Description of document:	Station (Development) Studies for the Washington Metropolitan Area Transit Authority (WMATA), 2003-2007
Requested date:	Early 2007
Released date:	April 2007
Posted date:	18-April-2011
Date range of documents:	April 2002 – March 2007
Source of document:	Office of General Counsel PARP Administrator Washington Metropolitan Area Transit Authority 600 Fifth Street, NW Washington, D.C. 20001
Note:	Additional information available here: http://www.wmata.com/about_metro/planning_dev.cfm

CRYSTAL CITY METRORAIL STATION ACCESS STUDY

Prepared for Arlington County, Virginia
by
Washington Metropolitan Area Transit Authority
Department of Capital Projects Management
June 2002

CRYSTAL CITY METRORAIL STATION ACCESS STUDY

Contents

Note: The report has been prepared to demonstrate the feasibility of the concepts presented. The concept is subject to further refinement and may be revised during future planning and/or engineering design phases of the project. The environmental planning process may include one or more of these alternatives along with others prior to any decision regarding implementation of a specific plan, which will be subject to professional engineering design principles.

Figures

Tables

Introduction

Crystal City is a high-density, multi-use neighborhood in southeast Arlington County, Virginia. It is located between the Pentagon and Ronald Reagan Washington National Airport, just minutes from Washington, D.C. Its proximity to these major centers of activity makes its location desirable for residents and businesses. Crystal City is home to over 12,000 residents and swells with over 50,000 employees on weekdays.

The Crystal City Metrorail station serves Blue and Yellow Line trains on the Metrorail system operated by the Washington Metropolitan Area Transit Authority (WMATA). Figure 1 is an aerial photograph of the station area; a schematic diagram of the station area is shown in Figure 2.

Objective

The Metrorail Station Access Study was conducted for WMATA and Arlington County, with a goal of generally maximizing the attractiveness of Metrorail to the Crystal City area. The study objective was to identify and evaluate specific station and area improvements to improve convenience and safety in accessing the station for customers of all modes. The access improvements proposed in the study include additional station entrances and mezzanines, improved traffic conditions on adjacent streets, and improved connections between Metrobus and Metrorail.

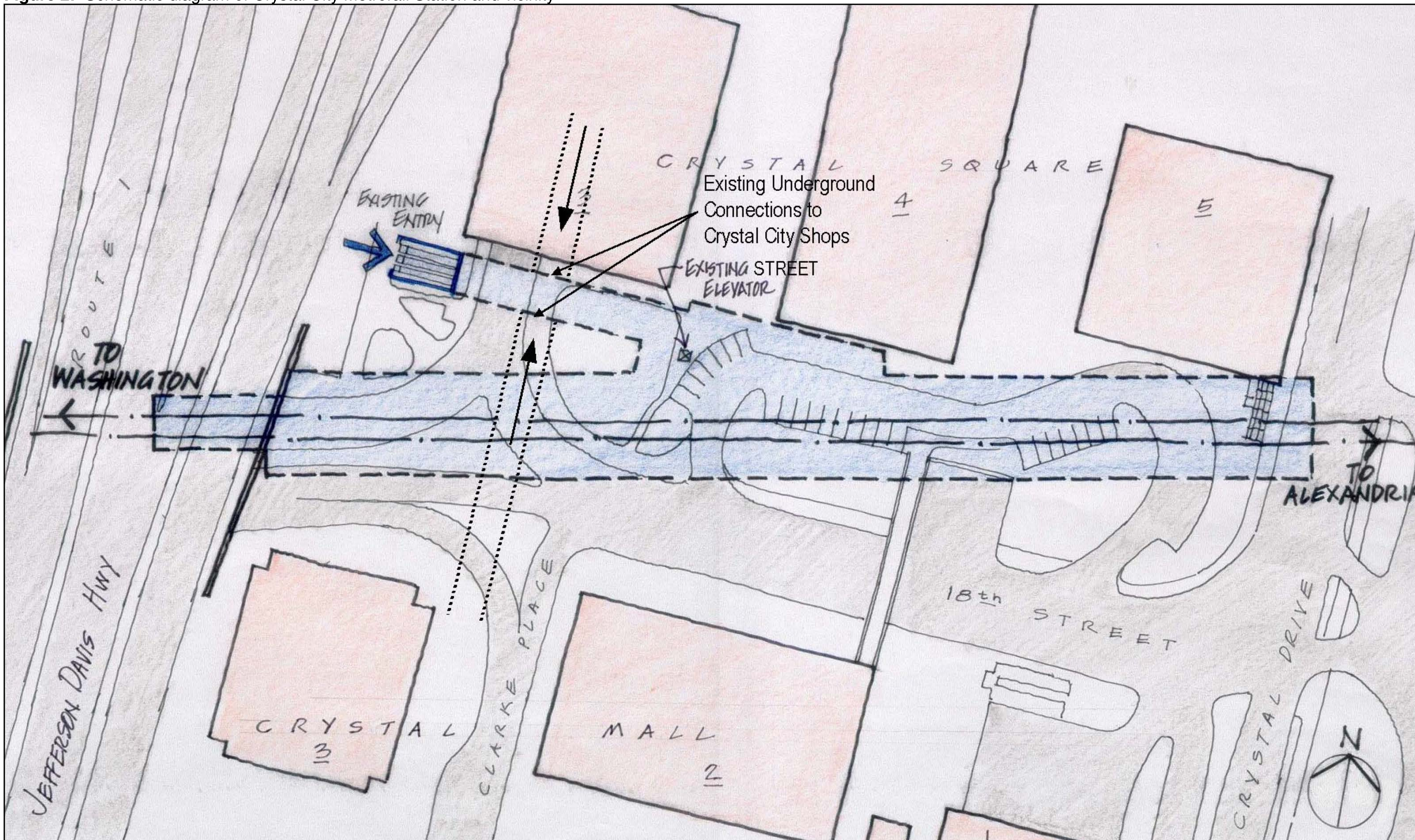
Existing Conditions

Transportation Facilities

Jefferson Davis Highway (U.S. Route 1), a north-south highway, passes through Crystal City on its way between Interstate 395 on the north and the City of Alexandria on the south. In addition to Jefferson Davis Highway, Crystal City's street network consists primarily of a one-way pair of streets, Crystal Drive for northbound traffic and Clark Street for southbound traffic. Several east-west cross streets connect these one-way streets. The area's streets are generally sufficient to accommodate existing traffic volumes. The use of one-way streets helps minimize conflicts at intersections and smooth traffic flow.

Figure 1: Aerial photograph of Crystal City Metrorail Station vicinity

Figure 2: Schematic diagram of Crystal City Metrorail Station and vicinity

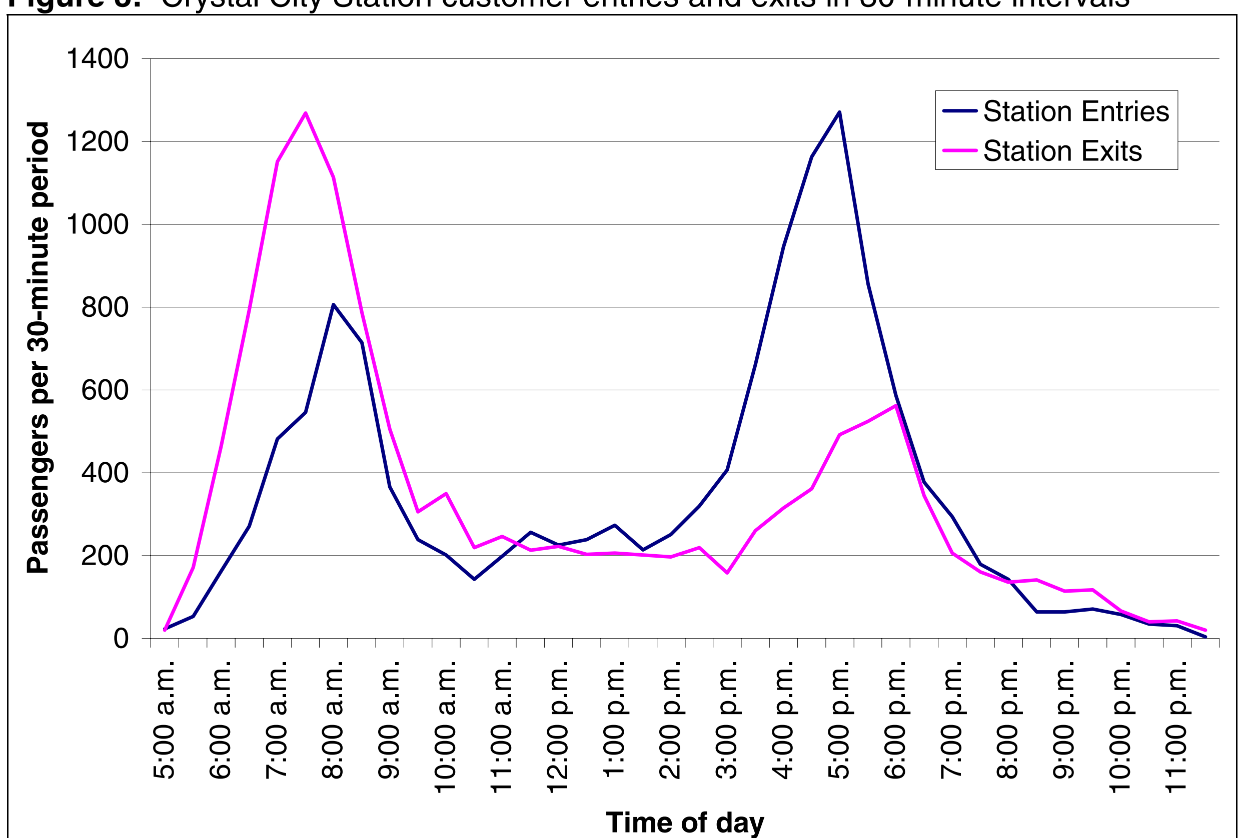


However, the street network can be confusing to some drivers, especially those unfamiliar with the area.

Crystal City boasts a high transit mode share and large number of transit customers. The Metrorail station entrance is centrally located in the area, conveniently near many large residential, office, and retail centers. In 2001, an average of 28,000 customers entered or exited the Crystal City Metrorail station each weekday, making it the 12th busiest of the 83 stations in the Metrorail system by customer volume. Figure 3 shows customer entries and exits at the Crystal City station in half-hour increments.

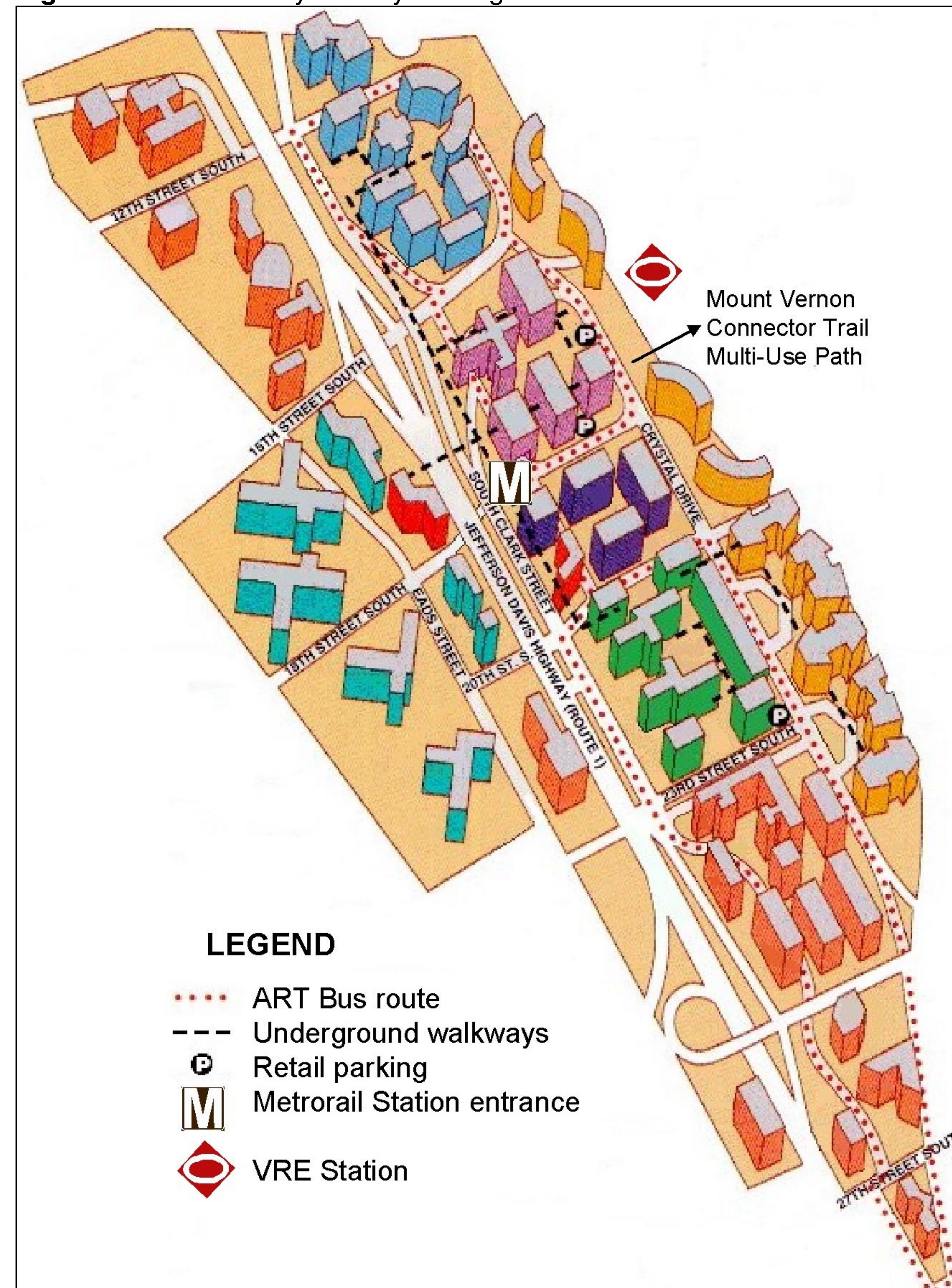
A distinctive element of Crystal City is its network of underground pedestrian walkways, the Crystal City Underground, that connect most major buildings in the Crystal City core. The walkways connect 12th Street on the north with 23rd Street on the south, a distance of nearly three-fourths of a mile. Walkways also connect the Crystal Gateway Marriott, west of the Jefferson Davis Highway, and Crystal Park, east of Crystal Drive. The Underground intersects the existing Metrorail station entrance, allowing Metrorail customers to access much of Crystal City in a climate-controlled environment. The Underground significantly enhances access to the existing station entrance. A diagram showing the limits of the Underground is presented in Figure 4.

Figure 3: Crystal City Station customer entries and exits in 30-minute intervals



Source: WMATA, Faregate data, September 26, 2001

Figure 4: Extent of Crystal City Underground



Source: crystalcity.com

Bus Service

Most buses serve the station from Clark Place north of 18th Street, underneath the Crystal Square 5 office building. The station is served by four Metrobus lines, a Fairfax Connector line, two Omniride lines, Arlington Transit (ART) buses, and several private shuttles. Crystal City is also a stop on the Virginia Railway Express (VRE) commuter rail lines to both Manassas and Fredericksburg.

Station-Area Problems

Unfortunately, the Underground is not fully accessible for disabled pedestrians. The Metrorail station's mezzanine-to-street elevator does not stop at the Underground level. Customers who are unable to use the station escalator must take the elevator to street level, where they are subject to weather conditions and conflict with vehicles en route to their final destination.

The Underground is an excellent pedestrian facility, but street-level pedestrian amenities are not as friendly, important for customers whose destinations are not served by the Underground. Crosswalks are long because of the wide streets, sidewalks are narrow in several locations, and the walking route along 18th Street under Jefferson Davis Highway is unappealing for pedestrians. Bicycle parking facilities are also substandard.

The Metrorail station entrance is not as convenient for customers transferring from VRE as it could be. These customers must walk as far west as Clark Place in order to enter the station, even though the platform extends as far east as Crystal Drive.

Customers unfamiliar with the area may have difficulty locating the Metrorail station entrance. The escalators are obscured from view by landscaping and there is little signing to help direct customers to either the escalators or the elevator.

Traffic and Pedestrian Studies

As part of the study, vehicle and pedestrian travel patterns were documented through several different types of studies. Table 1 summarizes the results of 24-hour directional traffic volume counts in the vicinity of the station.

Table 1: Results of 24-hour directional traffic volume counts

Study location	***Number of vehicles during peak hour***						***Number of vehicles per day***		
	8:00 – 9:00 a.m.			***5:00 – 6:00 p.m.***					
	EB	***WB***	***Total***	***EB***	***WB***	***Total***	***EB***	***WB***	***Total***
18th St. east of Eads St.	537	89	626	208	220	428	4,382	1,882	6,624
18th St. west of Crystal Dr.	1,110	NA	1,110	456	NA	456	9,508	NA	9,508
15th St. east of Clark St.	628	174	802	1,276	78	1,354	11,876	1,559	13,435
	NB	***SB***	***Total***	***NB***	***SB***	***Total***	***NB***	***SB***	***Total***
Eads St. south of 18th Street	566	550	1,116	586	790	1,376	8,830	10,349	19,179
Clark Pl. south of 18th St.	36	118	154	68	128	196	785	1,777	2,562
Clark Pl. north of 18th St.	NA	601	601	NA	337	337	NA	5,933	5,933
Crystal Dr. north of 18th St.	1,086	NA	1,086	1,702	NA	1,702	17,042	NA	17,042
Clark St. south of 15th St.	NA	175	175	NA	308	308	NA	3,887	3,887

Source: Traffic studies conducted by CTC, May 2001

Table 2: Number of peak-hour vehicles making each traffic movement at three station-area intersections; levels of service

Intersection	*Morning peak hour*												*Evening peak hour*												*Level of service*	
	Northbound			*Southbound*			*Eastbound*			*Westbound*			*Northbound*			*Southbound*			*Eastbound*			*Westbound*				
	L	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*AM*	*PM*
18th St. and Eads St.	81	398	65	75	317	22	82	361	271	26	8	14	188	414	36	49	351	30	53	100	250	33	43	17	B	B
18th St. and Clark Pl.	NA	NA	30	555	NA	37	NA	434	103	NA	NA	NA	NA	NA	82	180	NA	102	NA	126	75	NA	NA	NA	A	A
18th St. and Crystal Dr.	NA	721	9	NA	NA	NA	330	6	NA	NA	NA	NA	NA	1,078	3	NA	NA	NA	557	34	NA	NA	NA	NA	B	B

Source: Traffic studies conducted by CTC, May 2001

Table 2 summarizes the results of peak-period manual turning-movement counts at three nearby intersections, and shows the results of detailed capacity analysis conducted at these intersections, following procedures outlined in the *Highway Capacity Manual.* The analysis showed that traffic conditions are good during both morning and afternoon peak periods.

Table 3 presents the results of counts of pedestrians and bicyclists conducted near the station; Figure 5 summarizes some of the data in Table 3. The existence of the Underground greatly limits conflicts between pedestrians, bicycles, and vehicles, but as shown in Table 3, there is a high volume of pedestrians using street-level pedestrian facilities as well. By far the single intersection with the most pedestrian activity is Clark Place and 18th Street, which serves over 800 pedestrians per hour during the evening peak.

Figure 5: Summary of pedestrian and bicycle count results (AM/PM)

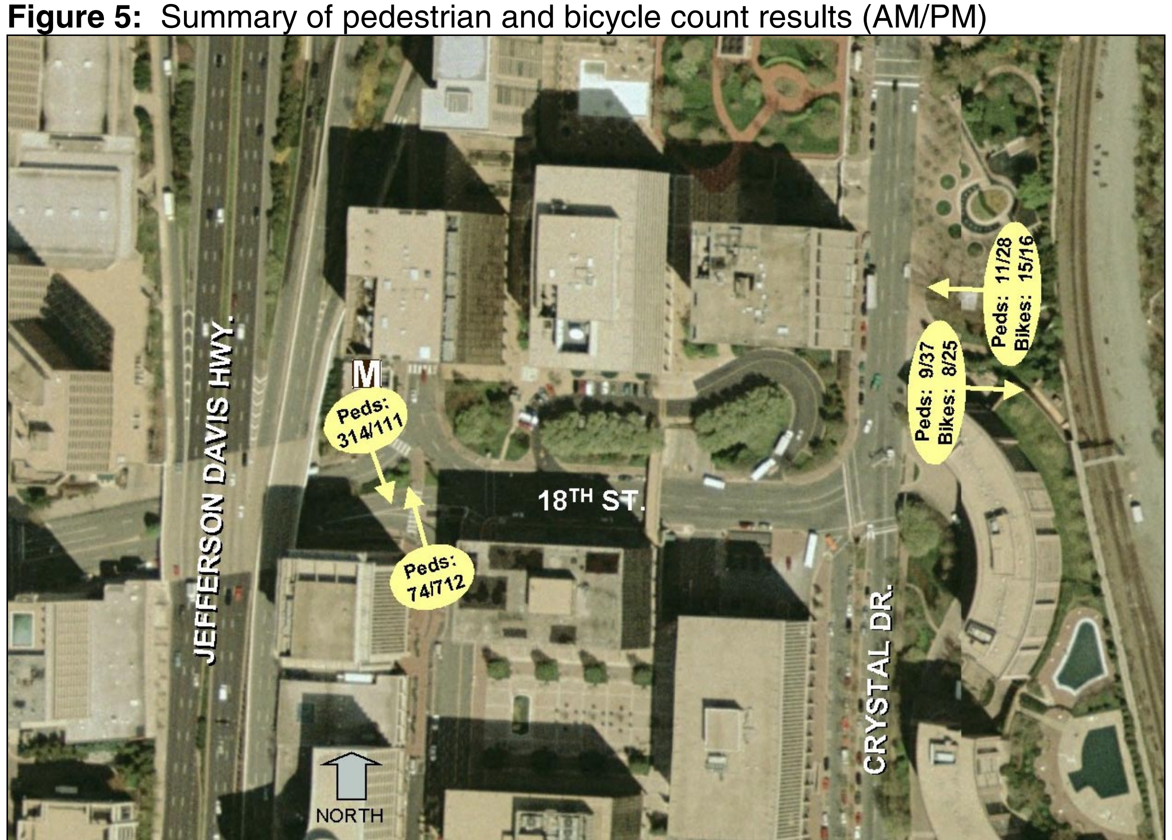


Table 3: Counts of pedestrians and bicyclists near the Crystal City Metrorail Station

Customer Pattern	*Proceeding toward Metrorail escalators*		*Proceeding away from Metrorail escalators*	
	Morning peak hour	*Evening peak hour*	*Morning peak hour*	*Evening peak hour*
Pedestrians crossing Clark Pl. and 18th St.	74	712	314	111
Pedestrians using the Mount Vernon Connector Multi-Use Path	11	28	9	37
Bicyclists using the Mount Vernon Connector Multi-Use Path	15	16	8	25
Customers transferring between Metrorail and Metrobus	23	1	10	15
Customers transferring between Metrorail and ART buses	9	4	53	7
Customers transferring between Metrorail and private shuttles	19	25	11	22

Source: Traffic studies conducted by CTC, May 2001

Customer Survey

In an effort to learn about customers' travel patterns, a customer survey was conducted at the Crystal City station on September 26, 2001. All customers entering the station that day from 6:30 to 8:30 a.m. and 4:00 to 6:00 p.m. were offered a survey card, which asked several questions about customers' trips to the station. The survey card is shown in Figure 6. The survey posed questions about mode of travel to the station, trip purpose, and origin of the trip to the station.

Customers exiting the station were not surveyed; it was assumed that customers entering the station during the morning peak would likely exit the station during the evening peak, and vice-versa.

The survey was conducted about two weeks after the events of September 11, 2001. Tourist traffic was much lower than usual on the date of the survey; however, the main focus of the survey was on commuters, and faregate data indicates that commuter traffic had returned to typical levels by September 26.

Of customers who received survey cards in the morning, 461 filled out and returned the cards, a 13 percent sample of the total morning peak station volume of 3,420 customers. The response rate results in a confidence interval of 5 percentage points at the 95 percent confidence level. Based on the results of the survey, one can be 95 percent confident that the percentages from the morning survey are within 5 percentage points of their true values. The morning peak survey's level of confidence is sufficient for analysis.

Of customers who received survey cards in the evening, 821 filled out and returned the cards. About 6,740 customers enter the station during the evening peak period, so the evening survey generated a response rate of 12 percent. At the 95 percent confidence level, the confidence interval from the evening survey is 4 percent. One can be 95 percent confident that the percentages from the evening survey are within 4 percentage points of their true values. Again, the evening peak survey's confidence level is sufficient for analysis.

Figure 6: Survey card distributed to customers entering the Crystal City Metrorail Station

ARLINGTON METRO STATION SURVEY

Please take a few moments to help plan for your transit needs by completing this survey and dropping it in any mailbox. No postage is required. Thank you.

A. How did you get to the Metrorail station where you received this card?

1 ☐ VRE
2 ☐ Walk
3 ☐ Shuttle bus
4 ☐ Bicycle
5 ☐ Tour bus
6 ☐ Taxi
7 ☐ ART bus
8 ☐ Metrobus (Route: _____)
9 ☐ Fairfax Connector (Route: ____)
10 ☐ Dropped off by someone
11 ☐ Drove a car and parked
12 ☐ Rode with someone who parked

B. What is the purpose of your Metrorail trip today?

1 ☐ Traveling to work
2 ☐ Traveling home from work
3 ☐ Job-related business
4 ☐ Shopping or meal
5 ☐ School
6 ☐ Personal trip
7 ☐ Sightseeing or recreation

C. Where did you start your trip to the Metrorail station today?

Address ____________________

OR Street & block no. ____________________

OR Nearest intersection ____________________

OR Building name ____________________

Table 4: Respondents' transportation modes. (Rounding may affect sums.)

Transportation Mode	*Morning Peak* Percent of respondents	*Morning Peak* Number of customers*	*Evening Peak* Percent of respondents	*Evening Peak* Number of customers*
Virginia Rail Express	11%	371	0%	49
Walk	63%	2,145	75%	5,083
Shuttle Bus	1%	22	3%	123
Bicycle	1%	22	0%	16
Taxi	0%	7	0%	0
ART bus	0%	7	1%	41
Metrobus	6%	215	3%	214
Fairfax Connector	0%	15	4%	156
Dropped off by someone	7%	230	3%	123
Drove and parked	4%	148	7%	468
Rode with someone who parked	2%	59	0%	16
No response	7%	178	8%	452
Total	**100**%	**3,421**	**100**%	**6,742**

* Calculated by applying the survey results to the total number of customers entering the station during morning (5:30 to 9:30 a.m.) and evening (3:00 to 7:00 p.m.) peak periods.

Table 5: Respondents' trip purposes. (Rounding may affect sums.)

Trip Purpose	*Morning Peak* Percent of respondents	*Morning Peak* Number of customers*	*Evening Peak* Percent of respondents	*Evening Peak* Number of customers*
Traveling to work	90%	3,087	20%	1,339
Traveling home from work	0%	7	74%	4,985
School	2%	74	1%	66
Job-related business	6%	208	3%	197
Shopping or meal	0%	0	1%	66
Personal trip	0%	15	1%	57
Sightseeing or recreation	1%	22	0%	16
No response	0%	7	0%	16
Total	**100**%	**3,421**	**100**%	**6,742**

* Calculated by applying the survey results to the total number of customers entering the station during morning (5:30 to 9:30 a.m.) and evening (3:00 to 7:00 p.m.) peak periods.

Customer Patterns

The data-collection efforts revealed numerous patterns about customers' trips to and from the station.

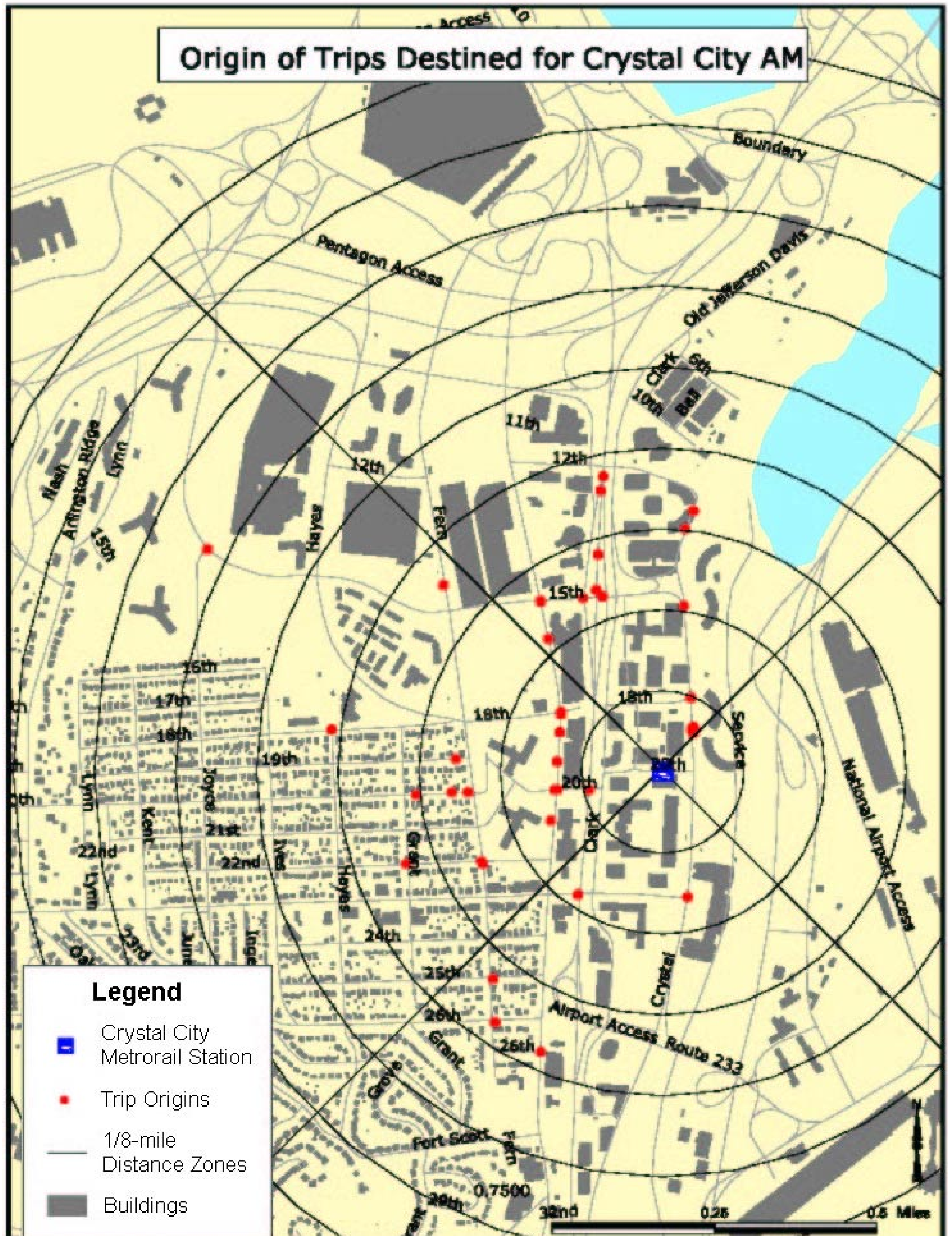
The first question on the survey asked customers about the mode of transportation they used to arrive at the station. In both the morning and evening periods, walking is the dominant mode, accounting for 63 percent of morning peak trips and 75 percent of evening peak trips. The large volume of pedestrians would normally raise concerns about interactions with vehicles, but about two-thirds of pedestrians use the underground walkways, vastly reducing conflicts with vehicles.

Notably, 11 percent of morning-peak customers arrive via VRE. VRE transfer customers generally walk from the VRE station to the Metrorail station, a distance of approximately one-eighth mile. Customers can opt to use the Underground for part of this walk.

Despite the large number of bus routes that serve the station, few Metrorail customers use a bus as part of their trips: seven percent in the morning peak and ten percent in the evening peak. Four percent of respondents in the morning peak and seven percent in the evening peak indicated that they drove to the station and parked. Crystal City is not an ideal commuter park-and-ride location, but there is some public parking in garages near the station. Complete results of the first survey question are summarized in Table 4.

The second question on the survey asked about customers' trip purpose. Here, a clear differentiation exists between morning and evening periods. In the morning period, 90 percent of respondents were traveling to work, with other trip purposes garnering negligible responses. As expected, most evening-peak customers, 74 percent, were traveling home from work, but an additional 20 percent were destined for work. Commute trips to and from work account for over 90 percent of customer traffic in both peak periods. Table 5 displays complete results of this question.

Figure 7: Origins of morning-peak pedestrian trips to the Crystal City Station



Sources: Arlington County, Census Bureau

Table 6: Origins of Morning Peak Walking Trips. Pedestrians whose morning-peak trips to the station originate from each of the zones shown in Figure 7. (Rounding may affect sums.)

Distance from station	*Percent of respondents*					*Number of customers**				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	7%	3%	0%	1%	**11**%	144	56	0	32	**231**
1/8 to 1/4 mile	0%	18%	0%	19%	**37**%	0	391	0	399	**789**
1/4 to 3/8 mile	35%	0%	0%	3%	**38**%	757	0	0	56	**813**
3/8 to 1/2 mile	6%	0%	0%	4%	**10**%	120	8	0	80	**207**
1/2 to 5/8 mile	0%	0%	0%	0%	**0**%	0	0	0	8	**8**
5/8 to 3/4 mile	0%	0%	0%	0%	**0**%	0	0	0	0	**0**
3/4 to 7/8 mile	0%	0%	0%	1%	**1**%	0	0	0	24	**24**
7/8 to 1 mile	0%	0%	0%	0%	**0**%	0	0	0	0	**0**
1 to 1-1/8 miles	0%	0%	0%	0%	**0**%	0	0	0	0	**0**
Over 1-1/8 miles	0%	3%	0%	0%	**3**%	8	56	8	0	**72**
Total	**48**%	**24**%	**0**%	**28**%	**100**%	**1,029**	**510**	**8**	**598**	**2,145**

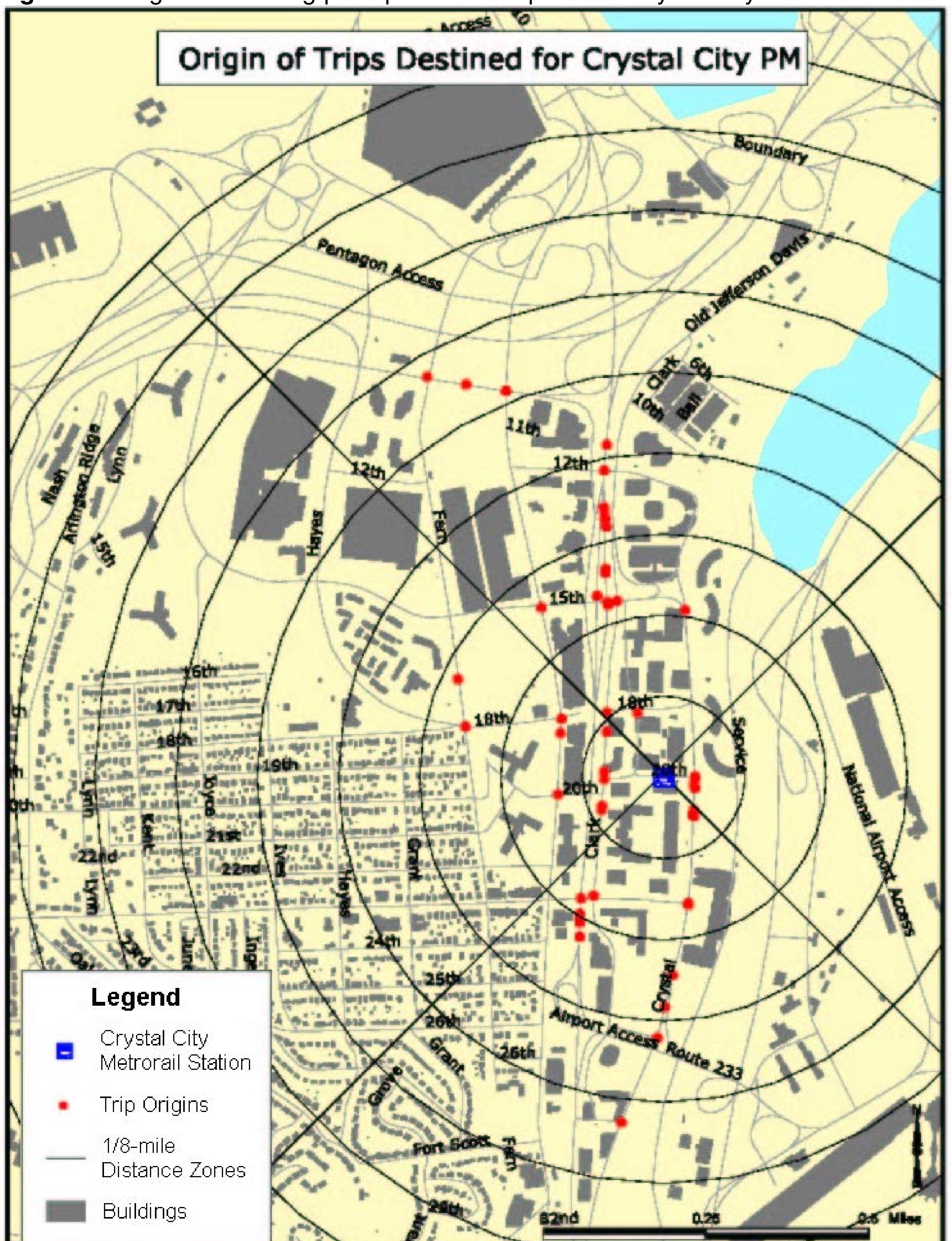
* Calculated by applying the survey results to the number of customers who walk to the station during the morning peak period (5:30 to 9:30 a.m.), as determined in Table 4.
Note: Anomalous data may be the result of inaccurate information provided on survey cards or imprecise geolocation of respondents who provided only the location of the nearest intersection to their trip origin.

Finally, the third question on the survey asked customers where they began their trips to the Metrorail station. Customers were given the option to respond with a specific street address, a street and block number, the nearest intersection, or a building name. Although results are available to this question from all respondents, respondents who walk to the station are particularly important for planning pedestrian improvements.

In the morning peak period, when most customers entering the station are area residents enroute to work, 269 respondents (63 percent) indicated that they walk to the station. Figure 7 shows in map form the origins of these pedestrian customers' trips to the station. The trips are summarized by distance and direction in Table 6.

Analyzing the results by distance shows that over 95 percent of pedestrians walk less than a half-mile to reach the Metrorail station. From a directional standpoint, the results show that the majority of customers arrive from the north of the station, fewer from the south and west, and virtually none from the east.

Figure 8: Origins of evening-peak pedestrian trips to the Crystal City Station



Sources: Arlington County, Census Bureau

Table 7: Origins of Evening Peak Walking Trips. Pedestrians whose morning-peak trips to the station originate from each of the zones shown in Figure 8. (Rounding may affect sums.)

Distance from station	*Percent of respondents*					*Number of customers**				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	9%	17%	9%	3%	**38%**	479	879	449	140	**1,947**
1/8 to 1/4 mile	0%	13%	0%	1%	**14%**	10	649	0	40	**699**
1/4 to 3/8 mile	7%	11%	0%	0%	**19%**	369	559	0	20	**949**
3/8 to 1/2 mile	5%	0%	0%	0%	**5%**	240	10	0	0	**250**
1/2 to 5/8 mile	2%	0%	0%	0%	**3%**	110	20	0	0	**130**
5/8 to 3/4 mile	1%	0%	0%	0%	**1%**	40	0	0	0	**40**
3/4 to 7/8 mile	0%	0%	0%	0%	**0%**	0	0	0	0	**0**
7/8 to 1 mile	0%	0%	0%	0%	**0%**	0	0	0	0	**0**
1 to 1-1/8 miles	3%	3%	2%	4%	**13%**	160	150	110	220	**639**
Over 1-1/8 miles	4%	2%	1%	2%	**8%**	190	80	70	90	**429**
Total	**31%**	**46%**	**12%**	**10%**	**100%**	**1,597**	**2,347**	**629**	**509**	**5,083**

* Calculated by applying the survey results to the number of customers who walk to the station during the morning peak period (5:30 to 9:30 a.m.), as determined in Table 4.
Note: Anomalous data may be the result of inaccurate information provided on survey cards or imprecise geolocation of respondents who provided only the location of the nearest intersection to their trip origin.

In the evening peak period, when most customers entering the station are area employees enroute home from work, 509 survey respondents indicated that they walk to the station. Figure 8 shows in map form the origins of these customers' trips to the station, and their trips are summarized by distance and direction in Table 7.

In the evening peak, over 75 percent of customers walk less than a half-mile to reach the station, slightly less than the morning peak. Directional distribution is similar to the morning peak, but in the evening peak, nearly half of all customers arrive from the south of the station. Customers arriving from the north and south remain much more prevalent than those from the east and west.

Data from non-pedestrian customers was analyzed for both morning and evening peak periods, but no significant pattern of trip origins was found.

Development Forecast

Development Sites

The Crystal City neighborhood features a mix of uses in a community of over 6,000 residential units, 5,000 hotel rooms, 800,000 square feet of retail space, and 10 million square feet of office space. The central location and convenient multi-modal transportation options create the potential for growth in the area. Growth in Metrorail ridership by 2020 will depend largely on development changes in the immediate vicinity of the station.

Development in the Metro Corridors 2000, a report published by the Arlington County Department of Community Planning, Housing and Development, was utilized to determine the existing development on the parcels near the Crystal City station. The report also provided specific information about new development planned for the area. Longer-term development forecasts, including parcels not listed in *Development in the Metro Corridors,* were prepared based on discussions with staff from the Arlington County Departments of Public Works and Community Planning, Housing, and Development.

Table 9 summarizes the specific development assumptions for parcels where development is likely to occur prior to 2020. Future Metrorail trips were projected according to these development assumptions.

Metrorail Customer Forecast

WMATA recently conducted a Core Capacity Study (CCS) to evaluate the capacity at key Metrorail stations, including Crystal City. The study shows that Metrorail volume at Crystal City will reach about 18,500 entries per weekday by the year 2020, a 42 percent increase over 2001 volumes. However, the CCS did not account for the possibility of light-rail transit (LRT) or bus rapid transit (BRT) service in the vicinity of the station. Preliminary calculations provided by the Virginia Department of Rail and Public Transportation (VDRPT) show that by the year 2020, approximately 7,400 customers per weekday would enter LRT or BRT vehicles at Crystal City and an equal number would exit at Crystal City. WMATA projects that approximately 34 percent of these customers would transfer to or from Metrorail, accounting for approximately 2,500 transfer customers per weekday to Metrorail and an additional 2,500 transfer customers from Metrorail to LRT or BRT vehicles.

