to Farragut North.)

- **Market 4 (secondary local traffic)** consists of riders who enter or exit the system at Farragut North or Farragut West, and who may choose to use the Farragut connection instead of transferring at Metro Center, but whose trips would not be shortened significantly as a result. (Example trip: Union Station to Farragut West.)

- **Market 5 (tertiary local traffic)** includes riders who enter or exit the system at Farragut North or Farragut West and who are already avoiding a transfer at Metro Center by walking between the stations. (Example trip: Rosslyn to Farragut West, for a commuter who works closest to Farragut North.)

The number of Metrorail trips in each of the six market types was determined using matrices of Metrorail origin and destination stations (O-D matrices). The rows of each O-D matrix correspond to the stations where riders enter the Metrorail system (trip origins), and the columns correspond to the stations where trips end (trip destinations). Each matrix has a total of 83 rows and 83 columns, matching the number of stations in the system.

WMATA prepared and supplied O-D matrices for the month of May 2003. In the year 2003, passenger volume in May was the closest to the annual average volume, so May was selected as the most representative month for the analysis. A total of four O-D matrices were supplied, one each for the four Metrorail time periods, as follows:

- Morning peak, opening to 9:30 a.m.
- Midday off-peak, 9:30 a.m. to 3:00 p.m.
- Afternoon peak, 3:00 to 7:00 p.m.
- Evening off-peak, 7:00 p.m. to closing

The complete O-D matrices are 83-by-83 grids, but they were simplified by grouping stations on common branches of the Metrorail system. For instance, riders entering the system at Vienna are equally likely to use the Farragut connection as riders entering at Dunn Loring, West Falls Church,

and all other Orange Line stations east of Farragut West. By grouping stations, the complete O-D matrices were reduced to 14-by-14 grids.

Exhibit 1 presents a simplified O-D matrix showing the markets assigned to each group of O-D pairs.

Exhibit 1: Market Types of Groups of Metrorail O-D Pairs

		DESTINATION STATION GROUP													
		Farragut West	Foggy Bottom	McPherson Square	Metro Center	Smithsonian	L'Enfant Plaza	Addison Road	Huntington	Arlington Cemetery	Waterfront	Archives	Glenmont	Dupont Circle	Farragut North
ORIGIN STATION GROUP	Farragut West	5	5	5	5	5	5	5	5	5	5	4	4	3	3
	Foggy Bottom	5	0	0	0	0	0	0	0	0	0	0	2	1	3
	McPherson Square	5	0	0	0	0	0	0	0	0	0	0	0	2	3
	Metro Center	5	0	0	0	0	0	0	0	0	0	0	0	0	5
	Smithsonian	5	0	0	0	0	0	0	0	0	0	0	0	2	4
	L'Enfant Plaza	5	0	0	0	0	0	0	0	0	0	0	0	2	4
	Addison Road	5	0	0	0	0	0	0	0	0	0	0	0	2	4
	Huntington	5	0	0	0	0	0	0	0	0	0	0	0	1	3
	Arlington Cemetery	5	0	0	0	0	0	0	0	0	0	0	2	1	3
	Waterfront	5	0	0	0	0	0	0	0	0	0	0	0	0	5
	Archives	5	0	0	0	0	0	0	0	0	0	0	0	0	5
	Glenmont	4	2	0	0	0	0	0	0	2	0	0	0	0	5
	Dupont Circle	3	1	2	0	2	2	2	2	1	0	0	0	0	5
	Farragut North	3	3	3	5	4	4	4	3	3	5	5	5	5	5

In Exhibit 1, the rows and columns are labeled with a single Metrorail station, but they apply to all other Metrorail stations in the same group of stations. For instance, the column labeled “Dupont Circle” applies to the Red Line Stations between Dupont Circle and Shady Grove, inclusive. A complete list of the stations included in each station group is presented in Appendix A.

It is clear from Exhibit 1 that the majority of Metrorail trips fall into Market 0; in fact, about 75 percent of O-D trip pairs would not use the Farragut pedestrian tunnel. However, every Metrorail station has some O-D pairs that fall into other markets as well.

B. Market Sizes

The number of trips in each market in the year 2003 was determined by adding the number of trips in the O-D matrices that have common market types. The total number of trips in each market is shown in Exhibit 2.

Exhibit 2: Average Number of Daily Metrorail Trips by Market Type, 2003

Time Period	*Market 0*	*Market 1*	*Market 2*	*Market 3*	*Market 4*	*Market 5*	*Total*
AM Peak	157,929	5,377	17,111	698	1,634	31,048	**213,797**
Midday	95,959	3,495	10,110	524	968	13,861	**124,917**
PM peak	167,787	5,965	18,180	906	1,425	28,740	**223,003**
Evening	64,405	3,332	6,783	285	336	7,832	**82,973**
Total	**486,080**	**18,169**	**52,184**	**2,413**	**4,363**	**81,482**	**644,690**

Exhibit 2 shows that about 75 percent of Metrorail trips fall in Market 0. Markets 1 and 2, the transfer markets, account for a combined total of about 11 percent of trips, with Market 2 trips outnumbering Market 1 trips by about 3 to 1. Markets 3, 4 and 5, the local markets, account for a total of about 14 percent of all trips, with the vast majority of these in Market 5. Markets 3 and 4 together comprise only about 1 percent of trips.

The size of the markets in the design year of 2030 was determined by assigning growth rates to each Metrorail station and updating the 2003 O-D matrices to 2030 levels.

The following assumptions were made in forecasting travel on the Metrorail system in 2030:

- The three new Metrorail stations currently under construction (New York Avenue, Morgan Boulevard, and Largo Town Center) would be the only new Metrorail stations open in the year 2030. Metrorail would not be extended to Tysons Corner and Dulles Airport, and the Orange Line would not be extended west toward Chantilly. No new Metrorail lines would be operational by 2030. (If this assumption is incorrect and additional Metrorail facilities are in place by 2030, pedestrian traffic in the Farragut tunnel would tend to be higher than forecast in this study. As such, this assumption is conservative.)

- The growth in Metrorail system ridership would average 1.25 percent per year between 2003 and 2030, excluding trips generated by the three new

stations. This rate corresponds to the annual growth rate in passenger trips observed by the Metrorail system since 1987.1

Growth rates at individual stations were determined by reviewing and consolidating station growth rates that have been assumed in recent WMATA studies, such as the Core Capacity Study and the Dulles rail extension study. The raw growth rates were then factored to match the assumed 1.25 percent average systemwide growth rate. The station-by-station growth rates assumed in this study are presented in Appendix B.

For the three new stations, WMATA provided the number of weekday station boardings in the year 2025. The boardings were increased to 2030 levels using the systemwide 1.25 percent growth rate.

The growth rate forecast for each station was applied to both the station's origins and destinations to compute the expected 2030 total station boardings and alightings. Complete O-D matrices for the year 2030 were then computed using the Fratar method, an iterative approach that forecasts the future values of cells in an O-D matrix according to the growth trends at both origin and destination stations.

For the three new stations, origin trips were assigned to destination stations according to patterns similar to nearby stations, and destination trips were assigned to origin stations in the same manner.

Exhibit 3 presents the forecast size of each market in the year 2030.

Exhibit 3: Average Number of Daily Metrorail Trips by Market Type, 2030

Time Period	*Market 0*	*Market 1*	*Market 2*	*Market 3*	*Market 4*	*Market 5*	*Total*
AM Peak	248,081	7,405	27,352	862	2,202	40,397	**326,298**
Midday	151,009	4,780	15,306	628	1,306	17,810	**190,840**
PM peak	263,847	8,346	28,213	1,118	1,930	37,396	**340,850**
Evening	102,430	4,578	10,617	348	454	10,099	**128,525**
Total	**765,366**	**25,108**	**81,488**	**2,957**	**5,892**	**105,701**	**986,513**

Market 0 is predicted to be the fastest-growing of the markets, growing in size by 58 percent between 2003 and 2030. The swell in Market 0 is due in part to the increasing popularity of trips between suburbs. By 2030, Market 0 is

1 Other studies have forecast larger annual growth rates; for instance, the Core Capacity Study (CCS) forecast annual passenger growth at core-area stations of 2.91 percent per year between 2000 and 2025. However, the intent of the CCS was to forecast demand for Metrorail service so that capacity bottlenecks could be identified. Actual ridership could only reach demand levels if massive capacity improvements are made, as noted in the CCS. The CCS further assumed that the Dulles and Chantilly extensions would be in place by 2025, increasing the study's growth rates.

expected to account for about 78 percent of all Metrorail trips, an increase over the 75 percent in 2003.

The transfer markets are the next-fastest growing. Market 1 is expected to increase in size by 38 percent by 2030, and Market 2 is expected to increase by 56 percent. The transfer markets are expected to continue to comprise about 11 percent of Metrorail trips by 2030.

The local markets are the slowest growing, again reflecting the larger proportion of suburb-to-suburb commute trips. By 2030, Market 3 is expected to increase in size by 22 percent, Market 4 by 35 percent, and Market 5 by 30 percent. Although the size of the local markets increases, their slower growth rates mean that the fraction of Metrorail trips in the local markets is anticipated to decline from about 14 percent in 2003 to about 11 percent in 2030.

C. Alternatives Considered

Of the two alternatives initially proposed for the pedestrian tunnel, Alternative 2 was chosen for detailed analysis. In Alternative 2, the south end of the tunnel would connect to the east end of the mezzanine at Farragut West, and the north end of the tunnel would connect to the south end of the Farragut north station. Total tunnel length would be about 370 feet. Other factors under consideration for Alternative 2 include the following:

- **Paid vs. free passageway.** In a paid passageway, transfer passengers could walk between Farragut West and Farragut North stations without passing through fare gate aisles, while passengers entering the Metrorail system would need to pay a fare as they enter the tunnel. In a free passageway, transfer passengers would pass through fare gate aisles at both Farragut West and Farragut North stations, but the tunnel could be used by pedestrians who do not pay a fare. (The fare collection system would be configured to allow transfer passengers to pass through the tunnel without paying a second fare.) In general, the paid passageway is expected to generate slightly more pedestrian trips than the free passageway because it reduces the impedance of the fare gate aisles to transfer passengers.

- **New entrance.** Multiple locations have been proposed for a new entrance to the pedestrian tunnel from street level. A new entrance is not expected to attract a significant number of new riders to Metrorail, because the existing Farragut North and Farragut West station entrances are already very close together (600 feet). However, a new entrance would increase use of the pedestrian tunnel by local passengers in Markets 3, 4 and 5. If a new entrance were not provided, Orange and Blue Line passengers would only be able to use the tunnel by navigating the Farragut North

Station and using its street escalators. The trip would include redundant vertical circulation down to the Farragut North platform and back up to a mezzanine, adding delay to the walking trip. For the purposes of this pedestrian forecast, it was assumed that at least one new entrance would be provided from the tunnel to street level.

- **Moving walkways.** Moving walkways would tend to slightly reduce tunnel travel time and hence slightly increase passenger volume in the tunnel.

- **Presence of retail.** Retail operations have the ability to attract passengers to the tunnel who may not otherwise use it. The tunnel would be a unique opportunity for passengers to patronize retail establishments without exiting from the Metrorail system and paying another fare to re-enter. This study does not investigate the additional passenger traffic that may be attracted by adding retail operations to the tunnel; however, retail operations are examined in detail elsewhere in this study.

- **Connection to Farragut North Station.** Several options have been considered for connection to the south end of the Farragut North Station, including various configurations of stairways, escalators, elevators, and connection bridges. However, all configurations considered to date include access to the tunnel from the south end of the platform. As such, all configurations have similar travel times and are not expected to result in differences in use of the tunnel, as long as sufficient capacity is provided for pedestrian travel.