Table 8: Customer entries and exits, 2001 and 2020

	Entering Customers		*Percent Increase*
	2001	***2020****	
AM Peak period (5:30 – 9:30 a.m.)	3,600	5,400	50%
PM Peak period (3:00 – 7:00 p.m.)	6,700	10,200	52%
Daily	14,000	21,000	50%

* 2020 customer forecasts include 2,500 daily customer entries attributable to LRT transfer customers.
Sources: CCS, WMATA faregate data, VDRPT LRT/BRT forecast

Customers transferring from VRE to Metrorail are also forecast to increase. VRE provided a forecast of the number of passengers transferring from VRE to Metrorail at Crystal City. The number of transfers in the morning peak hour is expected to increase from 1,500 per day in 2001 to approximately 2,300 per day in 2010, the only year for which data is available.

Table 8 presents existing and future customer volume forecasts for the year 2020, which are the sum of CCS projections and the LRT forecast.

These volumes represent total station patronage, but it is also important to separately evaluate the growth in pedestrian customers. Generally, the route used by non-pedestrian customers to reach the station entrance is relatively insensitive to minor changes in the location of the entrance. For example, if a customer is being dropped off at the station entrance, it makes little difference whether the station entrance is moved one block closer to the customer's trip origin: the customer's time savings is very small. In contrast, pedestrians travel much slower than other modes, and shortening a pedestrian customer's walk by one block is a significant improvement that can save several minutes of the customer's time.

Two sources of information were used to forecast the numbers of Metrorail customers who would walk from future developments. One was the results of the survey in the current study; the other was *Development Related Ridership Survey II*, a 1989 WMATA study that estimated transit mode share based on a larger sample of Metrorail customers.

The recent survey data collected for this report were used to relate present customers to existing buildings. For each 1/8-mile distance from the station, a ratio of peak-period customers per 1,000 square feet of building size was developed. The ratios were generally similar to those produced by the 1989 survey. For each 1/8-mile distance, a ratio to be used in the study was determined by drawing a best-fitting line between the means of the ratios calculated from the two surveys.

The final ratio would produce an estimate of additional customers from new developments, given assumptions about the sizes of the developments drawn from *Development in the Metro Corridors 2000.*

Direction from the station was also considered. At the Crystal City station, the Underground is available to the north and south of the station; as a result, more customers are likely to walk to the Metrorail station than the ratio suggests from the north and south. Directional factors were likewise assigned for each of the four cardinal directions.

Table 9: 2020 development forecast for Crystal City station area

Project Name	Location	New Development Type	Zone*	Net Change in Development: Office sq. feet	Net Change in Development: Retail sq. feet	Net Change in Development: Res. units	Net Change in Development: Hotel rooms	Net Change in Pedestrian Entries: Both peaks	Net Change in Pedestrian Entries: AM peak	Net Change in Pedestrian Entries: PM peak
Airport Plaza II	~2611 S. Jefferson Davis Hwy.	Hotel	S5		5,100		630	40	20	20
Warwick House II	~1300 S. Jefferson Davis Hwy.	Residential	N2			212		144	105	39
C&P SW. Ctr.	400 S. 11th St.	Office, Residential, Retail	N4	16,626	6,656	167		75	51	24
Hampton Inn	2000 S. Jefferson Davis Hwy.	Hotel	S2				399	80	40	40
Crystal Plaza Amendment	2001 S. Jefferson Davis Hwy.	Retail, Office	S2	34,725	116,942			119	53	67
Boundary Channel Office 1	333 S. Jefferson Davis Hwy.	Office, Retail	N7	173,166	500			0	0	0
Boundary Channel Office 2	333 S. Jefferson Davis Hwy.	Office, Retail	N7	170,066	1,700			0	0	0
Boundary Channel Hotel	333 S. Jefferson Davis Hwy.	Hotel	N7				198	0	0	0
Potomac Yard South A	~ S. Crystal Dr.	Office, Retail	S5	650,000	4,000			105	16	89
Potomac Yard South B	~ S. Crystal Dr.	Hotel, Retail	S6		10,000		625	8	4	4
Potomac Yard South C	~ S. Crystal Dr.	Office, Retail	S6	1,200,000	14,000			27	5	22
Potomac Yard South D	~ S. Crystal Dr.	Office, Residential, Retail	S7	515,000	10,000	250		0	0	0
Potomac Yard South E	~ S. Crystal Dr.	Office, Residential, Retail	S7	515,000	10,000	250		0	0	0
Potomac Yard South F	~ S. Crystal Dr.	Residential, Retail	S8		12,000	500		0	0	0
Crystal Mall Retail addition	1911 S. Jefferson Davis Hwy.	Retail, Office	E1	24,995	41,422			62	25	38
Clark/Ball/6th St/10th St site		Office, Hotel, Residential, Retail	N4	225,000	20,000	200	300	191	90	101
Eads/Fern/12th St/15th St site**		Residential, Hotel	N3			975	150	551	396	154
Total				**3,524,578**	**252,320**	**2,554**	**2,302**	**1,403**	**806**	**597**

Sources: *Development in the Metro Corridors 2000*, discussions with Arlington County Public Works and Planning staff

* Zone letter indicates direction from station; zone number indicates distance from station: value 1 indicates distance from 0 to 1/8 mile, value 2 indicates distance from 1/8 to 1/4 mile, etc.

** The Eads/Fern/12th St/15th St site is approximately equidistant from Pentagon City and Crystal City Metrorail stations. It was assumed that half of trips would use the Pentagon City station and half would use Crystal City. Development units shown are half of the total, reflecting this station split.

The methodology produced a single value for pedestrian customers approaching the station from each new development during the four-hour morning peak period and the four-hour evening peak period combined. These values were allocated to the morning versus evening peak periods using ratios from ITE's *Trip Generation*, 6th edition. Specifically, 85 percent of trips generated by office developments were assumed to enter the station during the evening peak period, while only 15 percent of these trips were assumed to enter during the morning peak period. Likewise, 73 percent of residential trips were assumed to enter the station during the morning peak period, and the remaining 27 percent were assumed to enter during the evening peak period. Trips from retail and hotel land uses were assumed to be equally split between morning and evening peak periods.

The final columns of Table 9 indicate the number of new pedestrian Metrorail customers forecast to enter the Crystal City station during morning and evening peak periods for each new development. Table 10 aggregates the values from these two columns by 1/8-mile distance away from the station and by direction from the station. The distance and direction intervals in Tables 10 and 11 correspond to the intervals used in Figures 7 and 8.

Table 11 shows the total number of pedestrian customer entries expected in the year 2020. These values were computed by adding current pedestrian flows (Tables 6 and 7) to pedestrian flows generated by new development (Table 10).

The forecast calls for an increase of about 800 pedestrian trips entering the station during the morning peak period, about 37 percent more pedestrian trips than in 2001. In the evening peak period, about 600 pedestrian trips entering the station will be generated by new development, an increase of about 12 percent over existing pedestrian trips.

Much of the new development in the Crystal City area is farther than a comfortable walking distance away from the Metrorail station entrance—nearly one mile in the case of both the Potomac Yard and Boundary Channel developments. At this distance, virtually no Metrorail customers would be expected to walk to the station entrance; instead, these customers would likely be dropped off, either by a private automobile or by public transit such as ART bus or future LRT service. Nearly 90 percent of new pedestrian trips are attributable to new development within a half mile of the station.

New development is concentrated primarily to the north and south of the station. Development in these two compass directions accounts for 95 percent of new pedestrian trips. The Potomac River lies east of the station, limiting development potential, and west of the station lies low-density residential neighborhoods unlikely to change in character. The proximity of the Pentagon City Metrorail Station further limits Crystal City's customer volume from the northwest.

Table 10: Net change in pedestrian station entries attributable to 2020 development

Distance from station	*Morning peak-period entries*					*Evening peak-period entries*				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	0	0	25	0	**25**	0	0	38	0	**38**
1/8 to 1/4 mile	105	93	0	0	**198**	39	107	0	0	**146**
1/4 to 3/8 mile	396	0	0	0	**396**	154	0	0	0	**154**
3/8 to 1/2 mile	141	0	0	0	**141**	125	0	0	0	**125**
1/2 to 5/8 mile	0	36	0	0	**36**	0	109	0	0	**109**
5/8 to 3/4 mile	0	9	0	0	**9**	0	26	0	0	**26**
Over 3/4 mile	0	0	0	0	**0**	0	0	0	0	**0**
Total	**642**	**138**	**25**	**0**	**805**	**318**	**242**	**38**	**0**	**598**

Source: Aggregated data from Table 9.

Table 11: Predicted 2020 pedestrian customer station entries

Distance from station	*Morning peak-period entries*					*Evening peak-period entries*				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	143	56	25	32	256	479	879	487	140	**1,985**
1/8 to 1/4 mile	105	484	0	399	987	49	756	0	40	**845**
1/4 to 3/8 mile	1,153	0	0	56	1,209	523	559	0	20	**1,103**
3/8 to 1/2 mile	261	8	0	80	348	365	10	0	0	**375**
1/2 to 5/8 mile	0	36	0	8	44	110	129	0	0	**239**
5/8 to 3/4 mile	0	9	0	0	9	40	26	0	0	**66**
3/4 to 7/8 mile	0	0	0	24	24	0	0	0	0	**0**
7/8 to 1 mile	0	0	0	0	0	0	0	0	0	**0**
1 to 1-1/8 miles	0	0	0	0	0	160	150	110	220	**639**
Over 1-1/8 miles	8	56	8	0	72	190	80	70	90	**429**
Total	**1,670**	**648**	**33**	**598**	**2,949**	**1,916**	**2,589**	**667**	**509**	**5,681**
Increase from 2001	**62%**	**27%**	**313%**	**0%**	**38%**	**20%**	**10%**	**6%**	**0%**	**11%**

Source: Sum of existing trips (Tables 6 and 7) and new trips (Table 10).
Notes:
1. Negative numbers were set to zero without adjusting marginal sums.
2. Anomalous data may be the result of inaccurate information provided on survey cards or imprecise geolocation of respondents who provided only the location of the nearest intersection to their trip origin.

Planned Station-Area Improvements

Some improvements that would enhance station access are already planned to be built by other parties.

Figure 9: Existing bus waiting area, looking north

Figure 10: Proposed new bus waiting area, looking north

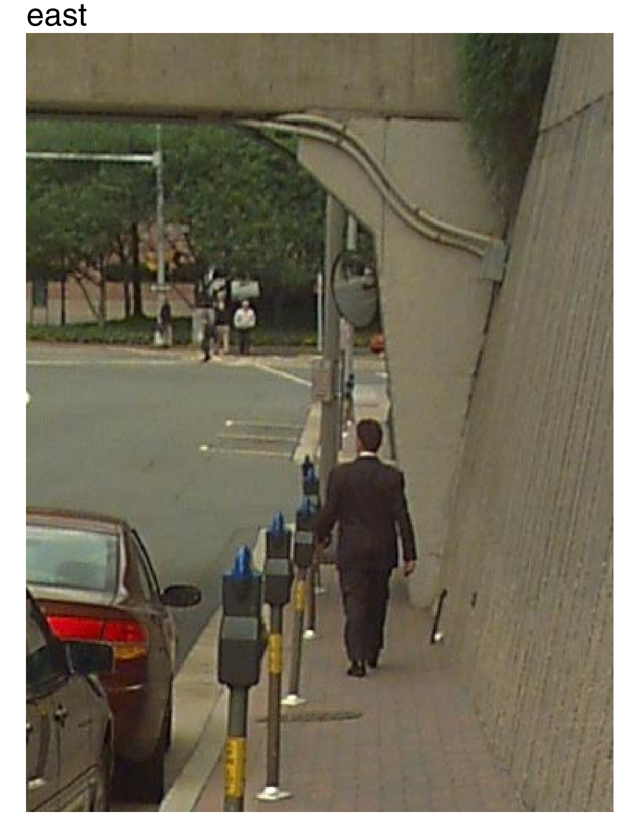
The Charles E. Smith Realty Companies are planning to improve the existing bus waiting area, which is beneath the Crystal Square Five office building north of the Metrorail station entrance. Figure 9 shows the existing bus waiting area; Figure 10 shows a similar view of a rendering of the proposed changes. The improvements include the following:

- The west curb on Clark Place will be shifted, narrowing the street and widening the sidewalk by 3 to 4 feet. The change will increase the space available to pedestrians waiting for buses. The new sidewalk will extend beyond the existing columns, increasing pedestrians' visibility of approaching buses and other traffic.
- The amount and quality of lighting will be improved, making the area underneath the building inviting and approachable during hours of darkness.
- Four new shelters will be constructed between existing columns to improve waiting conditions at the four bus stops. The shelters will be of higher quality than standard shelters.
- High-quality finishes will be installed throughout the waiting area, including granite and stainless steel accents.

Arlington County has authorized WMATA to begin a project to install a uniquely designed canopy over the existing escalator entrance that will connect to the bus facility.

The Charles E. Smith Companies have committed to converting 18th Street and Crystal Drive from one-way to two-way operation. This plan has been approved in concept by the Arlington County Board, but detailed site plans have not yet been prepared, and the project is not currently scheduled for construction. The project will also widen the sidewalk on the south side of 18th Street east of Clark Place (Figure 11).

Figure 11: Sidewalk on the south side of 18th Street east of Clark Place, looking east



Community Involvement

Meetings were held with residents surrounding the Metrorail station to allow the community to be involved in the planning process. A meeting was held on June 5, 2001 to solicit suggestions for station-area improvements from residents. On April 18, 2002, recommended station improvements were presented to residents and further comments were solicited.

Station-Area Recommendations

Station Entrance Identification

Customers unfamiliar with Crystal City may find it difficult to locate the existing escalator and elevator entrances to the station. Dense landscaping near the escalators (Figure 12) obscures customers' views of the escalators from the street. The elevator is not in view of the escalators, and can be difficult to locate. The planned escalator canopy will help customers locate the escalator entrance, but street-level directional signing to these entrances could also be improved.

The density of the landscaping also creates concealed spaces, which can be a security concern. The landscaping could be redesigned to promote both conspicuity of the station entrance and security. It would be convenient to make these changes as part of the Charles E. Smith companies' project to reconfigure the Crystal City roadway network.

Figure 12: Existing station entrance landscaping, looking north

Figure 13: 18th Street Pedestrian Route under Route 1 Overpass, looking west

Pedestrian Facilities

A comment from a station customer indicated that the walking route underneath the Jefferson Davis Highway overpass is of poor quality. The sidewalk facilities are of sufficient width, but the area is not inviting to pedestrians (Figure 13). Lighting is provided only by fixtures mounted on the bridge structure, designed to provide lighting for vehicles. The quality of this walking route could be improved by incorporating pedestrian-scale amenities, such as post-mounted pedestrian-level lighting and street furniture.

The walking path linking the bus stops with the Metrorail escalators is on an indirect route. Many customers walk along the north side of the escalators along a narrow section of pavement (Figure 14) not intended for use as a sidewalk, as a short-cut. The route should be improved with a wider sidewalk and the planned walkway canopy.

Figure 14: Existing walking route north of escalators, looking east

Bicycle Facilities

Few customers travel by bicycle to the station, according to the customer survey. However, the non-WMATA-owned bicycle storage facilities near the station are limited, and enhancing these facilities may encourage additional bicycle traffic. A comment from a station customer supported improved bicycle facilities.

Figure 15: Existing bicycle parking, looking northwest

The only bicycle parking provided at the station is a single bicycle rack located north of the station escalators (Figure 15). The rack's capacity is limited, and its design is obsolete, potentially damaging bicycle wheels. Additional bicycle storage facilities could be added to the station area in the same vicinity as the existing bicycle rack, increasing both the quality and quantity of bicycle parking. WMATA-owned bicycle racks and lockers cannot be installed at the Crystal City station because there is insufficient WMATA property near the station entrance. WMATA policy does not permit WMATA-owned bicycle lockers and racks to be installed on non-WMATA property. For such facilities to be installed near the station entrance, property owners and/or local jurisdictions would need to install and maintain the facilities. WMATA estimates that current demand for bicycle storage at the Crystal City station would warrant bicycle lockers with a capacity of 20 bicycles and bicycle racks with a capacity of 40 bicycles.

Potential New Station Entrances

The existing station entrance is situated near the west end of the station platform, minimizing redundant walking distance for customers approaching the station from the west. Customers approaching from the north and south are well served by the existing Underground access to the station. The only customers who could benefit from additional ways to enter the station are customers approaching the station from the east. Two possible locations for new entrances to the station, east of the existing entrance, were identified. Figure 16 presents the two entry alternatives, the "Proposed Entry" and the "Alternate Entry". Each proposed new entrance is discussed in further detail beginning on page 17.

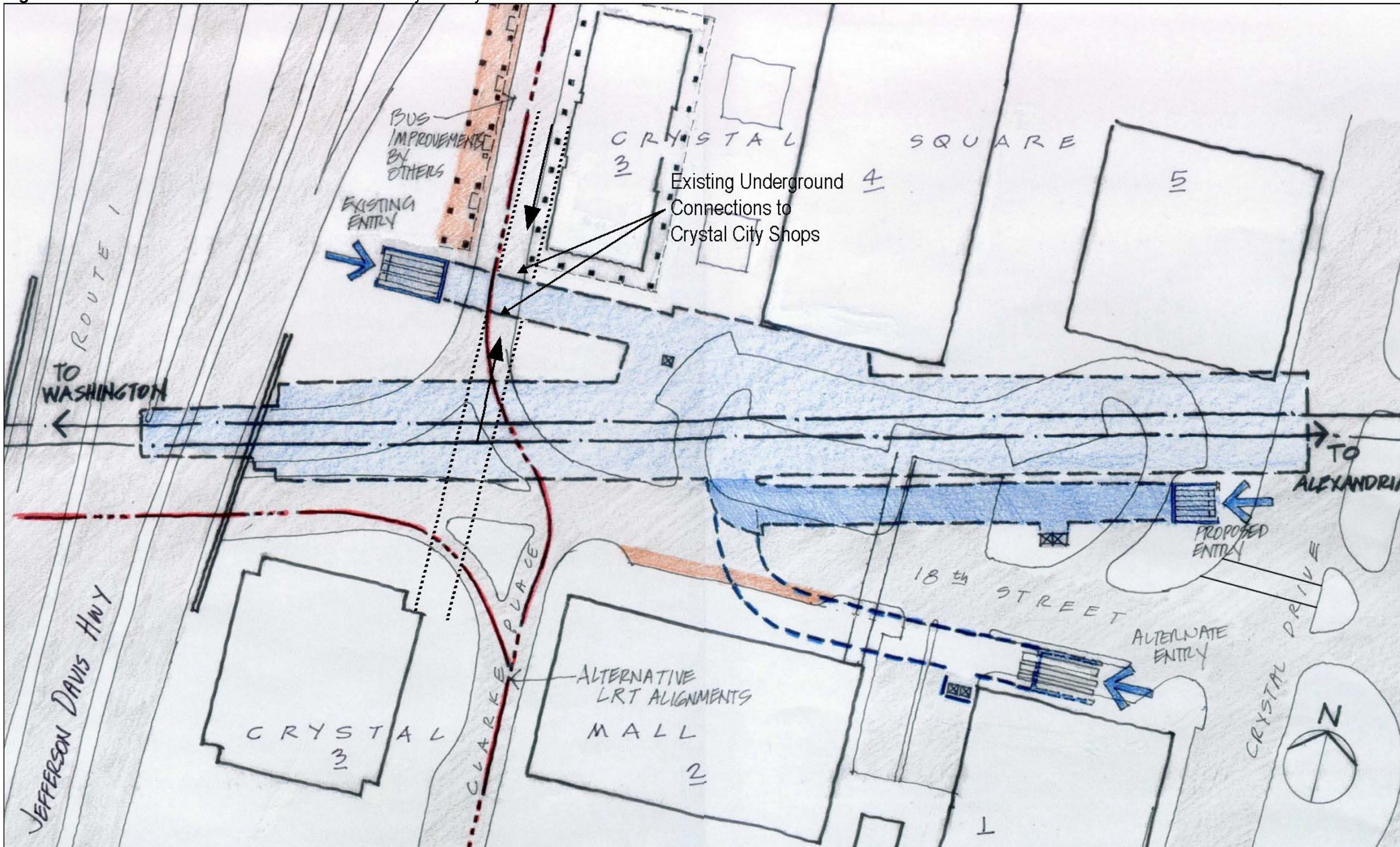
The new entrance alternatives would provide additional accessibility for customers arriving from the east, as well as customers transferring to Metrorail from VRE. Before entering the station, these customers currently must walk as far west as the west end of the station platform, incurring significant redundant walking distance. The new entrances would eliminate the redundant walking distance, shortening customers' walking trips by over 500 feet. Customers approaching the station at street level currently must ascend a grade when walking west on 18th Street toward the station entrance. The new entry alternatives would eliminate the need to make this redundant ascent.

The Core Capacity Study (CCS) does not indicate that an additional entrance is required for capacity purposes by the year 2025, that study's design year. However, the study projects that the current entrance will be at marginal capacity based on peak half-hour loadings, assuming all six escalators are functioning and that "crowded conditions" are acceptable to most customers. If a single escalator drops out of service, the capacity is dramatically reduced and the level of service drops well below an acceptable level during peak travel times. Several other factors were not considered by the CCS. A proposed BRT or LRT system would add significant numbers of transfer riders to the station. As VRE continues to expand, further increases in ridership are likely. If institutional barriers are overcome, there is the potential for MARC service from Maryland to provide direct service to Crystal City. These events, singly or in combination, would cause patronage to increase more than envisioned in the CCS ridership models. These increases in ridership would place further demands on the vertical circulation within the station. A new entrance, although not directly indicated by the CCS, could help provide surplus capacity to account for these additional factors.

The station is the 12th busiest in the system from a ridership standpoint, but it has only one surface entrance, the only station at this level of ridership without at least two surface entries to accommodate and distribute customer loads. Forecasting future rail patronage is an inexact science. Once an additional entry is provided, induced ridership beyond the forecast levels is likely, further reinforcing the benefits of adding a second surface area to this station.

With the continual expansion of Metrorail in the next 20 years, the development of LRT systems in Arlington County, and the service increases likely for VRE, the ridership forecasts for Crystal City have substantial opportunities to be greater than stated in the CCS. A second surface entry and expanded vertical circulation to and from the platform will result in a more customer-friendly environment for current and future customers of this station.

Figure 16: Potential new entrance locations for the Crystal City Metrorail station



Proposed Entry

The Proposed Entry features a new bank of three escalators on the northwest corner of 18th Street and Crystal Drive (Figure 17), connected via a new pedestrian tunnel to the station's existing mezzanine. An entrance to the mezzanine on the south side of the station would be constructed as part of this entry option.

The Proposed Entry also features two elevators that would connect the street level with the mezzanine level. The new elevators would be north of 18th Street and slightly further west than the escalatorway.

The new escalatorway would be almost due east of the existing escalators, at a distance of approximately 550 feet. The Proposed Entry's location would be a convenience to pedestrian customers approaching the station from the east, but it would not offer a benefit to pedestrians approaching from any other direction. The existing entrance's connection to the Crystal City Underground provides ideal service to customers approaching from the north and south.

The Proposed Entry would also serve VRE transfer customers particularly well. The customer survey showed that approximately 11 percent of morning-peak Metrorail customers are transferring from VRE, meaning that approximately 350 customers make this transfer. These customers' walking distance could be shortened by constructing the Proposed Entry, helping to encourage VRE-to-Metrorail transfer customers.

The Proposed Entry is also nearer to the Mount Vernon Connector Multi-Use Path than the existing entrance, shortening the walking distance for the few pedestrian customers who use that path. Bicycle customers may also benefit from the shorter distance if bicycle storage facilities are provided near the Proposed Entry.

In conjunction with the planned roadway improvements, the Charles E. Smith Companies are planning to change the character of Crystal Drive, converting it to a "Main Street" environment. Ground-floor retail establishments will be added, increasing the demand for pedestrian activity in the area. The Proposed Entry would serve this planned pedestrian center well.

Figure 17: Site of Proposed Entry escalatorway, looking northeast

In order to better serve pedestrian customers approaching the station from either the VRE station or the Mount Vernon Connector Multi-Use Path, a crosswalk should be installed on the north leg of the intersection of Crystal Drive and 18th Street if the Proposed Entry is installed.

The Proposed Entry would likely attract additional Metrorail customers from the east, but there is not a large base of development east of the station. Because of the shortened walking distance, the Proposed Entry would be expected to generate approximately 80 new pedestrian customers during the evening peak period and 110 new daily pedestrian trips.

Table 12 presents customer forecasts for the Proposed Entry if constructed. Pedestrian customers whose trips originate east of the station would likely use the new entrance, but all other pedestrians are likely to continue to use the existing entrance because of its convenient access to the Underground.

The red lines in Figure 16 indicate potential alignments for light rail service in Crystal City. These plans are in their early stages, but the current LRT alignments include service on either Clark Place or Eads Street. The existing escalators are well-positioned to capture LRT transfer customers from either of these alignments, so the Proposed Entry would not be a benefit to LRT transfer customers. Table 12 assigns all LRT transfer customers to the existing entry.

There is more uncertainty in the forecast of the number of customers using other modes who would shift to the new entrance, in part because the Crystal City street configurations are likely to change prior to 2020. As a general assignment, half of customers using other modes were assumed to shift to the new entrance.

Table 12: Forecast of station entries in 2020

	No new entrance constructed	***Proposed Entry constructed***	
	Customers using existing entry	***Customers using existing entry***	***Customers using new entry***
AM Peak Period	5,400	4,400	1,000
PM Peak Period	10,200	7,800	2,500
Daily	21,000	16,600	4,500

Table 12 forecasts 4,500 weekday customer entries for the Proposed Entry if constructed. The entry would serve a similar number of customer exits, for a total annual customer volume of approximately 2 million.

Bus transfer customers may benefit from the Proposed Entry. If Crystal Drive and Clark Street remain a one-way pair, Metrorail station entrances near each of these streets would simplify bus operations. Buses would not need to circulate to the existing station entrance; if it were more convenient, buses could stop on Crystal Drive near the Proposed Entry. Other dropped-off customers may achieve similar benefits.

The approximate cost of the Proposed Entry is detailed in Table 13.

Table 13: Order of magnitude cost estimate for Proposed Entry

Element	***Approximate Cost (FY 2002 dollars)***
Entry features: escalators, street elevators, passageway	$13,000,000
Mezzanine extension, internal station improvements	$5,000,000
Planning, design, construction management, agency costs, and contingencies	$10,000,000
Total Cost	**$28,000,000**

Note: Excludes right-of-way costs and new street-to-mezzanine elevators described on page 19.

Alternate Entry

The Alternate Entry features a new bank of three escalators on the southwest corner of 18th Street and Crystal Drive (Figure 18). Much like the Proposed Entry, the Alternate Entry would provide access to the station via a tunnel, connecting with the mezzanine at the same point as the Proposed Entry.

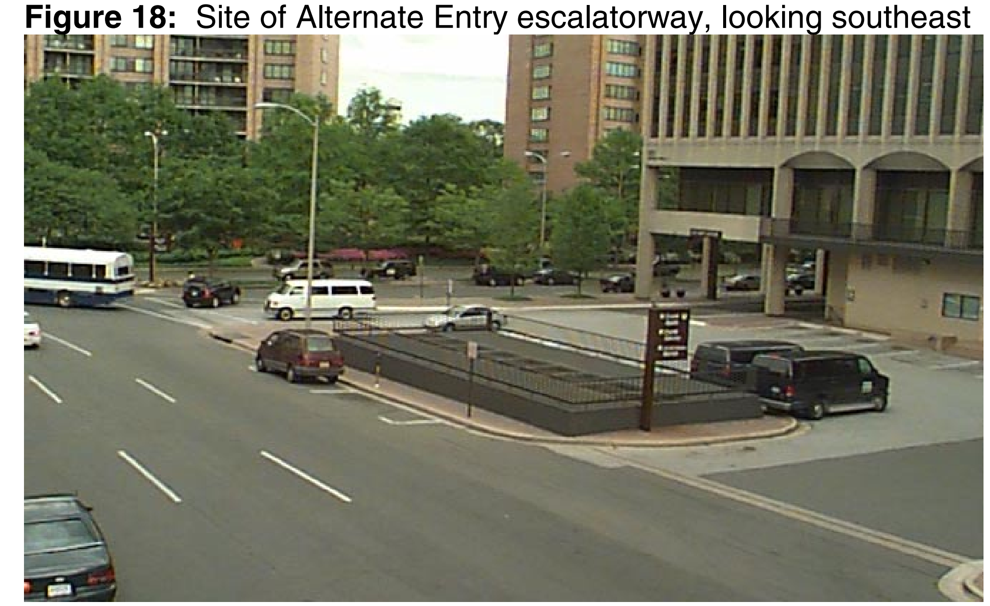
The primary challenge of the Alternate Entry is integrating its escalator bank with the existing and planned site development. The location of the Alternate Entry's escalator bank is currently planned for redevelopment, and at various phases of planning, the Alternate Entry has not been compatible with development considered for the site. Constructing the Alternate Entry would require careful cooperation with the redevelopment plans.

The Alternate Entry also conflicts with an underground cooling tower facility, greatly complicating the possibility of installing both a bank of escalators and a passageway.

Many of the advantages of the Proposed Entry would apply to the Alternate Entry as well, since the escalator banks are relatively near each other. The Alternate Entry would benefit customers approaching from south of 18th Street because they would not have to cross that street. However, this location would be less attractive than the Proposed Entry to VRE customers, who approach the station from the Mount Vernon Connection Multi-Use Path north of 18th Street. The Alternate Entry would be expected to attract new customers at approximately the same rate as the Proposed Entry, given their proximity.

However, because of the Alternate Entry's constructibility difficulties, it is not recommended for further consideration.

Figure 18: Site of Alternate Entry escalatorway, looking southeast



Internal Station Improvements

Improvements to the interior of the station area would be necessary if either new entrance were constructed. Figure 19 displays a mezzanine-level plan view of several internal changes that would be consistent with either new entrance. Each proposed improvement is discussed in detail below. The cost of these improvements is included in Table 13, with an exception noted below.

- Rearranged faregate arrays would be required to accommodate the entrance to the mezzanine from the south. The reconfigured faregates would have a secondary benefit of increasing capacity.
- New platform-to-mezzanine elevators would be added for both the north and south platforms, providing two elevators for each platform. The additional elevators would significantly reduce the chances that an out-of-service elevator would prevent customers with disabilities from using the station.
- The west end of the mezzanine would be extended, and stairs between mezzanine and platform would be added for both north and south platforms. New stairways would help provide vertical circulation, especially when one or more escalators are out of service. In addition, the stairways would increase capacity, which could be beneficial during peak periods.
- In order to provide better elevator service to the station, a bank of two new street-to-mezzanine elevators is proposed. The new elevators are shown in a street-level plan view in Figure 20 and an elevation view in Figure 21. The elevators are situated in such a way that they could stop at the Underground level, shortening disabled customers' trips to that level. These elevators are not included in the cost estimate in Table 13, for two reasons. First, construction would be contingent on disabled-accessible retrofits to the Underground entrances, which would need to be made by the owners of the Underground. Second, space for the elevators at street level would be contingent on integrating the elevators within the site plan for the Crystal Square Five structure. Space for the elevators would also need to be coordinated at Underground level; consideration would need to be given to the likely displacement of retail facilities.

The internal station improvements would provide an additional access point to the Underground. The rearranged faregates would allow people to enter through the new entrance and pass through the station. They could then proceed out of the station via the existing entrance or connect to the Underground.

Figure 19: Potential interior Crystal City Station improvements

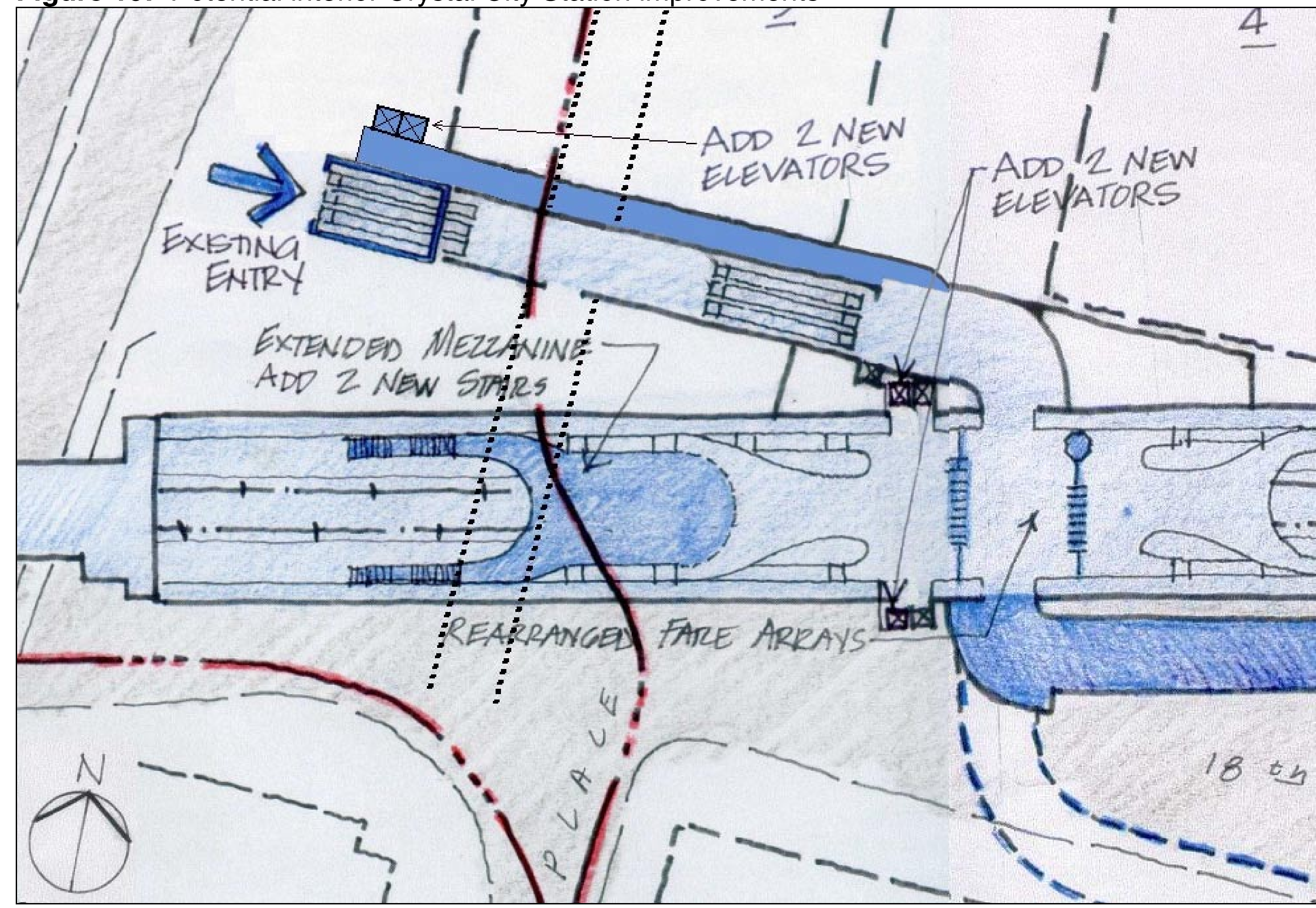


Figure 20: Street-level plan view of proposed street-to-mezzanine elevators and pedestrian and bicycle facilities

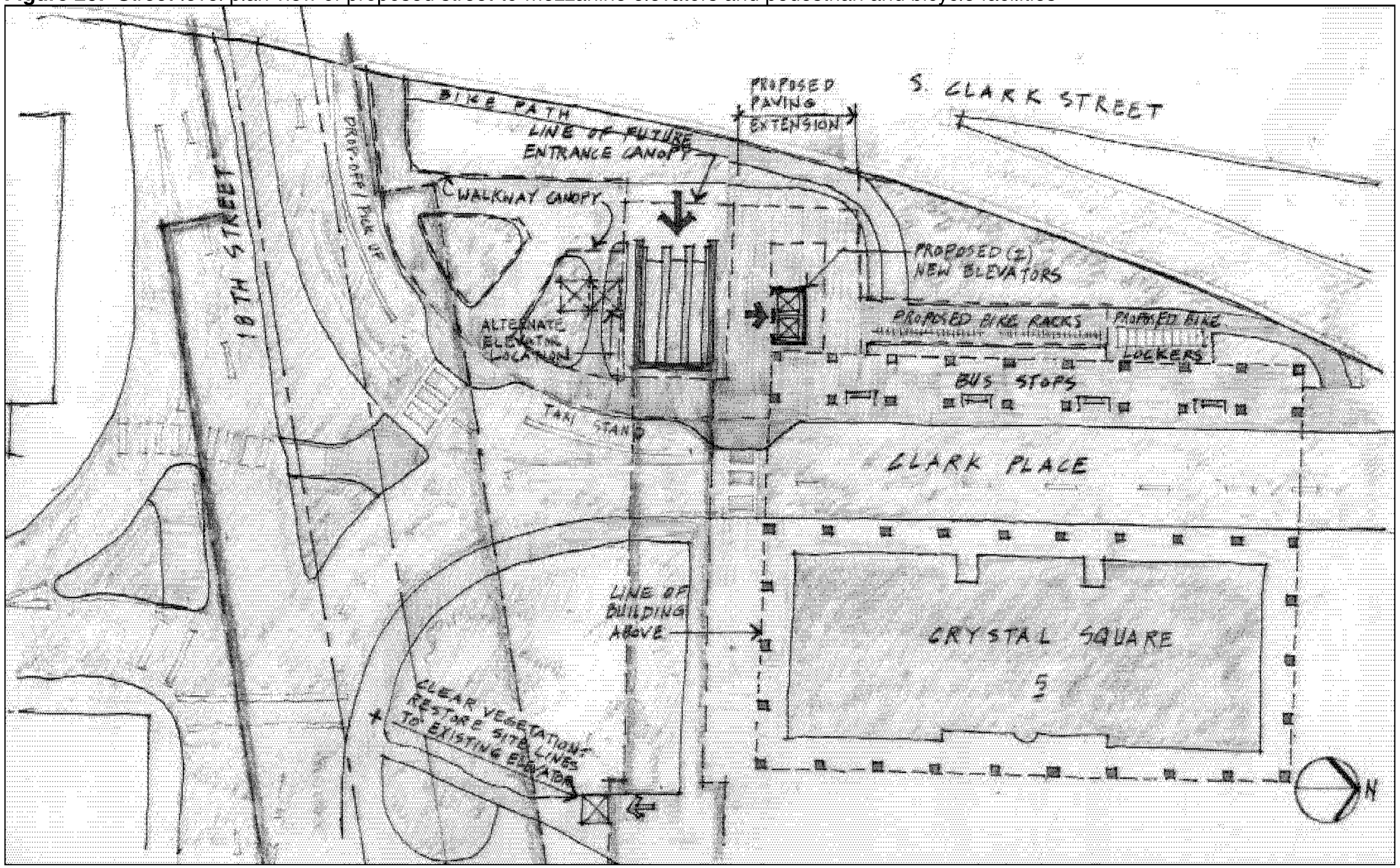
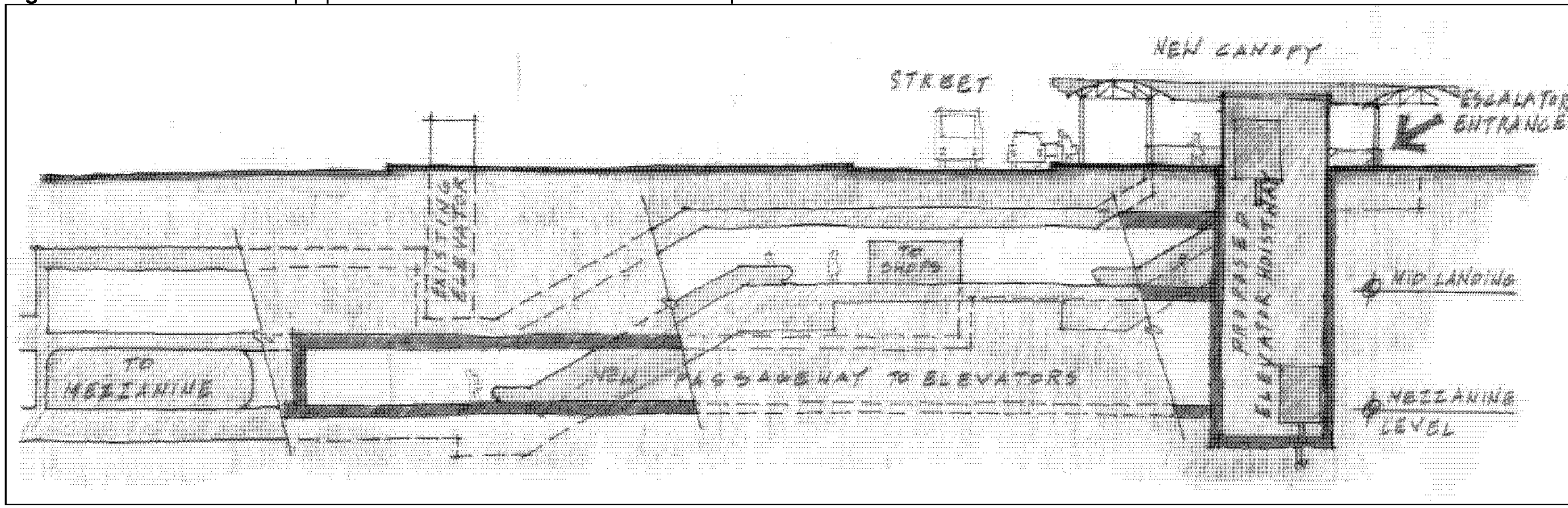
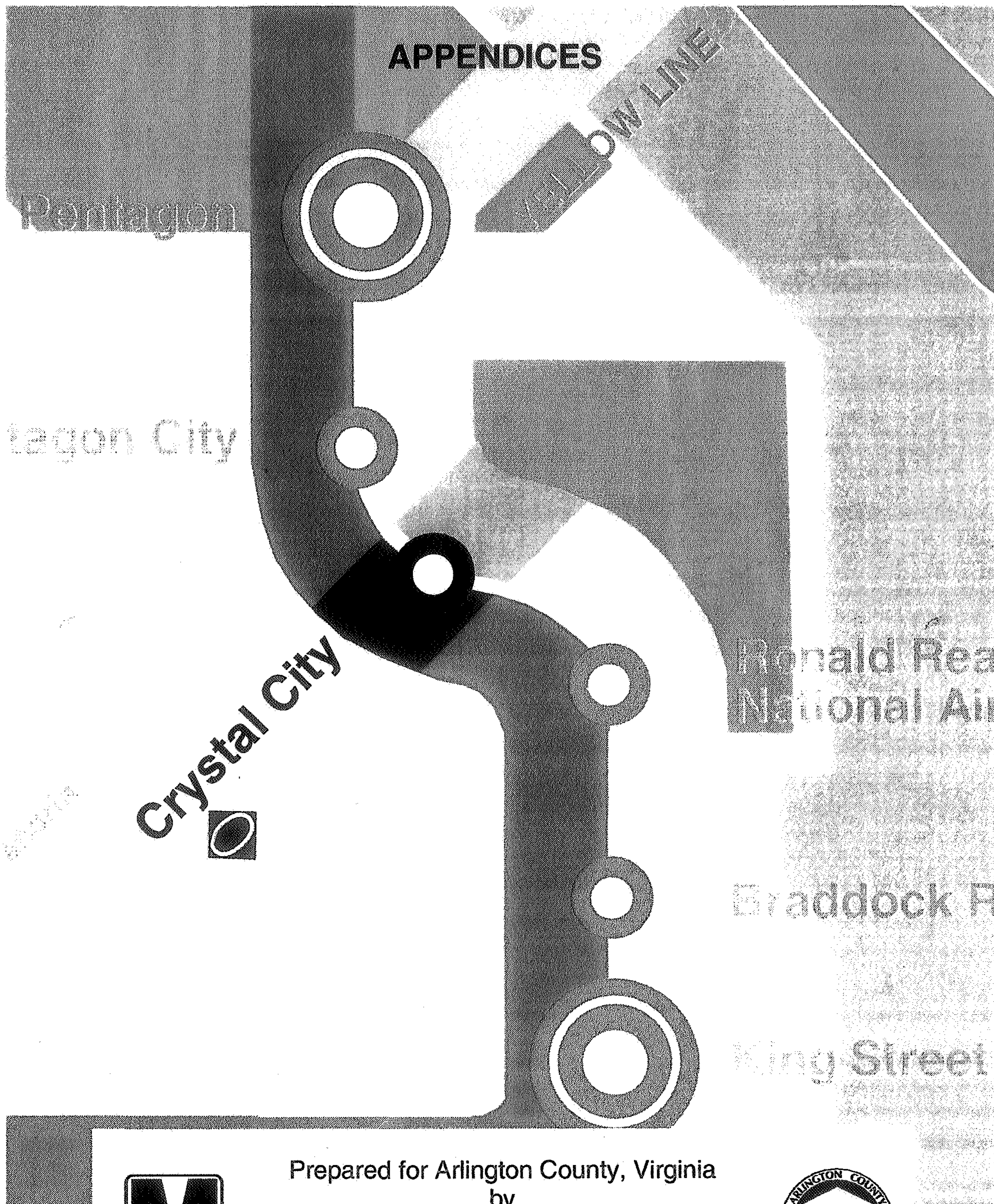