D. Elements Influencing Use Rate

Different use rates were assigned to each market according to the estimated probability that riders in each market would use the tunnel. Several factors may encourage passengers to use the tunnel. The factor most important to most Metrorail passengers is the travel time savings they could achieve. However, the wide variety in human behavior means that not all riders would use the tunnel even if it would shorten their travel time. The following lesser influences were considered as well:

- Out-of-vehicle time. Passengers perceive travel time inside a transit vehicle differently than travel time outside a vehicle. The Metropolitan Washington Council of Governments (MWCOG) Transportation Planning Model, Version 2.1D, assumes that an out-of-vehicle travel time increase is perceived by passengers as 2.5 times that of an in-vehicle travel time increase of the same duration. Some passengers, particularly senior or disabled riders, may not be willing to shorten total trip time if the amount of walking increases substantially.

- Avoidance of transfers. The need to transfer between transit vehicles is perceived as a deterrent by passengers, in addition to the increase in travel time the transfer requires. In the MWCOG model, passengers are assumed to perceive an additional 6 minute delay in total travel time for each transit transfer.

- Avoidance of congestion. Some passengers may prefer to avoid heavily-congested stations. Some riders may also attempt to board at stations where trains are less congested.

Use rates were derived for each market by weighing the importance of factors such as these to the pedestrians in each market. The MWCOG model was used to compute the percentage of riders who would choose to use the tunnel; however, results of the MWCOG computations were adjusted subjectively to account for factors the model does not represent well.

Many pedestrian tunnel users would use the tunnel primarily in lieu of changing trains at the Metro Center Station. Differences in travel time between changing trains at Metro Center and using the Farragut tunnel would arise from the following three possible sources:2

- **Train travel time.** Time needed to travel on the train between Metro Center and one or both of the Farragut stations.

- **Transfer walk time.** Time required to walk from the platform of the arriving train to the platform of the departing train.

- **Waiting time.** Time spent waiting on the departure platform for the next train to arrive. As noted earlier, in the MWCOG model, passengers are assumed to perceive transfer walk time and waiting time as 2.5 times less desirable than train travel time.

Each of these three elements is analyzed in detail in the balance of this section.

1. Train Travel Time
   Train travel times were collected in the field for Red Line trains traveling between Metro Center and Farragut North and for Orange and Blue Line trains traveling between Metro Center and Farragut West. Train travel times vary by time of day. In peak periods, trains must dwell in stations longer to permit larger passenger loads to board

2 Another possible source of differences in travel time is queuing delay, or the time spent waiting in queues to use escalators, stairways, or other station infrastructure. It is difficult to predict the level of queuing that will exist in the year 2030 because of the uncertainty in future ridership levels and station improvements. Queuing is expected to be prevalent at Farragut North and Farragut West as well as Metro Center, lessening its impact on the difference in travel time between the routes.

and alight, and railway congestion is more likely to lengthen train travel time during peak periods. The train travel times used in the study are presented in Exhibit 4; train travel times were assumed to remain unchanged in 2030.

Exhibit 4: Average Train Travel Times

Train Trip	*Average Train Travel Time (minutes)*		
	AM Peak	*PM Peak*	*Off-peaks*
Farragut West to Metro Center	3.4	3.1	3.1
Metro Center to Farragut West	3.9	3.6	3.4
Farragut North to Metro Center	2.3	2.1	2.0
Metro Center to Farragut North	2.1	2.2	2.1

2. Transfer Walk Time

Average transfer walk times are based on walking speeds of 4 feet per second (2.7 mph) and actual observed times both walking and riding up and down escalators. Some passengers are able to transfer faster than average because of faster walking speed or advantageous positioning on the train. Other passengers' walk times are slower than average.

Metro Center Station

Based on the configuration of the platforms, escalators and stairways and the position of stopped trains, approximate average transfer walk times at Metro Center were determined for 2003 (with six-car trains) and 2030 (with assumed eight-car trains), as presented in Exhibit 5.

Exhibit 5: Average Transfer Walk Times at Metro Center Station

Transfer from	*Transfer to*	*Average transfer walk time (minutes)*	
		2003	*2030*
Orange or Blue Line	Red Line to Shady Grove	1.1	1.2
Orange or Blue Line	Red Line to Glenmont	1.0	1.1
Red Line	Orange or Blue Line (either direction)	0.9	1.0

Farragut Pedestrian Tunnel

Average transfer walk time would be 3.6 minutes without moving walkways. Moving walkways are expected to increase total average

pedestrian speed to 6 feet per second on the walkways, reducing transfer walk time to 3.2 minutes. Neither time estimate is affected by travel direction or design year.

3. Waiting Time

Some passengers arrive at their departing platform at the same time as a train; these passengers have no waiting time. Passengers arriving slightly later must wait for the next train; these passengers' waiting time is equal to a full train headway. On average, assuming random arrivals and constant headways, passenger waiting time equals half the headway.

WMATA supplied typical headways for Metrorail operations in 2003. For morning peak, midday, and afternoon peak periods, headways are generally constant during the entire period. For the evening off-peak period, headways increase during the course of the period. For this period, weighted average headways were estimated.

A passenger's wait time depends on whether the passenger has a preference about which train to board. For instance, a passenger at Farragut West may be waiting for the Orange Line or the Blue Line, or may be waiting for whichever train arrives first. Likewise, some Red Line passengers must wait for the second train, since some trains do not travel to outlying stations. Because headways are similar for the Red Line and the Orange/Blue Lines, the same waiting time was assumed for all lines.

Headways were forecast in the year 2030 by assuming that headway recommendations in the Core Capacity Study would be implemented.

Average wait times are presented in Exhibit 6.

Exhibit 6: Average Waiting Times

Year	***Average Waiting Time (minutes)***			
	AM Peak	***Midday***	***PM Peak***	***Evening***
2003	2	5	2	6
2030	2	4	2	6

E. Use Rates by Market Type

The following assumptions were made in development of use rates:

- The east portal of the Farragut West station is currently closed to passengers in the late evenings and on weekends. This is the same

portal that would provide access to the proposed pedestrian tunnel. In this analysis, it was assumed that access to the tunnel would be provided during all Metrorail operating hours. This would require operating the escalators from platform to mezzanine at all times, and it may affect the staffing needs for the Station Manager kiosk at the east portal. The street-to-mezzanine escalators could continue to be closed for the purposes of this analysis; however, this may pose emergency egress problems.

- Both Farragut stations experience very high levels of passenger traffic. According to the Core Capacity Study, in the year 2000, the vertical circulation between the mezzanine and platform was at 121 percent of capacity at the Farragut North Station and at 229 percent of capacity at Farragut West. By contrast, the same study showed that the vertical circulation between platforms at Metro Center was at 56 percent of capacity. A goal of the pedestrian tunnel is reduction of congestion at Metro Center. However, the Farragut stations' infrastructure will not support large volumes of additional traffic without improvements to capacity. This forecast assumes that capacity is improved at both Farragut stations so passengers are not deterred from using the pedestrian tunnel by excessive congestion.

- Passengers transferring between Metrorail and Metrobus are expected to account for a small fraction of tunnel users, and as such, construction of the proposed K Street Busway is unlikely to significantly increase pedestrian traffic in the tunnel. The busway may cause bus passenger traffic to grow at a faster rate than rail traffic as a whole, but few bus/rail transfer passengers generated by the busway are expected to use the pedestrian tunnel. Busway passengers transferring to the Red Line could access the Farragut North Station using the portal on the northeast corner of Connecticut Avenue and K Street and would not need to use the tunnel. Since the Blue and Orange Lines operate parallel to the busway with several bus/rail transfer opportunities along the routes, large transfer volumes are not expected at Farragut West. According to WMATA's 2002 Passenger Survey, less than 5 percent of Farragut West patrons are bus/rail transfers, or about 1,000 per day in each direction. In this study, it is conservatively assumed that bus/rail transfers increase at the same rate as all rail traffic, to about 1,300 per day in each direction by 2030. Even if the busway results in twice as much growth in bus/rail transfers, the effect on tunnel use would be less than 300 passengers per day.

- Very few non-transit passengers are expected to use the tunnel to avoid walking at street level. A free passageway would potentially offer pedestrians a grade-separated crossing of 17th and Eye Streets. However, the crossing would significantly lengthen pedestrians' trip times because of the need to use escalators or stairs to drop below street level. By contrast, the existing at-grade crosswalks are pedestrian dominated

and easy to use. At the north end of the tunnel, even a free passageway would not allow pedestrians to cross K Street without paying a fare. In a paid passageway, all tunnel users would need to pay a fare.

The balance of this section examines use rates by market type for a paid passageway without moving walkways. Other possibilities are discussed in following sections.

1. Market 1: Primary Transfers

   The travel time savings the tunnel would offer Market 1 passengers was calculated for trips in both directions. Northbound walking trips through the tunnel are passengers transferring from the Orange or Blue Lines to the Red Line; southbound trips are the reverse transfers. Trips in both directions are able to avoid rail travel between Farragut West and Metro Center and between Metro Center and Farragut North. Average walk time would increase in the tunnel, but there would be no difference in the average waiting time. Total time savings for Market 1 trips are presented in Exhibit 7.

Exhibit 7: Travel Time Savings of Farragut Pedestrian Tunnel for Market 1 Trips

Tunnel Walking Direction	***Year***	***Average Travel Time Savings (minutes)***			
		AM Peak	***Midday***	***PM Peak***	***Evening***
Northbound	2003	3.0	2.7	2.8	2.7
	2030	3.1	2.8	2.9	2.8
Southbound	2003	3.5	2.7	3.0	2.7
	2030	3.6	2.8	3.1	2.8

Average time savings would range from 2.7 to 3.6 minutes in different years, time periods, and directions. Travel time savings would be greatest during peak periods because rail travel tends to take longer during those times. Based on travel time savings alone, all passengers would choose to use the tunnel.

The MWCOG model weights the tunnel's increase in walking time 2.5 times more heavily than the savings in train travel time. As such, there is very little difference between the weighted travel times of the two paths. The MWCOG model thus predicts very little difference in the use rates, with about 49 percent of trips using the tunnel and 51 percent transferring at Metro Center.

The actual use rate likely falls between the 100 percent rate of the shortest-path travel-time savings approach and the 49 percent rate of

the MWCOG model. For analysis purposes, it is assumed that the actual use rate lies about midway between these bounds, at 80 percent during peak periods and 70 percent during off-peak periods. The higher rate during peak periods reflects not only the greater possible time savings to be achieved during those periods, but also the greater likelihood that peak-hour (primarily commuter) traffic would be more willing to undertake a longer walk to reduce overall travel time.

2. Market 2: Secondary Transfers

   For all trips in Market 2, use of the Farragut pedestrian tunnel would require a longer total trip time than a transfer at Metro Center. As such, few Market 2 riders are expected to use the tunnel.

   Two individual trip types comprise Market 2: trips between, say, Vienna and Glenmont, and trips between, say, Shady Grove and New Carrollton. Passengers in the former group are able to avoid traveling through the McPherson Square Station by using the Farragut pedestrian tunnel; these passengers' trips would be lengthened by about 1 minute to use the tunnel. Passengers in the latter group must add a stop at McPherson Square to their trips to use the tunnel, so the tunnel would lengthen their trips by about 4 minutes. The trip time increases are even greater when weighted according to the MWCOG model.

   The most likely tunnel users are those traveling from, say, Vienna to, say, Glenmont, who would be able to board a Red Line train one stop earlier than normal. These passengers may find Red Line trains less congested at Farragut North than at Metro Center, particularly during the afternoon peak hour, easing their ability to board and/or find a seat.

   However, because the tunnel would lengthen average trip times for all trips in Market 2, only 2 percent of trips are expected to use the tunnel.

3. Market 3: Primary Local Traffic

   Market 3 includes passengers who pass through one of the Farragut stations and change trains at Metro Center, only to reverse direction and use the other Farragut station. These passengers' trips could be shortened significantly by using the Farragut tunnel. In addition to the train time savings of Market 1, Market 3 tunnel users would benefit by eliminating a transfer from their trip entirely, avoiding time spent waiting for a train to arrive and the MWCOG 6-minute transfer penalty. Total average travel time savings are shown in Exhibit 8.

Exhibit 8: Travel Time Savings of Farragut Pedestrian Tunnel for Market 3 Trips

Year	*Average Travel Time Savings (minutes)*			
	AM Peak	*Midday*	*PM Peak*	*Evening*
2003	5	8	5	9
2030	5	7	5	9

Travel time savings in Market 3 are greater during off-peak periods because of the longer headways at off-peak times.

Market 3 is the smallest of the markets, reflecting the fact that most existing Metrorail passengers prefer to use whichever Farragut station is most convenient to their Metrorail trip, not the station closest to their destination.

Passengers in Market 3 already have the ability to avoid the Metro Center transfer by walking between the stations at street level, but choose not to avoid the transfer. Long walks may be uncomfortable to some Market 3 riders, such as senior riders, disabled riders, and riders carrying large or heavy items. Tourists and other riders unfamiliar with Metrorail or the Farragut Square area may only be comfortable using the station nearest their destination.

For all of these groups, the Farragut tunnel would make the walk between stations a more seamless part of their trips, but the walk itself is likely to discourage some Market 3 patrons from using the tunnel. The MWCOG model predicts that about 59 percent of peak-hour trips would use the tunnel and that 63 to 67 percent of off-peak hour trips would use the tunnel. These MWCOG use rates are the highest of any market.

Again averaging the MWCOG rates with the 100 percent use expected according to the shortest-path travel-time estimate yields expected use rates of about 80 percent during peak hours and 85 percent during off-peak hours, reflecting the greater headway savings at off-peak times.

4. Market 4: Secondary Local Traffic

Market 4 traffic voluntarily changes trains at Metro Center to reach the Farragut Station most convenient to their destination, but their trips would pass through Metro Center even if they were to use the Farragut pedestrian tunnel instead. Using the tunnel would allow them to avoid a train transfer and the corresponding wait time, but train travel time would change only slightly. Like Market 2, some riders would be able to avoid traveling through the McPherson Square Station and see a corresponding reduction in travel time; others would have the

McPherson Square Station added to their trips and may see their travel times increase. Total travel time savings are presented in Exhibit 9.

Exhibit 9: Travel Time Savings of Farragut Pedestrian Tunnel for Market 4 Trips

Trip Type	*Year*	*Average Travel Time Savings* (minutes)*			
		AM Peak	*Midday*	*PM Peak*	*Evening*
Trips avoiding McPherson Square	2003	1	4	1	5
	2030	1	3	1	5
Trips adding McPherson Square	2003	-2	1	-2	2
	2030	-2	0	-2	2

* Positive numbers indicate a travel time savings; negative numbers indicate a travel time increase.

Market 4 riders, like those in Market 3, could avoid the Metro Center transfer today if they chose to use the Farragut Station that is not as convenient to their destination. Although not as small as Market 3, Market 4 also is small in size, indicating that existing Market 4 passengers are willing to tolerate the change at Metro Center to avoid a longer walk near Farragut Square at street level.

Because of the ability to avoid a transfer, use of the pedestrian tunnel is favored by the MWCOG model despite the small travel time savings. The MWCOG model predicts that about 55 percent of peak-hour trips and 60 percent of off-peak trips would use the tunnel. These values were used for analysis, since the shortest-path travel time varies within Market 4. The use rates are expected to include a larger share of the trips avoiding McPherson Square than those adding it.

5. Market 5: Tertiary Local Traffic

Because tertiary local traffic already uses the Farragut station that is not as convenient to their destination, the Farragut tunnel would not appreciably change trip times for Market 5 riders. As such, neither the MWCOG model nor the shortest-path travel time method is applicable to Market 5. However, many Market 5 users may choose to use the tunnel instead of walking at street level, especially during periods of inclement weather.

Of the two portals at the Farragut West Station, the east portal, which would coincide with the tunnel entrance, accounts for about 37 percent of existing boardings and alightings, according to fare gate data supplied by WMATA. Approximately one-third of the east portal's traffic is estimated to arrive and depart the station to and from the north; these passengers would thus be candidates for using the

pedestrian tunnel. If 75 percent of this traffic shifted to the tunnel, the total use rate would be about 9 percent of all Farragut West trips.

Likewise, 48 percent of Farragut North traffic uses the southeast portal, which is nearest the tunnel. About 30 percent of this portal's traffic is expected to travel south, and if the tunnel captured 75 percent of this traffic, the total use rate for Farragut North trips would be about 11 percent.

Because the Farragut North and Farragut West use rates are expected to be similar for Market 5, the use rate was set at the average of 10 percent.

The use rate for Market 5 depends on the presence of a new entrance from the tunnel to street level. This entrance would allow Market 5 traffic to use the tunnel without traversing the Farragut North Station's platform. If an entrance were not provided, Market 5's use rate would drop.

6. Use Rate Summary

   Exhibit 10 presents the use rates by market type and time period as discussed above.

Exhibit 10: Pedestrian Tunnel Use Rates by Market Type

Time Period	*Market 0*	*Market 1*	*Market 2*	*Market 3*	*Market 4*	*Market 5*
AM Peak	0%	80%	2%	80%	55%	10%
Midday	0%	70%	2%	85%	60%	10%
PM peak	0%	80%	2%	80%	55%	10%
Evening	0%	70%	2%	85%	60%	10%

F. Pedestrian Forecast Computation

With the market sizes and use rates established, the pedestrian forecast can be calculated by multiplying the market size by the use rate for each market and summing the products. The pedestrian forecast for the year 2003 is presented in Exhibit 11.

Exhibit 11: Farragut Pedestrian Tunnel Passenger Forecast, 2003

Time Period	*Market 0*	*Market 1*	*Market 2*	*Market 3*	*Market 4*	*Market 5*	*Total*

AM Peak	0	4,302	342	558	899	3,105	**9,205**
Midday	0	2,446	202	445	581	1,386	**5,061**
PM peak	0	4,772	364	725	784	2,874	**9,518**
Evening	0	2,332	136	242	202	783	**3,695**
Total	**0**	**13,852**	**1,044**	**1,971**	**2,465**	**8,148**	**27,480**

The trip forecast shows a total of about 27,000 pedestrians per day using the tunnel, of which the largest share, about half, are part of Market 1. Market 5 accounts for the next-largest group of users, at 30 percent. Markets 2 through 4 contribute far fewer users, with a combined total of 20 percent.

In the Metrorail system as a whole, trips during the morning peak hour account for about 39 percent of total morning peak-period traffic. Applying that same ratio to the peak period pedestrian tunnel forecast suggests that about 3,500 passengers per hour would use the tunnel during the peak hour. In the same manner, about 1,800 trips would be expected in the peak half-hour (PHH).

Total annual passenger traffic would measure about 7.9 million trips.

The forecast based on 2030 market sizes is presented in Exhibit 12.

Exhibit 12: Farragut Pedestrian Tunnel Passenger Forecast, 2030

Time Period	*Market 0*	*Market 1*	*Market 2*	*Market 3*	*Market 4*	*Market 5*	*Total*
AM Peak	0	5,924	547	690	1,211	4,040	**12,411**
Midday	0	3,346	306	534	784	1,781	**6,751**
PM peak	0	6,676	564	894	1,062	3,740	**12,936**
Evening	0	3,204	212	296	272	1,010	**4,995**
Total	**0**	**19,151**	**1,630**	**2,414**	**3,329**	**10,570**	**37,093**

By 2030, total tunnel use would increase to about 37,000 trips per day, with Market 1 comprising about 52 percent of the total, a larger fraction than in 2003. Market 5 would account for about 28 percent of the total trips, and the combination of the remaining markets would account for the other 20 percent of users.

Morning peak hour trips would increase to about 4,800, while PHH trips would increase to about 2,500. Annual traffic would measure about 10.7 million trips.

Passenger forecast data is presented in further detail in Appendix C.

1. Alternative Design Features

   The previous discussion, summarized in Exhibits 11 and 12, outlined the pedestrian forecast for a paid passageway without moving walkways. The addition of moving walkways or the change from a paid passageway to a free passageway would have minor impacts on the passenger forecast.

   a. Moving Walkways

      Adding moving walkways to the pedestrian tunnel would reduce the travel time through the tunnel by about 0.4 minutes for passengers in all market types. The 0.4-minute increase in travel time savings would represent about a 13 percent improvement in travel time savings for Market 1 and a 5 to 8 percent improvement for Market 3. (Travel time savings changes for other markets are highly variable.)

      Because of the small increase in travel time savings, the moving walkways are expected to increase tunnel use by 5 percent, from about 37,000 passengers per day to about 39,000 passengers per day in 2030.

   b. Free Passageway

      A free passageway would require all transfer traffic to pass through two additional sets of fare gate aisles to use the tunnel. Even though no additional fare would be charged, the presence of fare gates would serve as a visual and psychological deterrent to transfer traffic. Transfer traffic would account for about 56 percent of traffic in the tunnel by 2030, so the free passageway would impact a large fraction of tunnel users.

      However, it was assumed that the fare gate aisle arrays would be designed to operate without any additional delay to passengers, and that by 2030, passengers familiar with the Metrorail system would be fully educated about the ability to use the tunnel without paying a second fare. As such, a free passageway is expected to reduce passenger volume by only 3 percent, from about 37,000 trips per day to about 36,000.

G. Use Rate Sensitivity

In this section, the effect of minor changes to use rate on the total pedestrian forecast is examined. The results of the analysis, expressed to the nearest two significant digits, forecast pedestrian traffic to the nearest 1,000

passengers per day. Changes to use rate that affect the pedestrian forecast by less than 1,000 passengers per day are thus not significant changes. Exhibit 13 presents the threshold of significance for the use rate of each market type, according to the 1,000 passenger-per-day threshold.

Exhibit 13: Use Rate Sensitivity by Market Type

	Market Type					
	0	***1***	***2***	***3***	***4***	***5***
Weighted average use rate used for 2030 passenger forecast	0.0%	76.3%	2.0%	81.7%	56.5%	10.0%
Change in use rate that would result in a 1,000-passenger-per-day change in passenger forecast	0.1%	4.0%	1.2%	33.8%	17.0%	0.9%
Lower boundary of significant use rate range	0.0%	72.3%	0.8%	47.9%	39.5%	9.1%
Upper boundary of significant use rate range	0.1%	80.3%	3.2%	100.0%	73.5%	10.9%

Exhibit 13 shows that if the use rate selected for Market 1 is within plus or minus 4 percent of the actual use rate, the pedestrian forecast will be accurate to within 1,000 passengers per day. The lower rows of Exhibit 13 show the boundaries of the actual use rates that would allow the passenger forecast to remain within these limits.

Because of the small sizes of Markets 3 and 4, the sensitivity of the use rates in these markets is very low. The pedestrian forecast remains within 1,000 trips per day even if the actual use rates are much higher or lower than the expected rates. Sensitivity is much tighter for markets 2 and 5, where the passenger forecast is much more sensitive to small changes in use rate. However, these are also the markets with the lowest expected use rates, minimizing the chance of a large difference between expected and actual use rate.

H. Tunnel Capacity

Preliminary estimates of tunnel capacity were computed, under the assumption that tunnel capacity would be limited by the vertical circulation capacity approaching and departing the tunnel.