Figure 21: Elevation view of proposed street-to-mezzanine elevators and pedestrian facilities



CRYSTAL CITY METRORAIL STATION ACCESS STUDY

APPENDICES



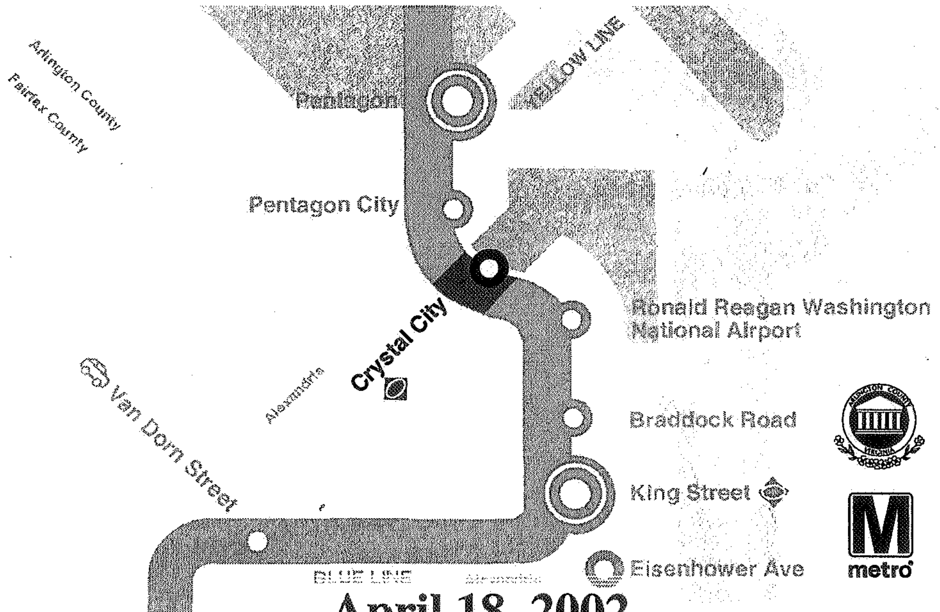
Prepared for Arlington County, Virginia
by
Washington Metropolitan Area Transit Authority
Department of Capital Projects Management
June 2002

CONTENTS

APPENDIX A

PRESENTATION GIVEN AT PUBLIC MEETING ON APRIL 18, 2002

Crystal City Metrorail Station Access Study

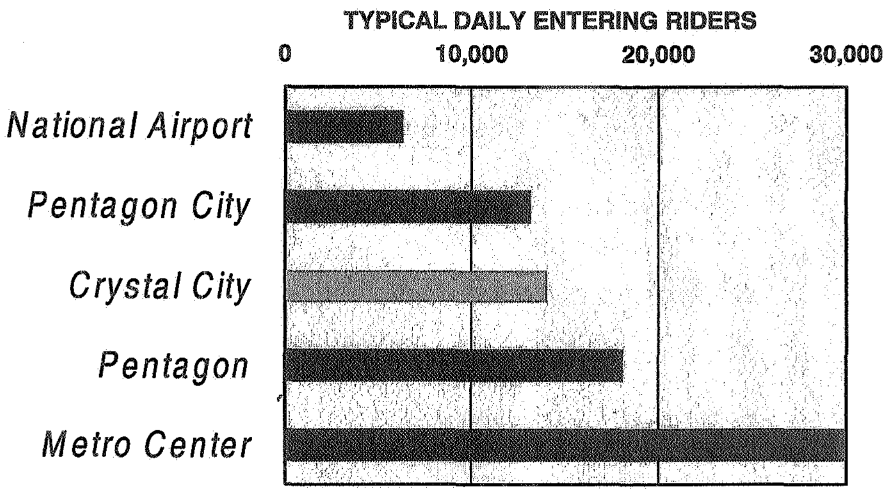


April 18, 2002

Study Purpose

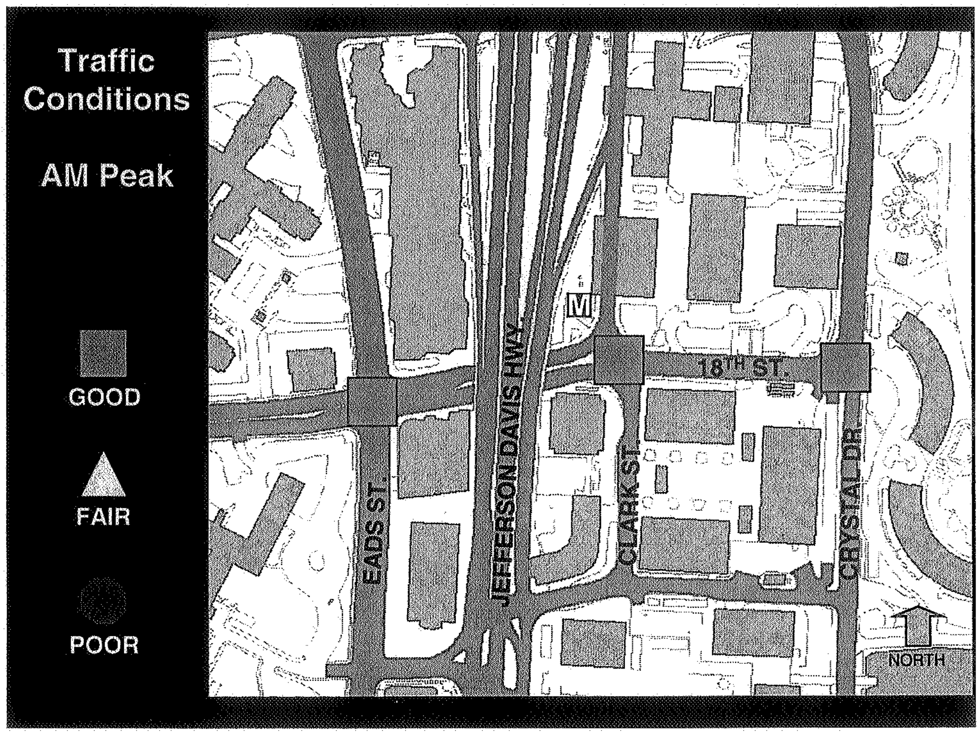
- Pedestrian & vehicle access patterns
- Future development forecast
- Station access improvements

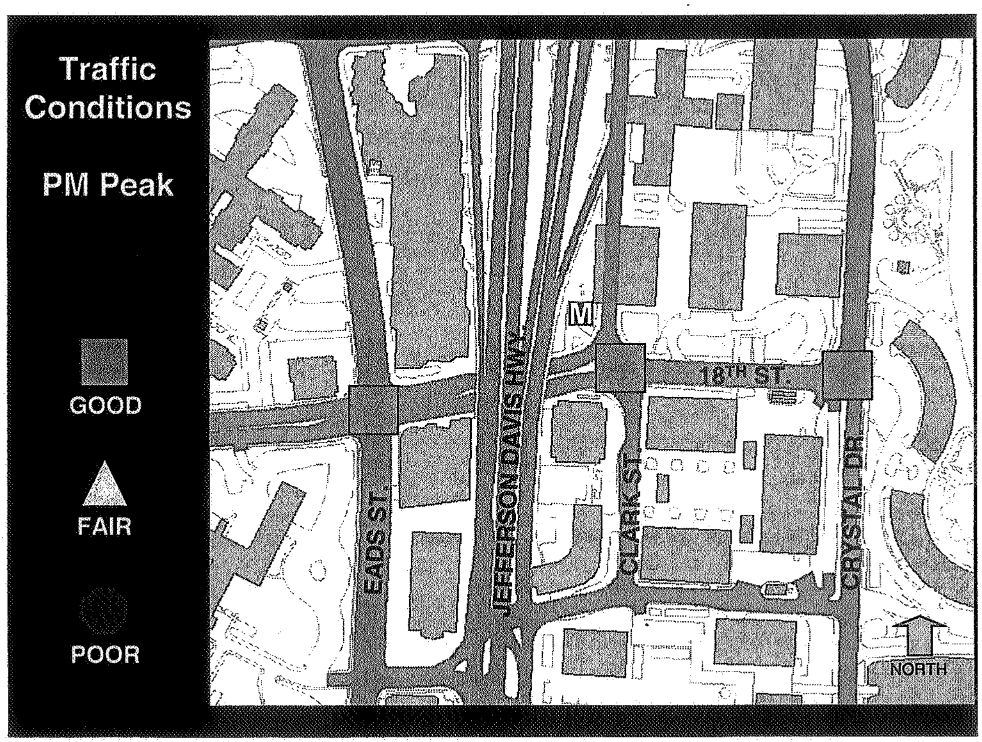
Metrorail Station Passenger Volumes



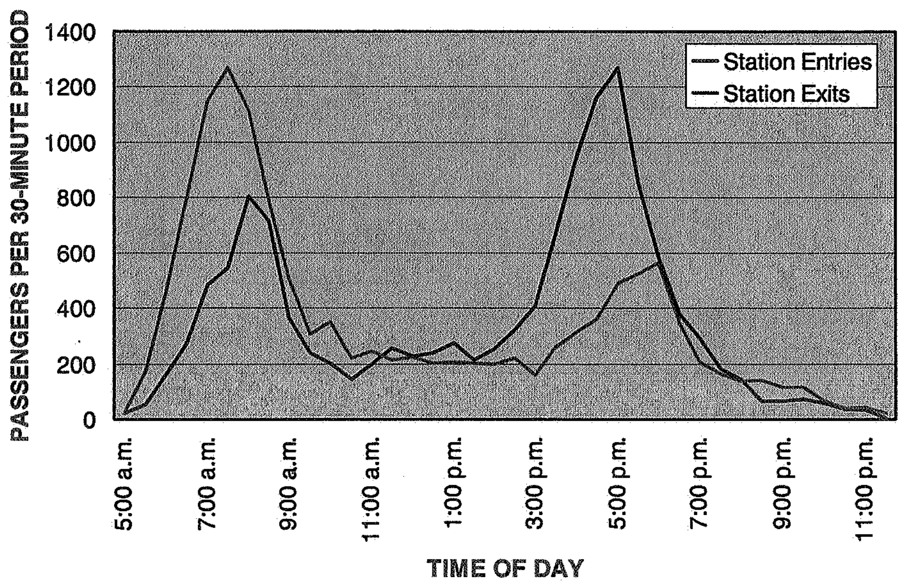
Data Collected

- Traffic on adjacent streets
- Nearby intersection turn counts
- Pedestrian street crossings
- Pedestrian arrival patterns
- Development forecast near station


Traffic Conditions
AM Peak
GOOD
FAIR
POOR
EADS ST.
JEFFERSON DAVIS HWY.
CLARK ST.
CRYSTAL DR.
18TH ST.
M
NORTH


Traffic Conditions
PM Peak
GOOD
FAIR
POOR
EADS ST.
JEFFERSON DAVIS HWY.
CLARK ST.
CRYSTAL DR.
18TH ST.
M
NORTH

Station Entries and Exits



Passenger Survey

ARLINGTON METRO STATION SURVEY

Please take a few moments to help plan for your transit needs by completing this survey and dropping it in any mailbox. No postage is required. Thank you.

A. How did you get to the Metrorail station where you received this card?

1 ☐ VRE 2 ☐ Walk
3 ☐ Shuttle bus 4 ☐ Bicycle
5 ☐ Tour bus 6 ☐ Taxi
7 ☐ ART bus
8 ☐ Metrobus (Route: ______)
9 ☐ Fairfax Connector (Route: _____)
10 ☐ Dropped off by someone
11 ☐ Drove a car and parked
12 ☐ Rode with someone who parked

B. What is the purpose of your Metrorail trip today?

1 ☐ Traveling to work
2 ☐ Traveling home from work
3 ☐ Job-related business
4 ☐ Shopping or meal
5 ☐ School
6 ☐ Personal trip
7 ☐ Sightseeing or recreation

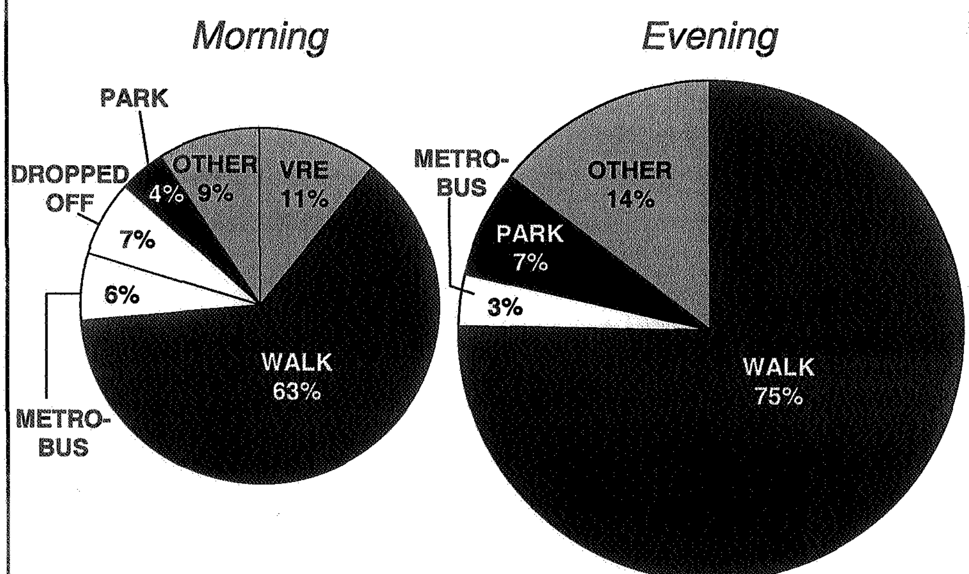
C. Where did you start your trip to the Metrorail station today?

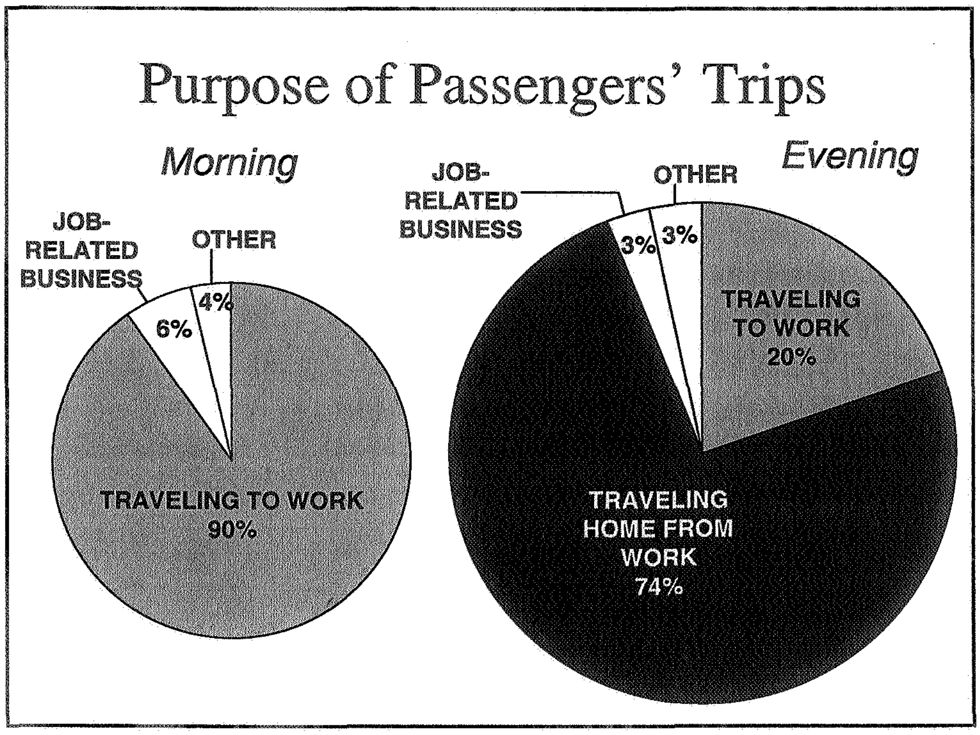
Address ____________
OR Street & block no. ____________
OR Nearest intersection ____________
OR Building name

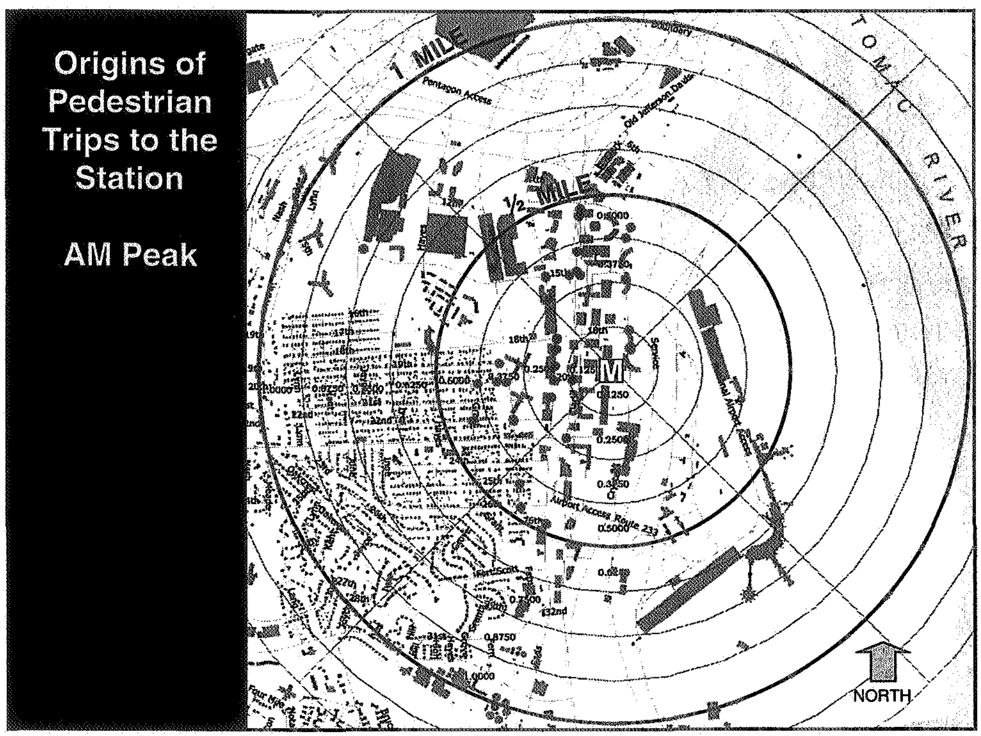
Passenger Survey

- Passengers offered a card while entering the station
- Survey date: September 26, 2001
- Survey response:
  - AM: 461 cards (13% of peak period)
  - PM: 821 cards (12% of peak period)

How Do Passengers Get to the Station?

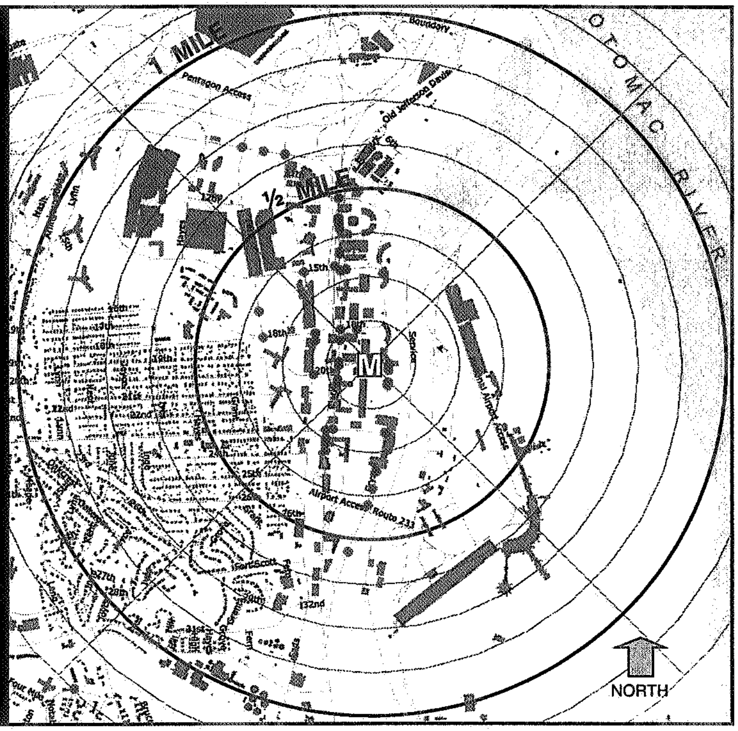



Purpose of Passengers' Trips
Morning
JOB-RELATED BUSINESS
OTHER
6%
4%
TRAVELING TO WORK 90%
Evening
JOB-RELATED BUSINESS
OTHER
3%
3%
TRAVELING TO WORK 20%
TRAVELING HOME FROM WORK 74%


Origins of Pedestrian Trips to the Station
AM Peak
1 MILE
1/2 MILE
M
NORTH

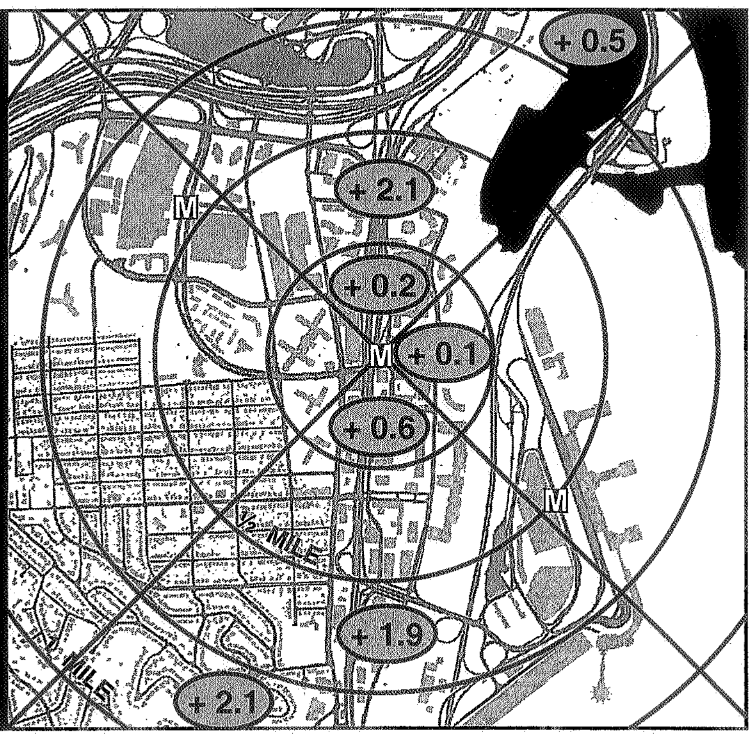
Origins of Pedestrian Trips to the Station

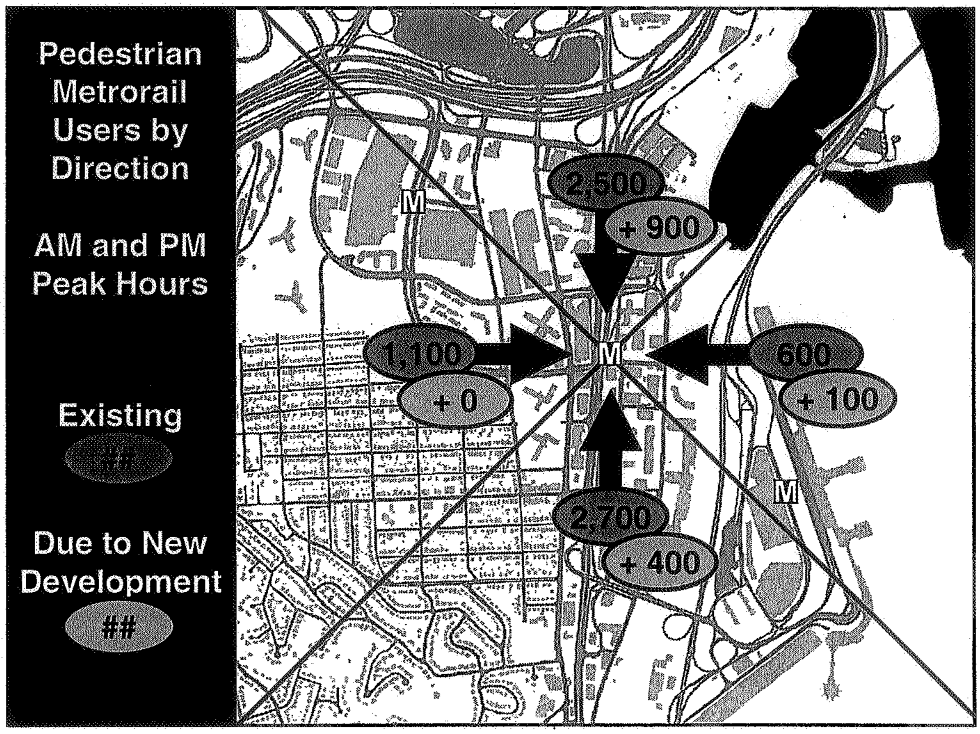
PM Peak



Net Change in Development

(millions of square feet)

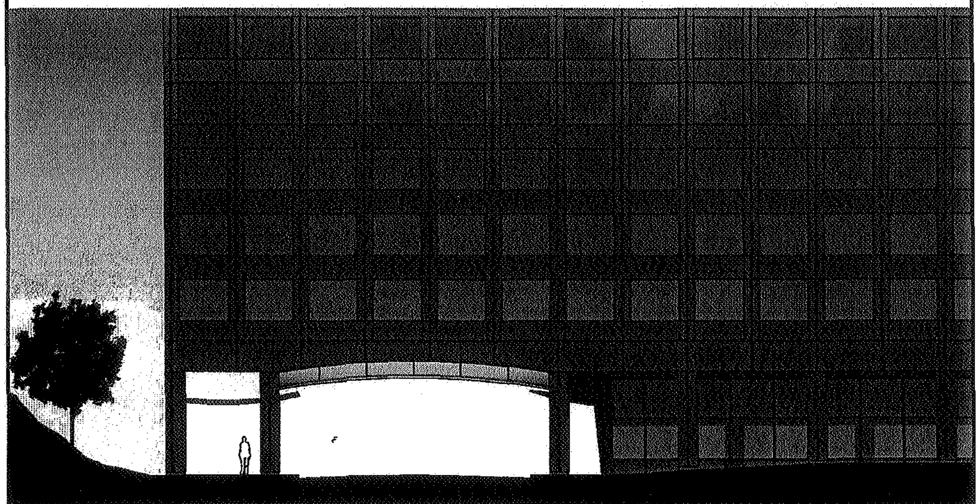




Station Access Priorities

1. Pedestrians and bicyclists
2. Disabled-accessible
3. Bus passengers
4. Dropped off passengers and motorcyclists
5. Passengers who drive and park

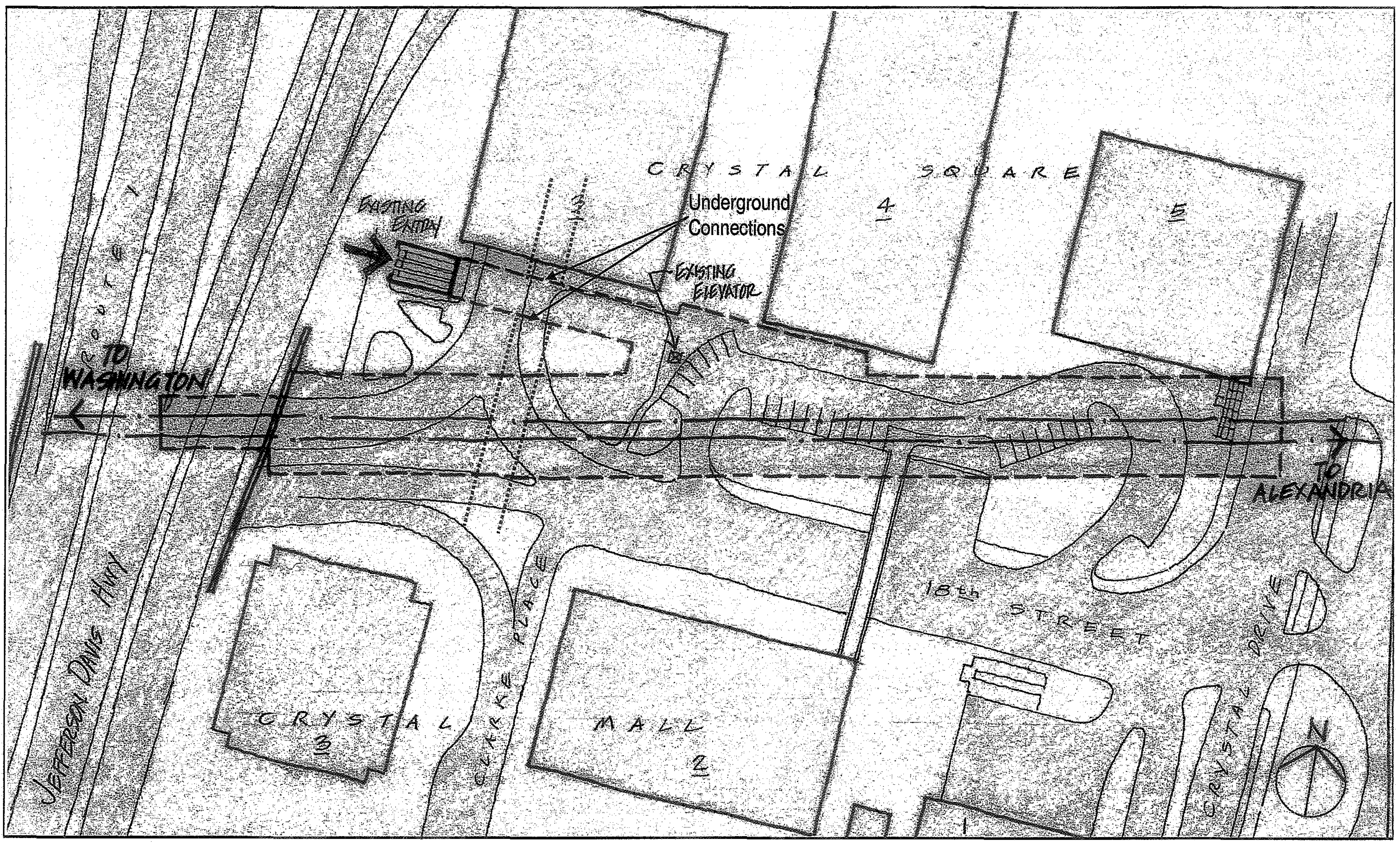
Planned Bus Bay Changes



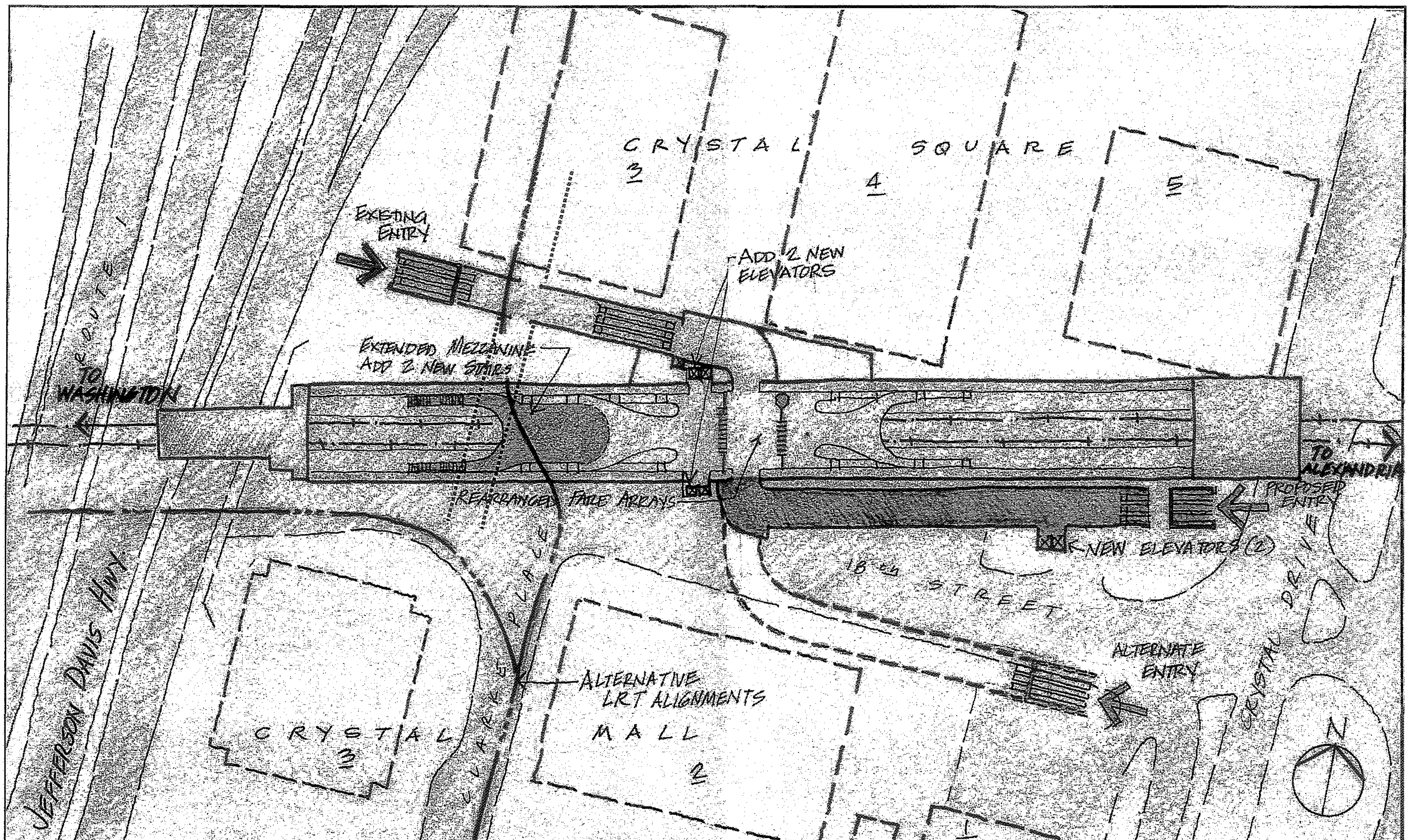
Comments by May 1

- By mail:
  - Capital Transit Consultants
    1133 15th St., N.W., Suite 700
    Washington, DC 20005
    Attn: Randy Dittberner
- By e-mail:
  - Randy.Dittberner@Parsons.com

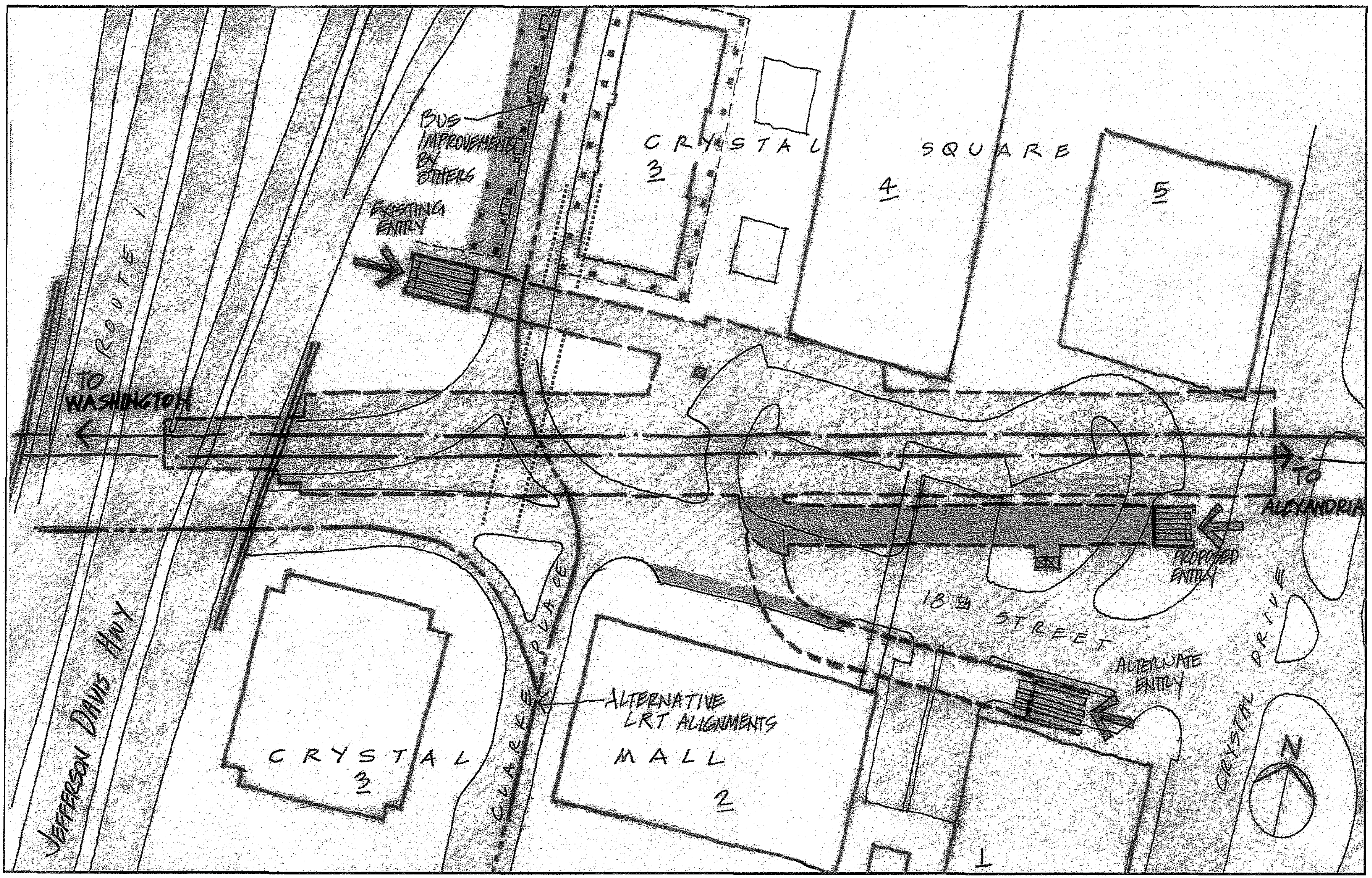
Existing Site Conditions



Internal Station Improvements



Station Access Improvements



APPENDIX B

TRAFFIC AND PEDESTRIAN DATA

Volume Count Report

Generated by MSC3000 Version 2.01 Copyright 1990-1992 Mitron Systems Corporation

Location .... Eads St., S. of 18th St., SB
Location Code 1113
County .... Arlington, VA
Recorder Set 05/07/01 15:41
Recording Start ... 05/15/01 00:00
Recording End 05/17/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 53
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Tuesday 05/15/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
81	52	26	27	64	201	385	441	559	581	442	517	639	649	537	583	729	766	771	673	546	408	270	182	10129
26	13	9	4	9	29	92	94	145	132	119	117	159	168	125	137	149	186	197	177	143	99	76	63	
18	17	5	7	12	34	105	114	127	157	117	127	154	163	130	123	188	191	171	189	141	105	73	45	
17	5	8	5	12	66	91	113	132	146	100	140	148	172	143	169	184	196	203	154	133	102	64	44	
20	17	4	11	31	72	97	120	155	146	106	133	178	146	139	154	208	193	200	153	129	102	57	30	

AM Peak Hour .... 08:45 to 09:45 (590 vehicles)
AM Peak Hour Factor 93.9%
PM Peak Hour .... 16:45 to 17:45 (781 vehicles)
PM Peak Hour Factor 93.9%

Wednesday 05/16/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
81	52	33	25	68	241	397	499	542	566	484	613	613	654	583	659	740	814	709	662	541	472	302	219	10569
23	19	11	6	12	32	97	108	143	155	124	131	160	159	153	140	182	190	182	175	153	112	86	79	
28	10	4	5	15	50	111	129	147	143	108	146	143	168	143	164	181	210	190	157	134	122	64	45	
21	15	11	8	16	65	100	119	124	152	126	150	147	165	133	176	200	219	170	178	135	123	90	54	
9	8	7	6	25	94	89	143	128	116	126	186	163	162	154	179	177	195	167	152	119	115	62	41	

AM Peak Hour .... 11:00 to 12:00 (613 vehicles)
AM Peak Hour Factor 82.4%
PM Peak Hour .... 17:00 to 18:00 (814 vehicles)
PM Peak Hour Factor 92.9%