At the Farragut North Station, the primary connection between the tunnel and the platform is proposed to be a stairway with a width of either four or 12 feet. According to WMATA design criteria, the capacity of a four-foot-wide stairway is 55 passengers per minute, or about 3,300 per hour if peak-volume conditions are sustained for an entire hour. By 2030, peak-hour tunnel trips are expected to reach about 4,800 per hour, of which at least 80 percent

(3,800 trips) are expected to connect to the tunnel via Farragut North. The peak-hour capacity of the four-foot wide stairway would be insufficient to handle peak-hour volumes. A 12-foot-wide stairway would have a theoretical capacity of 9,900 passengers per hour. Its theoretical capacity would satisfy the predicted 2030 volume, but by 2030, its capacity would be fully utilized to meet WMATA's goal of discharging platform traffic in a time equal to half the train headway.

At Farragut West, tunnel traffic would use the station's existing platform-to-mezzanine escalators. These escalators are well over capacity during peak hours; in fact, the Farragut West platform-to-mezzanine escalators are the most congested escalators in the Metrorail core, according to the Core Capacity Study. (Escalators at the east portal handle less traffic than those at the west portal, so overall conditions are better at the east portal.) The tunnel would increase the passenger load at Farragut West by about 3,400 passengers during the peak hour, a volume equal to about 60 percent of the maximum theoretical capacity of an escalator. Clearly, additional capacity would be needed at Farragut West for tunnel volume to reach demand levels during peak hours.

I. Metro Center Station Benefits

The Metro Center Station handled about 137,000 transfers per weekday in the year 2000, according to the Core Capacity Study. The Farragut Tunnel is expected to capture about 15,000 of these weekday transfers, reducing the transfer demand at Metro Center by about 11 percent.

By 2030, demand for transfers at Metro Center is expected to reach about 202,000 per weekday, according to the growth rates used in this study, and the Farragut tunnel would capture about 21,000 of these, reducing the demand for Metro Center transfers by about 10 percent.

The reduction in transfer traffic at Metro Center would potentially defer the need to make infrastructure improvements at that station. The Core Capacity Study expressed concern about the platform occupancy levels at Metro Center, notably on the upper level (Red Line) platforms, and proposed a $60 million improvement project to improve the effectiveness of the station. However, the Core Capacity Study predicted that the vertical circulation between the upper and lower platforms would be slightly below capacity by 2025, despite the study's high assumed growth rates. The Metro Center station is thus better equipped to handle the increased vertical circulation needs of transfer passengers than the existing Farragut stations, particularly Farragut West.

J. Total Travel Time Savings

On a weighted average basis across all markets, the pedestrian tunnel is expected to shorten each user's travel time by about 2.0 minutes. Tunnel users would collectively save about 900 hours per day in travel time based on 2003 ridership data, increasing to about 1,200 hours per day by 2030. On an annual basis, tunnel users would collectively save about 260,000 hours based on 2003 data and about 360,000 hours in 2030.

IX. JOINT DEVELOPMENT ANALYSIS

A. Introduction

This report contains an evaluation of the potential for retail space in a pedestrian passageway linking the Farragut North and Farragut West Metro Stations. This is part of an overall feasibility study of creating this pedestrian passageway to interconnect these two Metro Stations.

1. Purpose

   The purpose of this analysis is to determine demand for lease space in the pedestrian passageway, based primarily on Metro rail ridership, as the passageway as currently proposed is within the fare zone of the transit system and does not allow "free" passage for non transit users. The analysis is also to provide information on suggested tenant mix and evaluate feasibility issues.

2. Work Completed

   In the process of undertaking this analysis, Basile Baumann Prost & Associates (BBPA), participated in a series of work sessions with consultant and Metro staff. These work sessions examined feasibility issues related primarily to the construction, operation and ridership implications of alternative pedestrian tunnel configurations. Retail input was provided in these work sessions concerning the initial sizes of supportable retail space and the sources of retail demand. BBPA also conducted field surveys of competitive and comparable retail space within the walkshed of the two Metro stations. BBPA held discussions with area property owners, property managers and retail operators to determine the characteristics and performance of retail space in the general area.

   BBPA also held discussions with representatives of the Golden Triangle Business Improvement District who represent business interests in the area. The business improvement district provides a variety of retail marketing services and area maintenance and security similar to that of a regional mall. The Business Improvement District has specific marketing and image enhancing strategies and has

prepared a full inventory of retail and service space within the Business Improvement District.

BBPA also examined comparable retail facilities in other transit systems and comparable small-scale retail cart, kiosk and retail merchandising unit operations. Information was gathered on sales volumes and lease rates as well as operational characteristics.

BBPA estimated sales volumes as derived from ridership projections provided by the consultant team. The sales volumes were in turn translated into estimated supportable square footage and likely supportable occupancy costs. This information was provided as input into the Consultant Team and WMATA as part of the iterative work process. This served to help define the required space within the pedestrian connector to accommodate supportable retail. The refinement of the space configuration also served to help define the likely characteristics of the retail space.

This report follows the outline of the scope of services contained in the WMATA work program.

B. Retail Market Demand

1. Market Context

The walksheds (half mile radius) of the Farragut North and Farragut West Metro Stations are located within The Golden Triangle Business Improvement District. The area is dominated by office uses with over 29 million square feet of office space within the 42 square block area. The Business Improvement District is generally bounded by the south side of DuPont Circle on the north, 21st Street and New Hampshire Avenue to the west, Pennsylvania Avenue on the south, east to approximately 16th Street and north back to DuPont Circle.

The area has a strong daytime population with an order of magnitude of 115,000 employees. There is a relatively limited evening population as few residential units are located within the area albeit the area is home to approximately 2000 hotel rooms.

The area contains over 800 retail and service establishments. Most of these establishments are relatively small and primarily serve the daytime office population. The area has no particular retail focus. Although the area contains a significant number of restaurants and eating and drinking places it is not perceived as a dining destination. Similarly, the area has a large number of retail and service establishments but again has no particular retail focus or concentration

of destination retail establishments.

The area is well served with convenience type retail establishments that would normally be found within transit venues. Various coffee, snack and convenience stores (for example -- Starbucks) are literally located at the station portals.

The Farragut North and Farragut West stations are somewhat unique in that both are served by food courts and service retail. The northern portals of Farragut North, the most removed entrance from the proposed pedestrian connection contains one of the transit systems first food courts the Connecticut Connection. The far western portals of Farragut West, again most removed from the portals proximate to the transit pedestrian tunnel contains another food -court within International Square. The Connecticut Connection food court has generally been underperforming from a lack of visibility, indirect access from the Street and perceived limited space configuration. A mezzanine level food operation located one level above the food court, with greater visibility is experiencing significantly greater sales performance. The International Square food court with enhanced visibility and a location generally within the large International Square office building atrium also enjoys more success.

The area surrounding the transit stations are significantly dominated by office activity with most of the reported retail activity occurring Monday through Friday from 8 AM to 7 PM. There are significant convenience, less inexpensive food outlets (bakeries coffee shops, delicatessens). There is relatively limited nightlife (bars, nightclubs, residential) although there are approximately 2000 hotel rooms.

Predominant service retail includes: arts and framing, camera, drugstores, electronic stores, cellular phones, florists, gifts, liquor stores, newsstands, optical services, airline ticket offices, financial offices, copying centers, dry cleaning, medical, barber, beauty, etc. A more limited number of apparel, jewelry, furniture and shoe stores are also found.

The ground floor retail is generally well occupied with vacancy rates of under 5 percent. The general retail lease rates range from a low of approximately $25 per square foot per year to a high-end of $80 per square foot per year within an effective average rate of $52. Average store sizes are approximately 2000 square feet.

2. Transit Retail

Given the nature of retail in the area and the likely limited foot traffic

within the pedestrian tunnel, BBPA has supplemented its retail demand analysis with an examination of similar retail within other transit facilities and an examination of the performance and characteristics of small-scale carts, kiosks and what is referred to in the retail industry as "retail merchandising units" (ministores larger than traditional carts and kiosks providing a self-contained environment for storage, merchandise handling, lighting, cash wraps, security, signage etc.).

Parsons undertook a detailed data evaluation of retail uses in other major transit systems, which has been provided to WMATA in a separately bound volume. Most information was available from the New York, Chicago, Boston and San Francisco systems. These systems have an established tradition of providing retail services in their stations. Many of the establishments have a long history and have established and defined consumer patterns. The size of these retail facilities varies from approximately 100 to 1500 square feet. Most of the retail operations are found outside of the fare zone. The highest sales performance however were experienced by facilities at the platform level, literally on the platform.

The data on the retail sales volumes for transit systems is extremely limited. Estimated retail sales range from $ 100 to $1400 per square foot per year, averaging approximately $600. More comprehensive data is available on lease rates. Annual rent per square foot ranges tremendously from a low of $9 per square foot to a high of $264 per square foot.

An examination of sales per rider revealed no discernible pattern, ranging from $.03 per rider to $0.36 per rider. From our discussions and a review of the location of the facilities it appears that **location** is the key factor in determining sales potential. “Forcing” the transit patron by the retail establishments appears to optimize revenue potential. Riders appear not too go out of their normal pedestrian path to make purchases. An average of 5,000 transit patrons per day appears also to be a " threshold" for retail success.

3. Sales Projections

In estimating the sales potential for retail facilities within the pedestrian passageway we have examined the ridership projections. Based upon the experience of other transit systems and the nature of area retail we have assumed that the potential market for retail services in the passenger tunnel would only be derived from primary and secondary transfer market. Those passenger tunnel users who enter or exit the systems at Farragut North or Farragut West have so many more retail options that it is highly unlikely they would use retail facilities within the

tunnel. We also assumed that the market for retail activities would exist primarily in the AM, midday and PM peak. With relatively limited retail activity after 7 PM, it would be unlikely that the retail operator would choose to remain open during weekends and after 7 PM. (All the transit retail use agreements we examined limited time of opening to the hours of operation of the transit system but did not require facilities to remain open during the entire operating period.).

Although we do not have information on the seasonality of the ridership demand the retail operation would likely be highly seasonal with strong demand during the Christmas season (November and December) and selected holidays (Valentine's Day, Mother's Day, Halloween, etc.). Many retail carts/kiosks operate only on a seasonal basis. Carts and kiosk tenants are often charged three to nine times greater monthly rents for November and December. Similarly, days of extremely high Metro use (July 4th, demonstrations and other major events) may also contribute significantly to potential retail sales.

For analysis purposes we have utilized a projected average daily potential pedestrian tunnel retail client figure of approximately 14,700, which represents slightly less than half of the overall pedestrian tunnel passenger forecast. For the adjusted potential clientele base and have assumed approximately the midpoint of the annual per passenger retail sales of the other transit systems($0.195) for most of the year. We have however adjusted the figure upward to $0.25 to assume seasonal sales (November/December) 3 times the average annual. These figures result in an estimated 2003 ridership sales forecasts of approximate $915,000. Based upon the forecast of 2030 ridership, sales would rise to approximately $1.3 million (constant $2004). Assuming he targeted sales volume in the $ 500 to $600 per square foot range, reflective of both transportation system and mall kiosk midpoints, an initial increment of approximately 1600 square feet of space would be supported increasing to approximately 2300 square feet by 2030.

C. Likely Retail Market Venue

1. Concepts

The pedestrian connection primarily: serve as a transfer point between the two stations, support relatively limited retail, space, have limited hours of retail activity (approximately 7 AM-7 PM weekdays),

discourage sale of food items, operate in a relatively constrained space (height/width) and should present a high quality image but would have no natural light. The retail would also experience selected sales jumps during holidays and major events.