24-Hour Moving Total

01:00- 10129	02:00- 10129	03:00- 10136	04:00- 10134	05:00- 10138	06:00- 10178	07:00- 10190	08:00- 10248
09:00- 10231	10:00- 10216	11:00- 10258	12:00- 10354	13:00- 10328	14:00- 10333	15:00- 10379	16:00- 10455
17:00- 10466	18:00- 10514	19:00- 10452	20:00- 10441	21:00- 10436	22:00- 10500	23:00- 10532	24:00- 10569

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... 18th St., E. of Eads St., EB
Location Code 1222
County .... Arlington, VA
Recorder Set 05/07/01 14:32
Recording Start ... 05/15/01 00:00
Recording End 05/17/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 34
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Tuesday 05/15/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
16	8	3	7	15	142	417	478	544	449	248	192	269	291	221	186	197	214	168	127	89	90	62	32	4465
4	1	0	0	1	14	85	100	145	119	78	64	55	81	66	55	50	53	52	34	29	24	17	13	
5	4	0	1	3	25	100	128	133	123	55	43	67	68	52	38	43	50	37	34	13	26	21	4	
4	1	2	2	3	34	104	116	135	100	64	40	61	77	58	45	56	53	53	40	22	22	16	12	
3	2	1	4	8	69	128	134	131	107	51	45	86	65	45	48	48	58	26	19	25	18	8	3	

AM Peak Hour .... 07:45 to 08:45 (547 vehicles)
AM Peak Hour Factor 94.3%
PM Peak Hour .... 12:45 to 13:45 (312 vehicles)
PM Peak Hour Factor 90.7%

Wednesday 05/16/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
13	6	4	3	19	133	442	479	530	419	229	184	272	278	198	154	188	201	129	133	101	79	70	34	4298
6	2	3	0	1	11	93	109	128	116	63	45	57	66	51	41	42	53	39	31	34	25	5	8	
3	1	0	2	4	32	96	121	159	128	64	42	60	72	43	35	51	65	26	31	25	27	20	18	
3	2	0	0	4	30	125	103	124	101	48	48	77	65	55	40	48	34	35	30	26	11	21	3	
1	1	1	1	10	60	128	146	119	74	54	49	78	75	49	38	47	49	29	41	16	16	24	5	

AM Peak Hour .... 07:45 to 08:45 (557 vehicles)
AM Peak Hour Factor 87.6%
PM Peak Hour .... 12:30 to 13:30 (293 vehicles)
PM Peak Hour Factor 93.9%

24-Hour Moving Total

01:00-	4462	02:00-	4460	03:00-	4461	04:00-	4457	05:00-	4461	06:00-	4452	07:00-	4477	08:00-	4478
09:00-	4464	10:00-	4434	11:00-	4415	12:00-	4407	13:00-	4410	14:00-	4397	15:00-	4374	16:00-	4342
17:00-	4333	18:00-	4320	19:00-	4281	20:00-	4287	21:00-	4299	22:00-	4288	23:00-	4296	24:00-	4298

Volume Count Report

Generated by MSC3000 Version 2.01

```
Location .......... 18th St., E of Eads St., WB
Location Code ..... 1334
County ............ Arlington, VA
Recorder Set ...... 05/07/01 14:32
Recording Start ... 05/15/ 1 00:00
Recording End ..... 05/17/ 1 00:00
Sample Time ....... 15 Minutes
Operator Number ... 16
Machine Number .... 28
Channel ........... 1
Divide By ......... 2
Summation ......... No
Two-Way ........... No
```

Tuesday 05/15/ 1 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
11	1	0	5	9	16	44	88	79	80	67	104	121	119	104	146	175	235	190	103	75	69	59	29	1929
3	0	0	0	1	7	11	22	15	21	13	25	34	43	19	38	39	67	61	37	20	23	14	14	
4	0	0	5	3	4	11	19	20	19	21	29	39	24	18	32	56	43	40	23	24	16	23	9	
2	1	0	0	0	0	10	28	27	14	23	20	21	27	35	38	39	51	53	31	17	15	9	6	
2	0	0	0	5	5	12	19	17	26	10	30	27	25	32	38	41	74	36	12	14	15	13	0	

```
AM Peak Hour .................... 11:00 to 12:00 (104 vehicles)
AM Peak Hour Factor ............. 86.7%
PM Peak Hour .................... 17:00 to 18:00 (235 vehicles)
PM Peak Hour Factor ............. 79.4%
```

Wednesday 05/16/01 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
6	5	4	3	3	23	65	73	99	98	86	95	121	97	126	127	181	204	134	100	67	64	35	20	1836
0	0	0	0	0	6	28	13	27	27	18	27	43	20	25	33	52	75	52	36	23	6	6	4	
0	0	2	1	0	2	15	23	15	30	26	13	30	23	31	22	49	39	27	31	15	26	11	9	
5	5	0	0	1	7	3	15	24	15	18	26	25	28	31	24	42	36	28	13	17	18	5	3	
1	0	2	2	2	8	19	22	33	26	24	29	23	26	39	48	38	54	27	20	12	14	13	4	

```
AM Peak Hour .................... 08:30 to 09:30 (114 vehicles)
AM Peak Hour Factor ............. 86.4%
PM Peak Hour .................... 16:15 to 17:15 (204 vehicles)
PM Peak Hour Factor ............. 68.0%
```

24-Hour Moving Total

01:00-	1924	02:00-	1928	03:00-	1932	04:00-	1930	05:00-	1924	06:00-	1931	07:00-	1952	08:00-	1937
09:00-	1957	10:00-	1975	11:00-	1994	12:00-	1985	13:00-	1985	14:00-	1963	15:00-	1985	16:00-	1966
17:00-	1972	18:00-	1941	19:00-	1885	20:00-	1882	21:00-	1874	22:00-	1869	23:00-	1845	24:00-	1836

Volume Count Report

Generated by MSC3000 Version 2.01

```
Location .......... 18th St., W. of Crystal Dr., EB
Location Code ..... 1612
County ............ Arlington, VA
Recorder Set ...... 05/07/01 13:40
Recording Start ... 05/16/ 1 00:00
Recording End ..... 05/18/ 1 00:00
Sample Time ....... 15 Minutes
Operator Number ... 16
Machine Number .... 52
Channel ........... 1
Divide By ......... 2
Summation ......... No
Two-Way ........... No
```

Wednesday 05/16/ 1 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
38	13	7	11	36	271	804	1015	1067	944	596	410	605	623	473	439	462	466	354	244	166	159	86	57	9346
13	1	2	0	3	24	154	227	261	273	164	31	133	147	143	123	126	114	112	78	52	46	14	21	
13	7	0	3	6	38	186	242	273	242	146	121	133	163	127	96	97	114	79	57	44	34	27	14	
8	3	4	2	3	76	226	261	262	217	155	122	152	162	97	119	117	127	99	71	34	47	29	13	
4	2	1	6	24	133	238	285	271	212	131	136	187	151	106	101	122	111	64	38	36	32	16	9	

```
AM Peak Hour .................... 07:45 to 08:45 (1081 vehicles)
AM Peak Hour Factor ............. 94.8%
PM Peak Hour .................... 12:45 to 13:45 (659 vehicles)
PM Peak Hour Factor ............. 88.1%
```

Thursday 05/17/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
20	8	12	4	38	268	848	1049	1152	924	543	560	666	619	476	427	510	445	299	317	188	141	99	58	9671
10	3	9	2	4	20	180	227	312	261	161	116	166	163	129	116	130	118	81	78	61	37	17	22	
6	3	2	1	5	48	185	282	326	284	134	133	157	138	105	86	127	115	70	73	46	44	28	20	
3	0	0	0	10	70	220	242	264	199	117	157	174	157	125	129	129	108	84	84	42	34	33	9	
1	2	1	1	19	130	263	298	250	180	131	154	169	161	117	96	124	104	64	82	39	26	21	7	

```
AM Peak Hour .................... 07:45 to 08:45 (1200 vehicles)
AM Peak Hour Factor ............. 92.0%
PM Peak Hour .................... 12:00 to 13:00 (666 vehicles)
PM Peak Hour Factor ............. 95.7%
```

24-Hour Moving Total

01:00-	9328	02:00-	9323	03:00-	9328	04:00-	9321	05:00-	9323	06:00-	9320	07:00-	9364	08:00-	9398
09:00-	9483	10:00-	9463	11:00-	9410	12:00-	9560	13:00-	9621	14:00-	9617	15:00-	9620	16:00-	9608
17:00-	9656	18:00-	9635	19:00-	9580	20:00-	9653	21:00-	9675	22:00-	9657	23:00-	9670	24:00-	9671

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Clark Place, S. of 18th St., NB
Location Code 1411
County .... Arlington, VA
Recorder Set 05/06/01 15:35
Recording Start ... 05/15/ 1 00:00
Recording End 05/16/ 1 00:00
Sample Time .... 60 Minutes
Operator Number ... 16
Machine Number 38
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Tuesday 05/15/ 1 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
3	4	1	2	1	12	41	32	36	52	39	49	48	68	55	63	71	68	46	31	22	20	14	7	785

AM Peak Hour .... 09:00 to 10:00 (52 vehicles)
PM Peak Hour .... 16:00 to 17:00 (71 vehicles)

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Clark Place, S. of 18th St., SB
Location Code 1513
County .... Arlington, VA
Recorder Set 05/07/01 13:18
Recording Start ... 05/15/01 00:00
Recording End 05/17/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 14
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Tuesday 05/15/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
7	7	0	4	3	32	88	86	102	85	84	116	108	133	121	93	134	128	134	64	46	44	29	16	1664
1	1	0	0	1	7	12	20	31	25	18	40	25	39	27	25	25	36	54	22	13	13	8	9	
4	4	0	1	0	6	19	27	24	24	26	27	27	28	29	28	14	30	24	13	8	11	9	0	
2	0	0	0	2	8	31	15	26	17	18	25	28	32	33	27	54	36	31	23	14	12	9	5	
0	2	0	3	0	11	26	24	21	19	22	24	28	34	32	13	41	26	25	6	11	8	3	2	

AM Peak Hour .... 11:00 to 12:00 (116 vehicles)
AM Peak Hour Factor 72.5%
PM Peak Hour .... 16:30 to 17:30 (161 vehicles)
PM Peak Hour Factor 74.5%

Wednesday 05/16/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
3	2	2	3	6	22	100	97	135	135	132	91	117	150	148	168	168	128	59	65	47	50	45	17	1890
3	0	0	0	2	3	17	21	29	21	28	17	35	31	23	53	28	50	20	20	16	12	4	3	
0	0	0	2	1	5	21	27	25	30	42	17	36	34	40	24	34	24	11	14	8	23	15	7	
0	1	1	0	2	5	31	28	45	43	45	23	20	36	33	48	53	32	11	19	11	9	6	2	
0	1	1	1	1	9	31	21	36	41	17	34	26	49	52	43	53	22	17	12	12	6	20	5	

AM Peak Hour .... 09:45 to 10:45 (156 vehicles)
AM Peak Hour Factor 86.7%
PM Peak Hour .... 16:15 to 17:15 (190 vehicles)
PM Peak Hour Factor 89.6%

24-Hour Moving Total

01:00-	1660	02:00-	1655	03:00-	1657	04:00-	1656	05:00-	1659	06:00-	1649	07:00-	1661	08:00-	1672
09:00-	1705	10:00-	1755	11:00-	1803	12:00-	1778	13:00-	1787	14:00-	1804	15:00-	1831	16:00-	1906
17:00-	1940	18:00-	1940	19:00-	1865	20:00-	1866	21:00-	1867	22:00-	1873	23:00-	1889	24:00-	1890

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Clark Place, N. of 18th St., SB
Location Code 21113
County .... Arlington, VA
Recorder Set 05/07/01 15:15
Recording Start ... 05/15/ 1 00:00
Recording End 05/17/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 16
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Tuesday 05/15/ 1 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
22	6	4	7	21	151	475	612	566	514	308	324	398	365	294	315	313	339	274	167	129	122	77	42	5845
8	0	2	1	3	19	84	150	145	147	77	75	85	98	71	79	82	92	95	57	32	39	15	20	
8	3	1	5	4	22	120	136	144	131	91	80	83	91	83	77	85	81	67	39	40	28	21	12	
6	2	1	0	2	44	134	163	129	126	76	82	111	79	73	70	63	86	58	55	31	32	21	7	
0	1	0	1	12	66	137	163	148	110	64	87	119	97	67	89	83	80	54	16	26	23	20	3	

AM Peak Hour .... 07:30 to 08:30 (615 vehicles)
AM Peak Hour Factor 94.3%
PM Peak Hour .... 12:30 to 13:30 (419 vehicles)
PM Peak Hour Factor 88.0%

Wednesday 05/16/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
13	7	7	5	19	160	499	631	636	491	332	363	398	335	324	312	340	335	235	230	125	112	68	44	6021
5	0	4	1	2	15	120	137	166	142	92	80	105	85	81	74	95	108	71	62	43	23	16	16	
2	4	2	2	4	24	111	165	175	168	87	81	98	68	81	74	87	74	57	48	31	36	21	12	
5	1	1	1	8	44	126	163	149	93	73	106	97	92	84	78	83	70	63	66	24	27	14	10	
1	2	0	1	5	77	142	166	146	88	80	96	98	90	78	86	75	83	44	54	27	26	17	6	

AM Peak Hour .... 07:30 to 08:30 (670 vehicles)
AM Peak Hour Factor 95.7%
PM Peak Hour .... 12:00 to 13:00 (398 vehicles)
PM Peak Hour Factor 94.8%

24-Hour Moving Total

01:00-	5836	02:00-	5837	03:00-	5840	04:00-	5838	05:00-	5836	06:00-	5845	07:00-	5869	08:00-	5888
09:00-	5958	10:00-	5935	11:00-	5959	12:00-	5998	13:00-	5998	14:00-	5968	15:00-	5998	16:00-	5995
17:00-	6022	18:00-	6018	19:00-	5979	20:00-	6042	21:00-	6038	22:00-	6028	23:00-	6019	24:00-	6021

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Crystal Dr., N. of 18th St., NB
Location Code 1811
County .... Arlington, VA
Recorder Set 05/07/01 11:10
Recording Start ... 05/16/ 1 00:00
Recording End 05/18/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 25
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Wednesday 05/16/ 1 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
66	32	11	11	40	176	606	1025	1096	889	757	993	1026	1012	1141	1353	1655	1716	1168	721	446	366	268	154	16728
28	9	1	1	7	12	105	220	295	262	195	238	256	269	263	377	451	509	350	235	141	108	51	52	
14	11	3	1	6	35	146	244	267	239	173	229	269	270	272	291	382	389	330	201	101	95	79	48	
11	7	4	4	10	57	165	264	268	192	201	268	239	251	312	356	424	418	263	154	118	98	78	31	
13	5	3	5	17	72	190	297	266	196	188	258	262	222	294	329	398	400	225	131	86	65	60	23	

AM Peak Hour .... 07:45 to 08:45 (1127 vehicles)
AM Peak Hour Factor 94.9%
PM Peak Hour .... 16:30 to 17:30 (1720 vehicles)
PM Peak Hour Factor 84.5%

Thursday 05/17/01 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
62	28	21	10	38	196	631	1059	1077	901	838	1083	1255	1172	1120	1437	1681	1687	1127	778	457	334	224	141	17357
23	11	10	2	3	12	112	242	300	261	249	217	294	328	286	392	452	514	330	227	148	101	58	48	
17	11	3	1	12	40	153	236	283	231	186	270	290	299	253	316	400	403	308	184	115	75	68	34	
12	2	6	6	6	64	169	263	264	222	187	296	325	284	273	397	416	395	260	177	89	77	61	34	
10	4	2	1	17	80	197	318	230	187	216	300	346	261	308	332	413	375	229	190	105	81	37	25	

AM Peak Hour .... 07:45 to 08:45 (1165 vehicles)
AM Peak Hour Factor 91.6%
PM Peak Hour .... 16:30 to 17:30 (1746 vehicles)
PM Peak Hour Factor 84.9%

24-Hour Moving Total

01:00- 16724	02:00- 16720	03:00- 16730	04:00- 16729	05:00- 16727	06:00- 16747	07:00- 16772	08:00- 16806
09:00- 16787	10:00- 16799	11:00- 16880	12:00- 16970	13:00- 17199	14:00- 17359	15:00- 17338	16:00- 17422
17:00- 17448	18:00- 17419	19:00- 17378	20:00- 17435	21:00- 17446	22:00- 17414	23:00- 17370	24:00- 17357

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... S. Clark St., S. of 15th St.
Location Code 2313
County .... Arlington, VA
Recorder Set 06/28/01 12:26
Recording Start ... 06/28/ 1 13:00
Recording End 07/03/ 1 08:15
Sample Time .... 15 Minutes
Operator Number ... 13
Machine Number 17
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Thursday   06/28/ 1   Channel: 1   Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
													181	130	182	220	314	279	152	128	76	64	37	1763
													68	42	42	65	60	89	42	43	15	11	17	
													44	38	31	48	47	50	42	27	39	21	8	
													32	26	58	57	93	65	41	33	11	13	3	
													37	24	51	50	114	75	27	25	11	19	9	

AM Peak Hour .... Unavailable
AM Peak Hour Factor .... Unavailable
PM Peak Hour .... 17:30 to 18:30 (346 vehicles)
PM Peak Hour Factor 75.9%

Friday   06/29/01   Channel: 1   Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
30	16	5	12	21	138	279	270	175	256	241	390	231	211	187	173	276	303	224	155	100	78	68	48	3887
8	9	4	8	2	16	42	65	45	61	48	88	96	51	46	52	53	68	65	53	25	23	16	17	
12	5	0	0	4	19	63	74	49	77	53	79	44	76	49	38	68	62	64	42	25	30	16	8	
8	1	0	2	3	38	83	63	51	65	53	128	49	45	54	40	85	94	52	34	25	15	21	9	
2	1	1	2	12	65	91	68	30	53	87	95	42	39	38	43	70	79	43	26	25	10	15	14	

AM Peak Hour .... 11:00 to 12:00 (390 vehicles)
AM Peak Hour Factor 76.2%
PM Peak Hour .... 17:00 to 18:00 (303 vehicles)
PM Peak Hour Factor 80.6%

24-Hour Moving Total

01:00-	N/A	02:00-	N/A	03:00-	N/A	04:00-	N/A	05:00-	N/A	06:00-	N/A	07:00-	N/A	08:00-	N/A
09:00-	N/A	10:00-	N/A	11:00-	N/A	12:00-	N/A	13:00-	N/A	14:00-	3827	15:00-	3857	16:00-	3914
17:00-	3905	18:00-	3961	19:00-	3950	20:00-	3895	21:00-	3898	22:00-	3870	23:00-	3872	24:00-	3876

Saturday 06/30/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
28	22	9	10	13	18	34	48	64	86	141	125	84	56	58	77	107	99	93	71	56	40	48	22	1409
14	10	2	4	0	1	7	12	15	19	22	33	25	11	18	18	19	17	31	26	21	10	9	5	
8	8	1	4	4	7	8	11	17	15	45	23	18	11	8	15	22	24	26	20	13	5	15	8	
0	3	2	1	2	3	6	9	13	29	40	43	8	22	9	12	44	29	23	14	11	14	14	6	
6	1	4	1	7	7	13	16	19	23	34	26	33	12	23	32	22	29	13	11	11	11	10	3	

AM Peak Hour .... 10:15 to 11:15 (152 vehicles)
AM Peak Hour Factor 84.4%
PM Peak Hour .... 15:45 to 16:45 (117 vehicles)
PM Peak Hour Factor 66.5%

24-Hour Moving Total

01:00-	3885	02:00-	3891	03:00-	3895	04:00-	3893	05:00-	3885	06:00-	3765	07:00-	3520	08:00-	3298
09:00-	3187	10:00-	3017	11:00-	2917	12:00-	2652	13:00-	2505	14:00-	2350	15:00-	2221	16:00-	2125
17:00-	1956	18:00-	1752	19:00-	1621	20:00-	1537	21:00-	1493	22:00-	1455	23:00-	1435	24:00-	1409

Sunday 07/01/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
23	8	6	9	18	29	24	43	44	66	99	135	102	51	65	69	73	105	69	83	47	54	28	19	1269
3	1	0	0	2	11	11	13	4	6	21	38	25	16	10	21	22	17	16	19	19	8	9	8	
5	2	0	4	4	3	4	11	6	22	9	61	23	10	15	20	21	38	16	16	12	15	4	5	
9	1	5	2	6	4	3	14	17	17	32	17	39	10	19	14	20	28	22	24	11	13	9	4	
6	4	1	3	6	11	6	5	17	21	37	19	15	15	21	14	10	22	15	24	5	18	6	2	

AM Peak Hour .... 10:30 to 11:30 (168 vehicles)
AM Peak Hour Factor 68.9%
PM Peak Hour .... 17:00 to 18:00 (105 vehicles)
PM Peak Hour Factor 69.1%

24-Hour Moving Total

01:00-	1404	02:00-	1390	03:00-	1387	04:00-	1386	05:00-	1391	06:00-	1402	07:00-	1392	08:00-	1387
09:00-	1367	10:00-	1347	11:00-	1305	12:00-	1315	13:00-	1333	14:00-	1328	15:00-	1335	16:00-	1327
17:00-	1293	18:00-	1299	19:00-	1275	20:00-	1287	21:00-	1278	22:00-	1292	23:00-	1272	24:00-	1269

Volume Count Report

Location .... 15th St., E. of Clark Pl., EB
Location Code 2422
County .... Arlington, VA
Recorder Set 05/07/01 12:47
Recording Start ... 05/08/01 00:00
Recording End 05/10/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 5
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
57	20	8	9	12	93	340	618	627	557	498	719	743	726	748	978	1317	1291	915	559	355	277	205	121	11793
19	4	2	1	3	13	59	142	180	152	111	145	192	194	174	239	360	391	298	190	110	71	53	41	
18	9	2	4	0	20	77	141	154	138	134	165	210	167	171	250	274	320	251	144	98	64	57	31	
13	2	2	1	5	24	92	154	153	136	128	206	168	176	207	252	350	305	193	121	72	91	59	22	
7	5	2	3	4	36	112	181	140	131	125	203	173	189	196	237	333	275	173	104	75	51	36	27	

AM Peak Hour .... 11:00 to 12:00 (719 vehicles)
AM Peak Hour Factor 87.3%
PM Peak Hour .... 16:30 to 17:30 (1394 vehicles)
PM Peak Hour Factor 89.1%

189 05/09/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
45	25	17	9	18	97	352	610	628	566	587	752	764	761	732	1024	1278	1262	876	596	380	280	186	114	11959
19	10	11	5	3	12	70	142	180	156	183	168	174	206	169	242	320	365	270	168	132	90	61	39	
12	8	4	2	4	15	71	135	160	156	137	193	197	170	175	232	293	284	238	159	95	61	48	33	
7	2	1	2	3	33	107	153	164	145	126	202	198	194	187	288	355	333	207	130	76	57	50	21	
7	5	1	0	8	37	104	180	124	109	141	189	195	191	201	262	310	280	161	139	77	72	27	21	

AM Peak Hour .... 11:00 to 12:00 (752 vehicles)
AM Peak Hour Factor 93.1%
PM Peak Hour .... 16:15 to 17:15 (1323 vehicles)
PM Peak Hour Factor 90.6%

24-Hour Moving Total

01:00- 11781	02:00- 11786	03:00- 11795	04:00- 11795	05:00- 11801	06:00- 11805	07:00- 11817	08:00- 11809
09:00- 11810	10:00- 11819	11:00- 11908	12:00- 11941	13:00- 11962	14:00- 11997	15:00- 11981	16:00- 12027
17:00- 11988	18:00- 11959	19:00- 11920	20:00- 11957	21:00- 11982	22:00- 11985	23:00- 11966	24:00- 11959

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... 15th St., E. of Clark St., WB
Location Code 2524
County .... Arlington, VA
Recorder Set 05/07/01 12:40
Recording Start ... 05/08/01 00:00
Recording End 05/10/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 17
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/01 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
12	1	3	1	5	39	74	151	162	141	73	75	93	90	105	65	73	75	68	59	34	48	28	20	1495
7	0	1	0	0	3	16	33	39	45	21	15	24	20	23	16	24	30	19	20	5	16	13	5	
2	1	0	1	1	5	18	37	38	38	22	18	27	23	28	17	22	19	17	17	14	14	3	4	
2	0	1	0	1	5	14	34	43	23	10	18	19	27	30	18	14	18	16	12	4	11	8	5	
1	0	1	0	3	26	26	47	42	35	20	24	23	20	24	14	13	8	16	10	11	7	4	6	

AM Peak Hour .... 08:15 to 09:15 (168 vehicles)
AM Peak Hour Factor 93.3%
PM Peak Hour .... 14:00 to 15:00 (105 vehicles)
PM Peak Hour Factor 87.5%

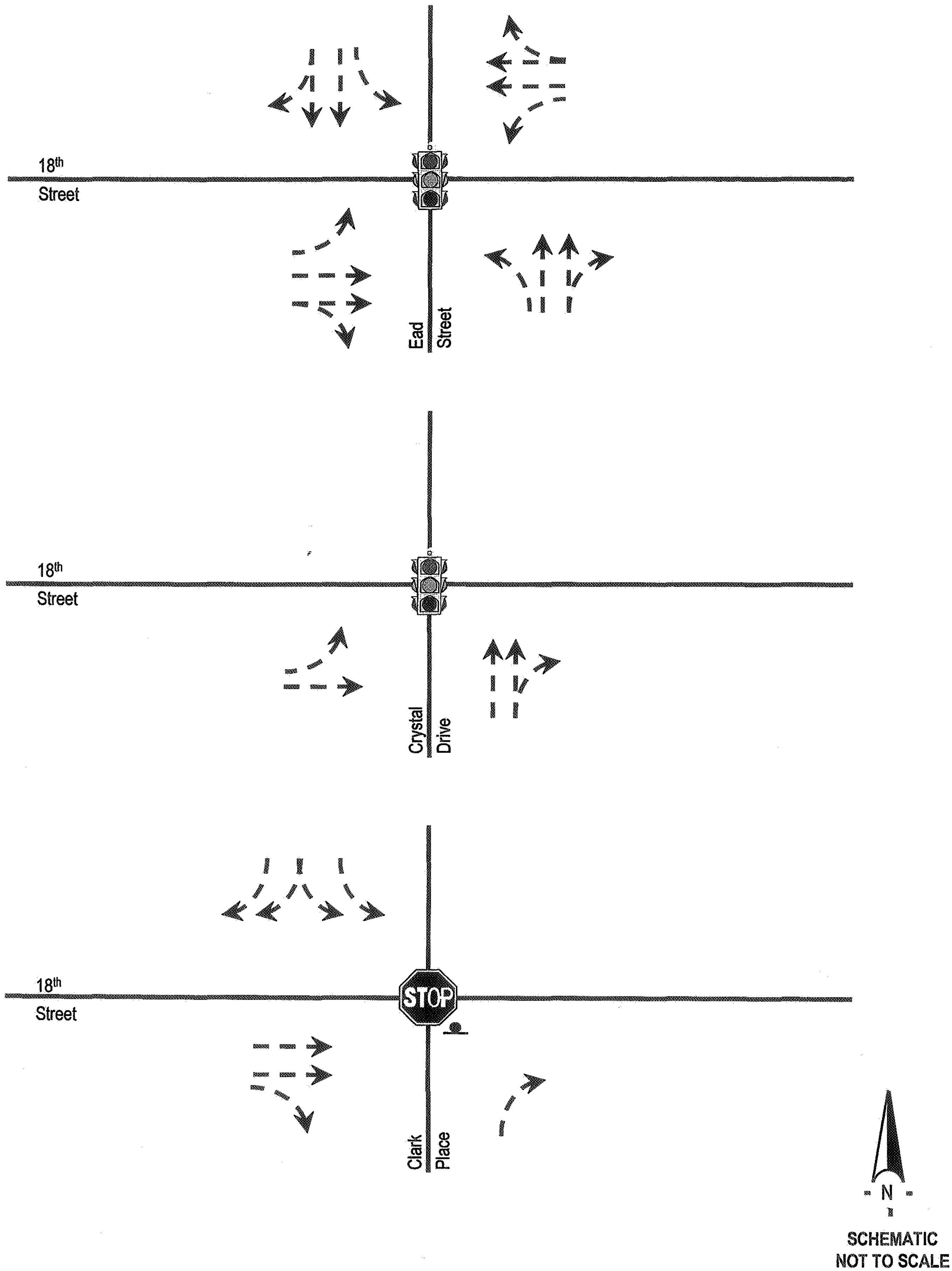
05/09/01 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
6	3	4	1	2	32	93	186	187	112	95	69	94	96	91	91	91	80	65	77	40	41	42	25	1623
3	2	0	0	0	5	18	49	63	43	31	14	19	26	26	18	19	21	16	18	6	16	9	13	
2	0	3	1	2	3	23	41	36	20	16	22	24	22	30	29	25	17	19	25	9	8	12	1	
1	0	0	0	0	8	20	53	46	29	19	19	34	29	14	25	24	24	16	14	10	7	8	5	
0	1	1	0	0	16	32	43	42	20	29	14	17	19	21	19	23	18	14	20	15	10	13	6	

AM Peak Hour .... 07:15 to 08:15 (200 vehicles)
AM Peak Hour Factor 79.4%
PM Peak Hour .... 13:30 to 14:30 (104 vehicles)
PM Peak Hour Factor 86.7%

24-Hour Moving Total

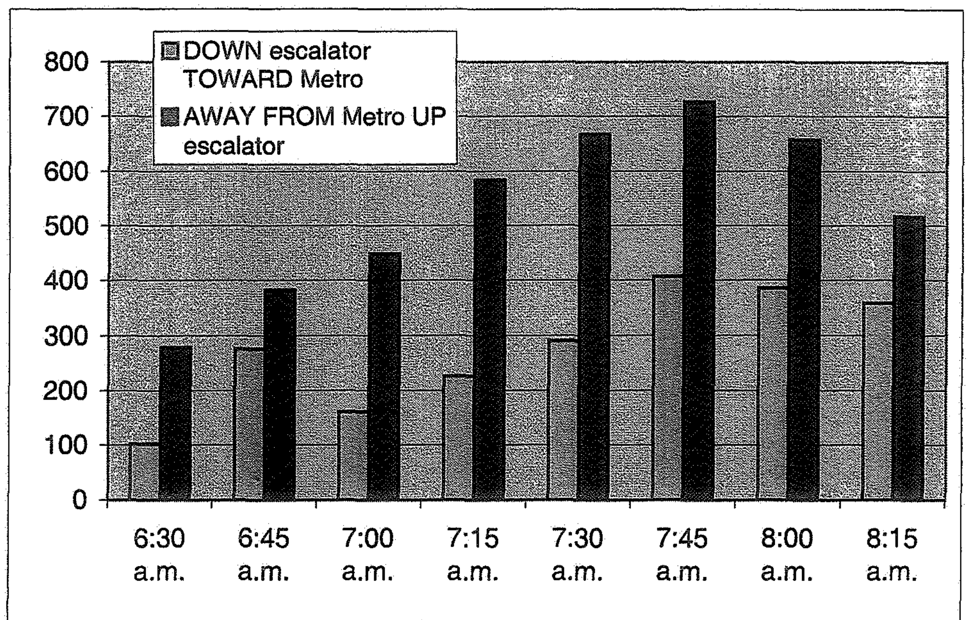
01:00-	1489	02:00-	1491	03:00-	1492	04:00-	1492	05:00-	1489	06:00-	1482	07:00-	1501	08:00-	1536
09:00-	1561	10:00-	1532	11:00-	1554	12:00-	1548	13:00-	1549	14:00-	1555	15:00-	1541	16:00-	1567
17:00-	1585	18:00-	1590	19:00-	1587	20:00-	1605	21:00-	1611	22:00-	1604	23:00-	1618	24:00-	1623

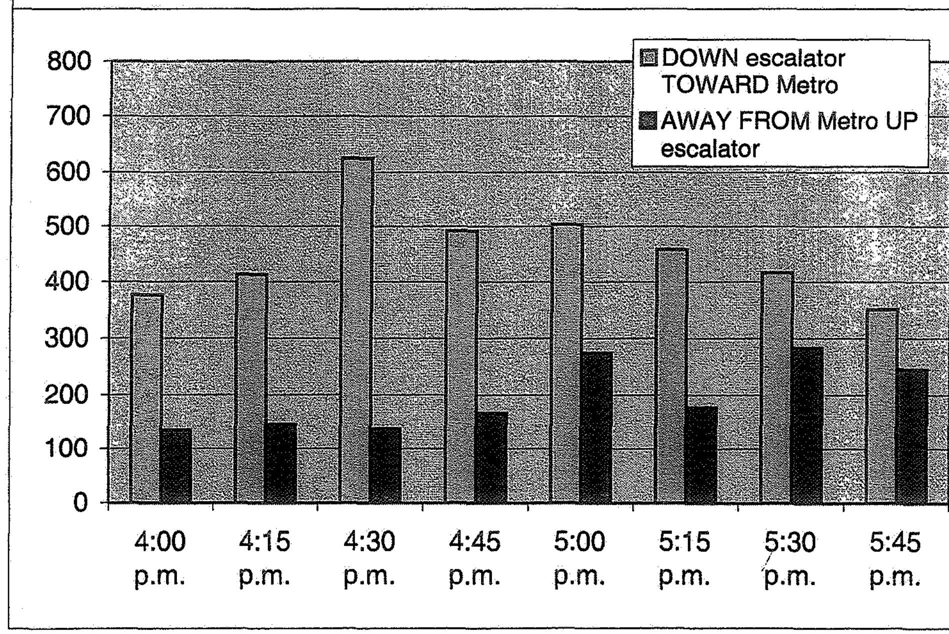


O. R. GEORGE & ASSOCIATES, INC.	Contract No.: PARSONS IAWP Counts
	LANE CONFIGURATION Crystal City Counts ARLINGTON COUNTY

Crystal City Escalator/Elevator users

			All elevator users		Elevator users with need	
	DOWN escalator TOWARD Metro	AWAY FROM Metro UP escalator	INTO elevator	OUT OF elevator	INTO elevator	OUT OF elevator
6:30 a.m.	102	280	12	0	2	0
6:45 a.m.	277	382	10	2	6	1
7:00 a.m.	161	448	12	1	6	0
7:15 a.m.	227	584	11	5	5	5
7:30 a.m.	291	668	17	0	6	0
7:45 a.m.	406	726	13	1	6	0
8:00 a.m.	385	658	15	2	6	1
8:15 a.m.	358	516	7	4	5	4
4:00 p.m.	376	135	0	21	0	5
4:15 p.m.	413	145	2	21	1	3
4:30 p.m.	625	137	3	29	1	10
4:45 p.m.	492	167	9	23	2	6
5:00 p.m.	504	274	8	21	0	1
5:15 p.m.	458	177	1	21	1	3
5:30 p.m.	417	283	1	15	0	0
5:45 p.m.	351	246	1	24	0	3





Crystal City Pedestrian Count: Crosswalk/ART

	Cross Clark Pl TOWARD Metro	Cross Clark Pl AWAY FROM Metro	BOARD ART bus	GET OFF ART bus
6:30 a.m.	12	53	1	1
6:45 a.m.	10	45	1	4
7:00 a.m.	6	66	0	1
7:15 a.m.	13	79	0	4
7:30 a.m.	12	60	0	4
7:45 a.m.	10	98	0	1
8:00 a.m.	27	77	0	0
8:15 a.m.	25	79	0	1
4:00 p.m.	129	33	0	5
4:15 p.m.	131	28	1	9
4:30 p.m.	180	23	0	5
4:45 p.m.	189	21	0	4
5:00 p.m.	206	44	0	13
5:15 p.m.	137	23	0	7
5:30 p.m.	166	32	0	2
5:45 p.m.	94	37	0	4

Crystal City Pedestrian Count: Buses, etc.

	MetroBus		ART/Fairfax Connector		Private shuttle		Taxi		Kiss & Ride	
	ENTER vehicle	EXIT vehicle	ENTER vehicle	EXIT vehicle	ENTER vehicle	EXIT vehicle	ENTER vehicle	EXIT vehicle	ENTER vehicle	EXIT vehicle
6:30 a.m.	No data recorded									
6:45 a.m.	2	0	4	2	0	2	0	1	0	10
7:00 a.m.	1	1	12	4	9	10	0	0	0	15
7:15 a.m.	0	8	4	8	0	5	0	1	0	8
7:30 a.m.	3	2	31	2	2	3	0	1	0	14
7:45 a.m.	0	0	7	0	0	4	0	0	1	9
8:00 a.m.	3	10	7	7	11	11	0	0	0	15
8:15 a.m.	4	11	8	0	0	1	0	0	0	20
4:00 p.m.	No data recorded									
4:15 p.m.	2	1	2	3	7	8	0	0	0	2
4:30 p.m.	5	0	3	3	2	6	0	0	0	1
4:45 p.m.	0	0	0	0	1	9	0	0	2	6
5:00 p.m.	10	0	3	0	9	9	0	3	3	6
5:15 p.m.	0	0	1	1	10	1	1	1	0	3
5:30 p.m.	3	1	3	1	3	2	0	0	2	4
5:45 p.m.	1	0	2	2	8	7	0	0	2	2

Pedestrian and Bicycle users of Mount Vernon Connector Multi-Use Path

	Exiting path, toward Crystal City		Entering path, away from Crystal City	
Start time	Peds	Bikes	Peds	Bikes
8:00 a.m.	3	5	4	1
8:15 a.m.	0	4	4	3
8:30 a.m.	3	2	0	4
8:45 a.m.	5	4	1	0
AM total	**11**	**15**	**9**	**8**
5:00 p.m.	5	4	6	4
5:15 p.m.	8	5	16	5
5:30 p.m.	10	4	9	5
5:45 p.m.	5	3	6	11
PM total	**28**	**16**	**37**	**25**

Notes:

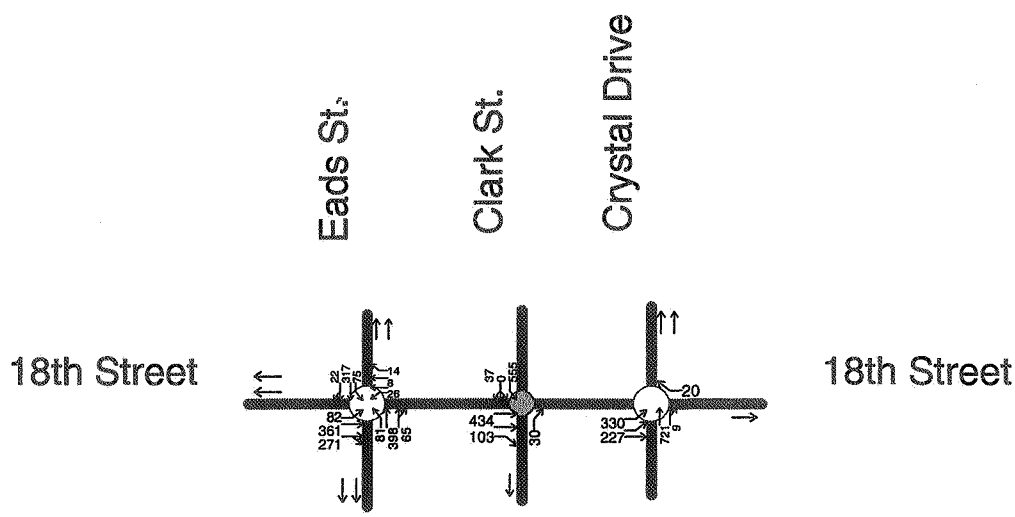
Most pedestrian users of the path are recreational (joggers, etc.).
Recreational use is much higher in the evening peak, accounting for the higher volume of peds.
There were no users of the path other than pedestrians and bicyclists.

Crystal City Traffic Analysis			
2001 Conditions			
AM & PM Peak Hours			
	Level of Service		
Intersection	AM Peak	PM Peak	Notes
18th St & Eads St.	B	B	
18th St & Clark St.	A	A	
18th St & Crystal Dr.	B	B	

Crystal City Station Access Study

Synchro Capacity Analysis Results

Existing 2001 Traffic Conditions: AM Peak Hour

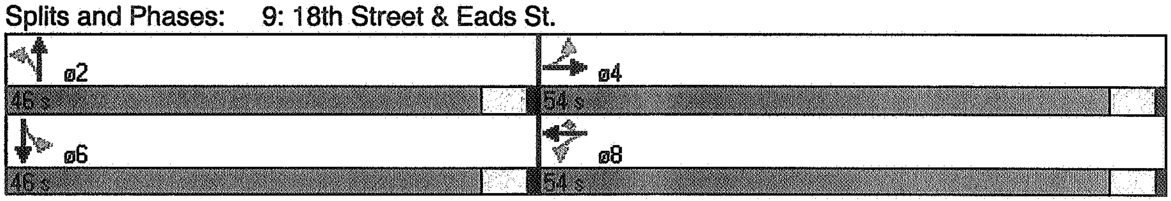

Eads St.
Clark St.
Crystal Drive
18th Street
18th Street
22
317
75
14
8
26
82
361
271
81
398
65
37
0
555
434
103
30
20
330
227
721
9

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	82	361	26	8	14	81	398	75	317
Turn Type	Perm		Perm		Perm	Perm		Perm	
Protected Phases		4		8			2		6
Permitted Phases	4		8		8	2		6	
Detector Phases	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	54.0	54.0	54.0	54.0	54.0	46.0	46.0	46.0	46.0
Total Split (%)	54%	54%	54%	54%	54%	46%	46%	46%	46%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	50.0	50.0	50.0	50.0	50.0	42.0	42.0	42.0	42.0
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.42	0.42	0.42	0.42
v/c Ratio	0.13	0.41	0.09	0.01	0.02	0.23	0.34	0.26	0.25
Uniform Delay, d1	13.3	15.7	13.1	12.6	0.0	18.6	18.7	18.9	18.3
Delay	13.6	16.0	13.7	12.6	5.9	19.3	18.9	19.8	18.5
LOS	B	B	B	B	A	B	B	B	B
Approach Delay		15.7		11.2			18.9		18.7
Approach LOS		B		B			B		B

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.41
Intersection Signal Delay: 17.3 Intersection LOS: B
Intersection Capacity Utilization 49.0% ICU Level of Service A

Splits and Phases: 9: 18th Street & Eads St.

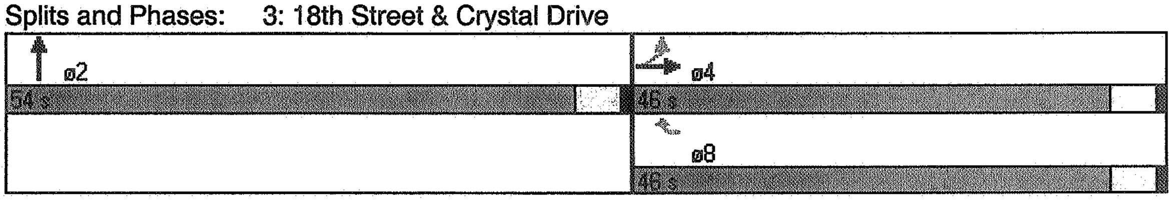


Lane Group	EBL	EBT	WBR	NBT
Lane Configurations				
Volume (vph)	330	227	20	721
Turn Type	Perm		custom	
Protected Phases		4		2
Permitted Phases	4		8	
Detector Phases	4	4	8	2
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	46.0	46.0	46.0	54.0
Total Split (%)	46%	46%	46%	54%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	Max	Max
Act Effct Green (s)	42.0	42.0	42.0	50.0
Actuated g/C Ratio	0.42	0.42	0.42	0.50
v/c Ratio	0.22	0.32	0.03	0.45
Uniform Delay, d1	4.4	19.4	0.0	16.1
Delay	3.6	17.5	0.0	16.3
LOS	A	B	A	B
Approach Delay		9.2		16.3
Approach LOS		A		B

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 14 (14%), Referenced to phase 2:NBT and 6:, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.45
Intersection Signal Delay: 13.0 Intersection LOS: B
Intersection Capacity Utilization 45.5% ICU Level of Service A

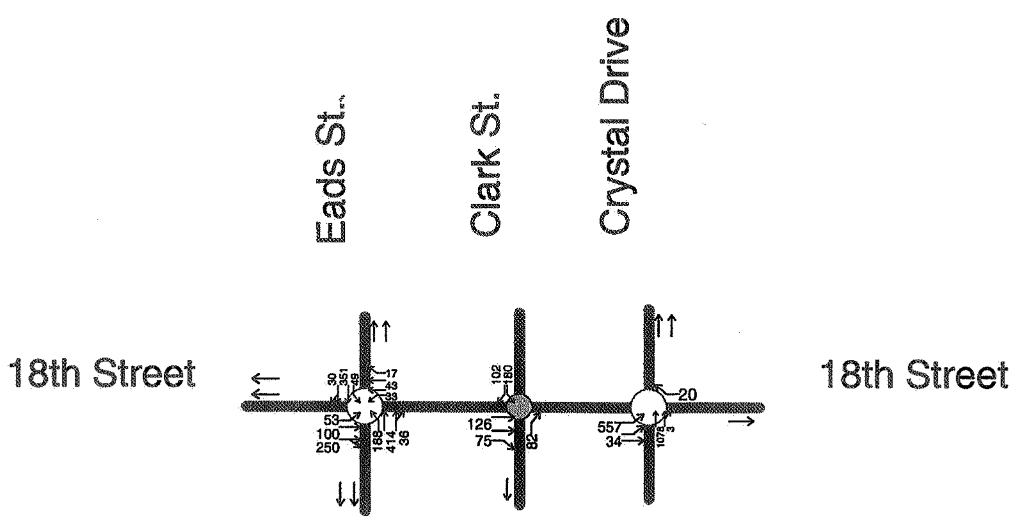
Splits and Phases: 3: 18th Street & Crystal Drive



Crystal City Station Access Study

Synchro Capacity Analysis Results

Existing 2001 Traffic Conditions: PM Peak Hour

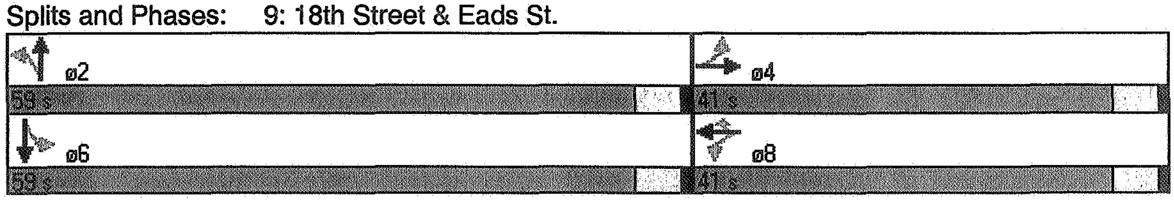

Eads St.
Clark St.
Crystal Drive
18th Street
18th Street
30
351
49
17
43
33
53
100
250
188
414
36
102
180
126
75
82
20
557
34
1078
3

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	53	100	33	43	17	188	414	49	351
Turn Type	Perm		Perm		Perm	Perm		Perm	
Protected Phases		4		8			2		6
Permitted Phases	4		8		8	2		6	
Detector Phases	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	41.0	41.0	41.0	41.0	41.0	59.0	59.0	59.0	59.0
Total Split (%)	41%	41%	41%	41%	41%	59%	59%	59%	59%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	37.0	37.0	37.0	37.0	37.0	55.0	55.0	55.0	55.0
Actuated g/C Ratio	0.37	0.37	0.37	0.37	0.37	0.55	0.55	0.55	0.55
v/c Ratio	0.12	0.33	0.11	0.04	0.03	0.41	0.25	0.12	0.22
Uniform Delay, d1	20.7	22.6	20.7	20.1	0.0	13.0	11.4	10.8	11.0
Delay	21.2	22.8	21.3	20.3	8.8	13.7	11.5	11.2	11.2
LOS	C	C	C	C	A	B	B	B	B
Approach Delay		22.6		18.6			12.2		11.2
Approach LOS		C		B			B		B

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.41
Intersection Signal Delay: 15.0 Intersection LOS: B
Intersection Capacity Utilization 44.7% ICU Level of Service A

Splits and Phases: 9: 18th Street & Eads St.

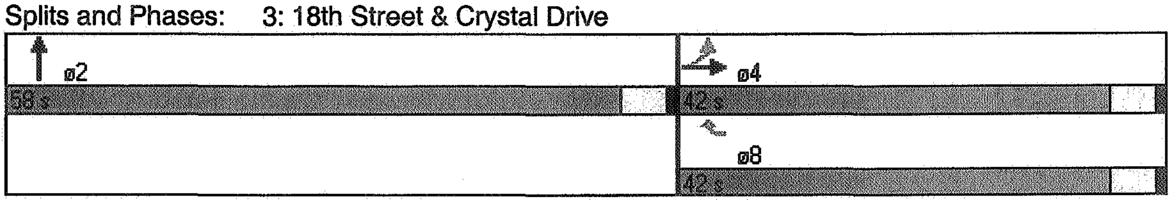


Lane Group	EBL	EBT	WBR	NBT
Lane Configurations				
Volume (vph)	557	34	20	1078
Turn Type	Perm		custom	
Protected Phases		4		2
Permitted Phases	4		8	
Detector Phases	4	4	8	2
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	42.0	42.0	42.0	58.0
Total Split (%)	42%	42%	42%	58%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	Max	Max
Act Effct Green (s)	38.0	38.0	38.0	54.0
Actuated g/C Ratio	0.38	0.38	0.38	0.54
v/c Ratio	0.46	0.05	0.03	0.61
Uniform Delay, d1	23.3	19.6	0.0	15.8
Delay	22.0	18.3	0.0	16.1
LOS	C	B	A	B
Approach Delay		21.7		16.1
Approach LOS		C		B

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 36 (36%), Referenced to phase 2:NBT and 6:, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 17.9 Intersection LOS: B
Intersection Capacity Utilization 63.1% ICU Level of Service B

Splits and Phases: 3: 18th Street & Crystal Drive



APPENDIX C

SURVEY DATA

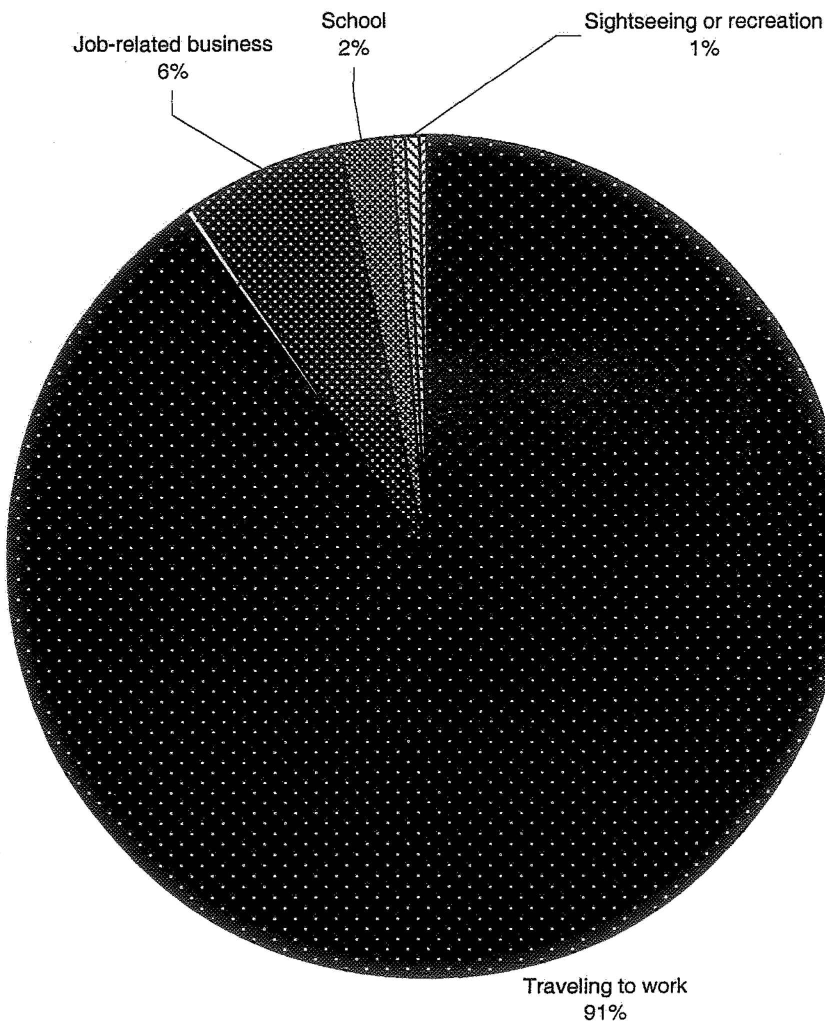
Crystal City Passenger Survey Results

	AM	PM	AM	PM
Response				
Survey Date	9/26/01	9/26/01		
Number of surveys returned	461	821		
Peak period passenger volume entering station	3421	6742		
Response rate	13.5%	12.2%		
90% Confidence Interval	4.3%	3.2%		
Transportation Mode used by Passengers to Reach the Station				
	Number of respondents		Percent of respondents	
Virginia Rail Express	50	6	10.85%	0.73%
Walk	289	619	62.69%	75.40%
Shuttle Bus	3	15	0.65%	1.83%
Bicycle	3	2	0.65%	
Taxi	1			
ART bus	1	5		0.61%
Metrobus	29	26	6.29%	3.17%
Fairfax Connector	2	19		2.31%
Dropped off by someone	31	15	6.72%	1.83%
Drove a car and parked	20	57	4.34%	6.94%
Rode with someone who parked	8	2	1.74%	
No response	24	55	5.21%	6.70%
Total Responses	**461**	**821**	**100%**	**100%**
Trip Purpose				
	Number of respondents		Percent of respondents	
Traveling to work	416	163	90.24%	19.85%
Traveling home from work	1	607		73.93%
Job-related business	28	24	6.07%	2.92%
Shopping or meal		8		0.97%
School	10	8	2.17%	0.97%
Personal trip	2	7		0.85%
Sightseeing or recreation	3	2	0.65%	
No response	1	2		
Total Responses	**461**	**821**	**100%**	**100%**

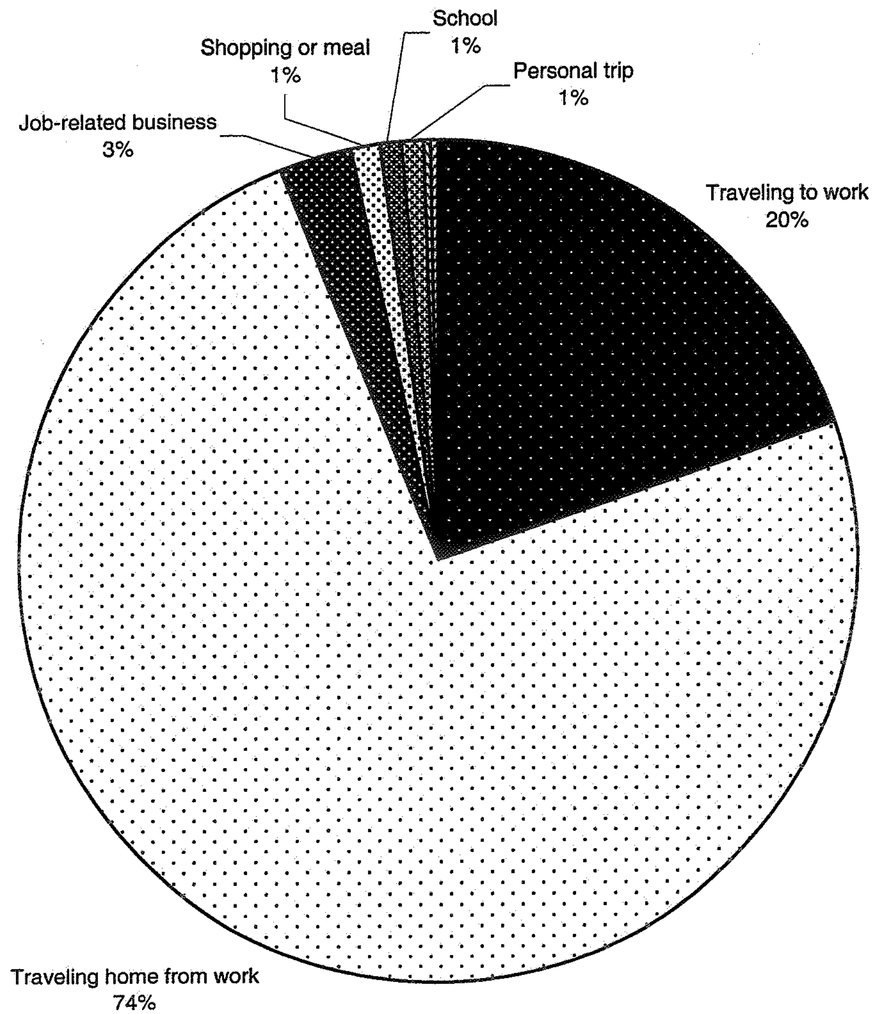
Crystal City Passenger Survey Results

	AM	PM	AM	PM
Fairfax Connector Bus Passenger Routes Used				
	Number of respondents		Percent of respondents	
40		1		5%
101	1	3	50%	16%
102		2		11%
108		1		5%
109		1		5%
110		1		5%
202		1		5%
204		1		5%
301		1		5%
304		1		5%
427		1		5%
980		2		11%
989	1		50%	
Unspecified Route		3		16%
Total Fairfax Connector	**2**	**19**	**100%**	**100%**
Metrobus Passenger Routes Used				
	Number of respondents		Percent of respondents	
4E		1		4%
4S		1		4%
7C		1		4%
7E		1		4%
7X		1		4%
8Z		1		4%
10E	2		7%	
11P	7	1	24%	4%
12S		1		4%
16		2		8%
16E	1		3%	
16W	1		3%	
17H		1		4%
17L		1		4%
18E	1		3%	
22B	1	1	3%	4%
23	2		7%	
23A	4		14%	
28C		3		12%
29		1		4%
70A	1		3%	
97	1		3%	
98O		1		4%
301		1		4%
385		1		4%
A9	1		3%	
F18		1		4%
W19	1		3%	
Omniride	1		3%	
Unspecified Route	5	5	17%	19%
Total Metrobus	**29**	**26**	**100%**	**100%**

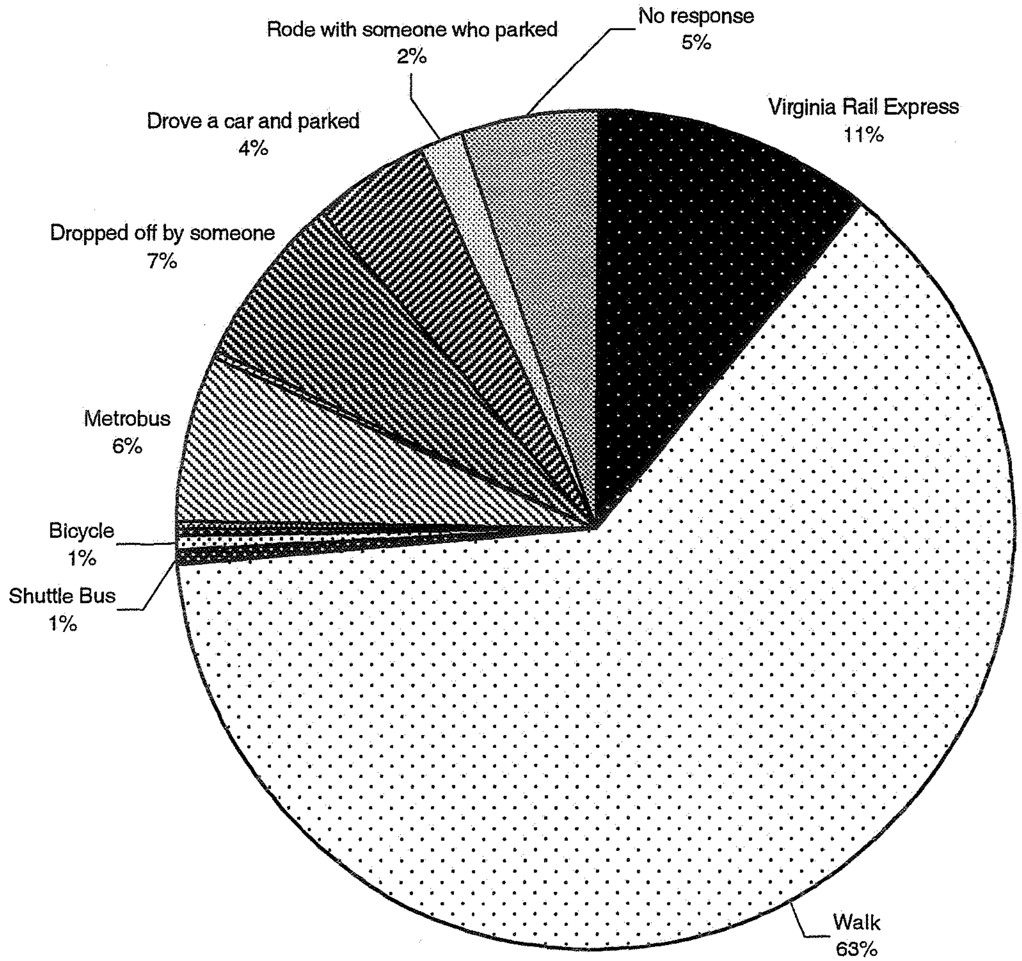
Crystal City AM Trip Purpose



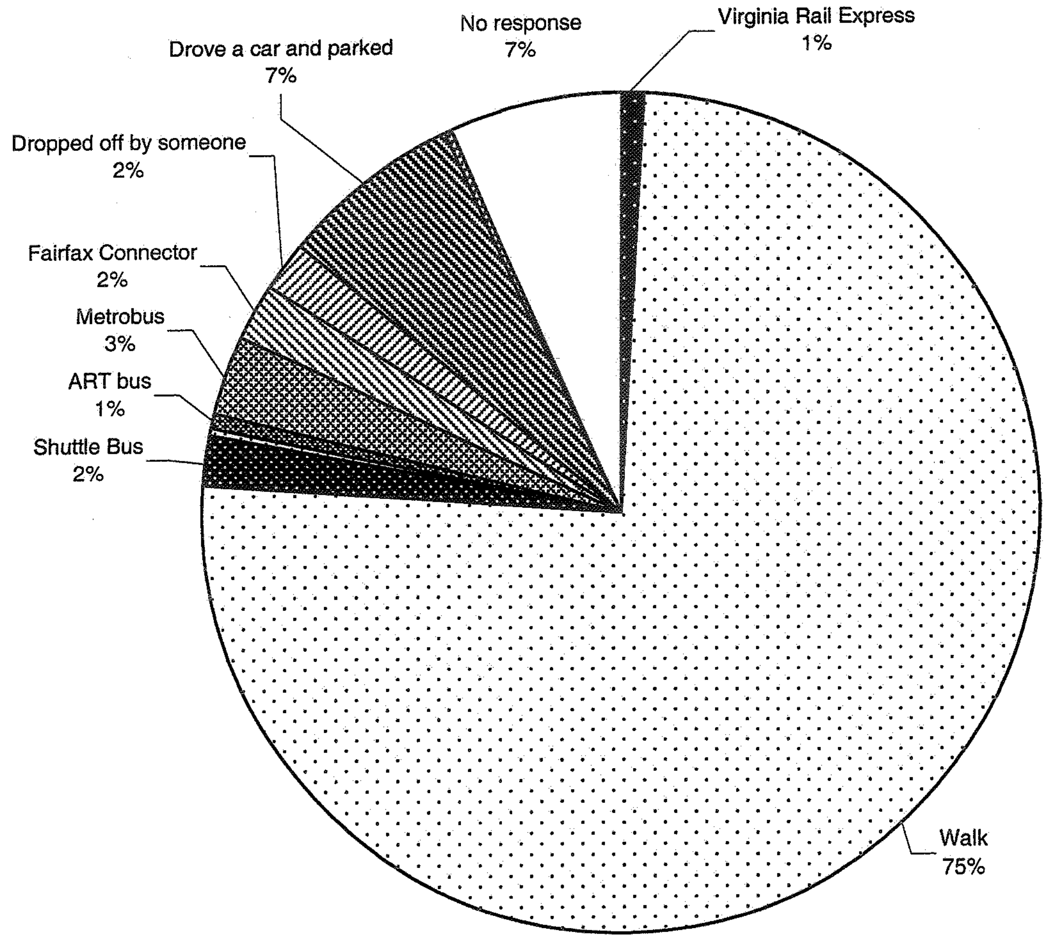
Crystal City PM Trip Purpose



Crystal City AM Mode Split



Crystal City PM Mode Split



APPENDIX D

DEVELOPMENT AND RIDERSHIP FORECAST DATA

Crystal City Metrorail Passenger Forecast

This document provides a more detailed description of the methodology for forecasting Metrorail ridership than was included in the body of the report. The number of new pedestrian Metrorail riders was computed using a two-prong method. Results from the passenger survey were compared with a previous transit mode share study to determine ridership for the Crystal City Station.

First, results of the passenger survey were examined in detail. Survey respondents who reported that they walked to the station were grouped according to which existing development marked the origin of their trip. The size of these facilities was determined from *Development in the Metro Corridors 2000.* A ratio was then established to determine the number of peak-period pedestrian Metrorail passengers per 1,000 square feet of building size. Ratios for each development type were consolidated into 1/8-mile zones by distance from the Metrorail station.

Ratios were also computed, independent of the passenger survey, using the methodology outlined in *Development-Related Ridership Survey II.* This study was conducted in 1989, but it is the most current WMATA survey devoted to estimating transit mode share. This study was used because it included a larger sample of respondents than the Crystal City passenger survey. The study's equations were used to predict transit mode share based on distance from the Metrorail station, development type, and location within the metropolitan area. These transit mode shares were converted to ratios of peak-period passengers per 1,000 square feet of building size and averaged for each of the 1/8-mile zones.

Ratios from the passenger survey and the 1989 study were then compared by zone. Generally, the values were similar for the two methods. A final ratio was selected, usually as the mean of the two individual ratios. A best-fitting line was drawn between the final ratios as a predictor of Metro ridership by distance from the station.

Direction from the station was also considered. The passenger survey did not include enough data to make specific mode share predictions by both direction and distance, and the 1989 study did not evaluate mode share as a function of direction from Metrorail stations. Instead, directional factors were assigned for passengers approaching the station from the north, south, east, and west. These factors were determined by general knowledge of the topography and transportation corridors in the vicinity of the station. For a given distance from the station, the factors account for the likelihood that passengers would use Metrorail when approaching from a certain direction.

At the Crystal City station, the Underground is a significant inducement to pedestrian use of Metrorail; as such, the directional factor for passengers from the north and south was set at 1.00. The factor was set at 1.05 for passengers from the east and 0.95 for passengers from the west. A unique value for each zone was calculated by multiplying the appropriate directional factor by the appropriate distance factor.

The table entitled "Crystal City Metro Entries, AM and PM peak periods," included in this appendix, presents the distance, directional, and zonal factors for each zone and development type.

This methodology produces a single value for pedestrian passengers approaching the station from each new development during the four-hour morning peak period and the four-hour evening peak period combined. These values were allocated to the morning versus evening peak periods using ratios from ITE's *Trip Generation*, 6th edition. Specifically, 85 percent of trips generated by office developments were assumed to enter the station during the evening peak period, while only 15 percent of these trips were assumed to enter during the morning peak period. Likewise, 73 percent of residential trips were assumed to enter the station during the morning peak period, and the remaining 27 percent were assumed to enter during the evening peak period. Retail and hotel land uses were assumed to be equally split between morning and evening peak periods.

The table entitled "Crystal City Development Summary," included in this appendix, is an expanded version of Figure 12 in the body of the report. This table documents the trip production calculations presented in the report.

The calculation of the number of new passengers that would be attracted by opening additional entrances to the Metrorail station followed a similar procedure. Passengers who would benefit from the new entrance were assigned a different zonal factor to account for the shorter walking distance to the new entrance. The new factor was computed by interpolating the reduction in walking distance between the fixed 1/8-mile zones. The number of new passengers was then calculated by subtracting the number of passengers computed using the existing zonal factors from the number of passengers computed using the new zonal factors.

	Crystal City Metro Entries, AM and PM peak periods															
	Metro riders per 1000 sf office				Metro riders per residential unit				Metro riders per hotel unit				Metro riders per 1000 sf retail			
	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis
Zone 1	0.60	0.62	0.80	0.71	0.90	0.87	0.76	0.82	0.10	0.10	0.87	0.25			1.00	1.00
Zone 2	0.51	0.49	0.65	0.57	0.51	0.66	0.70	0.68		0.08	0.73	0.20			0.85	0.85
Zone 3	0.25	0.36	0.51	0.44	0.58	0.45	0.63	0.54		0.06	0.59	0.16			0.69	0.69
Zone 4	0.39	0.23	0.36	0.30		0.24	0.57	0.40	0.03	0.03	0.45	0.11			0.52	0.52
Zone 5		0.10	0.21	0.16		0.03	0.50	0.27		0.01	0.31	0.06	No data		0.37	0.37
Zone 6		-0.03	0.07	0.02		-0.18	0.44	0.13		-0.01	0.17	0.01			0.21	0.21
Zone 7		-0.16	-0.08	0.00		-0.39	0.37	0.00		-0.04	0.03	0.00			0.04	0.04
Zone 8		-0.29	-0.22	0.00		-0.60	0.31	0.00		-0.06	-0.11	0.00			0.00	0.00
Zone 9		-0.42	-0.37	0.00		-0.81	0.24	0.00		-0.08	-0.25	0.00			0.00	0.00

	Spatial adjustments															
1.00	1.00	1.00	1.05	0.95												
	North	South	East	West	North	South	East	West	North	South	East	West	North	South	East	West
Zone 1	0.71	0.71	0.75	0.67	0.82	0.82	0.86	0.77	0.25	0.25	0.26	0.24	1.00	1.00	1.05	0.95
Zone 2	0.57	0.57	0.60	0.54	0.68	0.68	0.71	0.65	0.20	0.20	0.21	0.19	0.85	0.85	0.89	0.81
Zone 3	0.44	0.44	0.46	0.41	0.54	0.54	0.57	0.51	0.16	0.16	0.16	0.15	0.69	0.69	0.72	0.66
Zone 4	0.30	0.30	0.31	0.28	0.40	0.40	0.42	0.38	0.11	0.11	0.11	0.10	0.52	0.52	0.55	0.49
Zone 5	0.16	0.16	0.17	0.15	0.27	0.27	0.28	0.25	0.06	0.06	0.06	0.06	0.37	0.37	0.38	0.35
Zone 6	0.02	0.02	0.02	0.02	0.13	0.13	0.13	0.12	0.01	0.01	0.01	0.01	0.21	0.21	0.22	0.19
Zone 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.05	0.04
Zone 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zone 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Crystal City Development Summary

Dev. Name	No.	Project name	GLUP designation	Zoning	Year compl.	Site area, sf	Office GFA, sf	Retail GFA, sf	Res. Units	Hotel rooms
					Existing	**8,008,338**	**10,558,784**	**791,655**	**5,795**	**4,440**
					Approved	**4,531,705**	**3,239,858**	**73,956**	**1,379**	**1,852**
					2020	**900,000**	**284,720**	**178,364**	**1,175**	**450**
					Total	**13,440,043**	**14,083,362**	**1,043,975**	**8,349**	**6,742**
Approved, not built										
Airport Plaza II	CRC19.02	Hotel	High Residential/ High O-A-H	C-O	not built	144,793		5,100		630
	CRC20.02	Warwick House II	High Residential	RA-H-3.2	not built	47,304			212	
*	CRC21	C&P Sw.Ctr. (built)/rem. Not	High Residential	RA-H-3.2	sw. ctr. Built	39,365	16,626	6,656	167	
	CRC28	Hampton Inn	High Residential	RA-H-3.2	under const.	105,664				399
**	CRC29	Crystal Plaza Amendment	High Residential/ High O-A-H	C-O/RA 4.8	renovate	785,574	0			
Boundary Channel Plaza	CRC30.01	Office Bldg. 1	High-Medium Residential		not built	102,899	173,166	500		
	CRC30.02	Office Bldg. 2	High-Medium Residential		not built	102,899	170,066	1,700		
	CRC30.03	Hotel	High-Medium Residential		not built	102,899				198
Potomac Yard	CRC32.01	South A	2/3 Low O-A-H, 1/3 Med. Res.	C-O-1.5	not built	312,691	650,000	4,000		
	CRC32.02	South B	2/3 Low O-A-H, 1/3 Med. Res.	C-O-1.5	not built	191,249		10,000		625
	CRC32.03	South C	2/3 Low O-A-H, 1/3 Med. Res.	C-O-1.5	not built	580,439	1,200,000	14,000		
	CRC32.04	South D	2/3 Low O-A-H, 1/3 Med. Res.	C-O-1.5	not built	394,450	515,000	10,000	250	
	CRC32.05	South E	2/3 Low O-A-H, 1/3 Med. Res.	C-O-1.5	not built	394,450	515,000	10,000	250	
	CRC32.06	South F	2/3 Low O-A-H, 1/3 Med. Res.	C-O-1.5	not built	292,610		12,000	500	
	CRC32.07	North 1	Service Industry	M-1, M-2	not built	774,780				
	CRC32.08	North 2	Low O-A-H	M-2	not built	124,943				
	CRC32.09	North 3	Public	S-3A	not built	34,696				
Assumed to develop by 2020										
		Crystal Plaza Retail addition	(source: Arlington County Site Plan Review Subcommittee minutes, 3/13/01)				34,725	116,942		
		Crystal Mall Retail addition					24,995	41,422		
		Clark/Ball/6th/10th site				450,000	225,000	20,000	200	300
		Regional rec. facility								
		Eads/Fern/12th/15th site (Pentagon City)	(Assume trips split equally between Crystal City and Pentagon City by halving sizes.)			450,000			975	150

* Assume half planned office, retail, residential is built; half remains to be built.

** Renovation. Assume no net increase in office GFA of 120,000 sf.

										T[illegible]daily							
					Peak period metro entries per				12.01	10.70	4.62	8.23	Peak period Metro entries				
Dev. Name	No.	Project name	Parking spaces	Zone	1000 sf office	1000 sf retail	Res. unit	Hotel unit	Office	Retail	Res	Hotel	Office	Retail	Res	Hotel	Total
			28,097														
			7,924														
			0														
			36,021														
Approved, not built																	
Airport Plaza II	CRC19.02	Hotel		S5	0.16	0.37	0.27	0.06	0	0	0	5185	0	2	0	38	40
	CRC20.02	Warwick House II	225	N2	0.57	0.85	0.68	0.2	0	0	979	0	0	0	144	0	144
*	CRC21	C&P Sw.Ctr. (built)/rem. Not		N4	0.3	0.52	0.4	0.11	200	0	772	0	5	3	67	0	75
	CRC28	Hampton Inn	451	S2	0.57	0.85	0.68	0.2	0	0	0	3284	0	0	0	80	80
**	CRC29	Crystal Plaza Amendment		S2	0.57	0.85	0.68	0.2	0	0	0	0	0	0	0	0	0
Boundary Channel Plaza	CRC30.01	Office Bldg. 1	353	N7	0	0.04	0	0	2080	0	0	0	0	0	0	0	0
	CRC30.02	Office Bldg. 2	350	N7	0	0.04	0	0	2042	0	0	0	0	0	0	0	0
	CRC30.03	Hotel	139	N7	0	0.04	0	0	0	0	0	1630	0	0	0	0	0
Potomac Yard	CRC32.01	South A	970	S5	0.16	0.37	0.27	0.06	7807	0	0	0	104	1	0	0	105
	CRC32.02	South B	478	S6	0.02	0.21	0.13	0.01	0	0	0	5144	0	2	0	6	8
	CRC32.03	South C	1,818	S6	0.02	0.21	0.13	0.01	14412	0	0	0	24	3	0	0	27
	CRC32.04	South D	1,171	S7	0	0	0	0	6185	0	1155	0	0	0	0	0	0
	CRC32.05	South E	1,171	S7	0	0	0	0	6185	0	1155	0	0	0	0	0	0
	CRC32.06	South F	798	S8	0	0	0	0	0	0	2310	0	0	0	0	0	0
	CRC32.07	North 1	0	S7	0	0	0	0	0	0	0	0	0	0	0	0	0
	CRC32.08	North 2	0	S7	0	0	0	0	0	0	0	0	0	0	0	0	0
	CRC32.09	North 3	0	S7	0	0	0	0	0	0	0	0	0	0	0	0	0
Assumed to develop by 2020									0	0	0	0	0	0	0	0	0
		Crystal Plaza Retail addition		S2	0.57	0.85	0.68	0.2	417	1251	0	0	20	99	0	0	119
		Crystal Mall Retail addition		E1	0.75	1.05	0.86	0.26	300	443	0	0	19	43	0	0	62
		Clark/Ball/6th/10th site		N4	0.3	0.52	0.4	0.11	2702	0	924	2469	68	10	80	33	191
		Regional rec. facility		N8	0	0	0	0	0	0	633	0	0	0	0	0	0
		Eads/Fern/12th/15th site (Pentagon City)		N3	0.44	0.69	0.54	0.16	0	0	4505	1235	0	0	527	24	551

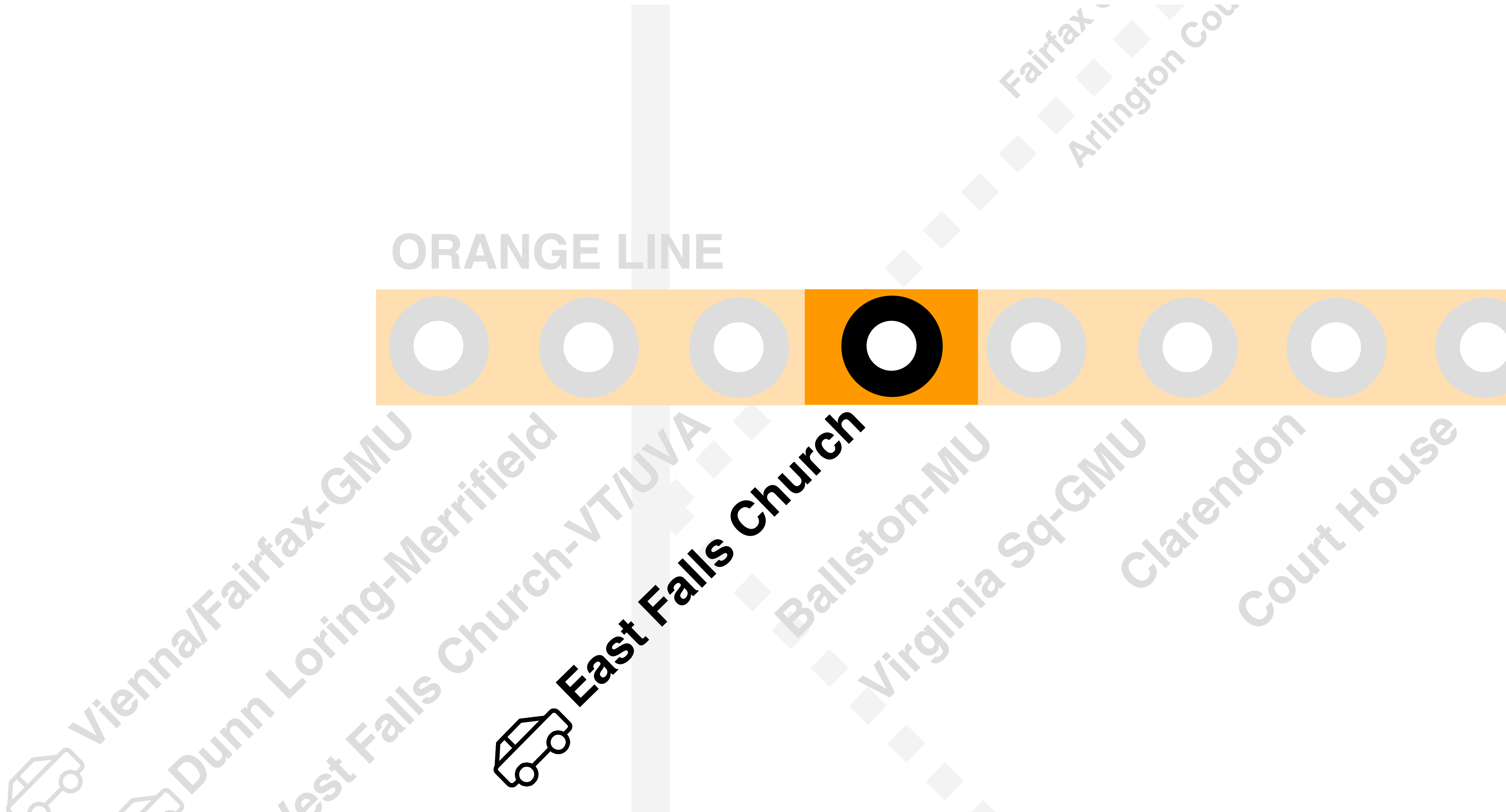
* Assume half planned office, retail, residential is built; half remains to be built.
** Renovation. Assume no net increase in office GFA of 120,000 sf.

			AM p[illegible]peric[illegible]tro [illegible]s					[illegible] pea[illegible]iod [illegible] ent[illegible]				
			0.15	0.50	0.73	0.50		0.85	0.50	0.27	0.50	
Dev. Name	No.	Project name	Office	Retail	Res	Hotel	Total AM	Office	Retail	Res	Hotel	Total PM
Approved, not built												
Airport Plaza II	CRC19.02	Hotel	0	1	0	19	20	0	1	0	19	20
	CRC20.02	Warwick House II	0	0	105	0	105	0	0	39	0	39
*	CRC21	C&P Sw.Ctr. (built)/rem. Not	1	2	49	0	51	4	2	18	0	24
	CRC28	Hampton Inn	0	0	0	40	40	0	0	0	40	40
**	CRC29	Crystal Plaza Amendment	0	0	0	0	0	0	0	0	0	0
Boundary Channel Plaza	CRC30.01	Office Bldg. 1	0	0	0	0	0	0	0	0	0	0
	CRC30.02	Office Bldg. 2	0	0	0	0	0	0	0	0	0	0
	CRC30.03	Hotel	0	0	0	0	0	0	0	0	0	0
Potomac Yard	CRC32.01	South A	16	1	0	0	16	88	1	0	0	89
	CRC32.02	South B	0	1	0	3	4	0	1	0	3	4
	CRC32.03	South C	4	1	0	0	5	20	1	0	0	22
	CRC32.04	South D	0	0	0	0	0	0	0	0	0	0
	CRC32.05	South E	0	0	0	0	0	0	0	0	0	0
	CRC32.06	South F	0	0	0	0	0	0	0	0	0	0
	CRC32.07	North 1	0	0	0	0	0	0	0	0	0	0
	CRC32.08	North 2	0	0	0	0	0	0	0	0	0	0
	CRC32.09	North 3	0	0	0	0	0	0	0	0	0	0
Assumed to develop by 2020			0	0	0	0	0	0	0	0	0	0
		Crystal Plaza Retail addition	3	50	0	0	53	17	50	0	0	67
		Crystal Mall Retail addition	3	22	0	0	25	16	22	0	0	38
		Clark/Ball/6th/10th site	10	5	58	17	90	57	5	22	17	101
		Regional rec. facility	0	0	0	0	0	0	0	0	0	0
		Eads/Fern/12th/15th site (Pentagon City)	0	0	384	12	396	0	0	142	12	154

* Assume half planned office, retail, residential is built; half remains to be built.

** Renovation. Assume no net increase in office GFA of 120,000 sf.

EAST FALLS CHURCH METRORAIL STATION ACCESS STUDY



Prepared for Arlington County, Virginia
by
Washington Metropolitan Area Transit Authority
Department of Capital Projects Management
April 2002

EAST FALLS CHURCH METRORAIL STATION ACCESS STUDY

Contents

Figures

Note: This report has been prepared to demonstrate the feasibility of the concept presented. The concept is subject to further refinement and may be revised during future planning and/or engineering design phases of the project. The environmental planning process may include one or more of these alternatives along with others prior to any decision regarding implementation of a specific plan, which will be subject to professional engineering design principles.

EAST FALLS CHURCH METRORAIL STATION ACCESS STUDY

Introduction

The East Falls Church Metrorail station is located in western Arlington County, Virginia and serves the surrounding neighborhoods of mostly low-density residential land use. Despite the station's name, it is not located in the City of Falls Church, but rather in Arlington County. The station serves Orange Line trains on the Metrorail system operated by the Washington Metropolitan Area Transit Authority (WMATA). Figure 1 is an aerial photograph of the station area.

This Metrorail Station Access Study was conducted for WMATA and Arlington County, with two goals:

- Identify and evaluate potential access improvements to the station, to generally maximize the attractiveness of Metrorail as a service to the western portion of Arlington County.
- Evaluate the traffic impacts of possible development in the vicinity of the station.

Coincident with this study, the area's Neighborhood Conservation Plan is in the process of being updated. Information from this study is also intended to help guide decisions about updates to the Conservation Plan.

Existing Conditions

Transportation Facilities

The Metrorail Orange Line runs in the median of Interstate 66 as it passes through the East Falls Church station. Interstate 66 is a primary east-west transportation corridor for the area, although unlike most freeways on the Interstate system, I-66 is closed to truck traffic. The freeway's high-occupancy vehicle (HOV) restrictions are also uncommon. During the morning peak, eastbound travel lanes (toward downtown Washington) are restricted to exclusively HOV traffic. Likewise, during the afternoon peak, westbound lanes (away from downtown Washington) are restricted to exclusively HOVs.