It is our understanding that in addition to generating revenue, the retail should:

- Provide services to transit patrons which will reduce the amount of travel required to purchase goods and services,
- Increase transit ridership to reduce air quality impacts, energy consumption,
- Generate additional activity at stations which enhances use of the transit service perceptions of safety and security, and
- Introduce development opportunities for the private sector and small and minority businesses.

Based on these factors, we have explored a focus to small retail facilities, which: occupy minimal space; can be wheeled away for storage, or attractively secured; enhance customer flow and decrease customer waiting time; provide self contained lighting; have relatively modest cost; can flexibly be moved or relocated; have minimal maintenance costs; and present specialized security opportunities.

2. Unit Types

There are a variety of unit types, which could be used:

a. Carts

Retail carts are designed for efficiency, safety, mobility, and appeal for almost any venue. Carts occupy minimal space and are secured or wheeled away for storage. Custom carts include unique merchandising fixtures, materials, cash wraps, canopies, lighting, and various specialized features.

b. Kiosks

Custom kiosks provide the ability to merchandise or sell a variety of products. Custom kiosks can be designed with wheels, or knock down walls or interchangeable modular fixtures. A kiosk may be designed to complement the architecture of the location or they may be designed to market

specific product. Kiosks occupy slightly more space than carts and are generally less mobile than carts.

c. Retail Merchandising Units (RMU's)

Retail merchandising Units (RMU'S) serve as a "mini stores" for many retail products. An unlimited number of options are available to satisfy all requirements for size, materials, storage, merchandise handling, lighting, cash wraps, security, signage, and mobility.

d. Wall Units

Occupy minimal space (as little as two foot depth) and can sell a variety of retail products. They can be relatively easily secured and present an attractive façade when not open. They may require a modification in the tunnel design to allow for a vertical wall in what is now a curved design.

e. Dual Use Security/Merchandising Carts

The dual-use security cart system enables combining a revenue generating point-of-sale and a digital video security system simultaneously to a commercial space. The Security-Cart can be mobilized on a retail basis, security basis, or both.

f. Wi-Fi Station

The WI-FI Station is a wireless broadband internet delivery system, which can attract and retain customers, connect PDA's and laptops and contain broadband Megabit Feed.

g. Electronic Kiosks

Electronic Kiosks are self service computer touch pads occupying a minimum of space. This "self service" market includes retail and point of sales (POS) applications. This includes ATM; airport ticketing; information; bookstore kiosks; building directory kiosks; clothing retailers e.g., virtual sales assistants; customer electronic stores (web awareness-internet access to their on-line store); convenience store kiosks; and customer service kiosks (e.g. Photokiosk).

3. Target Store Types

Most carts, kiosks and RMU are non food based. From discussions with retailers and suppliers and review of sales data, it is our understanding that popular offerings with above average sales should target:

- Newsstand/sundries
- Cellular phones
- Sunglasses
- Cosmetics
- Health supplements
- Flowers/gift baskets
- Hat/toques
- Jewelry/rings/pendants
- Key-chains
- Perfume/after shave
- Children's books
- Coffee mugs/products
- Scarves/ties
- Sports jerseys
- T-shirts/boxers
- Wallets/purses
- Watches

D. Feasibility Issues

This section discusses feasibility issues in terms of how the tenant mix could be translated into a retail configuration within the pedestrian tunnel, likely rentals to be received by WMATA and potential capital and operating costs to WMATA.

1. Retail Configuration

   As part of the iterative process between the design and retail analysis of the proposed pedestrian connection option with a retail component has been configured as the center portion of the tunnel with a length of approximately 150 feet, a width of 38 feet in a height of approximately 17'6" feet at center. Of the 38 foot width, 22 feet of which is assumed to be required for pedestrian flow. This provides a total of 2,400 square feet for retail use. As currently configured the pedestrian way runs through the center of the tunnel leaving only 8 feet of depth for retail on each side of the pedestrian pathway, or two 8 feet by 150 feet retail areas.

   As noted above, a variety of retail configuration could be utilized. The minimal space would be occupied by wall units, which have a depth of

only two feet. A typical cart or kiosk is four to six feet wide and would require approximately four to eight feet additional on the perimeter to accommodate sales areas.

It appears that the wall units could be accommodated within the current configuration. However, the current curved nature of the walls would have to be modified, adding significantly to the cost or placing the wall units away from the current wall occupying additional ground space. The wall units would also be very linear and may tend to exaggerate the length of the walkway.

The most likely configuration would be kiosks occupying a four to six foot area. Ideally the lease footprint of the kiosk would be 20 foot by 16 foot area (320 square feet). The 16 foot depth would provide eight feet of "sales space" along the pedestrian flow, 4 feet for the cart/kiosk and an additional 4 feet between the cart/kiosk in the wall for supplemental sales area.

This 16 foot depth would fit within the configuration of the tunnel but would either require a single loaded corridor with potential modifications in the current design to place the wider area of the tunnel all on one side. From a retail marketing perspective a preferred approach, maybe for the kiosks to be placed on both sides of the tunnel in a staggered fashion creating a more serpentine pedestrian flow which would maintain a 16 foot pedestrian way, enhance retail visibility but may make the walk appear more circuitous but hopefully more attractive and interesting.

The 20 foot lengths would allow for the cart and a stool and provide 14 feet between the carts. The current size of the tunnel could accommodate the projected 5 to 8 sales units supportable by market demand, which would occupy 1600 to 2560 square feet of space.

The retail units would likely provide their own lighting and signage. The only requirements for the transit system would be to provide standard electrical power and telephone hookup for credit card and Internet connections. This design would likely not require storage space. The provision if exclusively nonfood vendors would reduce any maintenance and trash requirements. Servicing of the retail facilities would be to be by the elevators during non transit operating hours.

2. Lease Revenues

Likely lease rates will be reflective of a combination of transit type lease rates, kiosk lease rates, lease rates for smaller square footage within The Golden Triangle area and reflective lease rates supportable by retail sales volumes of small retail venues. For smaller type uses,

as proposed, lease rates generally would be in the ten to 18 percent of retail sales range. Smaller size facility lease rates in the Golden Triangle area generally are in the $ 50 to $ 85 per square foot range. Transit agency lease rates vary greatly. For smaller space lease rates can be over $100 per square foot for prime locations.

Kiosk lease rates also vary greatly depending upon the venue. Kiosk rates are generally quoted on a monthly basis and often are differentiated between the holiday season (November/December) and the rest of the year. Nonholiday monthly rates generally range from approximately $ 800 to $2400 per month for the nonholiday season, with the high end of the range reflective of major regional and super regional malls. During the holiday season monthly lease rates can be 3 to nine times the monthly rate for the remainder of the year. Kiosks and carts in more successful venues generally also are charged an "overage" or percentage lease amount, charging an additional occupancy cost for sales over a minimum threshold. Usually, occupancy costs are the greater of a base rent (for example $800 to $2400 per month) or 15 percent of retail sales.

Given the proposed average size allocation of 320 square foot per unit these lease rates would translate into an annual rates ranging from $40 to $210 per square foot. Most of the lease rates would be in the $60 to $80 per square foot range plus an overage rent. These rents are generally all-inclusive and include the kiosk and common area maintenance charges. Electricity is sometimes included and sometimes an additional expense. Kiosks are typically provided electrical and telephone hookups.

In the pedestrian connection projected lease rates sales volumes as a percentage of sales (10 to 18 percent) would range in the $50 to $108 per square foot rate. In monthly terms this would range from approximately $1300 to $2900. Given the uncertain nature of sales performance in the pedestrian tunnel it is suggested that lease rates be placed in the low-end of the percent calculation or 10 percent of sales generating a projected per square foot lease rate of $50 to $60 per square foot or $1300 to $1600 per month.

This rate combined with the provision of a ready to operate retail facility should attract potential operators and potentially create opportunities for small and disadvantaged businesses. The potential seasonal nature of retail sales and operation should be taken into consideration in order to encourage lively activity approaching and including the holiday season. In addition to the monthly charges retail operators would typically pay a security deposit equivalent to one to six months rent. Operators also would be required to maintain their own

liability insurance. Typically units are also charged a startup or turnkey/opening fees generally ranging from$300 to $1500.

These projected lease rates would generate initial annual revenues for the transit agency of $80,000 to $96,000, based on 1600 square feet leased and excluding any percentage rents or premium for holiday rentals. At an estimated 2030 buildout of 2560 square feet constant annual revenues, excluding percentage rents and holiday premiums would range from $128,000 to $154,000 (constant $2004).

Growth in revenues related to increases in ridership would be relatively modest given the projected 1.25 percent per year change in ridership. Growth in sales unrelated to ridership would likely grow at least at or near the rate of inflation to as high as growth in real sales per square foot of 3 to 5 percent per year.

Over a twenty-year projection period from 2004 to 2030, constant $2004 lease rates would be projected to advance the from a range of $80,000 to $96,000 to a 2030 level of between $173,000 (at a 3%/yr increase) to $341,000 (at a 5%/yr increase).

The net present value of this income flow would be approximately $1,473,000 to $2,210,000 at a 6 percent discount rate and $1,040,000 to $1,248,000 at a 9 percent discount rate. The 6 percent discount rate serving as a proxy for the cost of financing the improvements over time and the 9 percent discount rate representing the time value of money utilized by WMATA in evaluating Joint Development Projects.

This does **not** include additional revenues from percentage rents or premium rents for holiday rentals. Initially, these premiums would likely not be charged but clearly could be generated once the basic performance of the facilities has been established. These premiums could boost rentals by 40 to 100 percent assuming holiday lease rates three to six times average monthly rates and modest overage rental representing an additional 5 to 10 percent of base lease rates.

3. Feasibility Issues

While there is no established track record for retail within the Washington Metro system based on the experience of other transit systems and the likely level of pedestrian traffic through the proposed Farragut North to West Farragut connector there appears to be sufficient activity to attract potential retail operators.

Assuming relatively minimal startup costs in terms of a modest opening fee and the cost of inventory there could be sufficient interest,

particularly if initially, short-term monthly leases were provided and kiosks were made available on a turnkey basis. The relative attractiveness of starting up a business in the pedestrian tunnel would be enhanced if the initial leasing period were close to the holiday season. Prospective lease revenues of 10 percent of sales would be feasible from a tenants prospective, particularly given the minimum required startup capital requirements.

The key from the transit agency's perspective is to select quality tenants and a quality tenant mix, which will attract retail customer interest. Initially it may be more appropriate to master lease to a single experienced retail operator or leasing agent who would be responsible for creating, monitoring and maintaining quality tenant operations. Once quality tenants had been identified and the operational mix tested it could then be possible for the transit agency to operate and manage the retail as do other major transit agencies (Boston, New York, Chicago and San Francisco).

Initial annual lease revenue would be relatively modest, on the order of magnitude of $80,000 to $96,000. Over time even modest increases in annual sales volumes could double these revenues over approximately a 20 year timeframe. The estimated net present value of the lease revenue stream assuming relatively modest success and a 6 percent discount rate would be on the order magnitude of $1.5 million to $2.2 million through 2030. As a 9 percent discount rate the net present value would be approximately $1.0 million to $1.3 million. Assuming a significantly more successful operation with retail overages and strong seasonal performance the net present value could increase by as much as 40 percent to 100 percent to a net present value on the order of magnitude of $2.1 million to as high as $4.4 million at a 6 percent discount rate and $1.4 million to $2.6 million at a 9 percent discount rate.

This broad and somewhat speculative potential revenue stream must be measured in terms of the incremental capital and operating cost to effectuate the retail operations. The primary cost is the incremental capital costs to **construct** the additional underground area. The incremental cost of the Pedestrian Tunnel with retail is approximately $3.6 million more than a pedestrian tunnel only ($20.7 million vs. $17.1 million) and $6.6 million less than a tunnel with a moving walkway ($6.6 million).