Figure 1: Aerial photograph of East Falls Church Metrorail Station and vicinity

EAST FALLS CHURCH METRORAIL STATION ACCESS STUDY

Sycamore Street is a north-south arterial street that passes under I-66 and beneath the East Falls Church station platform. Sycamore has two lanes in each direction and includes a half-diamond interchange (to the east) with I-66. South of the station area, Sycamore Street's name changes to Roosevelt Street.

Washington Boulevard is an east-west arterial street that intersects Sycamore Street just north of the Metrorail station. Washington has two lanes in each direction west of Sycamore, but narrows to one lane in each direction east of Sycamore. In this eastern portion, Washington takes on the character of a collector street as it passes through residential neighborhoods.

West of Sycamore, eastbound and westbound Washington split. Westbound traffic stays on the north side of I-66, while eastbound traffic crosses the freeway on a curved, one-way overpass. Further west, westbound Washington Boulevard changes its name to Westmoreland Street, and eastbound Washington changes its name to Fairfax Drive. These one-way streets serve as a half-diamond I-66 interchange to the west, complementing the Sycamore interchange.

A map of the transportation facilities in the vicinity of the station is shown in Figure 2.

Figure 2: Schematic diagram of East Falls Church Metrorail station and vicinity

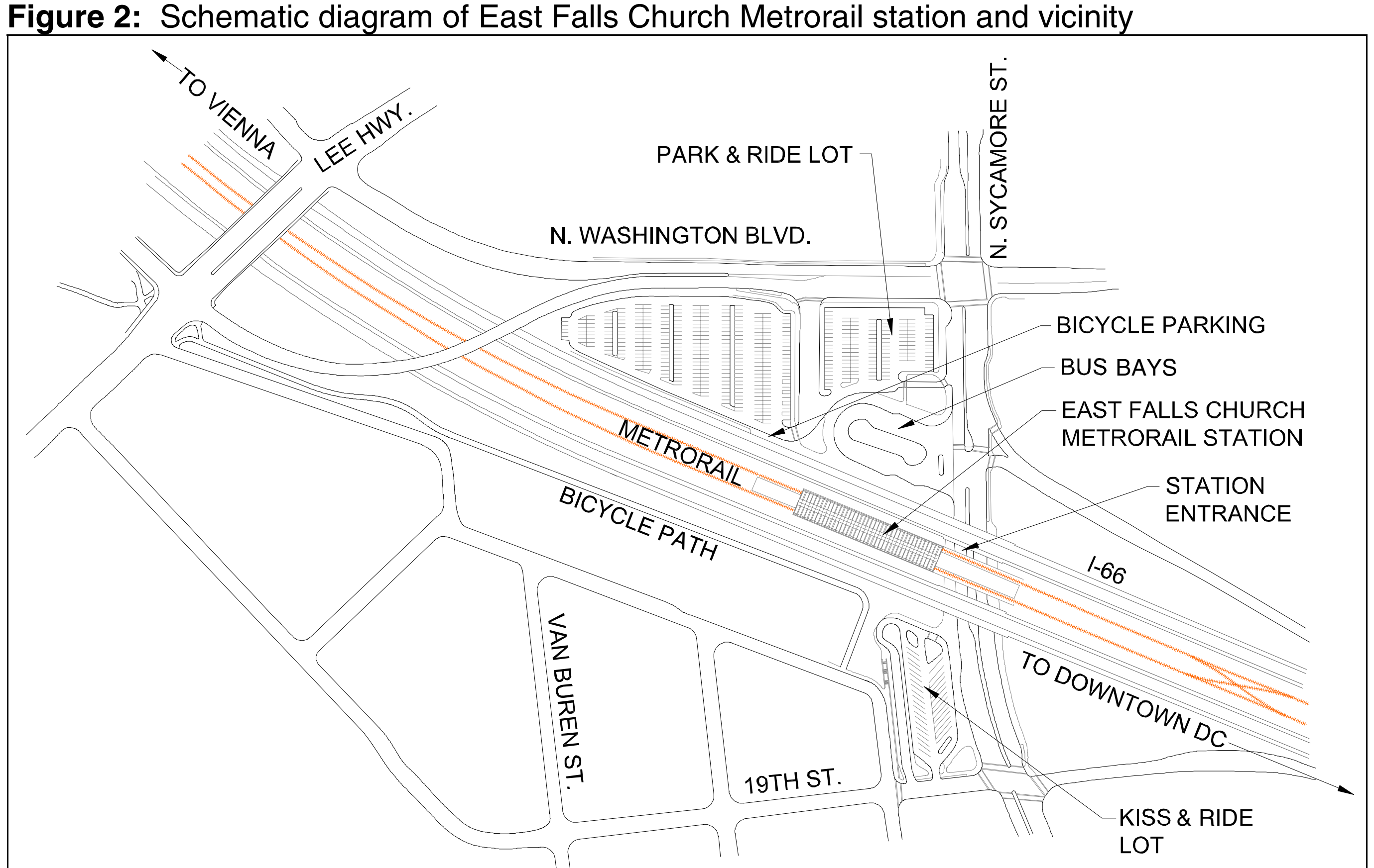
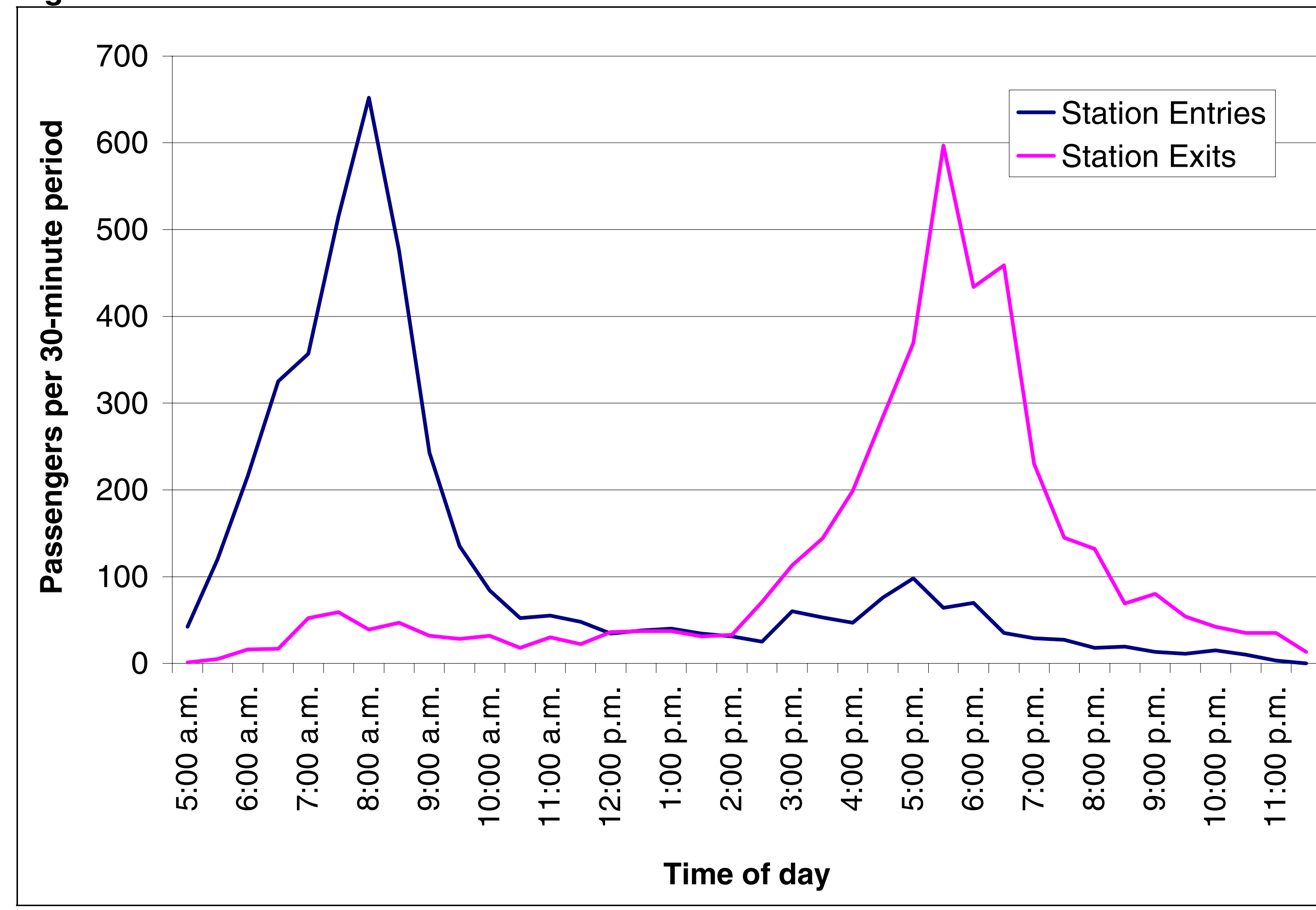


Figure 3: East Falls Church customer entries and exits in 30-minute intervals



Source: WMATA, Faregate data, September 19, 2001

The East Falls Church station averages about 4,100 customers per day, which means that about 4,100 customers enter the system at the station and about the same number exit the system at the station. Of the 83 stations in the Metrorail system, East Falls Church ranks 57th for daily ridership. Customer traffic is highly directional at East Falls Church, with large numbers of customers entering the station in the morning and large numbers exiting in the evening. Figure 3 shows customer entries and exits in half-hour intervals.

The station is a stop on five Metrobus routes that together account for 25 buses per hour during morning and afternoon peak periods, and nearly 300 buses per day. Buses serve the station from an appropriately sized bus transfer facility just north of the station entrance.

The station property also includes a kiss & ride lot south of the station with approximately 50 parking spaces, and a park & ride lot north of the station with approximately 425 spaces.

The size of the kiss & ride lot appears to be appropriate for its current usage. The lot rarely fills completely even during peak periods, and queuing is much less likely to be a problem than at other stations. However, demand for the park & ride lot exceeds the number of spaces available. The lot fills by 7:00 a.m. on a typical weekday, well before the peak hour of the adjacent roadway network.

North of Washington Boulevard, across the street from the park & ride lot entrance, lies a private parking lot known as the Palmer Lot. The lot has capacity for approximately 60 vehicles. Vehicles typically do not begin to use the Palmer Lot until the Metrorail park & ride lot fills.

Traffic and Pedestrian Studies

As part of the study, vehicle and pedestrian travel patterns were documented through several different types of studies.

Twenty-four hour directional volume traffic counts were conducted at the following locations:

- Washington Boulevard east of North Sycamore Street

Figure 4: Survey card distributed to customers entering the station

ARLINGTON METRO STATION SURVEY

Please take a few moments to help plan for your transit needs by completing this survey and dropping it in any mailbox. No postage is required. Thank you.

A. How did you get to the Metrorail station where you received this card?

1 ☐ VRE
2 ☐ Walk
3 ☐ Shuttle bus
4 ☐ Bicycle
5 ☐ Tour bus
6 ☐ Taxi
7 ☐ ART bus
8 ☐ Metrobus (Route: ______)
9 ☐ Fairfax Connector (Route: ____)
10 ☐ Dropped off by someone
11 ☐ Drove a car and parked
12 ☐ Rode with someone who parked

B. What is the purpose of your Metrorail trip today?

metro

1 ☐ Traveling to work
2 ☐ Traveling home from work
3 ☐ Job-related business
4 ☐ Shopping or meal
5 ☐ School
6 ☐ Personal trip
7 ☐ Sightseeing or recreation

C. Where did you start your trip to the Metrorail station today?

Address ______________________

OR Street & block no. ______________________

OR Nearest intersection ______________________

OR Building name ______________________

- Washington Boulevard west of North Sycamore Street
- North Sycamore Street north of Washington Boulevard
- North Sycamore Street south of Washington Boulevard
- North Roosevelt Street south of 19th Street
- Van Buren Street south of 19th Street

Manual turning movement counts were conducted at the following intersections during morning and afternoon peak periods:

- North Sycamore Street and Washington Boulevard
- North Sycamore Street and 19th Street
- North Sycamore Street and the I-66 westbound off-ramp

Detailed capacity analysis was conducted at these three intersections, following procedures outlined in the *Highway Capacity Manual.* This analysis shows that traffic conditions at these intersections are fair during the morning peak period. The left-turn movement from northbound Sycamore Street to Washington Boulevard operates under constrained conditions.

The analysis also shows that afternoon peak-period traffic conditions are slightly better than those in the morning peak. In the afternoon, the heavy turning movement is a right turn from eastbound Washington Boulevard to Sycamore Street; the right turn does not contribute to congestion to the same degree as the congested morning-peak left turn.

The following counts of customers who reach the station using nonmotorized transportation were conducted during morning and afternoon peak periods:

- Pedestrians crossing at the intersection of North Sycamore Street and Washington Boulevard
- Pedestrians crossing at the intersection of North Sycamore Street and 19th Street
- Pedestrians entering and exiting the station from the west-side station access
- Bicycles and other users on the Washington and Old Dominion (W&OD) multi-use path where it crosses 19th Street.
- Bicycles locked in the immediate vicinity of the Metrorail station
- Customers transferring between Metrorail and Metrobus, taxis, and auto drop-offs, distinguishing mobility-impaired customers.

Customer Survey

In an effort to learn about customers' travel patterns, a customer survey was conducted at the East Falls Church station on September 19, 2001. All customers entering the station that day from 6:30 to 8:30 a.m. and 4:00 to 6:00 p.m. were offered a survey card, which asked several questions about customers' trips to the station. The survey card is shown in Figure 4. The

Figure 5: Respondents' transportation modes. (Rounding may affect sums.)

Transportation Mode	*Morning Peak*		*Evening Peak*	
	Percent of respondents	*Number of customers**	*Percent of respondents*	*Number of customers**
Walk	36	1047	22	110
Shuttle Bus	3	87	2	12
Bicycle	3	77	5	25
Metrobus	15	446	20	98
Dropped off by someone	20	582	17	86
Drove and parked	22	640	29	147
Rode with someone who parked	1	19	0	0
No response	1	39	5	25
Total	**100**	**2946**	**100**	**503**

* Calculated by applying the survey results to the total number of customers entering the station during morning (5:30 to 9:30 a.m.) and evening (3:00 to 7:00 p.m.) peak periods.

Figure 6: Respondents' trip purposes. (Rounding may affect sums.)

Trip Purpose	*Morning Peak*		*Evening Peak*	
	Percent of respondents	*Number of customers**	*Percent of respondents*	*Number of customers**
Traveling to work	95	2801	15	74
Traveling home from work	0	0	37	184
School	1	29	15	74
Job-related business	1	29	5	25
Shopping or meal	0	0	7	37
Personal trip	2	48	15	74
Sightseeing or recreation	0	0	7	37
No response	1	19	0	0
Total	**100**	**2946**	**100**	**503**

* Calculated by applying the survey results to the total number of customers entering the station during morning (5:30 to 9:30 a.m.) and evening (3:00 to 7:00 p.m.) peak periods.

survey posed questions about mode of travel to the station, trip purpose, and origin of the trip to the station.

Customers exiting the station were not surveyed; it was assumed that customers entering the station during the morning peak would likely exit the station during the evening peak, and vice-versa.

Of customers who received survey cards in the morning, 304 filled out and returned the cards. This represents a 10 percent sample of the total morning peak station volume of 2,950 customers.

This response rate results in a confidence interval of 6 percentage points at the 95 percent confidence level. Based on the results of the survey, one can be 95 percent confident that the percentages from the morning survey are within 6 percentage points of their true values. This level of confidence is sufficient for analysis.

Of customers who received survey cards in the evening, only 41 filled out and returned the cards. Few customers enter the station during the evening peak period—about 560—but the response rate of 7 percent was lower than that of the morning peak.

Because of the lower customer volumes during the evening peak, the evening survey did not produce a high level of statistical confidence. At the 95 percent confidence level, the confidence interval is 15 percentage points. One can be 95 percent confident that the percentages from the evening survey are within 15 percentage points of their true values. Because of the low confidence level, the analysis was based on results from the morning peak survey. Evening peak survey results are shown for information purposes only.

Customer Patterns

The data collection efforts revealed numerous patterns about customers' trips to and from the station.

The first question on the survey asked customers about the mode of transportation they used to arrive at the station. In both the morning and evening periods, survey results indicated that four modes of travel—walking, driving and parking, being dropped off, and riding Metrobus—accounted for over 90 percent of respondents' trips. Other modes, such as carpooling and bicycling, produced negligible responses. Detailed results of this question are shown in Figure 5.

Figure 7: Origins of morning-peak pedestrian trips to the East Falls Church station

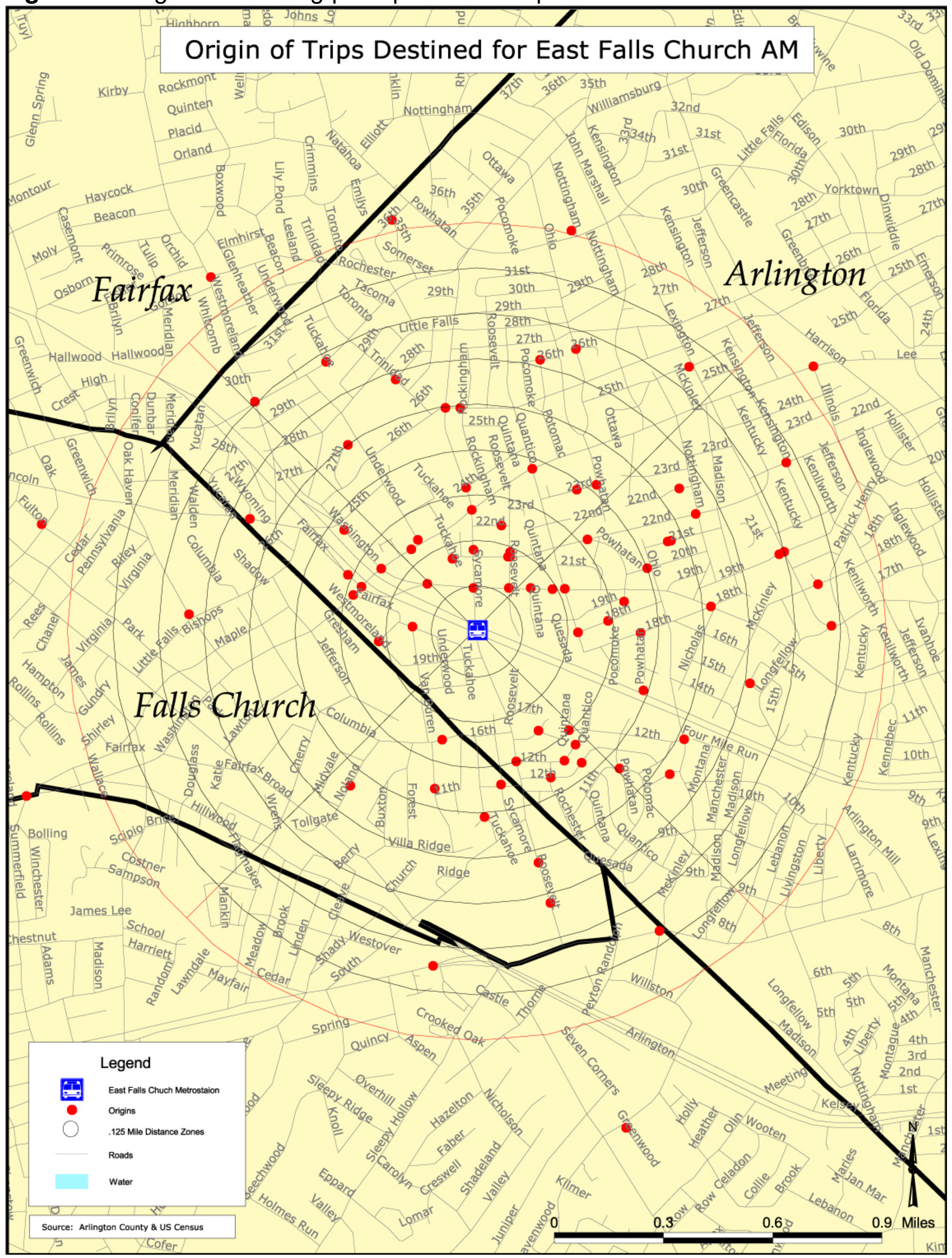


Figure 8: Origins of Morning Peak Walking Trips. Pedestrians whose morning-peak trips to the station originate from each of the zones shown in Figure 7. (Rounding may affect sums.)

Distance from station	*Percent of respondents*					*Number of customers**				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	1	0	0	0	**1**	10	0	0	0	**10**
1/8 to 1/4 mile	7	0	2	3	**12**	71	0	20	30	**122**
1/4 to 3/8 mile	10	3	0	7	**19**	102	30	0	71	**203**
3/8 to 1/2 mile	6	8	6	2	**21**	61	82	61	20	**224**
1/2 to 5/8 mile	3	2	3	0	**8**	30	20	30	0	**82**
5/8 to 3/4 mile	2	5	5	1	**13**	20	51	51	10	**132**
3/4 to 7/8 mile	3	1	3	1	**8**	30	10	30	10	**82**
7/8 to 1 mile	4	2	3	0	**9**	41	20	30	0	**91**
1 to 1-1/8 miles	0	0	0	0	**0**	0	0	0	0	**0**
Over 1-1/8 miles	4	2	1	3	**10**	41	20	10	30	**102**
Total	**39**	**22**	**22**	**16**	**100**	**406**	**233**	**233**	**173**	**1047**

* Calculated by applying the survey results to the number of customers who walk to the station during the morning peak period (5:30 to 9:30 a.m.), as determined in Figure 4.

The second question on the survey asked about customers' trip purpose. Here, a clear differentiation exists between morning and evening periods. In the morning period, 95 percent of respondents were traveling to work, with other trip purposes garnering negligible responses. However, in the evening, trips were well distributed among several purposes, including trips both from work to home and home to work, personal trips, and trips to and from school. Figure 6 shows detailed results of this question.

Finally, the third question on the survey asked customers where they began their trips to the Metrorail station. Customers were given the option to respond with a specific street address, a street and block number, the nearest intersection, or a building name. Although results are available to this question from all respondents, respondents who walk to the station are particularly important for planning pedestrian improvements.

In the morning peak period, 103 respondents (36 percent) indicated that they walk to the station. Figure 7 shows in map form the origins of these pedestrian customers' trips to the station. The trips are summarized by distance and direction in Figure 8.

Analyzing the results by distance shows that over 50 percent of pedestrians walk less than a half-mile to reach the Metrorail station, and that over 90 percent walk less than one mile. From a directional standpoint, the results show that the majority of customers arrive from the north of the station, and few customers arrive from the west of the station. Very few pedestrians arrive at the station from the southwest.

In the evening peak period, only eight survey respondents indicated that they walk to the station, too few for statistically significant judgments.

Park & Ride Patterns

On October 11, 2001, license plate numbers were collected from all vehicles in the park & ride lot, the long-term section of the kiss & ride lot, and the private Palmer Lot. These plate numbers were forwarded to the Virginia Department of Motor Vehicles (DMV), which provided the addresses of the registered owners of the vehicles. The addresses were grouped geographically to determine the origins of park & ride customers.

This technique cannot produce a perfect representation of trip origins, because vehicle trips do

Figure 9: Origins of park & ride trips to the station

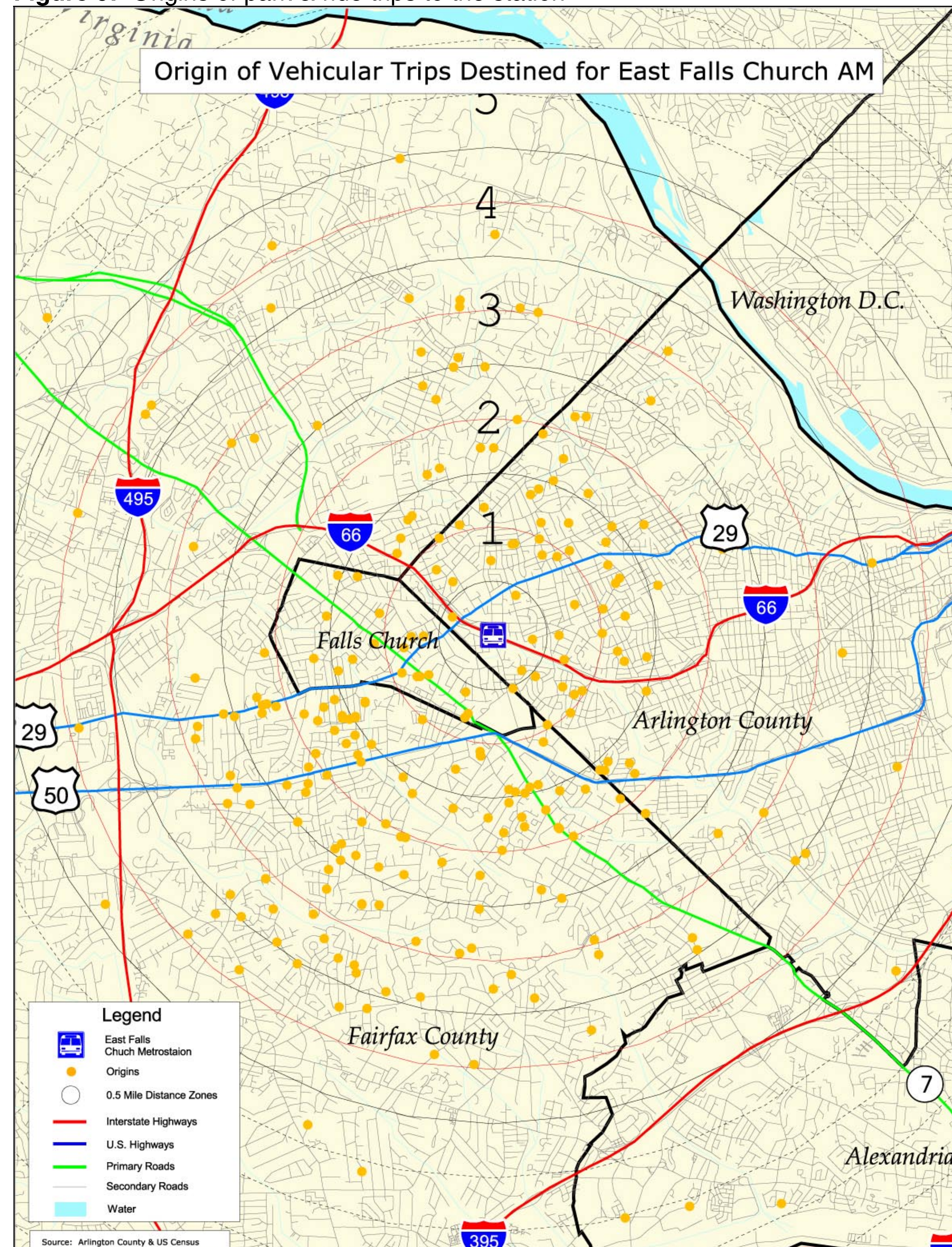


Figure 10: Origins of Park & Ride Trips. Park & ride customers whose trips to the station originate from zones shown in Figure 9. (Rounding may affect sums.)

Distance from station	***Percent of responses by direction***					***Number of vehicles by direction****				
	North	***South***	***East***	***West***	***Total***	***North***	***South***	***East***	***West***	***Total***
0 to ½ mile	0	0	0	0	**1**	1	1	1	1	**6**
½ to 1 mile	2	1	3	3	**9**	12	7	15	13	**47**
1 to 1½ miles	4	4	4	3	**15**	18	19	22	16	**75**
1½ to 2 miles	2	6	1	6	**16**	12	29	7	32	**81**
2 to 2½ miles	2	4	0	4	**11**	9	21	1	22	**53**
2½ to 3 miles	1	4	1	3	**9**	7	18	3	16	**44**
3 to 3½ miles	2	5	1	0	**8**	9	25	6	1	**41**
3½ to 4 miles	1	2	1	2	**6**	3	12	4	10	**29**
4 to 4½ miles	1	0	0	0	**1**	3	0	1	1	**6**
4½ to 5 miles	0	1	1	0	**1**	0	3	3	0	**6**
Over 5 miles	2	5	0	16	**23**	9	23	1	79	**113**
Total	**16**	**32**	**13**	**39**	**100**	**82**	**158**	**66**	**194**	**500**

* Calculated by applying license-plate study results to parking capacity: 422 spaces in the park & ride lot, approximately 60 spaces in the Palmer Lot, and 15 spaces in the long-term section of the kiss & ride lot, rounded to a total of 500 spaces.

not necessarily begin from the address of the registered owner of a vehicle. However, this approach indicates the general distribution of parked vehicles.

Of the 409 license plates collected, the DMV was able to provide addresses for 350 registered owners, or 86 percent. Seven of these addresses were post-office boxes and were excluded from the analysis, which left 343 addresses for study. Figure 9 shows the geographic distribution of these addresses; Figure 10 shows the addresses grouped by distance and direction from the East Falls Church Metrorail station.

The park & ride facilities at East Falls Church primarily serve customers who live north, south and west of the station. Arlington residents comprise only 22 percent of park & ride customers. Customer distribution by jurisdiction is shown in Figure 11.

The results show a wide distribution in trip lengths for park & ride customers. Over 50 percent of customers drive less than 2½ miles to the station, but nearly 25 percent drive over 5 miles.

Most park & ride customers' trips begin north or south of the station. Since the Orange Line runs east-west in this area, customers far east or far west of East Falls Church can use a closer station. A few customers bypass a closer station to park at East Falls Church, perhaps because their trips include intermediate stops, such as picking up carpoolers or dropping off children at school or day care.

Most Orange Line customers travel eastbound in the morning, so it is not surprising that more park & ride customers come from west of the station than from east of the station. Park & ride customers coming from the east are backtracking—their trips may be shortened by using a station further east, such as Ballston.

Figure 11: Distribution of park & ride customers by ZIP code and jurisdiction. (Rounding may affect sums.)

		From ZIP code or area		*From jurisdiction*	
Jurisdiction	***ZIP code or area****	***Percent of vehicles***	***Number of vehicles*****	***Percent of vehicles***	***Number of vehicles*****
Arlington County	22205 (West Arlington)	8	38	22	112
	22207 (North Arlington)	8	39		
	22213 (Far west Arlington)	2	9		
	Elsewhere in Arlington	5	26		
City of Falls Church	22046	8	42	8	42
Fairfax County (including independent communities Fairfax City, Herndon, and Vienna)	22203 (Annandale area)	6	31	57	285
	22041 (Bailey's Crossroads area)	4	22		
	22042 (southeast of Falls Church)	19	96		
	22044 (southwest of Falls Church)	7	35		
	22101 (McLean area)	6	28		
	22043 (northwest of Falls Church)	2	12		
	Vienna, Fairfax areas	3	15		
	Tysons Corner, Great Falls areas	2	12		
	Reston, Herndon areas	4	20		
	Centreville, Chantilly, Clifton areas	1	7		
	Springfield, Burke areas	2	9		
Alexandria area		2	10	2	10
Loudoun County		6	28	6	28
Prince William County		1	3	1	3
Maryland suburbs		1	3	1	3
Outside Washington, D.C. metropolitan area		3	17	3	17
	Total	**100**	**500**	**100**	**500**

* Results are accurate for ZIP codes but approximate for jurisdictions. ZIP code boundaries do not always correspond with jurisdictional boundaries.

** Calculated by applying license-plate study results to parking capacity: 422 spaces in the park & ride lot, approximately 60 spaces in the Palmer Lot, and 15 spaces in the long-term section of the kiss & ride lot, rounded to a total of 500 spaces.

Community Involvement

Meetings were held with residents surrounding the Metrorail station to allow the community to be involved in the planning process. A meeting was held on June 20, 2001 to solicit suggestions for station-area improvements from residents. On December 6, 2001, recommended station improvements were presented to residents and further comments were solicited.

Several suggestions for improvements were evaluated to determine whether they would be appropriate for implementation at the station. The evaluation showed that some suggestions would not have appreciably improved station accessibility. The more significant of these suggestions include the following:

- It was suggested to move the entrance to the kiss & ride lot from 19th Street to Sycamore Street, with the goal of reducing traffic impacts on 19th Street. This change would be infeasible. The distance between the proposed kiss & ride lot entrance and the existing 19th Street intersection would be far too short to allow effective operation of the traffic signals. Northbound and southbound left-turns would interlock, causing poor operation. In addition, there is a grade difference between Sycamore Street and the north end of the kiss & ride lot, with the difference increasing further north. This grade difference makes it infeasible to relocate the entrance to the north end of the kiss & ride lot, where the distance from the 19th Street intersection would be the greatest.

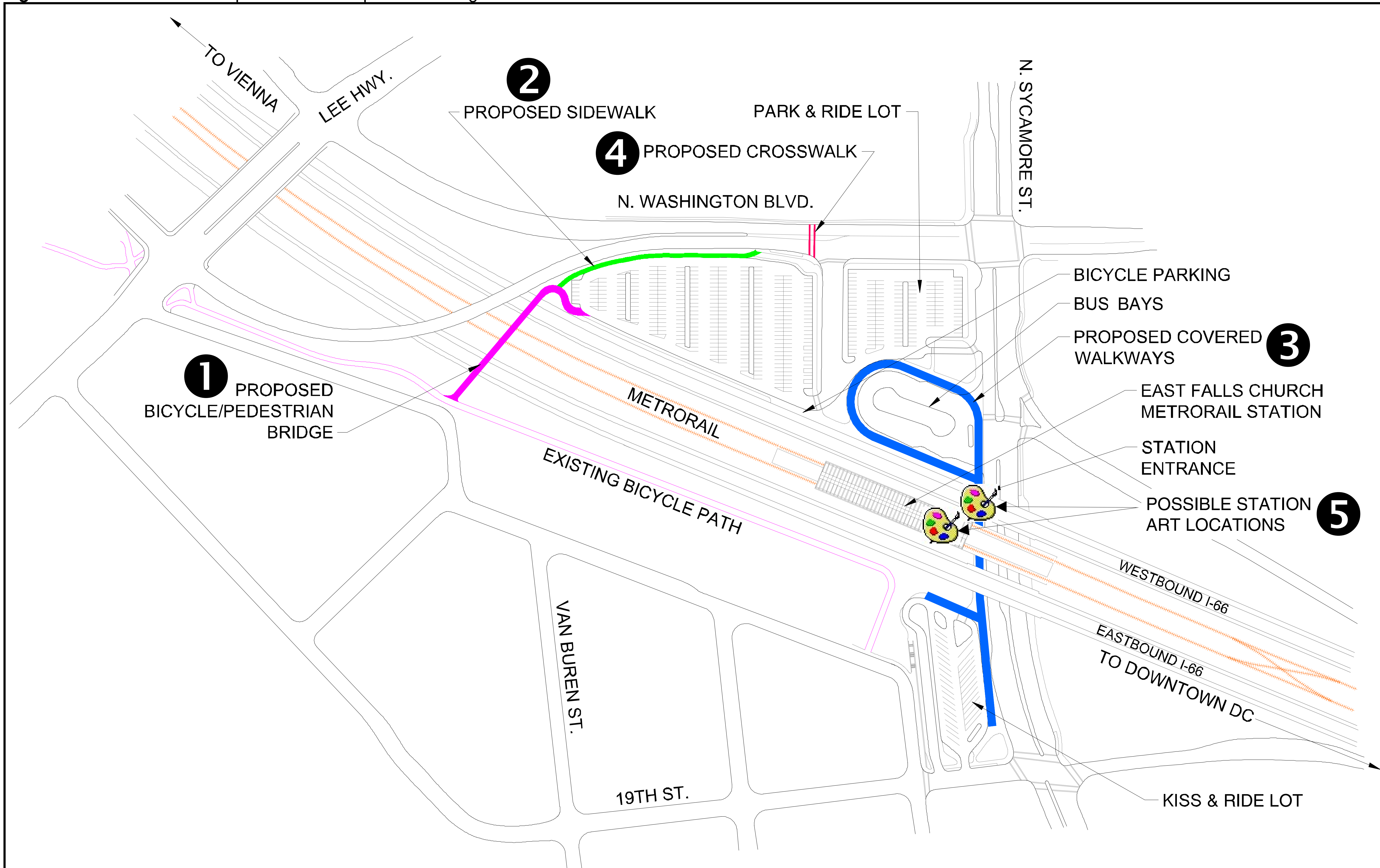
- It was suggested to switch the locations of the bus bays and the kiss & ride lot, again with the goal of reducing traffic impacts on 19th Street. Such a switch is technically feasible, but it does not appear that it would accomplish the desired goal. Bus traffic would likely be just as intrusive on 19th Street as kiss & ride traffic. The location of the lot would also make bus access more difficult, increasing the time most buses would need to access the station. The limited area would make it challenging to accommodate the large turning radii required by buses.

- The current location of the taxi stand is somewhat unorthodox. Taxis stand in the right turn pocket on southbound Sycamore Street approaching 19th Street. Consideration was given to relocating the taxi stand, but no superior location was found. In their current location, taxis do not interrupt traffic flow on Sycamore; other potential taxi stand locations would cause more traffic disruption or be less convenient for taxi patrons. The taxi stand formerly served as a Metrobus stop. The taxi stand only operates as effectively as it does because the bus stop was removed. If the bus stop were restored, additional consideration would need to be given to relocating the taxi stand.

Recommended Station Improvements

Elements numbered 1, 2, and 3 in Figure 12 are station improvements that are recommended to help improve customer access to the station. Each improvement is discussed in further detail below. Elements numbered 4 and 5 are possible changes to the station, discussed in a subsequent section.

Figure 12: Recommended Improvements and possible changes to East Falls Church Metrorail station access



❶ *Pedestrian/Bicycle Bridge Over I-66*

Accessibility to the station from the west is particularly poor. Few customers walk to the station from this direction, likely in part because of the lack of convenient walking routes. The W&OD multi-use path parallels I-66 west of the station, but it does not allow customers easy access to the station. Bicycle customers must ride on the path until it ends at Tuckahoe Street, then take 19th Street to Sycamore, cross under I-66 past the station entrance to the bicycle parking. This route takes bicycles through several intersections where they must interact with automobiles, past the station entrance where they must interact with pedestrian traffic, and either through or past the entrance to the kiss & ride lot where additional conflicts may arise. The bicycle lockers at the station are on the north side of the station, a further inconvenience to customers who use the lockers.

Pedestrian customers have a somewhat shorter route if they choose to use the stairs from Tuckahoe Street to the kiss & ride lot. Although this route is shorter, it is not accessible for disabled customers, and it does not alleviate interactions with kiss & ride traffic.

Bicycle traffic would be much better served by accessing the station from the north side; however, there are few opportunities for nonmotorized traffic to cross to the north side of I-66. The Washington Boulevard bridge over I-66 has no facilities for nonmotorized traffic. Sidewalks exist on both sides of the Lee Highway overpass, but bicycle traffic using that route would need to ride on the north side of Washington Boulevard, against traffic, to reach the station. Customers would still need to travel to Sycamore in order to cross Washington at a controlled location.

A bridge for nonmotorized traffic (Figure 13) just east of the Washington Boulevard bridge would allow a convenient connection between the W&OD path and the park & ride lot on the north side of the station. This would eliminate virtually all conflicts with pedestrian and vehicle traffic for customers approaching from the west.

An overpass would cause only minor losses of landscaping and parking in the park & ride lot.

The approximate cost of the bridge and approach ramps is detailed in Figure 14.

For customers approaching the station from the west, the bridge would shorten walking distance by about 100 feet, likely not enough to attract new customers solely on the basis of decreased walking distance. However, the bridge may attract new customers because it would create a better-quality path. The bridge would eliminate interactions with motor vehicles and eliminate the need to use the stairs on the west side of the kiss & ride lot. The bridge would reduce the length of the disabled-accessible walking path by about 600 feet.

Figure 13: Proposed pedestrian/bicycle bridge over I-66

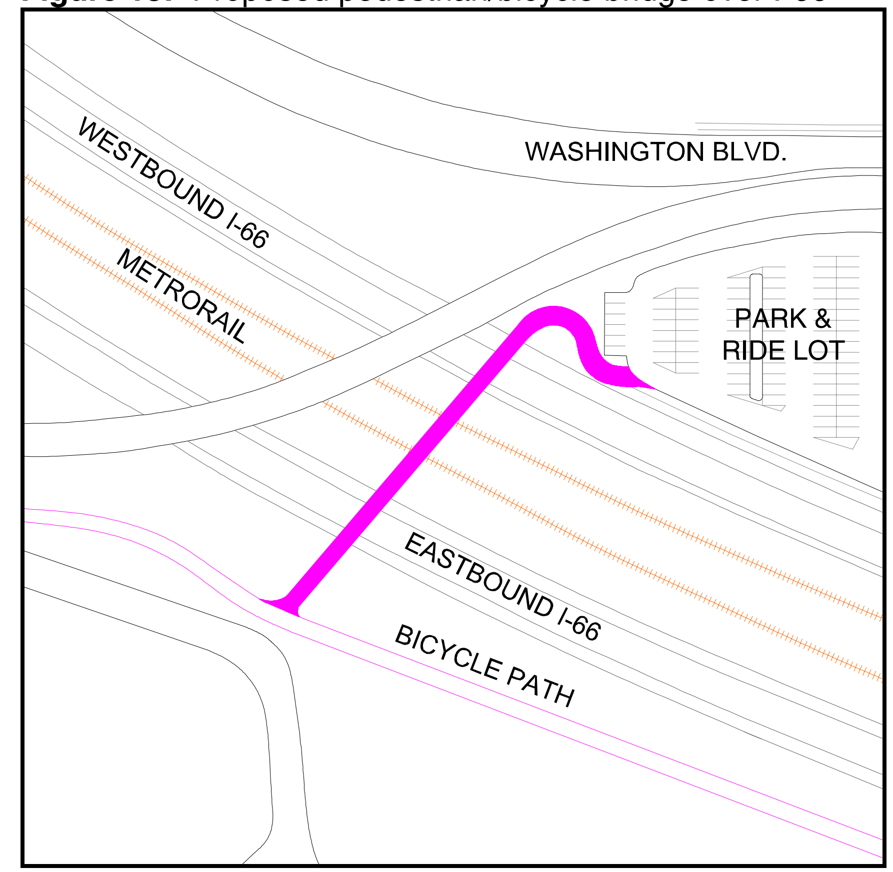


Figure 14: Cost estimate for pedestrian/bicycle bridge over I-66

Element	***Details***	***Approximate Cost***
Bridge structure	300 ft long x 15 ft wide x $150 per sq. ft.	$675,000
Approach ramps	100 ft long x 15 ft wide x $100 per sq. ft.	$150,000
Contingency, market allowance, design, construction management, agency costs		$825,000
Total Cost		**$1,650,000**

❷ *Washington Boulevard Sidewalk Connection*

The utility of a new overpass could be increased with a connection to the existing sidewalk on the south side of Washington Boulevard, which currently ends just west of the entrance to the park & ride lot. The connection (Figure 15) would not be a direct benefit to station access, because customers coming from the west would be able to enter the station most conveniently by using the existing sidewalk on the south side of the park & ride lot. However, for community accessibility, a sidewalk connection at this location may be logical.