The incremental capital costs of adapting this additional space to retail operations is fairly minimal consisting primarily of additional domestic electrical and telephone service. The costs of the actual carts and or kiosks are also relatively modest. These units can range in costs from

$2000 to $10,000 each with the high-end range of costs of retail units approximately $80,000 equivalent to approximately 1 years lease income.

Direct incremental operating costs in terms of utilities, cleaning, maintenance and management should also be relatively modest given the nonfood nature of the facilities and will not materially impact the analysis. Transit agencies typically do not pass these costs to the retail operators. Discussions with WMATA personnel concerning any special labor cost implications and or union related maintenance and operation costs will have to be determined. Likewise potential security issues need to be examined. Metro security cameras and or specialized security systems integrated into the retail units could be provided.

E. Summary

In summary, there appears to be potential modest retail opportunities within the transit connector. These initially would generate relatively modest annual lease revenues in the $80,000 to $96,000 range. With a successful retail operation these revenues could be expected to more than double over a 20 to 25 year timeframe. With utilization of retail kiosks, with flexible lease terms (monthly lease arrangements) and lease rates approximately 10 percent of projected sales there should be private sector interest.

The potential transit agency revenues are relatively modest and must be weighed against relatively modest operating costs and capital costs of adapting space to accommodate carts or kiosks and actually purchase the kiosks. The most significant costs would be the incremental costs of constructing additional underground space. Operating and management issues must also be carefully examined, as they obviously are not typical Metro functions.

Appendix A

Stations Included in Station Groups

Station Group Name	***Stations in Group***
Farragut West	Farragut West
Foggy Bottom	Vienna

	Dunn Loring West Falls Church East Falls Church Ballston Virginia Square Clarendon Courthouse Rosslyn Foggy Bottom
McPherson Square	McPherson Square
Metro Center	Metro Center
Smithsonian	Federal Triangle Smithsonian
L'Enfant Plaza	L'Enfant Plaza
Addison Road	Federal Center SW Capitol South Eastern Market Potomac Ave Stadium-Armory Minnesota Ave Deanwood Cheverly Landover New Carrollton Benning Road Capitol Heights Addison Road Morgan Blvd (future) Largo Town Center (future)
Huntington	Franconia-Springfield Van Dorn King Street Braddock Road National Airport Crystal City Pentagon City Pentagon Eisenhower Huntington
Arlington Cemetery	Arlington Cemetery

Station Group Name	***Stations in Group***
Waterfront	Branch Ave Suitland Naylor Road Southern Ave Congress Heights Anacostia Navy Yard Waterfront
Archives	Archives
Glenmont	Gallery Place Mt. Vernon Square Shaw U St/Cardozo Columbia Heights Georgia Ave Fort Totten West Hyattsville Prince George's Plaza College Park Greenbelt Judiciary Square Union Station New York Ave (future) Rhode Island Ave Brookland Takoma Silver Spring Forest Glen Wheaton Glenmont
Dupont Circle	Shady Grove Rockville Twinbrook White Flint Grosvenor Medical Center Bethesda Friendship Heights Tenleytown Van Ness Cleveland Park Woodley Park Dupont Circle
Farragut North	Farragut North

Appendix B

Forecast of Annual Growth Rates in Station-by-Station Entries and Exits, 2003 to 2030

Station	*Growth Rate*	*Station*	*Growth Rate*	*Station*	*Growth Rate*
Addison Road	-0.14%	Federal Center SW	0.75%	Potomac Ave	1.24%
Anacostia	1.51%	Federal Triangle	1.07%	Prince George's Plaza	1.34%
Archives	1.21%	Foggy Bottom	0.85%	Rhode Island Ave	0.75%
Arlington Cemetery	0.98%	Forest Glen	0.58%	Rockville	1.37%
Ballston	1.20%	Fort Totten	1.03%	Rosslyn	1.40%
Benning Road	1.32%	Franconia-Springfield	1.44%	Shady Grove	1.99%
Bethesda	1.20%	Friendship Heights	1.32%	Shaw	2.41%
Braddock Road	-0.36%	Gallery Place	3.85%	Silver Spring	1.44%
Branch Ave	1.53%	Georgia Ave	1.65%	Smithsonian	1.01%
Brookland	0.79%	Glenmont	1.43%	Southern Ave	1.20%
Capitol Heights	0.25%	Greenbelt	1.52%	Stadium-Armory	1.23%
Capitol South	1.04%	Grosvenor	0.95%	Suitland	1.10%
Cheverly	0.44%	Huntington	1.24%	Takoma	0.70%
Clarendon	2.91%	Judiciary Square	1.61%	Tenleytown	1.16%
Cleveland Park	1.13%	King Street	1.34%	Twinbrook	0.82%
College Park	1.58%	L 'Enfant Plaza	0.87%	U St/Cardozo	1.45%
Columbia Heights	1.45%	Landover	-0.03%	Union Station	1.58%
Congress Heights	1.45%	McPherson Square	0.96%	Van Dorn	1.23%
Courthouse	1.25%	Medical Center	0.04%	Van Ness	0.71%
Crystal City	1.03%	Metro Center	1.23%	Vienna	1.48%
Deanwood	0.61%	Minnesota Ave	1.06%	Virginia Square	2.72%
Dunn Loring	1.86%	Mt. Vernon Square	2.60%	Waterfront	1.45%
Dupont Circle	0.93%	National Airport	1.30%	West Falls	2.20%
East Falls	0.97%	Navy Yard	5.13%	West Hyattsville	1.02%
Eastern Market	0.73%	Naylor Road	1.08%	Wheaton	0.93%
Eisenhower	1.32%	New Carrollton	1.01%	White Flint	1.64%
Farragut North	0.79%	Pentagon	1.39%	Woodley Park	1.20%
Farragut West	0.83%	Pentagon City	1.76%		

Appendix C

Tunnel Pedestrian Volume Forecast, 2003

		Market Type						*TOTALS*	
		0	***1***	***2***	***3***	***4***	***5***	***MARKETS 1-5***	***MARKETS 0-5***
Size of Market (passengers per month)	AM Peak	3,654,328	124,421	395,941	16,142	37,808	718,428	**1,292,740**	**4,947,068**
	Midday	2,434,559	88,671	256,496	13,284	24,571	351,670	**734,692**	**3,169,251**
	PM peak	4,117,640	146,378	446,146	22,239	34,968	705,309	**1,355,040**	**5,472,680**
	Evening	1,503,592	77,791	158,352	6,660	7,842	182,848	**433,493**	**1,937,085**
	TOTAL	**11,710,119**	**437,261**	**1,256,935**	**58,325**	**105,189**	**1,958,255**	**3,815,965**	**15,526,084**
Size of Market (passengers per day)	AM Peak	157,929	5,377	17,111	698	1,634	31,048	**55,868**	**213,797**
	Midday	95,959	3,495	10,110	524	968	13,861	**28,958**	**124,917**
	PM peak	167,787	5,965	18,180	906	1,425	28,740	**55,216**	**223,003**
	Evening	64,405	3,332	6,783	285	336	7,832	**18,568**	**82,973**
	TOTAL	**486,080**	**18,169**	**52,184**	**2,413**	**4,363**	**81,482**	**158,610**	**644,690**
Use rate	AM Peak	0%	80%	2%	80%	55%	10%	**16.5%**	**4.3%**
	Midday	0%	70%	2%	85%	60%	10%	**17.5%**	**4.1%**
	PM peak	0%	80%	2%	80%	55%	10%	**17.2%**	**4.3%**
	Evening	0%	70%	2%	85%	60%	10%	**19.9%**	**4.5%**
	AVERAGE	**0.0%**	**76.2%**	**2.0%**	**81.7%**	**56.5%**	**10.0%**	**17.3%**	**4.3%**
Tunnel Users per day	AM Peak	0	4,302	342	558	899	3,105	**9,205**	**9,205**
	Midday	0	2,446	202	445	581	1,386	**5,061**	**5,061**
	PM peak	0	4,772	364	725	784	2,874	**9,518**	**9,518**
	Evening	0	2,332	136	242	202	783	**3,695**	**3,695**
	TOTAL	**0**	**13,852**	**1,044**	**1,971**	**2,465**	**8,148**	**27,480**	**27,480**
Percent of Users by Time Period	AM Peak	0%	47%	4%	6%	10%	34%	**100%**	**100%**
	Midday	0%	48%	4%	9%	11%	27%	**100%**	**100%**
	PM peak	0%	50%	4%	8%	8%	30%	**100%**	**100%**
	Evening	0%	63%	4%	7%	5%	21%	**100%**	**100%**
	AVERAGE	**0%**	**50%**	**4%**	**7%**	**9%**	**30%**	**100%**	**100%**
Users per:	AM PHH	0	850	68	110	177	613	**1,818**	**1,818**
	AM Pk Hr	0	1,659	132	215	347	1,197	**3,550**	**3,550**
	Year	0	4,000,540	301,664	571,652	713,115	2,349,906	**7,936,878**	**7,936,878**

Tunnel Pedestrian Volume Forecast, 2030

		Market Type						*TOTALS*	
		0	***1***	***2***	***3***	***4***	***5***	***MARKETS 1-5***	***MARKETS 0-5***
Size of Market (passengers per month)	AM Peak	5,740,362	171,335	632,892	19,956	50,948	934,739	**1,809,870**	**7,550,232**
	Midday	3,831,223	121,284	388,328	15,942	33,137	451,863	**1,010,554**	**4,841,777**
	PM peak	6,475,025	204,807	692,378	27,429	47,371	917,730	**1,889,715**	**8,364,740**
	Evening	2,391,321	106,868	247,874	8,125	10,599	235,760	**609,226**	**3,000,547**
	TOTAL	**18,437,931**	**604,294**	**1,961,472**	**71,452**	**142,055**	**2,540,092**	**5,319,365**	**23,757,296**
Size of Market (passengers per day)	AM Peak	248,081	7,405	27,352	862	2,202	40,397	**78,217**	**326,298**
	Midday	151,009	4,780	15,306	628	1,306	17,810	**39,831**	**190,840**
	PM peak	263,847	8,346	28,213	1,118	1,930	37,396	**77,003**	**340,850**
	Evening	102,430	4,578	10,617	348	454	10,099	**26,096**	**128,525**
	TOTAL	**765,366**	**25,108**	**81,488**	**2,957**	**5,892**	**105,701**	**221,147**	**986,513**
Use rate	AM Peak	0%	80%	2%	80%	55%	10%	**15.9%**	**3.8%**
	Midday	0%	70%	2%	85%	60%	10%	**16.9%**	**3.5%**
	PM peak	0%	80%	2%	80%	55%	10%	**16.8%**	**3.8%**
	Evening	0%	70%	2%	85%	60%	10%	**19.1%**	**3.9%**
	AVERAGE	**0.0%**	**76.3%**	**2.0%**	**81.7%**	**56.5%**	**10.0%**	**16.8%**	**3.8%**
Tunnel Users per day	AM Peak	0	5,924	547	690	1,211	4,040	**12,411**	**12,411**
	Midday	0	3,346	306	534	784	1,781	**6,751**	**6,751**
	PM peak	0	6,676	564	894	1,062	3,740	**12,936**	**12,936**
	Evening	0	3,204	212	296	272	1,010	**4,995**	**4,995**
	TOTAL	**0**	**19,151**	**1,630**	**2,414**	**3,329**	**10,570**	**37,093**	**37,093**
Percent of Users by Time Period	AM Peak	0%	48%	4%	6%	10%	33%	**100%**	**100%**
	Midday	0%	50%	5%	8%	12%	26%	**100%**	**100%**
	PM peak	0%	52%	4%	7%	8%	29%	**100%**	**100%**
	Evening	0%	64%	4%	6%	5%	20%	**100%**	**100%**
	AVERAGE	**0%**	**52%**	**4%**	**7%**	**9%**	**28%**	**100%**	**100%**
Users per:	AM PHH	0	1,170	108	136	239	798	**2,451**	**2,451**
	AM Pk Hr	0	2,285	211	266	467	1,558	**4,787**	**4,787**
	Year	0	5,530,952	470,753	700,097	963,024	3,048,110	**10,712,936**	**10,712,936**

Appendix D
2003 NFPA 130 Analysis - Chapter 5 Stations

This chapter applies to all fixed guideway transit and passenger rail stations whether they are entirely, or in any part, below, at, or above grade. Per paragraph 5.1.2.1, stations are primarily for the use of transit passengers whose stay in a station structure is limited to that necessary to wait for and enter a departing transit vehicle or to exit the station after arriving on an incoming transit vehicle.

Requirements applicable to the proposed pedestrian tunnel connecting Farragut North and Farragut West are as follow:

Paragraph 1.3 Application:

Requirement: The standard shall also be used for purchases of new rolling stock and retrofitting of existing equipment or facilities except in those instances where compliance with the standard will make the improvement or expansion incompatible with the existing system.

Conclusion: This paragraph limits the application of NFPA 130 requirements to the new work included in this project or, specifically, the pedestrian tunnel and the modified portions of Farragut North and Farragut West. In addition, NFPA 130 compliance is not required for new work if this results in incompatibilities with existing systems.

Paragraph 5.1.2.2 Occupancy:

Requirement: Where contiguous commercial occupancies are not in common with the station, or where the station is integrated into a building the occupancy of which is neither for transit nor for passenger rail, special considerations beyond this standard shall be necessary.

Conclusion: Determine the point at which the proposed commercial areas can no longer be considered incidental to the stations and must be considered a separate occupancy (Type M mercantile) per the DC Building Code (2000 International Building Code with DC supplements).

Factors consist of the following:

- Commercial space size

- Access to the commercial space (i.e. Access from the “Free” or “Paid” station area. If access is possible only from the Paid area then only WMATA patrons are likely to use the commercial space and the space could be considered incidental to the stations)

Paragraph 5.2.1 Construction Materials:

Requirement: Building construction for all new rapid transit stations shall be not less than Type I– or Type II– or combinations of Type I– and Type II–approved

noncombustible construction as defined in NFPA 220, as determined by an engineering analysis of potential fire exposure hazards to the structure.

Conclusion: Incorporate requirements.

Paragraph 5.2.3.5.1 Fire Separation:

Requirement: All station public areas shall have a fire separation of at least 3 hours from all nontransit occupancies.

Conclusion: Provide 3 hour fire separation in options where commercial area is considered a separate occupancy.

Paragraph 5.2.3.6 Openings:

Requirement: (Reference 5.2.3.6.1& 2) All openings (e.g., private entrances) from station public areas to all nontransit occupancies shall be protected by approved fire-protective assemblies with an appropriate rating for the location in which they are installed. Where a fire door is required to be open, one of the following shall apply:

(1) The door shall be of the automatic closing type.
(2) The door shall be activated by listed smoke detectors.
(3) Where a separate smoke barrier is provided, the operation shall be permitted to be by fusible links.

Conclusion: Provide fire doors as required to separate transit and nontransit occupancies.

Paragraph 5.3 Ventilation:

Requirement: Emergency ventilation shall be provided in enclosed stations in accordance with NFPA 130 Chapter 7.

Conclusion: The existing station ventilation systems (underplatform exhaust fans) and the adjacent fan shafts currently provide emergency ventilation.

5.4 Wiring Requirements:

Requirement: All wiring materials and installations within stations other than for traction shall conform to requirements of NFPA 70 and, in addition, shall satisfy the requirements of NFPA 130 paragraphs 5.4.2 through 5.4.9.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.5 Means of Egress:

Requirement: The provisions for means of egress for a station shall comply with Chapter and Chapter 12 of NFPA 101, except as herein modified.

Conclusion: Perform exit calculations for both Farragut North and Farragut West stations to determine exit times.

Requirement: (Reference 5.5.2.6.1) At concourses, mezzanines, or multilevel stations, simultaneous loads shall be considered for all egress routes passing through that area.

Conclusion: Incorporate commercial space patron load into exit calculations if commercial and transit exits coincide.

Requirement: (Reference 5.5.2.7) Where an area within a station is intended for use by other than transit patrons or employees, the occupant load for that area shall be determined in accordance with the provisions of NFPA 101 as appropriate for the class of occupancy.

Conclusion: Incorporate commercial space patron load into exit calculations if commercial and transit exits coincide. Do not consider commercial space patron loads if commercial spaces are accessible only from the “Paid” station area.

Requirement: (Reference 5.5.2.7.1) The additional occupant load shall be included in determining the required egress from that area.

Conclusion: Incorporate commercial space patron load into exit calculations if commercial and transit exits coincide. Do not consider commercial space patron loads if commercial spaces are accessible only from the “Paid” station area.

Requirement: (Reference 5.5.2.7.2) The additional occupant load is not required to be added to the station occupant load when the area has independent means of egress of sufficient number and capacity.

Conclusion: Station exit calculations will not consider commercial space patron load if the commercial space is provided with separate exits.

5.5.3 Number and Capacity of Exits:

Requirement: (Reference 5.5.3.2 Evacuation Time to a Point of Safety) The station shall be designed to permit evacuation from the most remote point on the platform to a point of safety in 6 minutes or less.

Conclusion: Perform exit calculations for both Farragut North and Farragut West stations to determine exit times. Addition of pedestrian tunnel will tend to reduce overall exit times.

Requirement: (Reference 5.5.3.3.2.5) Escalators shall not account for more than half of the units of exit at any one level.

Conclusion: Incorporate stairs in pedestrian tunnel entrance.

5.5.3.3.3.1 Doors and Gates:

Requirement: Doors and gates in a means of egress shall be a minimum of 914.4 mm (36 in.) wide.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.5.3.3.4.Fare Collection Gates:

Requirement: (Reference 5.5.3.3.4.1) Fare collection gates shall meet the following criteria:

(1) They shall provide a minimum of 508 mm (20 in.) clear width when deactivated.
(2) Consoles shall not exceed 1016 mm (40 in.) in height.
(3) They shall have a capacity of 50 people per minute (ppm) for egress calculations.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

Requirement: (Reference 5.5.3.4) Emergency exit gates shall be in accordance with NFPA 101.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

Requirement: (Reference 5.5.3.4.1) Gate-type exits shall be provided for at least 50 percent of the required emergency exit capacity unless fare collection equipment provides unobstructed exiting under all conditions.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.5.4 Escalators:

Requirement: (Reference 5.5.4.1) Escalators shall be permitted as a means of egress in stations provided the following criteria are met:

(1) The escalators are constructed of noncombustible materials.
(2) Escalators running in the direction of egress shall be permitted to remain operating.
(3) Escalators running reverse to the direction of egress shall be capable of being stopped remotely or manually.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

Requirement: (Reference 5.5.4.2) Escalators with or without intermediate landings shall be acceptable as a means of egress, regardless of vertical rise.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements. Current WMATA criteria limit escalator rise to 30 feet. Rise above 30 feet requires multiple escalators with intermediate landings.

5.5.5 Fare Collection Gates or Turnstiles:

Requirement: (Reference 5.5.5.1) Fare gates shall assume an emergency exit mode in the event of loss of power to the fare gates or upon actuation of a manual or remote control.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

Requirement: (Reference 5.5.5.2) Fare collection gates or turnstiles shall be designed so that their failure to operate properly will not prohibit movement of passengers in the direction of the emergency egress.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.6 Emergency Lighting:

Requirement: Stations shall be provided with a system of emergency lighting in accordance with NFPA 101, except as otherwise noted in this standard. Emergency lighting for stairs and escalators shall be designed to emphasize illumination on the top and bottom steps and landings. All newel- and comb-lighting on escalator steps shall be on emergency power circuits.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.7.1 Protective Signaling Systems:

Requirement: Stations equipped with fire alarm devices shall be protected by a proprietary system as defined in NFPA 72.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.7.2 Emergency Communication:

Requirement: (Reference 5.7.2.1) A public address (PA) system and emergency voice alarm reporting devices, such as emergency telephone boxes or manual fire alarm boxes, conforming to NFPA 72 shall be required in transit stations.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

Requirement: (Reference 5.7.2.3) Emergency alarm reporting devices shall be located on passenger platforms and throughout the passenger station such that the travel distance from any point in the public area shall not exceed 91.4 m (300 ft) unless otherwise approved by the authority having jurisdiction.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.7.3 Automatic Sprinkler Systems:

Requirement: An automatic sprinkler protection system shall be provided in areas of transit stations used for concessions, in storage areas, in trash rooms, and in the steel truss area of all escalators and other similar areas with combustible loadings, except trainways.

Conclusion: Add sprinklers to concession areas. If commercial space is considered a different occupancy, incorporate DC Building Code (2000 International Building Code with DC supplements).

5.7.4 Standpipe and Hose Systems:

Requirement: Each underground transit station shall be equipped with a standpipe system of either Class I- or Class III-type, as defined in NFPA 14.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements. Consider extending standpipe to pedestrian tunnel.

5.7.5 Portable Fire Extinguishers:

Requirement: Portable fire extinguishers in such number, size, type, and location as determined by the authority having jurisdiction shall be provided.

Conclusion: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

5.8 Storage Tanks and Service Stations:

Requirement: Aboveground storage tanks above subsurface stations shall meet the requirement of 6.2.8.4. Underground storage tanks above subsurface station structures shall meet the requirements of 6.2.8.5. Service stations above subsurface station structures shall meet the requirements of 6.2.8.6. Existing storage tanks in or under buildings shall meet the requirements of 6.2.8.7.

Conclusion: Requires survey to determine existence of any fuel storage tanks within the limits defined by 2003 NFPA 130 and WMATA criteria. Final design of pedestrian passageway will need to include remedial actions per 2003 NFPA 130.

Appendix E
Meeting Minutes

Parsons

		DATE:	3/31/04
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	LOCATION:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Farragut North/West 3/30/04 Team Meeting FILE NO: 645536 42000

John Magarelli had not received any written comments as a result of the last Team Meeting held on 3/09/04. NPS had been in contact with him and indicated that they will be providing written comments shortly. NPS' verbal comments indicated that they did not want significant impacts to Farragut Square.

Bill Gallagher reviewed the Pedestrian Passageway Alternatives. As a result a number of comments were made:

- Movable walkways are a new technology. As such, what is their reliability? Also, WMATA would need to train staff to repair them.
- A comparison was made between the NFPA130 and the International Building Code. NFPA130 is the fire protection code for transit systems. The NFPA130 is being followed for all of the alternatives except the ones with retail. Once retail is introduced the more restrictive International Building Code is followed, which is DC's standard for retail.
- Discussion on relocating the vent shaft from 17th Street to the sidewalk along K Street within the sidewalk adjacent to Farragut Square. Currently, there appears to be adequate room for it. One of the options for the K Street Busway includes reducing this sidewalk width. If this option for the Busway is carried forward, there may not be enough room for the vent shaft grating.
- The option of keeping the vent shaft in the same location but going around it for the short tunnel was introduced. This would reduce the line of sight in the tunnel as well as reduce the amount of retail area.
- Discussion on the need to construct a new mezzanine at Farragut North for the short tunnel options. Without the mezzanine the vertical circulation improves. With it, an escalator is not needed.
- Determine the type of exits required for the tunnel. Can only an emergency exit be provided (stairs)? Do escalators have to be provided?
- Determine the operating hours for the retail. Only during rush hours? On weekends?