This connection would be much more difficult to construct than a typical sidewalk. There is a significant grade difference between the park & ride lot and Washington Boulevard, and the sidewalk's profile would need to gradually transition between the two grades. Considerable use of structures such as retaining walls would be necessary. The trees on the north side of the park & ride lot would need to be removed, and minor losses in parking may occur in the park & ride lot.

The approximate cost of the sidewalk connection is shown in Figure 16.

The sidewalk would be difficult to justify solely on the basis of Metrorail station access. Customers would not need to use it enroute to the station, so it would be unlikely to attract new customers to Metrorail. The expense would need to be justified from a community accessibility standpoint, as it would encourage pedestrian and bicycle connectivity in the general vicinity of the station.

Figure 15: Proposed Washington Boulevard sidewalk

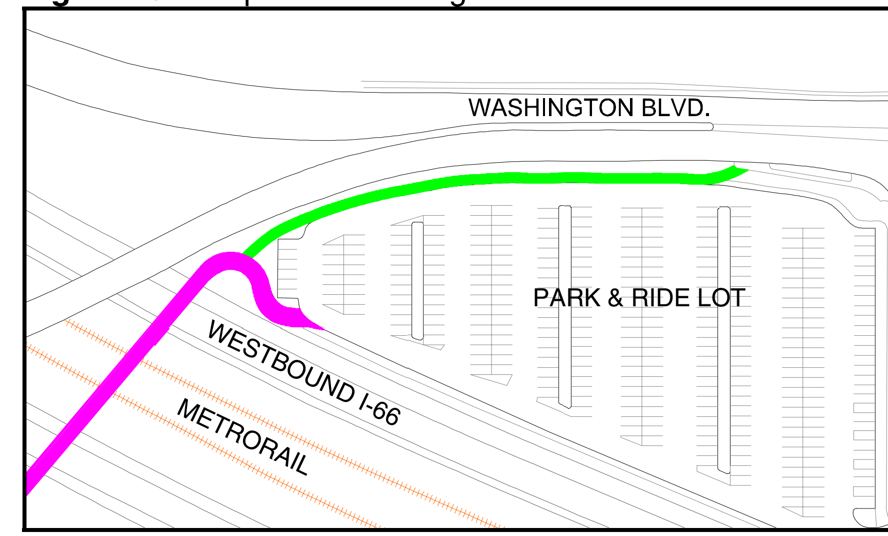


Figure 16: Cost estimate for Washington Boulevard sidewalk connection

Element	***Details***	***Approximate Cost***
Sidewalk	400 ft long x 5 ft wide x $5 per sq. ft.	$10,000
Retaining wall		$100,000
Contingency, market allowance, design, construction management, agency costs		$110,000
Total Cost		**$220,000**

❸ *Covered Walkways*

Customers walking between various parts of the station property currently do so on sidewalks largely exposed to the elements. A few waiting shelters are available for the use of bus and kiss & ride customers; however, many more customers use the station than can be accommodated by the shelters during inclement weather.

New covered walkways (Figure 17) could encircle the bus bays, providing sheltered access to the station for all bus customers. A covered walkway could also extend south of the station for the use of kiss & ride customers, and it could continue as far south as the taxi stand.

Approximate costs for the covered walkways are shown in Figure 18.

All customers who enter or exit at the East Falls Church station would traverse some portion of the covered walkways, since all customers use the Sycamore Street sidewalk to access the station entrance. Current ridership levels are approximately 1 million entering customers per year and an additional 1 million exiting customers per year. Over the approximate 20-year lifespan of the covered walkways, if ridership levels remain constant, about 40 million customers would enter or exit the station. Historic climate trends suggest that precipitation occurs during about ten percent of trips, and that shade would be beneficial for about another five percent of trips. Thus, considering customers using all transportation modes, about 6 million customers would benefit from the covered walkways.

Customers using kiss & ride and buses would derive even more benefit from the covered walkways, because the walkways could protect these customers from inclement or hot weather for longer periods of time and for nearly their entire walking distance. Approximately 20 percent of customers use kiss & ride, 15 percent use Metrobus, and three percent use shuttle bus during the morning peak hour. If these levels were consistent throughout the day, and if they were constant over 20 years, then approximately 2 million customers would derive this larger benefit.

The covered walkways are shown extending across the bus bay entrance, providing additional protection to customers north of the station. This location could also present an opportunity for an artistic gateway feature.

Figure 17: Proposed covered walkways

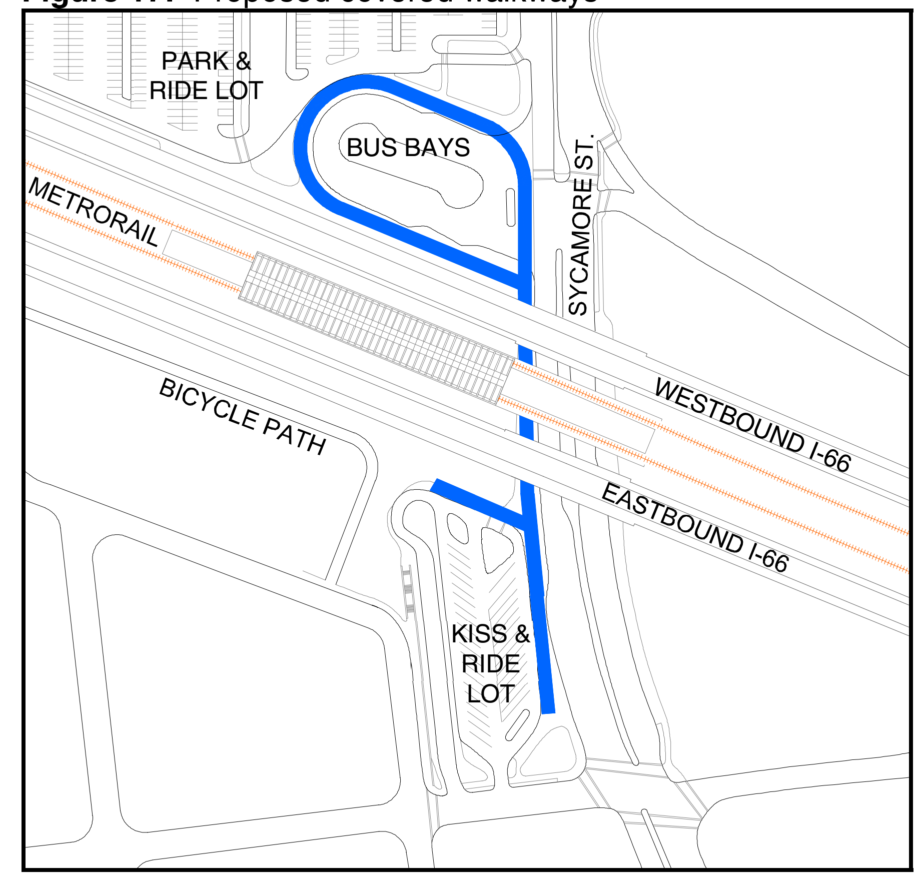


Figure 18: Cost estimate for covered walkways

Element	***Details***	***Approximate Cost***
Covered walkways	1250 ft long x 15 ft wide x $80 per sq. ft.	$1,500,000
Contingency, market allowance, design, construction management, agency costs		$1,500,000
Total Cost		**$3,000,000**

Possible Changes

In addition to the recommended improvements discussed above, the following changes could be considered.

4 ***Washington Boulevard Crosswalk***

Pedestrian customers approaching the station from the northwest walk eastbound along the north side of Washington Boulevard. Some customers choose to walk as far east as Sycamore Street to cross Washington at a traffic signal. Others choose to cross Washington midblock and walk through the park & ride lot to reach the station entrance. The midblock crossing shortens the route slightly, but the crossing is not ideal because the rolling profile of Washington severely limits sight distance for pedestrians and drivers.

A member of the community suggested that a signalized crosswalk (Figure 19) just west of the park & ride lot entrance would make this shorter route more attractive to pedestrians. It would allow all pedestrians, including those who do not feel comfortable crossing midblock, to take advantage of the shorter route to the station. It would promote safety for pedestrians who currently cross midblock because the signal would give motorists a clear view of the crossing.

The crosswalk is considered a possible change, as opposed to a recommended improvement, because it has several drawbacks that offset its benefits.

Protecting the crossing with a traffic signal would require signalizing the intersection of the park & ride lot with Washington Boulevard. This would help drivers make safer left turns into and out of the park & ride lot, but it would not benefit other automobile traffic. No matter how well timed, a new signal would impede traffic flow on Washington, where traffic is already congested during peak hours.

Some pedestrians choose to disregard traffic signal indications, especially if they believe they can cross safely on their own. As such, some pedestrians may not wait for a green signal indication to cross if a signal were installed.

Pedestrians who currently cross midblock frequently use a median refuge island west of the proposed crossing. A new median island could be incorporated into the crossing, but a new island may require an undesirable shortening of the eastbound left-turn pocket approaching the Sycamore intersection.

A crosswalk would invite pedestrians to enter the park & ride lot at the same point as vehicles, but the lot does not have a provision for pedestrian traffic at this location. The existing lot entrance is not wide enough to accommodate a sidewalk along with the three existing vehicle lanes. Consideration could be given to eliminating one lane to provide additional pedestrian access.

Approximate costs for the crosswalk are shown in Figure 20.

If customers were to divert their routes and use the proposed crosswalk instead of the Sycamore crosswalk, their routes would be shortened by about 100 feet, with no significant changes in vehicle conflicts. This change in route characteristics is likely not enough to attract new customers to Metrorail. Thus, the crosswalk would need to be justified by evaluating its advantages and disadvantages in a larger context.

Figure 19: Proposed Washington Boulevard Crosswalk

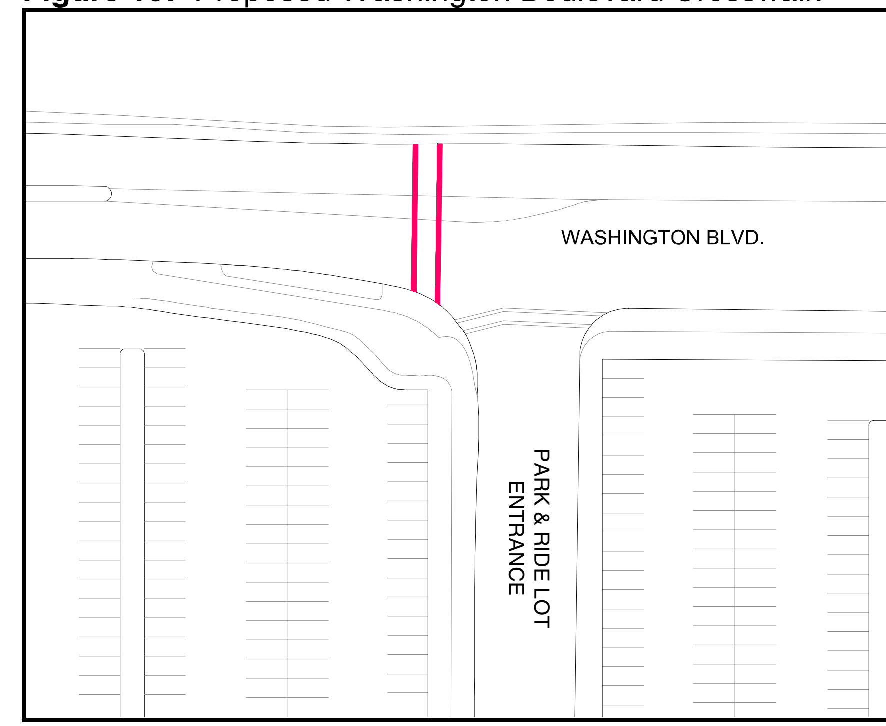


Figure 20: Cost estimate for covered walkways

Element	***Details***	***Approximate Cost***
Crosswalk	Signing, marking	$5,000
Traffic signal		$100,000
Contingency, market allowance, design, construction management, agency costs		$105,000
Total Cost		**$210,000**

❺ *Station Art*

There is now no artwork in the station. A comment in the public review of the potential station improvements suggested that artwork, either within the station or on the site, could improve the station's appearance and create aesthetic and thematic linkages to the community.

A preliminary WMATA site review identified the following areas suitable for artwork in the non-paid areas of the station:

- The large exterior wall to the north of the station entry gates (Figure 21) is suitable for a mosaic or porcelain-enamel mural.
- The two skylight wells in the ticket area (Figure 22) are suitable for hanging sculptures or mobiles.

Artwork at these locations would be expected to range in cost from $85,000 to $110,000. Identifying a funding source would be necessary, as there is no source for funding artwork at existing Metrorail stations in Arlington County.

WMATA's Arts in Transit Program works with communities, arts professionals, jurisdictional arts councils, and the WMATA Board to select artwork for the Metrorail system. If funding is identified for artwork at the station, Arts in Transit will manage and facilitate a project to select artwork that best represents the community's cultural, historic, and artistic interests.

Figure 21: Wall north of station entry

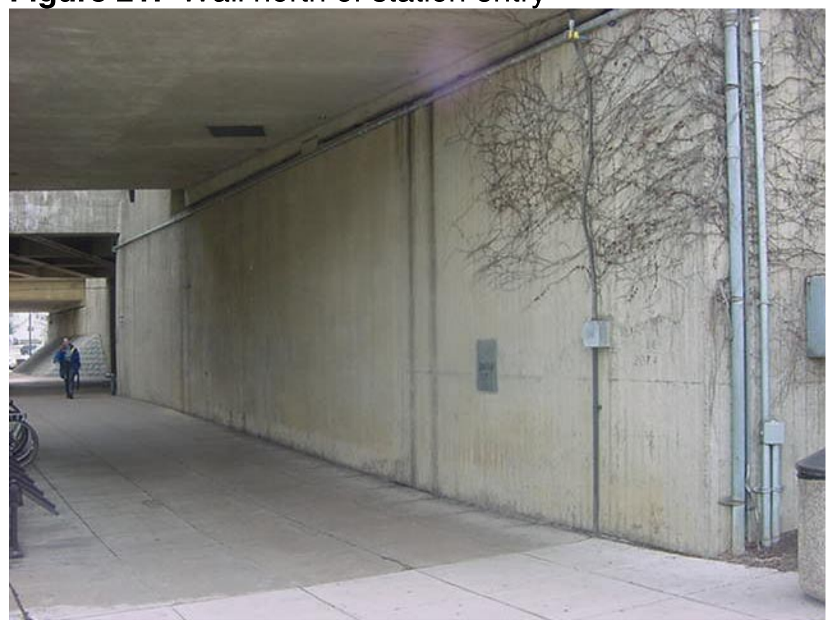
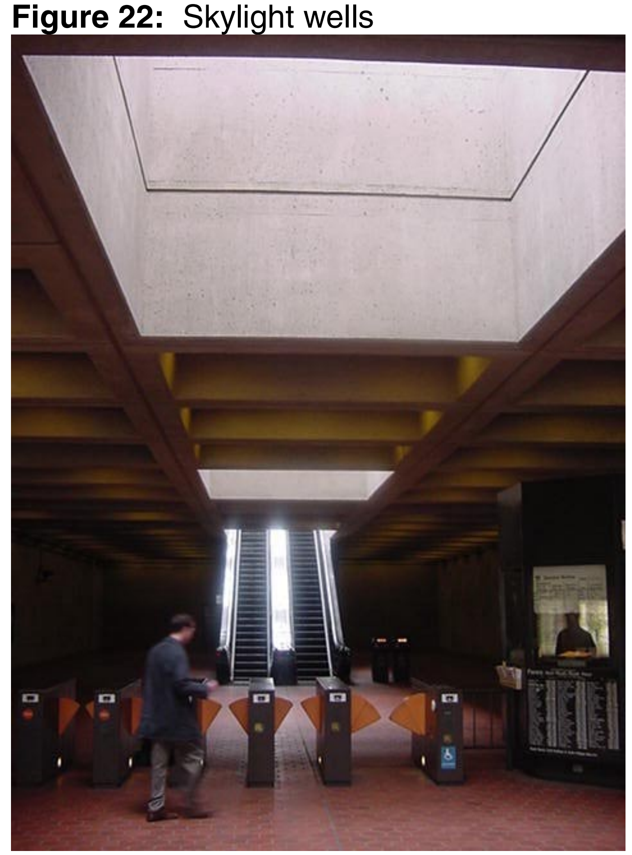


Figure 22: Skylight wells



Traffic Effects of Station-Area Development

Land close to Metrorail stations is among the most appropriate for higher-density development. Residents in the area around the East Falls Church station have discussed the potential for development there and requested that this study consider that possibility. However, no changes to Arlington County's General Land Use Plan (GLUP) have been proposed.

The lack of high-density development is a significant characteristic of the immediate vicinity of the East Falls Church station. Stations further east on the Orange Line generally are surrounded by medium- or high-density development; the East Falls Church area has a much different atmosphere because of its low density.

Development scenarios were based on the following three parcels:

- The kiss & ride lot, a 1.2-acre parcel just south of the station entrance
- The park & ride lot, a 3.7-acre parcel north of the station
- The Palmer parcel, which includes the existing Palmer lot and several adjacent residential structures. Total area of this parcel is 1.4 acres.

This study includes an analysis of the effects on traffic of potential development on these three parcels. Traffic is only one of many factors that must be addressed in the consideration of station-area development. The purpose of this analysis is to provide information to assist that consideration, not to make a recommendation for or against development.

If development were to occur on the WMATA-owned park & ride or kiss & ride lots, the development would need to retain the function of these lots, according to WMATA Joint Development Policy. For instance, if the kiss & ride lot were developed with residential land use, the kiss & ride function must continue to be accommodated, perhaps on the same site by integrating it with the development site plan.

Development Scenarios

Four development scenarios were defined for analysis. They incorporate different combinations of land uses at the three parcels under consideration. These scenarios are not intended to represent all potential development possibilities, but merely to provide representative examples to illustrate the effects of various types and densities of development.

- *Residential.* This scenario features residential development of 16 dwelling units per acre on the three parcels. Arlington County's General Land Use Plan (GLUP) considers this density as the minimum for low/medium residential development. This density is consistent with townhouse development as currently exists in the neighborhood northwest of the station.

- *Residential/Retail.* This scenario includes residential development of 36 dwelling units per acre on the three parcels. Arlington County's GLUP considers this density as the maximum for low/medium residential development, and it would be consistent with garden apartments in three- to four-story structures. This scenario also includes approximately 5,000 square feet of retail development on each parcel, a typical figure in Arlington County.

- *Office/Retail.* This scenario assumes office and retail development on the park & ride parcel with a floor-to-area ratio (FAR) of 1.5. Arlington County's GLUP considers this as the maximum FAR for low-density office development, and typically would result in office buildings of two to four floors. Office use was assumed to account for 93 percent of the development, while retail use was assumed to account for the remaining seven percent. This split is consistent with similar developments profiled in the County's *Development in the Metro Corridors 2000* report. This scenario was assumed to include no development on either the kiss & ride or the Palmer parcels.

- *Retail Center.* This scenario includes retail development on both the park & ride and Palmer parcels with an FAR of 1.0. Arlington County's GLUP considers this density as midrange for retail use. A similar retail center is Market Common, a 220,000 square-foot facility in Clarendon. This scenario would include no development on the kiss & ride parcel.

Figure 23: Summary of development scenarios by parcel

Development Scenario	*Development on park & ride parcel*	*Development on kiss & ride parcel*	*Development on Palmer parcel*	*Total of all parcels*
Residential	• 59 dwelling units	• 20 dwelling units	• 22 dwelling units	• 101 dwelling units
Residential/Retail	• 133 dwelling units • 5,000 square ft. retail	• 45 dwelling units • 5,000 square ft. retail	• 50 dwelling units • 5,000 square ft. retail	• 228 dwelling units • 15,000 square ft. retail
Office/Retail	• 225,000 square ft. office • 17,000 square ft. retail	No development	No development	• 225,000 square ft. office • 17,000 square ft. retail
Retail Center	• 161,000 square ft. retail	No development	• 61,000 square ft. retail	• 222,000 square ft. retail

The scenarios are summarized in Figure 23.

The park & ride lot's current capacity does not serve all the demand for parking at the station. As part of the analysis of development scenarios, an expansion of park & ride capacity was considered. An expansion of park & ride capacity from 422 spaces to 1,000 spaces was assumed for this analysis, although smaller or larger expansions would also be possible.

Peak-Hour Analysis

Traffic conditions were analyzed during the one hour of the morning and the one hour of the evening when traffic volume is heaviest. Traffic studies showed that the morning peak hour occurred between 7:30 and 8:30 a.m. and the evening peak hour occurred between 5:30 and 6:30 p.m.

Conditions at the following four intersections were analyzed:
- Sycamore Street and Washington Boulevard
- Sycamore Street and I-66 exit ramp
- Sycamore Street and 19th Street/I-66 entrance ramp
- Washington Boulevard and park & ride lot entrance

The analysis of the development scenarios was conducted using Synchro and SimTraffic simulation modeling software. These two software programs collectively form a state-of-the-art traffic evaluation package for a network of intersections. Synchro implements the methods of Chapter 16 of the 2000 *Highway Capacity Manual* and SimTraffic implements the vehicle and driver performance characteristics developed for use in traffic modeling through research by the Federal Highway Administration.

The models were first applied to existing traffic and roadway characteristics to ensure that they could represent present traffic conditions. The result was then used as a baseline against which to compare other scenarios.

Traffic Volume Forecast for Development

Traffic volumes were forecast for each scenario. First, existing traffic volumes were increased by ten percent to account for regional growth that will likely occur in the next three to five years. This growth rate is in accordance with historical trends from the Virginia Department of Transportation (VDOT). Traffic generated by the development in the various scenarios was then added to these increased volumes.

Site-specific traffic volume depends on the size and use of the development. For the residential scenarios, the size of the development is measured by the number of dwelling units. For the office and retail scenarios, the size of the development is measured in square feet.

The number of trips a given development will generate were estimated using *Trip Generation*, 6th Edition, published by the Institute of Transportation Engineers in 1997. The average number of vehicle trips generated by each site was calculated for morning and evening peak hours.

Since the East Falls Church Metrorail station is immediately adjacent to the site, transit customers would account for a large fraction of the total trips. The fraction of trips that would use transit was estimated using *Development-Related Ridership Survey II*, a 1989 WMATA report, to be as follows:

- 20 percent for office use
- 60 percent for residential use
- 45 percent for retail use

The total vehicle trips for the development scenarios were computed by subtracting transit trips from the total trips computed using *Trip Generation*.

New vehicle trips were then dispersed through the roadway network. Existing traffic patterns were extrapolated to estimate the routes that new vehicles would follow through the study area. Each intersection's final traffic volume was adjusted to account for the new trips that pass through it in each of the development scenarios.

Traffic Volume Forecast for Park & Ride Expansion

The additional traffic attracted by an expanded park & ride lot was also forecasted. During the morning peak hour, the existing park & ride lot is usually full well before the morning peak hour begins at 7:30 a.m., so the existing lot generates very few trips during the morning peak hour. However, the expanded lot would fill later than the existing lot, so traffic would be more likely to enter the lot during the morning peak hour. It was assumed that 30 percent of the lot would fill during the morning peak hour, and that these vehicles would arrive according to existing peak-hour traffic patterns.

During the evening peak hour, vehicles leaving the expanded park & ride lot were assumed to depart according to existing traffic patterns.

Analysis Assumptions

The following assumptions were made in the coding of the models:

- For each development scenario, the traffic signal system was optimized to minimize delay using a Synchro algorithm.

- In accordance with *Trip Generation*, retail-oriented developments attract a portion of their trips from traffic passing the site on the way from an origin to an ultimate destination. These retail trips may not add new traffic to the adjacent street system. Therefore, a 25 percent pass-by reduction factor was utilized in the evening peak retail scenario to account for this effect.

- The intersection of Washington Boulevard and the park & ride lot is currently unsignalized, but it would operate with less delay with a traffic signal in some of the development scenarios. In those cases, a traffic signal was assumed.

Measures of Effectiveness

The model provides several measures of traffic operational effectiveness that were compared to determine the relative impact of each scenario. Two primary measures of effectiveness are included in the report:

- *Total Network Delay:* a measure of the cumulative delay experienced by all vehicles traversing the study area during the peak hour.
- *Intersection Operation:* a measure of the level of congestion at intersections. Figure 24 shows the three operational levels used to evaluate each intersection.

Figure 24: Definition of intersection operational levels

	Good conditions. Most vehicles pass through intersection without waiting for more than one change of the traffic signal.
	Fair conditions. Some vehicles must wait for more than one change of the traffic signal.
	Poor conditions. Traffic is very congested. Most vehicles wait more than one change of the traffic signal.

Results of Traffic Simulation for Development Scenarios

Figure 25 shows results of morning peak-hour analysis for development scenarios, assuming no increase in park & ride lot capacity. In the morning peak hour, retail and residential land uses do not significantly aggravate traffic conditions. Retail facilities often do not open until after the peak hour ends at 8:30 a.m.; residential land uses take extensive advantage of transit. But office land uses cause significant impacts on traffic, as employees arrive by car during the morning peak. The traffic impacts of the Office/Retail scenario would be severe and would warrant further study of roadway improvements.

No intersection would operate under poor conditions except in the Office/Retail scenario. Traffic movements prone to failure include the northbound left turn from Sycamore Street to 19th Street in the Office/Retail scenario, and the southbound left turn from Sycamore Street to Washington Boulevard in the Retail scenario.

The Residential, Residential/Retail, and Retail Center scenarios would have delays about 30 percent higher than existing conditions. However, the Office/Retail scenario would have delays over 90 percent higher than existing conditions. An increase in delay of 30 percent translates to slightly longer average vehicle travel times; an increase of 90 percent translates to nearly doubling average vehicle travel times.

Figure 25: Results of morning peak-hour simulation of development scenarios with existing-size park & ride lot

Development scenario	Intersection operation: Sycamore St. & 19th St.	Sycamore St. & Bus Entrance	Sycamore St. & Washington Blvd.	Washington Blvd. & Park & ride lot	Total network delay	Change in total network delay over existing conditions	Overall network operation
Existing	■	▲	▲	■		baseline	▲
Residential	■	▲	▲	■		+ 29%	▲
Residential/Retail	■	▲	▲	■		+ 31%	▲
Office/Retail	▲	⯃	⯃	■		+ 92%	⯃
Retail Center	■	▲	▲	■		+ 29%	▲

Figure 26 shows results of evening peak-hour analysis for development scenarios. Retail land use greatly affects traffic during the evening peak hour, as drivers returning home from work tend to visit retail establishments on their way home. The traffic impacts of the retail scenario would be severe, warranting further study of roadway improvements.

The Retail scenario would suffer from three poorly operating intersections due to heavy traffic demand backing up through the network; in total, six traffic movements would fail in the Retail scenario. In the Office/Retail scenario, the northbound left turn from Sycamore Street to Washington Boulevard would operate under failing conditions.

The network delays for the Residential, Residential/Retail, and Office/Retail scenarios would be from 40 to 50 percent higher than existing conditions. However, network delay for the Retail scenario would be nearly 250 percent higher than existing conditions.

Figure 26: Results of evening peak-hour simulation of development scenarios with existing-size park & ride lot

Development scenario	Intersection operation: Sycamore St. & 19th St.	Sycamore St. & Bus Entrance	Sycamore St. & Washington Blvd.	Washington Blvd. & Park & ride lot	Total network delay	Change in total network delay over existing conditions	Overall network operation
Existing	■	■	▲	■		baseline	■
Residential	▲	■	⯃	■		+ 41%	▲
Residential/Retail	▲	■	⯃	■		+ 46%	▲
Office/Retail	▲	■	⯃	■		+ 51%	▲
Retail Center	▲	⯃	⯃	⯃		+ 242%	⯃

Results of Traffic Simulation for Expanded Park & Ride Lot Capacity

Results of morning-peak hour simulation of the expanded park & ride lot with no development are shown in Figure 27. All three intersections along Sycamore Street would operate poorly with the expanded park & ride lot. Network delay would increase nearly 200 percent with the park & ride lot expansion in the morning peak, a bigger increase than would be caused by any of the development scenarios alone.

The expanded park & ride lot would cause severe impacts to traffic conditions even with no development; as such, development scenarios were not considered in combination with the expanded park & ride lot.

Results of the evening peak-hour simulation are shown in Figure 28. No intersections would operate well, and a total of three traffic movements would fail. Network delay would increase by 80 percent with the park & ride lot expansion, more than for any development scenario except the Retail scenario. Again, the severe increase in traffic congestion precluded analysis of development together with park & ride lot expansion.

Traffic volumes used during the simulation of the park & ride lot expansion are shown in Figure 29, for morning and evening peak hours at the intersection of Washington Boulevard and the park & ride lot entrance.

Conclusions from Traffic Simulation

For the existing-size park & ride lot, the Residential and Residential/Retail scenarios would be acceptable, based on traffic operational conditions, during both morning and evening peak hours. Traffic would operate poorly both in the Retail scenario during the evening peak hour and in the Office/Retail scenario during the morning peak hour.

Expanding the park & ride lot capacity to 1,000 parking spaces would worsen traffic conditions because more vehicles would arrive during the morning peak hour; network delay would increase by an unacceptable level even without development. The traffic impacts of the larger lot would be severe, warranting further study of roadway improvements. A smaller expansion of the lot could be considered, but would require careful analysis of traffic impacts.

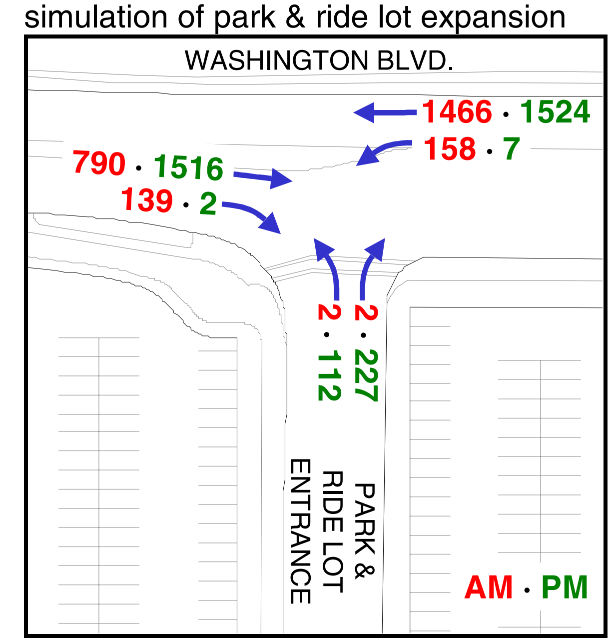
Figure 27: Results of morning peak-hour simulation of expanded park & ride lot

Park & ride lot size	*Intersection operation:* *Sycamore St. & 19th St.*	*Sycamore St. & Bus Entrance*	*Sycamore St. & Washington Blvd.*	*Washington Blvd. & Park & ride lot*	*Total network delay*	*Change in total network delay over existing conditions*	*Overall network operation*
Existing	■	▲	▲	■		baseline	▲
Expanded	⯃	⯃	⯃	■		+ 189%	⯃

Figure 28: Results of evening peak-hour simulation of expanded park & ride lot

Park & ride lot size	*Intersection operation:* *Sycamore St. & 19th St.*	*Sycamore St. & Bus Entrance*	*Sycamore St. & Washington Blvd.*	*Washington Blvd. & Park & ride lot*	*Total network delay*	*Change from existing conditions*	*Overall network operation*
Existing	■	■	▲	■		baseline	■
Expanded	▲	⯃	⯃	▲		+ 79%	⯃

Figure 29: Traffic volumes used in simulation of park & ride lot expansion



Parking Demand Forecast

Demand for parking at the station clearly exceeds current supply. The study examined the demand for parking at the station in both existing and future years. WMATA has used a standard methodology to estimate parking demand when considering parking structures at other stations. This same methodology has been applied to the East Falls Church Station.

Existing Parking Demand

WMATA estimated current parking demand by comparing existing parking accumulation patterns at the East Falls Church station with parking accumulation patterns at stations with an unconstrained supply of parking; that is, facilities that did not reach capacity on typical weekdays. The estimate suggests that existing demand for parking at the East Falls Church Station is in the range of 800 to 900 parking spaces, approximately twice the current supply of 422 spaces.

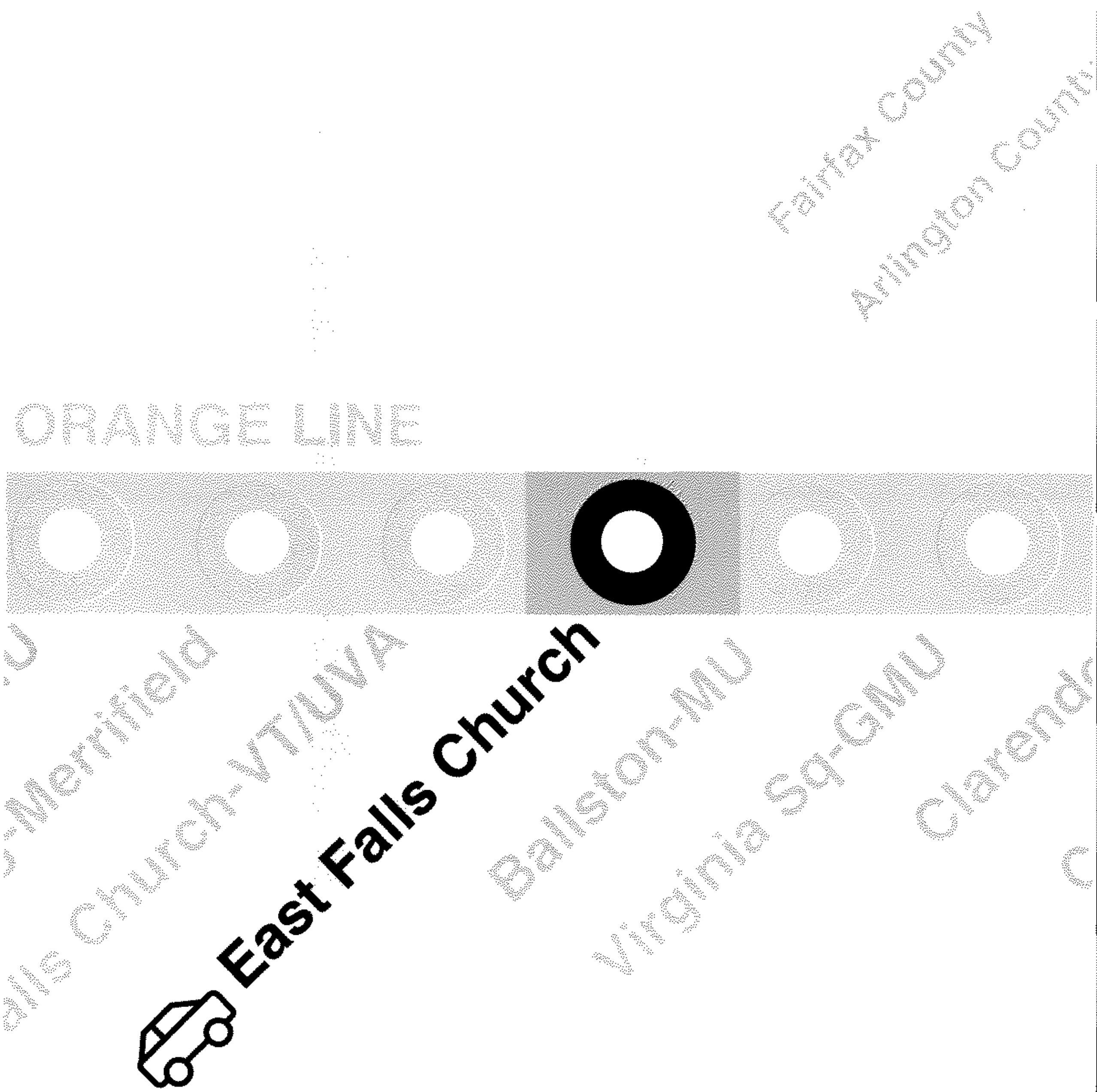
Future Parking Demand

WMATA estimated future parking demand by modeling current parking patterns against changes in land use, transit boarding patterns, and transit service. This estimate suggest that an additional 250 spaces will be needed at the East Falls Church station to accommodate demand by the year 2025. This estimate relies on the following transit service assumptions:

- Extension of the Metrorail Orange line from Vienna to Centreville
- Completion of a Metrorail line from West Falls Church to SR-772 in Loudoun County via the Dulles Corridor
- Completion of a Metrorail Purple line in Prince George’s County from Branch Avenue to Eisenhower Avenue, and in Montgomery County from Rock Springs to Greenbelt
- Completion of Georgetown Branch light-rail transit from Bethesda to Silver Spring

EAST FALLS CHURCH METRORAIL STATION ACCESS STUDY

APPENDICES



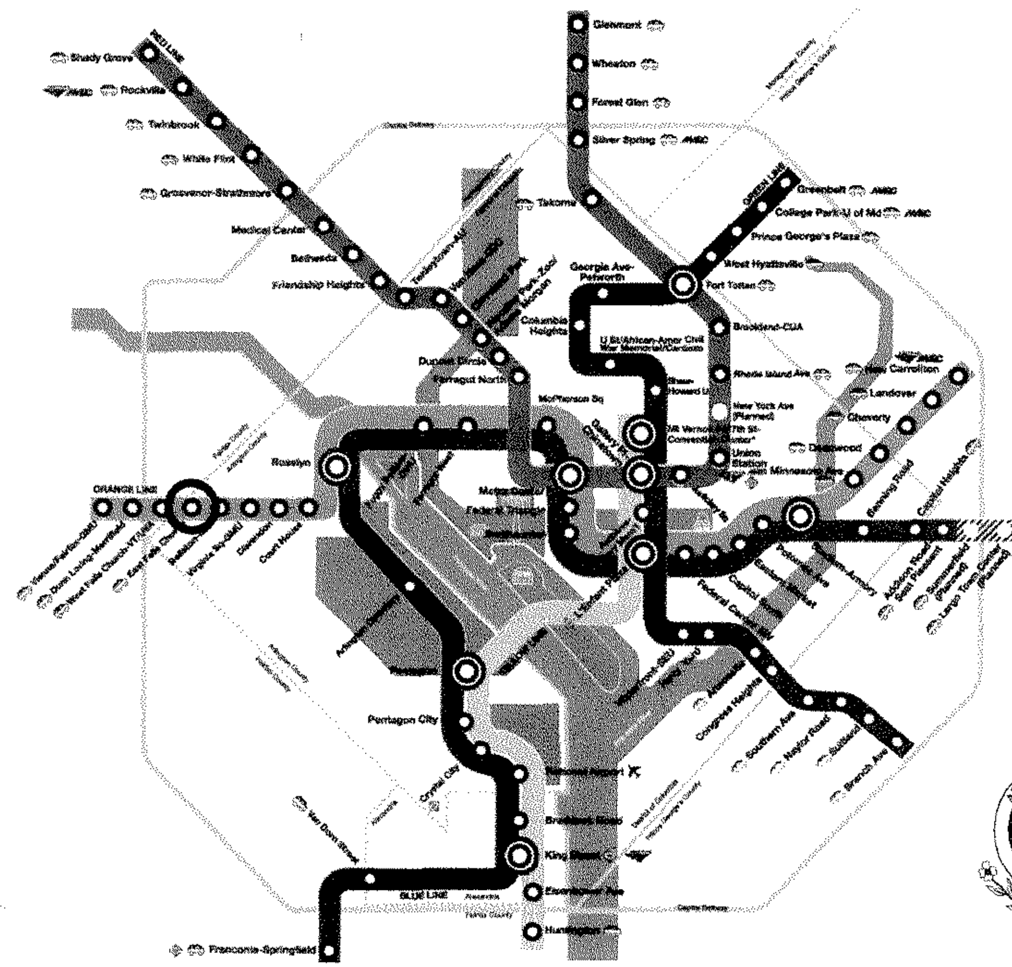
Prepared for Arlington County, Virginia
by
Washington Metropolitan Area Transit Authority
Department of Capital Projects Management
April 2002

CONTENTS

APPENDIX A

PRESENTATION GIVEN AT PUBLIC MEETING ON DECEMBER 6, 2001

East Falls Church Metrorail Station Access Study



Capital Transit Consultants

ARLINGTON COUNTY VIRGINIA

metro

Study Purpose

- Pedestrian & vehicle access patterns
- Station access improvements
- Traffic effects of development

Morning Traffic Conditions

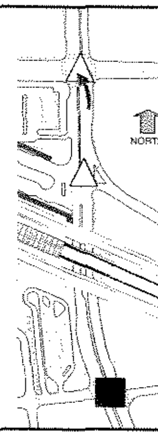
GOOD

FAIR

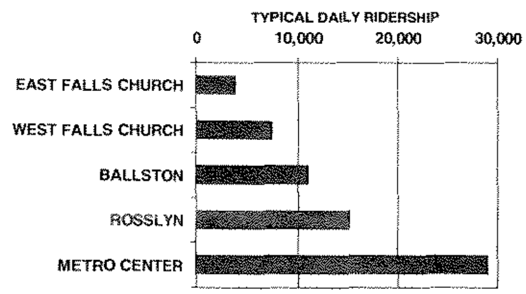
POOR

HEAVY MOVEMENT

Overall Conditions: △



Metrorail Station Passenger Volumes



Evening Traffic Conditions

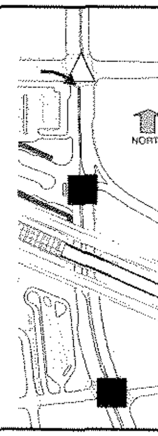
GOOD

FAIR

POOR

HEAVY MOVEMENT

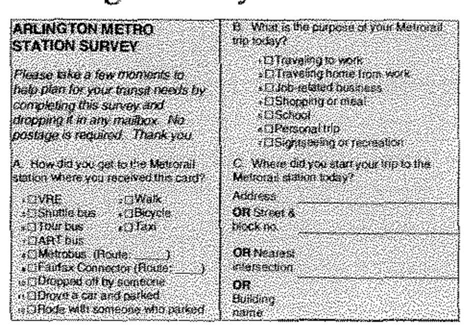
Overall Conditions: ■



Data Collected

- Traffic on adjacent streets
- Nearby intersection turn counts
- Pedestrian street crossings
- Kiss & Ride and Park & Ride usage
- Parked cars' home locations
- Pedestrian arrival patterns

Passenger Survey



ARLINGTON METRO STATION SURVEY

Please take a few moments to help plan for your transit needs by completing this survey and dropping it in any mailbox. No postage is required. Thank you.