Farragut North and Farragut West Pedestrian Passageway Tunnel

- The results of the Joint Development Analysis will determine the feasibility of retail. The short tunnel alternative may not have enough usable square footage to make retail feasible.

Randy Dittberner provided an update on the Ridership Analysis. Very preliminary calculations indicate approximately 25,000 people will be using the tunnel daily with the number rising to 45,000 in the year 2030.

The Project Team feels that more input is required from the Joint Development and Ridership analyses in order to make a decision on which alternative to carry forward.

The next Team Meeting will take place in approximately two weeks.

Parsons

		DATE:	4/16/04
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	LOCATION:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Farragut North/West 4/14/04 Team Meeting FILE NO: 645536 42000

Attendees:

John Magarelli	WMATA	202.962.1357
Bill Gallagher	KGP	202.822.2102
Randy Dittberner	Parsons	202.775.6088
Jim Prost	BBPA	301.970.2298
Bob Irwin	DDOT/IPMA	202.671.4542
Scott Peterson	WMATA/BPPD	202.962.1458
Ed Riley	WMATA/ENGA	202.962.1384
David P. Robinson	WMATA/OLIA	202.962.2432
Deirdre Smith	Parsons	202.775.3396
Dan Hertz	WMATA	202.962.2108
M. Nasim	WMATA/ENGA	202.962.1397
Karina Ricks	DC-OP	202.442.7607

Bill Gallagher began with a review of the Pedestrian Passageway Alternatives. Comments are as follows:

- The alternatives themselves had not changed but Bill had further developed the mezzanine/stairway/elevator arrangement for the south end of the Farragut North Station on Alternative 2 (short tunnel). Based on a site visit earlier that week, it was determined that the equipment room, located at the south end of the station, had space to locate an elevator in it to connect the mezzanine level to the platform level. By locating the elevator there, the ductwork under the platform would not be disturbed. Using this concept, he came up with a number of alternatives to access the platform level. The best received ones were the elevator/stairway combinations – not the escalator ones. One of the problems with the escalator options was that the existing ductwork underneath the platform would need to be relocated. The final location of the elevator still needs to be determined, further study is required.

- It was determined that Alternative 2 (short tunnel) also provided for increased vertical circulation at the Farragut North Station (versus

Alternative 1) because it added additional platform to mezzanine level access. Another plus is that it provides access at the end of the platform where there currently isn't access. Alternative 1 uses the existing mezzanine with adding stairs, etc.

- The question can up about the application of NFPA130. Both stations were designed prior to the implementation of NFPA130 and they do not conform. Since we are modifying both stations, do we need to bring both stations completely into compliance? Or does just the tunnel need to be in compliance?

- For the alternatives where the tunnel is a paid area (which would require a faregate and the mid-tunnel entrance), it was suggested by WMATA's Office of Operations Liaison (OLIA) and Engineering and Architecture (ENGA) that a kiosk should not be placed there. This would reduce the cost by not having to provide all the wiring, ductwork, etc. that the kiosk would need and well as having to staff it. There is already precedence for this at the MCI and National Airport stations.

- After a review of the tunnel cross sections, the comment was made to have the cross section to reflect the Metro style architecture, including the more rounded section at the base of the tunnel along with the handrail mounted on the wall. By adding the handrail, the tunnel diameter would increase by 2 ½ feet on each side.

- DC Office of Planning did not see the usefulness of a people mover since the distance was only a block long.

- DC Office of Planning preferred a wider tunnel section, such as the one used for the people mover section, but without the people mover.

Jim Prost provided information on the Joint Development Analysis, which is at a very preliminary stage.

- From a retail standpoint, the tunnel could be kept as a paid area since there would not be a big draw from the outside. The outside area is already well served by a variety of food and retail.

- Primary market appears to be transit users passing through the tunnel.

- Additional access along 17th Street and Farragut Park would greatly enhance retail opportunities.

- Tunnel could support 3 to 4 shops.

- WMATA stressed that it would not want any kind of food/drink sold within the tunnel.

- Office of Planning has concerns about retail in the tunnel drawing street vendors off of the street and changing the character of the area.

Farragut North and Farragut West Pedestrian Passageway Tunnel

The decision was made to carry forward and further develop the Alternative 2 (short tunnel) alignments and work will proceed on that basis. Reasons for the decision are as follows:

- The tunnel is shorter and presumably will cost less.
- This alternative minimizes the impact to K Street during construction
- Alternative 2 provides for another egress from the platform to the mezzanine with this egress being located at the south end of the platform, whereas, Alternative 1 does not.

Action Items:

- Follow up on NFPA130 to determine if both stations must be brought up to full compliance.
- Research utilities
- Continue with overall design

The next Team Meeting will take place in approximately two weeks.

Parsons

		DATE:	5/3/04
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	LOCATION:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Farragut North/West 4/29/04 Team Meeting FILE NO: 645536 42000

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357
Bill Gallagher	KGP	202.822.2102
Randy Dittberner	Parsons	202.775.6088
Scott Peterson	WMATA/BPPD	202.962.1458
Deirdre Smith	Parsons	202.775.3396
Dan Hertz	WMATA	202.962.2108
John Grimm	WMATA/OLIA	202.962.2775
Tom Harrington	WMATA/BPPD	202.962.1357
James Darmody	WMATA/ENGA	202.962.2091
David Levy	NCPC	202.482.7247

Randy Dittberner began with a review of the Ridership Analysis Draft Report. Tom Harrington requested that some sort of user-benefit ratio or cost effectiveness number (a number that shows a cost savings to the user) be added to the report.

Jim Prost was unable to attend, so Deirdre Smith presented the update on the Joint Development Analysis.

- The focus was on small retail facilities, which occupy minimal space. A variety of units can be considered:
  - Carts
  - Kiosks
  - Retail merchandising units (RMU's)
  - Wall units. It was decided that wall units would not be a good idea considering the rounded cross section on the tunnel near the floor. This would create an unusable space that would be difficult to clean and secure.
  - Dual use security/merchandising carts
  - Wi-Fi station
  - Electronic kiosks – ATM, airport ticketing, customer electronic stores, customer service kiosks, etc.

- It was asked whether or not a service-oriented business, such as Kinko's, would be feasible.
- Considering the different factors, the resulting retail space would probably result in a number of small (100 to 600 square foot) carts/kiosks.

- It was requested that the Joint Development report be distributed to the Team.

Bill Gallagher updated the team on the NFPA130 issue. There was a question at the last meeting about how NFPA130 would be applied on this project. It will be applied to the tunnel in all options except in the retail option when the square footage reaches a certain limit, then the DC Building Code would need to be followed. As far as the work within the station areas, there was concern about having to bring the entire station into compliance with the NFPA130. The code states that it will be followed except where compliance with the standard will make the improvement or expansion incompatible with the existing system. Our interpretation is that it would result in incompatibilities with the existing systems and therefore would not apply.

Bill Gallagher presented updated concepts of the tunnel. The new concept included a rotunda (based on the Friendship Heights concept) approximately midway through the tunnel. This would be included in all three tunnel options (pedestrian tunnel, pedestrian tunnel with people mover, and pedestrian tunnel with people mover and retail). The concept was well liked and Bill was directed to include it in all the concepts. He needs to further develop the concept and determine the final size of it, especially within the retail option, as the retail would be located within it. Further design issues included:

- All the tunnels will be considered as being "paid". This will require people entering the tunnel at the midpoint entrance to pass through faregates.

- The final location of the midtunnel entrance (and the rotunda) needs to be determined. It should not be located in front of the historic buildings. Also, it should be closer to Farragut West. Another benefit of placing it closer to Farragut West is that it is closer to a WMATA kiosk.

- The midtunnel entrance will require two elevators, spaced so that the doors will be facing each other with queuing spacing between. In order to have them fit on the sidewalk, they will need to be smaller than the standard WMATA and yet still be ADA compliant. A separate meeting will be held to discuss the specifics of the elevator itself.

- The midtunnel elevators will be shown on the drawings as being located in the street, but it will be mentioned in the final report that another potential location is within the buildings. The alternative location will be included in the cost estimate as an option.

- The elevators within the stations will need to be the smaller sized ones also.

Farragut North and Farragut West Pedestrian Passageway Tunnel

David Levy, NCPC, doesn't believe NPS would have any objections to the plans as they are currently presented without a new entrance on Farragut Square side. He also believes that the relocation of the existing vent shaft on the north side of the park in the sidewalk should not be a problem.

The next Team Meeting will take place in approximately three weeks.

Parsons

		DATE:	5/21/04
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	LOCATION:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Farragut North/West 5/20/04 Team Meeting FILE NO: 645536 42000

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357
Bill Gallagher	KGP	202.822.2102
Deirdre Smith	Parsons	202.775.3396
Dan Hertz	WMATA/LAND	202.962.2108
Ed Riley	WMATA/ENGA	202.962.1384
Alex Eckmann	DC DOT	202.671.0537
Jim Prost	BBPA	301.970.2298
David Levy	NCPC	202.482.7247
Alexa Viets	NPS – National Mall	202.485.9871
John Grimm	WMATA/OLIA	202.962.2775
Karina Ricks	DC - OP	202.442.7607
John Bumanis	Parsons	703.247.4447
Kwong Tse	Parsons	202.775.3409
Dave Glen	Parsons	703.247.4454
James Darmody	WMATA/ENGA	202.962.2091

Bill Gallagher presented an update of the tunnel concepts. The following are the topics that were discussed.

- Emergency exits, along with areas of rescue, have been located at each end of the tunnel. The emergency hatch is flush with the sidewalk and opens onto the sidewalk adjacent to Farragut Square. Bill is looking into having an emergency stair from the platform of Farragut North that would connect at the mezzanine level to the pedestrian tunnel's northern emergency exit. Also, an area of rescue needs to be included with that configuration.

- Both the elevators that will move from street level to the mezzanine level and those that will move from mezzanine to platform level have been located on the plans. The elevators from street level to the mezzanine have been located adjacent to the existing escalators at the east entrance to the Farragut West Station. If two WMATA standard sized elevators are

used, then it will impact the existing building. If two smaller sized (ADA compliant) elevators are used, then it is possible that they can be completely located within WMATA controlled property. It was decided that the two WMATA standard sized elevators will be shown on the drawings with a note stating that it is possible to apply for a variance to WMATA criteria to allow two smaller ADA compliant elevators, or just one standard size. WMATA criteria requires two elevators. The two Farragut West platform to mezzanine elevators are WMATA standard sized and are located on each side of the station at the east end. The two elevators from the mezzanine to platform level for the Farragut North Station are located at the south end of the station and are the smaller ADA compliant ones. These need to be the smaller size due to mechanical problems within the mechanical room and will require a variance on WMATA criteria.

- It was requested that the drawings differentiate between existing and proposed features.

- Jim Prost indicated that if the tunnel section within the commercial segment was changed to a vertical wall (without the handrail) instead of the standard curved then the retail wall units could be used. Only eight to ten feet would need to be vertical to fit in the wall units. Ed Riley stated that this would be okay as the intent of the handrails was to keep people from touching the walls.

- Jim Prost and Bill Gallagher will coordinate on cart spacing within the commercial area.

- It was suggested that if the commercial option was build and was not successful then the area could be used for artwork.

- Ed Riley would like to factor in the maintenance costs for the moving walkways into the cost estimate.

- Alexa Viets indicated that she believes the NPS should not have any problem with having the emergency escape hatches or vents shafts located in the sidewalks of Farragut Square – as indicated on the plans.

The next Team Meeting will take place in approximately three weeks at which time the study team will submit the draft report and cost estimate for review.

Appendix F
Meeting Sign-in Sheets