A. How did you get to the Metrorail station where you received this card?

☐ VRE ☐ Walk
☐ Shuttle bus ☐ Bicycle
☐ Tour bus ☐ Taxi
☐ ART bus
☐ Metrobus (Route: ____)
☐ Fairfax Connector (Route: ____)
☐ Dropped off by someone
☐ Drove a car and parked
☐ Rode with someone who parked

B. What is the purpose of your Metrorail trip today?

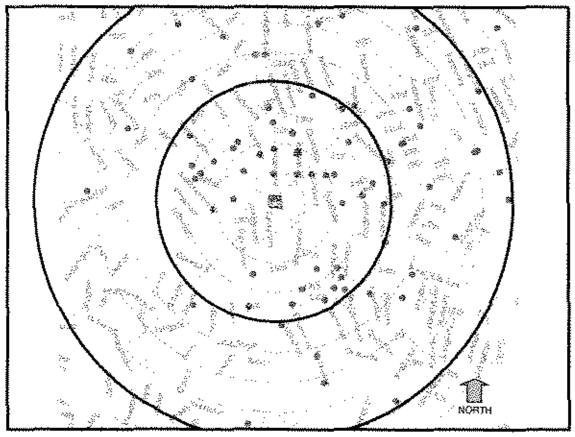
☐ Traveling to work
☐ Traveling home from work
☐ Job-related business
☐ Shopping or meal
☐ School
☐ Personal trip
☐ Sightseeing or recreation

C. Where did you start your trip to the Metrorail station today?

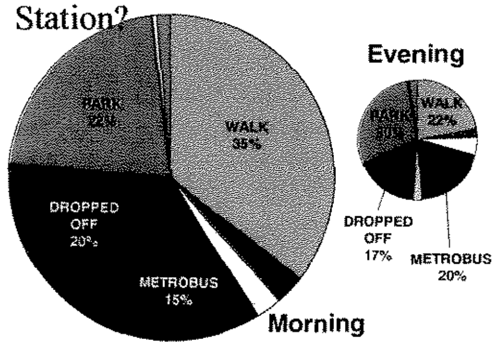
Address ____
OR Street & block no. ____
OR Nearest intersection ____
OR Building name ____

Passenger Survey

- Passengers offered a card while entering the station
- Survey date: September 19, 2001
- Survey response:
  - AM: 304 cards (11%)
  - PM: 41 cards (9%)



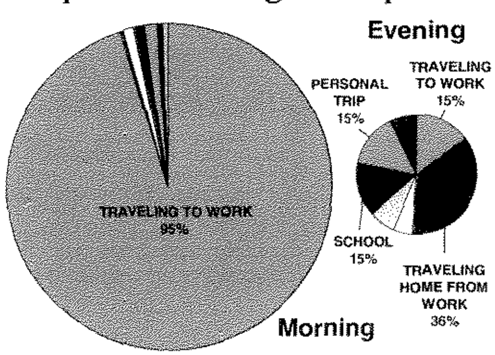
How Do Passengers Get to the Station?



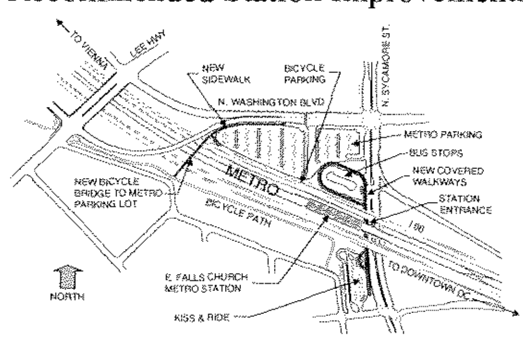
Station Access Priorities

1. Pedestrians and bicyclists
2. Disabled-accessible
3. Bus passengers
4. Kiss & Ride passengers and motorcyclists
5. Park & Ride passengers

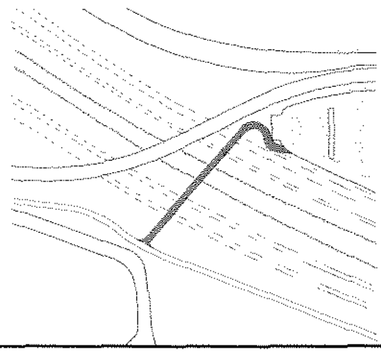
Purpose of Passengers' Trips



Recommended Station Improvements



Bicycle/Pedestrian Bridge

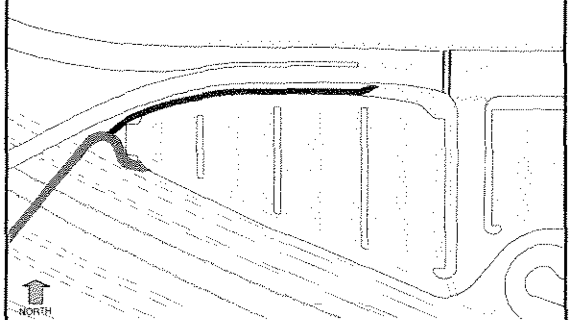


Development Possibilities

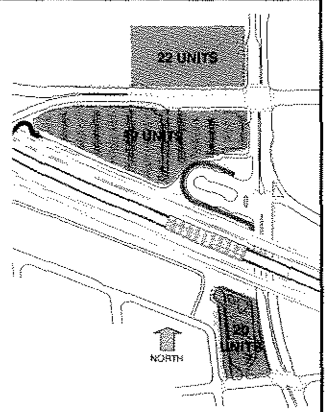
- Residential
- Residential/Retail
- Office/Retail
- Retail Center

- Expand Park & Ride lot

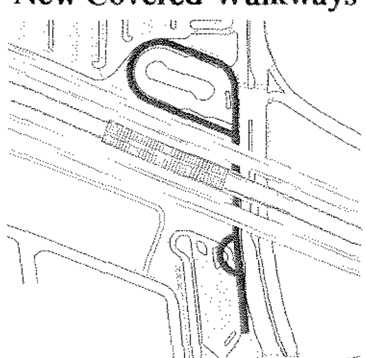
New Sidewalk/Crosswalk



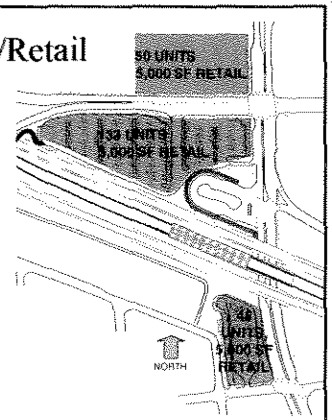
Residential Scenario



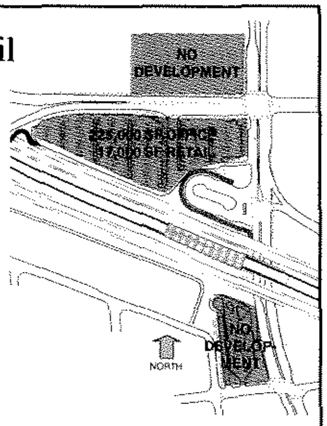
New Covered Walkways



Residential/Retail Scenario



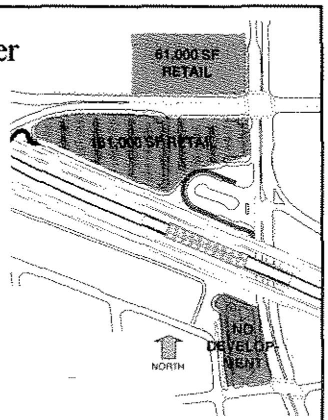
Office/Retail Scenario



Comments?

- By mail:
  - Capital Transit Consultants
    1133 15th St., N.W., Suite 700
    Washington, DC 20005
    Attn: Randy Dittberner
- By e-mail:
  - Phil_Braum@URSCorp.com

Retail Center Scenario



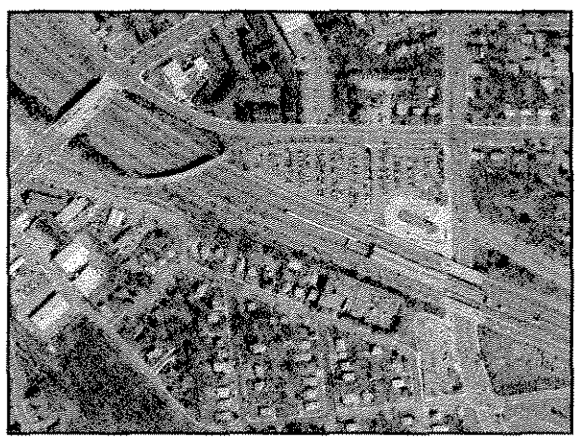
Next Steps

- Final report
- County Board review
- WMATA Board review

Traffic Impacts of Development

Legend: ■ GOOD; △ FAIR; ⬣ POOR

Development Scenario	Existing Park & Ride lot (422 spaces)		Expanded Park & Ride lot (1000 spaces)	
	AM	PM	AM	PM
Existing	FAIR	GOOD	POOR	POOR
Residential	FAIR	FAIR	POOR	POOR
Residential/Retail	FAIR	FAIR	POOR	POOR
Office/Retail	POOR	FAIR	POOR	POOR
Retail Center	FAIR	POOR	POOR	POOR



APPENDIX B

TRAFFIC AND PEDESTRIAN DATA

Counted by :ORGA-OH, LM
Board :D4-2236, D4-2240
City/County:Falls Church/Fairfax
Weather :Hot/Clear/Dry

O.R. George & Associates, Inc.
10210 Greenbelt Road, Suite 310
Greenbelt, MD 20706
Tel: (301)794-7700 Fax: (301)794-4400

Study Name: SYC@19TH
Site Code : 16542236
Start Date: 06/13/01
Page : 1

Total Traffic

End	N. Sycamore St From North				N. Sycamore St From South				I-66 E. On Ramp From East				19th Street From West				Intvl.
Time	Left	Thru	Right	Aprch. Total	Left	Thru	Right	Aprch. Total	Left	Thru	Right	Aprch. Total	Left	Thru	Right	Aprch. Total	Total
06/13/01																	
07:15	15	47	11	73	10	171	7	188	0	0	0	0	16	11	11	38	299
07:30	34	52	25	111	27	206	10	243	0	0	0	0	17	13	15	45	399
07:45	56	73	20	149	20	225	10	255	0	0	0	0	28	15	28	71	475
08:00	48	86	26	160	13	164	16	193	0	0	0	0	31	17	20	68	421
Hour	153	258	82	493	70	766	43	879	0	0	0	0	92	56	74	222	1594
08:15	52	84	30	166	19	177	15	211	0	0	0	0	39	19	27	85	462
08:30	49	82	26	157	18	182	23	223	0	0	0	0	33	19	25	77	457
08:45	42	75	24	141	17	181	10	208	0	0	0	0	21	16	22	59	408
09:00	45	97	15	157	11	171	13	195	0	0	0	0	20	24	15	59	411
Hour	188	338	95	621	65	711	61	837	0	0	0	0	113	78	89	280	1738
09:15	81	116	10	207	10	167	15	192	0	0	0	0	14	32	13	59	458
09:30	64	96	12	172	8	165	15	188	0	0	0	0	12	13	15	40	400
[BREAK]																	
Hour	145	212	22	379	18	332	30	380	0	0	0	0	26	45	28	99	858
[BREAK]																	
16:45	34	178	13	225	11	115	17	143	0	0	0	0	6	4	10	20	388
17:00	46	205	15	266	6	127	12	145	0	0	0	0	11	14	21	46	457
Hour	80	383	28	491	17	242	29	288	0	0	0	0	17	18	31	66	845
17:15	38	234	25	297	10	132	15	157	0	0	0	0	13	20	35	68	522
17:30	49	192	31	272	21	138	17	176	0	0	0	0	17	24	28	69	517
17:45	45	221	44	310	16	148	30	194	0	0	0	0	30	19	43	92	596
18:00	58	167	40	265	20	143	15	178	0	0	0	0	29	14	34	77	520
Hour	190	814	140	1144	67	561	77	705	0	0	0	0	89	77	140	306	2155
18:15	60	187	54	301	11	174	9	194	0	0	0	0	23	13	37	73	568
18:30	51	214	37	302	19	177	15	211	0	0	0	0	33	20	41	94	607
18:45	58	214	31	303	10	161	18	189	0	0	0	0	30	13	44	87	579
19:00	53	184	27	264	9	107	12	128	0	0	0	0	19	27	26	72	464
Hour	222	799	149	1170	49	619	54	722	0	0	0	0	105	73	148	326	2218
Total	978	2804	516	4298	286	3231	294	3811	0	0	0	0	442	347	510	1299	9408
% Apr.	22.7	65.2	12.0	-	7.5	84.7	7.7	-	-	-	-	-	34.0	26.7	39.2	-	-
% Int.	10.3	29.8	5.4	-	3.0	34.3	3.1	-	-	-	-	-	4.6	3.6	5.4	-	-

O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-OH
Board :D4-2239
City/County:Falls Church/Arlington
Weather :Warm/Clear/Dry

Study Name: 66@SYCAM
Site Code : 42542239
Start Date: 04/24/01
Page : 1

Passenger Vehicles

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	I-66 Off Ramp From East Left	Thru	Right	U-Turn	Aprch Total	Metro Station From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
4/24/01																					
07:15	0	112	0	0	112	0	218	0	0	218	4	0	11	0	15	0	0	0	0	0	345
07:30	0	123	0	0	123	0	251	0	0	251	7	0	23	0	30	0	0	0	0	0	404
07:45	0	161	0	0	161	0	297	0	0	297	6	0	15	0	21	0	0	0	0	0	479
08:00	0	163	0	0	163	0	294	0	0	294	5	0	17	0	22	0	0	0	0	0	479
Hour	0	559	0	0	559	0	1060	0	0	1060	22	0	66	0	88	0	0	0	0	0	1707
08:15	0	172	0	0	172	0	277	0	0	277	8	0	14	0	22	0	0	0	0	0	471
08:30	0	170	0	0	170	0	223	0	0	223	5	0	12	0	17	0	0	0	0	0	410
08:45	0	170	0	0	170	0	210	0	0	210	4	0	9	0	13	0	0	0	0	0	393
09:00	0	161	0	0	161	0	227	0	0	227	6	0	15	0	21	0	0	0	0	0	409
Hour	0	673	0	0	673	0	937	0	0	937	23	0	50	0	73	0	0	0	0	0	1683
09:15	0	195	0	0	195	0	228	0	0	228	11	0	19	0	30	0	0	0	0	0	453
09:30	0	172	0	0	172	0	194	0	0	194	18	0	21	0	39	0	0	0	0	0	405
[BREAK]																					
Hour	0	367	0	0	367	0	422	0	0	422	29	0	40	0	69	0	0	0	0	0	858
[BREAK]																					
16:45	0	263	0	0	263	0	127	0	0	127	16	0	17	0	33	0	0	0	0	0	423
17:00	0	254	0	0	254	0	135	0	0	135	16	0	29	0	45	0	0	0	0	0	434
Hour	0	517	0	0	517	0	262	0	0	262	32	0	46	0	78	0	0	0	0	0	857
17:15	0	313	0	0	313	0	181	0	0	181	23	0	41	0	64	0	0	0	0	0	558
17:30	0	350	0	0	350	0	223	0	0	223	37	0	43	0	80	0	0	0	0	0	653
17:45	0	299	0	0	299	0	160	0	0	160	22	0	39	0	61	0	0	0	0	0	520
18:00	0	327	0	0	327	0	187	0	0	187	29	0	47	0	76	0	0	0	0	0	590
Hour	0	1289	0	0	1289	0	751	0	0	751	111	0	170	0	281	0	0	0	0	0	2321
18:15	0	320	0	0	320	0	141	0	0	141	33	0	33	0	66	0	0	0	0	0	527
18:30	0	349	0	0	349	0	197	0	0	197	10	0	27	0	37	0	0	0	0	0	583
18:45	0	312	0	0	312	0	207	0	0	207	28	0	45	0	73	0	0	0	0	0	592
19:00	0	248	0	0	248	0	122	0	0	122	30	0	61	0	91	0	0	0	0	0	461
Hour	0	1229	0	0	1229	0	667	0	0	667	101	0	166	0	267	0	0	0	0	0	2163
Total	0	4634	0	0	4634	0	4099	0	0	4099	318	0	538	0	856	0	0	0	0	0	9589
Apr.	-	100.0	-	-	-	-	100.0	-	-	-	37.1	-	62.8	-	-	-	-	-	-	-	-
Int.	-	48.3	-	-	-	-	42.7	-	-	-	3.3	-	5.6	-	-	-	-	-	-	-	-

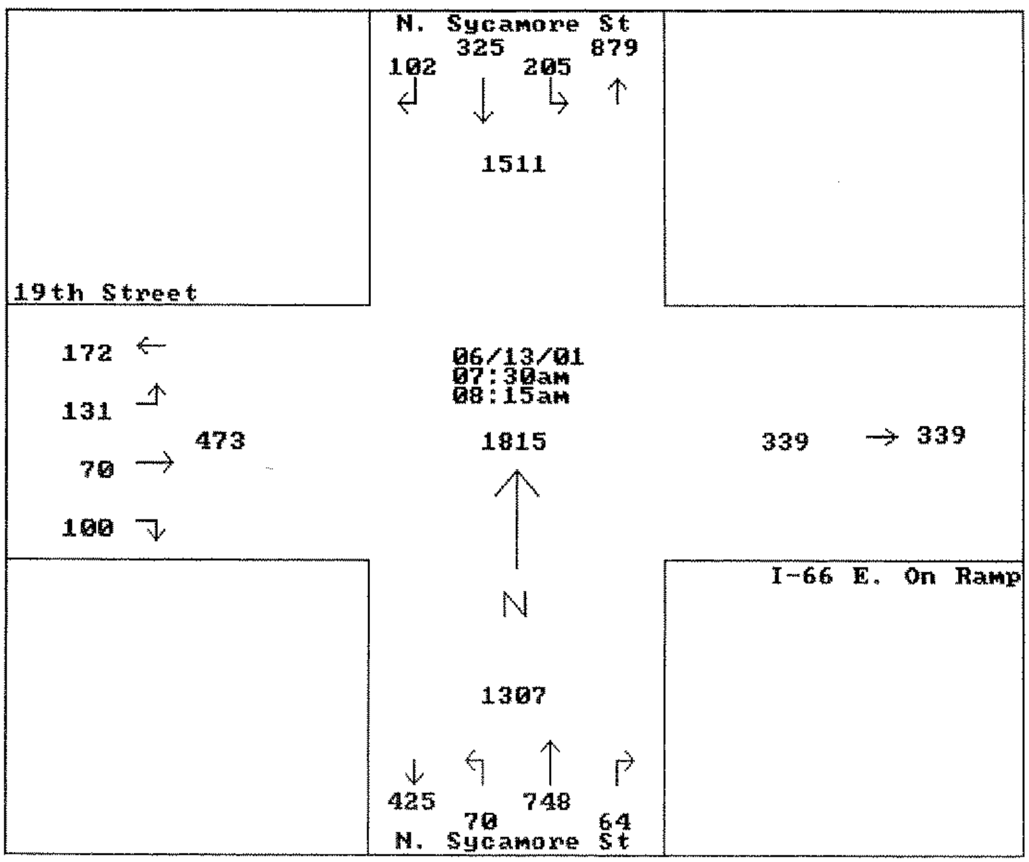
O.R. George & Associates, Inc.
10210 Greenbelt Road, Suite 310
Greenbelt, MD 20706
Tel: (301)794-7700 Fax: (301)794-4400

Counted by :ORGA-OH, LM
Board :D4-2236, D4-2240
City/County:Falls Church/Fairfax
Weather :Hot/Clear/Dry

Study Name: SYC@19TH
Site Code : 16542236
Start Date: 06/13/01

Total Traffic

	N. Sycamore St From North				N. Sycamore St From South				I-66 E. On Ramp From East				19th Street From West				
End Time	Left	Thru	Right	Aprch. Total	Left	Thru	Right	Aprch. Total	Left	Thru	Right	Aprch. Total	Left	Thru	Right	Aprch. Total	Intvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 07:00 on 06/13/01 to 09:15 on 06/13/01																	
Time	07:30				07:30				07:30				07:30				
Vol.	205	325	102	0	70	748	64		0	0	0		131	70	100		
Pct.	32.4	51.4	16.1		7.9	84.8	7.2		0.0	0.0	0.0		43.5	23.2	33.2		
Total	632				882				0				301				
High	08:00				07:30				08:00				08:00				
Vol.	52	84	30		20	225	10		0	0	0		39	19	27		
Total	166				255				0				85				
PHF	0.951				0.864				0.000				0.885				



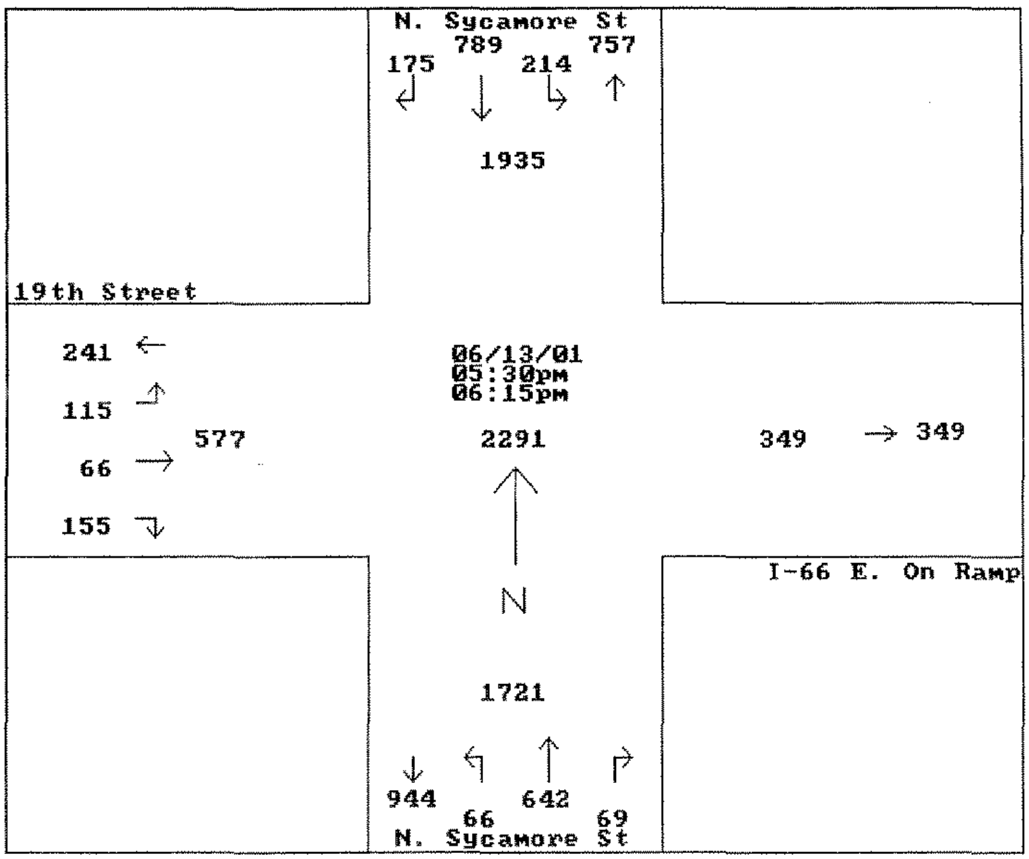
O.R. George & Associates, Inc.
10210 Greenbelt Road, Suite 310
Greenbelt, MD 20706
Tel: (301)794-7700 Fax: (301)794-4400

Counted by :ORGA-OH, LM
Board :D4-2236, D4-2240
City/County:Falls Church/Fairfax
Weather :Hot/Clear/Dry

Study Name: SYC@19TH
Site Code : 16542236
Start Date: 06/13/01
Page : 3

Total Traffic

End Time	N. Sycamore St From North Left	Thru	Right	Aprch. Total	N. Sycamore St From South Left	Thru	Right	Aprch. Total	I-66 E. On Ramp From East Left	Thru	Right	Aprch. Total	19th Street From West Left	Thru	Right	Aprch. Total	Intvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 16:00 on 06/13/01 to 18:45 on 06/13/01																	
Time	17:30				17:30				17:30				17:30				
Vol.	214	789	175	1	66	642	69		0	0	0		115	66	155		
Pct.	18.1	66.9	14.8		8.4	82.6	8.8		0.0	0.0	0.0		34.2	19.6	46.1		
Total	1178				777				0				336				
High	17:30				18:15				17:30				18:15				
Vol.	45	221	44		19	177	15		0	0	0		33	20	41		
Total	310				211				0				94				
PHF	0.950				0.920				0.000				0.893				



O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-OH
Board :D4-2239
City/County:Falls Church/Arlington
Weather :Warm/Clear/Dry

Study Name: 66@SYCAM
Site Code : 42542239
Start Date: 04/24/01
Page : 1

Trucks

End	N. Sycamore Street From North					N. Sycamore Street From South					I-66 Off Ramp From East					Metro Station From West					Intvl
Time	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Total
4/24/01																					
07:15	0	2	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	3
07:30	0	3	0	0	3	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	7
07:45	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
08:00	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Hour	0	7	0	0	7	0	7	0	0	7	0	0	0	0	0	0	0	0	0	0	14
08:15	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
[BREAK]																					
08:45	0	2	0	0	2	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	6
09:00	0	1	0	0	1	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	4
Hour	0	6	0	0	6	0	7	0	0	7	0	0	0	0	0	0	0	0	0	0	13
09:15	0	1	0	0	1	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	4
09:30	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[BREAK]																					
Hour	0	2	0	0	2	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	5
[BREAK]																					
17:00	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hour	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[BREAK]																					
17:45	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
18:00	0	1	0	0	1	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	3
Hour	0	2	0	0	2	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	5
[BREAK]																					
18:45	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
19:00	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2
Hour	0	1	0	0	1	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	3
Total	0	19	0	0	19	0	21	0	0	21	1	0	0	0	1	0	0	0	0	0	41
% Apr.	-	100.0	-	-	-	-	100.0	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-
% Int.	-	46.3	-	-	-	-	51.2	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-

O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-OH
Board :D4-2239
City/County:Falls Church/Arlington
Weather :Warm/Clear/Dry

Study Name: 66@SYCAM
Site Code : 42542239
Start Date: 04/24/01
Page : 1

Buses

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	I-66 Off Ramp From East Left	Thru	Right	U-Turn	Aprch Total	Metro Station From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
04/24/01																					
07:15	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
07:30	0	2	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	3
07:45	0	5	0	0	5	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	6
08:00	0	2	0	0	2	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	4
Hour	0	10	0	0	10	0	5	0	0	5	0	0	0	0	0	0	0	0	0	0	15
08:15	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:30	0	6	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
08:45	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
09:00	0	3	0	0	3	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	4
Hour	0	13	0	0	13	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	14
09:15	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
09:30	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
[BREAK																					
Hour	0	8	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
[BREAK																					
16:45	0	6	0	0	6	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	7
17:00	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Hour	0	8	0	0	8	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	9
17:15	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
17:30	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
17:45	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
18:00	0	3	0	0	3	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	4
Hour	0	14	0	0	14	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	15
18:15	0	6	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
18:30	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
18:45	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19:00	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Hour	0	10	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Total	0	63	0	0	63	0	6	0	0	6	1	0	1	0	2	0	0	0	0	0	71
% Apr.	-	100.0	-	-	-	-	100.0	-	-	-	50.0	-	50.0	-	-	-	-	-	-	-	-
% Int.	-	88.7	-	-	-	-	8.4	-	-	-	1.4	-	1.4	-	-	-	-	-	-	-	-

O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA
Board :D4-2241
City/County:Falls Church/Arlington
Weather :Warm/Sunny/Dry

Study Name: WASH@MET
Site Code : 14172241
Start Date: 05/08/01
Page : 1

Total Traffic

End	Metro Entrance From South				Washington Boulevard From East				Washington Boulevard From West				
Time	Left	Right	U-Turn	Apprch. Total	Left	Thru	U-Turn	Apprch. Total	Thru	Right	U-Turn	Apprch. Total	Intrvl. Total
05/08/01													
07:15	0	1	0	1	17	298	0	315	133	17	0	150	466
07:30	0	0	0	0	15	323	0	338	174	7	0	181	519
07:45	0	1	0	1	8	361	0	369	181	5	0	186	556
08:00	1	1	0	2	9	320	0	329	165	5	0	170	501
Hour	1	3	0	4	49	1302	0	1351	653	34	0	687	2042
08:15	1	0	0	1	4	329	0	333	198	4	0	202	536
08:30	1	4	0	5	2	292	1	295	202	3	0	205	505
08:45	1	0	0	1	1	225	1	227	134	5	0	139	367
09:00	0	1	0	1	1	197	0	198	187	2	0	189	388
Hour	3	5	0	8	8	1043	2	1053	721	14	0	735	1796
09:15	2	2	0	4	5	214	0	219	162	5	0	167	390
09:30	2	3	0	5	5	230	0	235	212	6	0	218	458
[BREAK]	---				---				---				---
Hour	4	5	0	9	10	444	0	454	374	11	0	385	848
[BREAK]	---				---				---				---
16:45	10	15	0	25	2	209	0	211	242	1	0	243	479
17:00	12	34	0	46	1	224	0	225	269	2	0	271	542
Hour	22	49	0	71	3	433	0	436	511	3	0	514	1021
17:15	14	28	0	42	1	268	0	269	270	0	0	270	581
17:30	8	15	0	23	1	260	0	261	318	4	0	322	606
17:45	10	22	0	32	2	303	1	306	322	4	0	326	664
18:00	11	22	1	34	2	270	0	272	340	1	0	341	647
Hour	43	87	1	131	6	1101	1	1108	1250	9	0	1259	2498
18:15	4	17	0	21	2	244	0	246	300	0	0	300	567
18:30	8	16	0	24	0	276	0	276	315	1	0	316	616
18:45	6	9	0	15	4	282	0	286	268	0	0	268	569
19:00	3	11	0	14	0	251	0	251	270	1	0	271	536
Hour	21	53	0	74	6	1053	0	1059	1153	2	0	1155	2288
19:15	1	9	0	10	1	235	0	236	256	0	0	256	502
19:30	2	7	0	9	2	231	0	233	243	1	0	244	486
Total	97	218	1	316	85	5842	3	5930	5161	74	0	5235	11481
% Apr.	30.6	68.9	0.3	-	1.4	98.5	-	-	98.5	1.4	-	-	-
% Int.	0.8	1.8	-	-	0.7	50.8	-	-	44.9	0.6	-	-	-

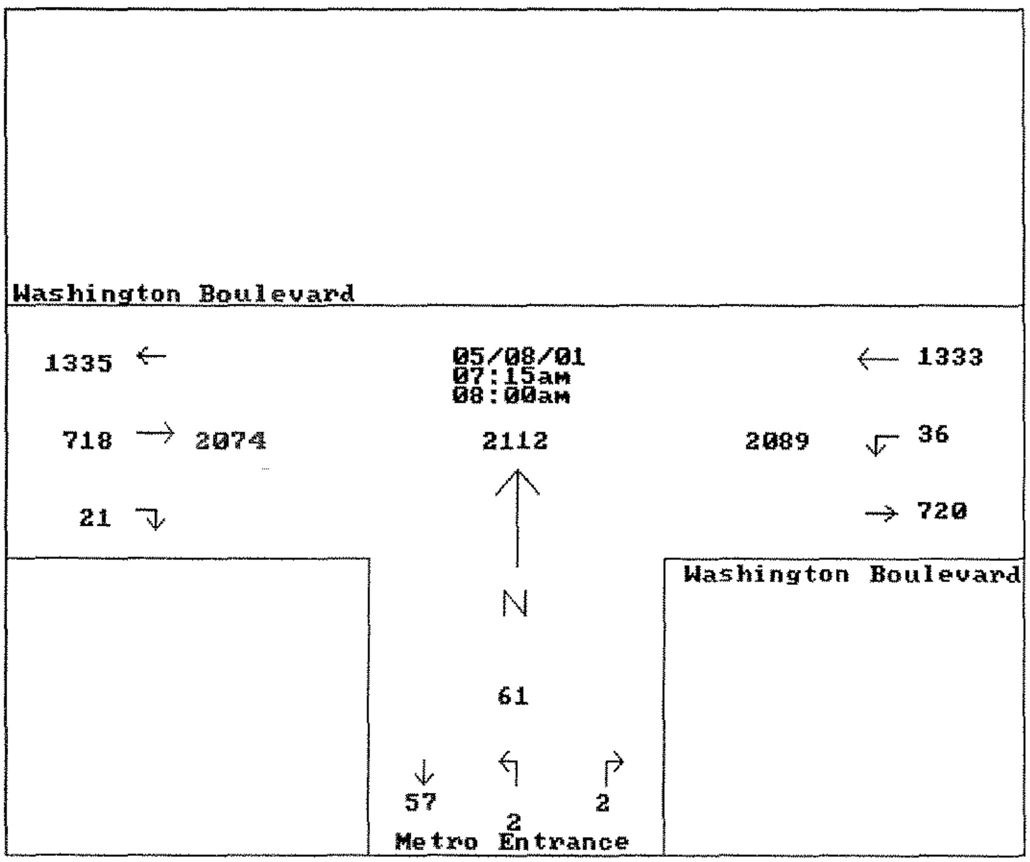
O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA
Board :D4-2241
City/County:Falls Church/Arlington
Weather :Warm/Sunny/Dry

Study Name: WASH@MET
Site Code : 14172241
Start Date: 05/08/01

Total Traffic

	Metro Entrance From South				Washington Boulevard From East				Washington Boulevard From West				
End Time	Left	Right	U-Turn	Apprch. Total	Left	Thru	U-Turn	Apprch. Total	Thru	Right	U-Turn	Apprch. Total	Intrvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 07:00 on 05/08/01 to 08:45 on 05/08/01													
Time	07:15				07:15				07:15				
Vol.	2	2	0:15		36	1333	0		718	21	0		
Pct.	50.0	50.0	0.0		2.6	97.3	0.0		97.1	2.8	0.0		
Total	4				1369				739				
High	07:45				07:30				08:00				
Vol.	1	1	0		8	361	0		198	4	0		
Total	2				369				202				
PHF	0.500				0.927				0.914				



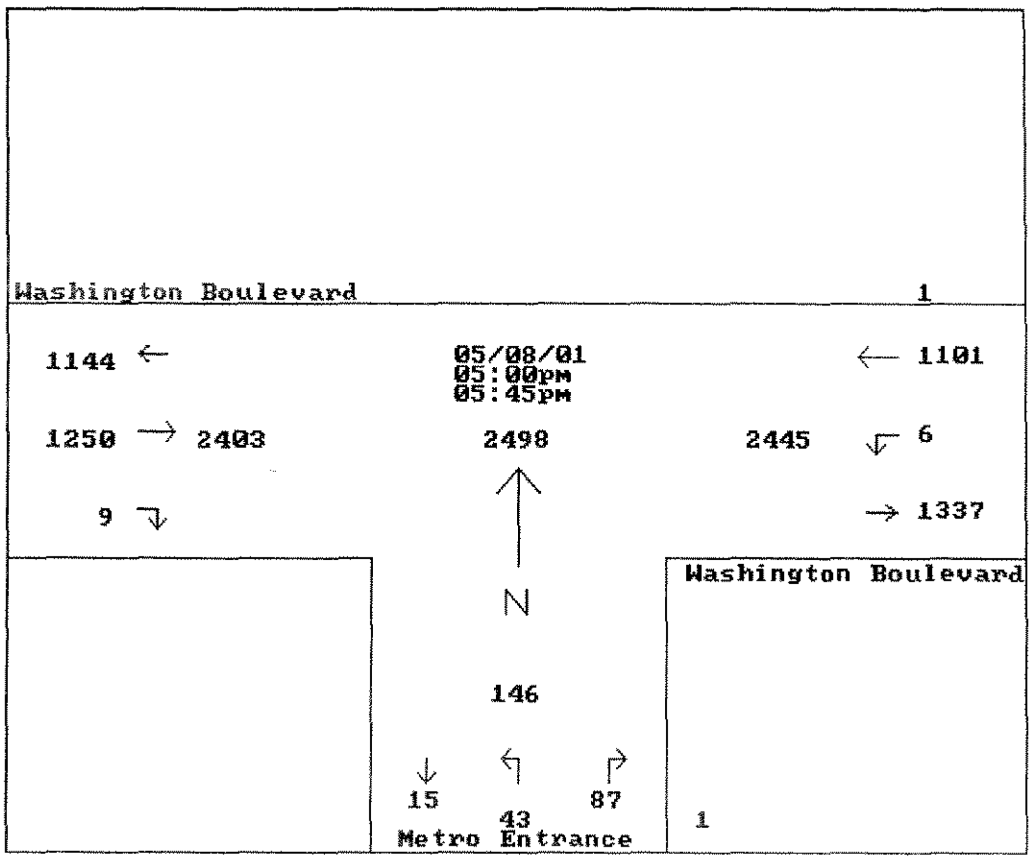
O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA
Board :D4-2241
City/County:Falls Church/Arlington
Weather :Warm/Sunny/Dry

Study Name: WASH@MET
Site Code : 14172241
Start Date: 05/08/01
Page : 3

Total Traffic

End Time	Metro Entrance From South Left	Right	U-Turn	Apprch. Total	Washington Boulevard From East Left	Thru	U-Turn	Apprch. Total	Washington Boulevard From West Thru	Right	U-Turn	Apprch. Total	Intrvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 16:00 on 05/08/01 to 18:45 on 05/08/01													
Time	17:00				17:00				17:00				
Vol.	43	87	1:00		6	1101	1		1250	9	0		
Pct.	32.8	66.4	0.7		0.5	99.3	0.0		99.2	0.7	0.0		
Total	131				1108				1259				
High	17:00				17:30				17:45				
Vol.	14	28	0		2	303	1		340	1	0		
Total	42				306				341				
PHF	0.779				0.905				0.923				



O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA
Board :D4-2241
City/County:Falls Church/Arlington
Weather :Warm/Sunny/Dry

Study Name: WASH@MET
Site Code : 14172241
Start Date: 05/08/01
Page : 1

Passenger Vehicles

	Metro Entrance From South				Washington Boulevard From East				Washington Boulevard From West				
End Time	Left	Right	U-Turn	Apprch. Total	Left	Thru	U-Turn	Apprch. Total	Thru	Right	U-Turn	Apprch. Total	Intrvl. Total
05/08/01													
07:15	0	1	0	1	17	296	0	313	132	17	0	149	463
07:30	0	0	0	0	15	321	0	336	172	7	0	179	515
07:45	0	1	0	1	8	358	0	366	179	5	0	184	551
08:00	1	1	0	2	9	319	0	328	164	5	0	169	499
Hour	1	3	0	4	49	1294	0	1343	647	34	0	681	2028
08:15	1	0	0	1	4	324	0	328	195	4	0	199	528
08:30	1	4	0	5	2	290	1	293	197	3	0	200	498
08:45	1	0	0	1	1	223	1	225	133	5	0	138	364
09:00	0	1	0	1	1	193	0	194	186	2	0	188	383
Hour	3	5	0	8	8	1030	2	1040	711	14	0	725	1773
09:15	2	2	0	4	5	212	0	217	160	5	0	165	386
09:30	2	3	0	5	5	227	0	232	210	6	0	216	453
[BREAK]													
Hour	4	5	0	9	10	439	0	449	370	11	0	381	839
[BREAK]													
16:45	10	15	0	25	2	206	0	208	238	1	0	239	472
17:00	12	34	0	46	1	219	0	220	268	2	0	270	536
Hour	22	49	0	71	3	425	0	428	506	3	0	509	1008
17:15	14	28	0	42	1	265	0	266	266	0	0	266	574
17:30	8	15	0	23	1	258	0	259	316	4	0	320	602
17:45	10	22	0	32	2	296	1	299	318	4	0	322	653
18:00	11	22	1	34	2	268	0	270	338	1	0	339	643
Hour	43	87	1	131	6	1087	1	1094	1238	9	0	1247	2472
18:15	4	17	0	21	2	241	0	243	296	0	0	296	560
18:30	8	16	0	24	0	274	0	274	315	1	0	316	614
18:45	6	9	0	15	4	277	0	281	263	0	0	263	559
19:00	3	11	0	14	0	248	0	248	268	1	0	269	531
Hour	21	53	0	74	6	1040	0	1046	1142	2	0	1144	2264
19:15	1	9	0	10	1	235	0	236	256	0	0	256	502
19:30	2	7	0	9	2	231	0	233	243	1	0	244	486
Total	97	218	1	316	85	5781	3	5869	5113	74	0	5187	11372
% Apr.	30.6	68.9	0.3	-	1.4	98.5	-	-	98.5	1.4	-	-	-
% Int.	0.8	1.9	-	-	0.7	50.8	-	-	44.9	0.6	-	-	-

O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA
Board :D4-2241
City/County:Falls Church/Arlington
Weather :Warm/Sunny/Dry

Study Name: WASH@MET
Site Code : 14172241
Start Date: 05/08/01
Page : 1

Trucks

	Metro Entrance From South				Washington Boulevard From East				Washington Boulevard From West				
End Time	Left	Right	U-Turn	Apprch. Total	Left	Thru	U-Turn	Apprch. Total	Thru	Right	U-Turn	Apprch. Total	Intrvl. Total
05/08/01													
07:15	0	0	0	0	0	1	0	1	1	0	0	1	2
07:30	0	0	0	0	0	0	0	0	1	0	0	1	1
07:45	0	0	0	0	0	1	0	1	2	0	0	2	3
[BREAK]													
Hour	0	0	0	0	0	2	0	2	4	0	0	4	6
08:15	0	0	0	0	0	2	0	2	1	0	0	1	3
08:30	0	0	0	0	0	1	0	1	2	0	0	2	3
08:45	0	0	0	0	0	2	0	2	0	0	0	0	2
09:00	0	0	0	0	0	3	0	3	1	0	0	1	4
Hour	0	0	0	0	0	8	0	8	4	0	0	4	12
09:15	0	0	0	0	0	2	0	2	0	0	0	0	2
09:30	0	0	0	0	0	1	0	1	1	0	0	1	2
[BREAK]													
Hour	0	0	0	0	0	3	0	3	1	0	0	1	4
[BREAK]													
16:45	0	0	0	0	0	2	0	2	1	0	0	1	3
17:00	0	0	0	0	0	2	0	2	0	0	0	0	2
Hour	0	0	0	0	0	4	0	4	1	0	0	1	5
17:15	0	0	0	0	0	2	0	2	1	0	0	1	3
17:30	0	0	0	0	0	1	0	1	2	0	0	2	3
17:45	0	0	0	0	0	3	0	3	1	0	0	1	4
18:00	0	0	0	0	0	2	0	2	1	0	0	1	3
Hour	0	0	0	0	0	8	0	8	5	0	0	5	13
18:15	0	0	0	0	0	0	0	0	1	0	0	1	1
18:30	0	0	0	0	0	1	0	1	0	0	0	0	1
18:45	0	0	0	0	0	3	0	3	2	0	0	2	5
19:00	0	0	0	0	0	1	0	1	0	0	0	0	1
Hour	0	0	0	0	0	5	0	5	3	0	0	3	8
[BREAK]													
Total	0	0	0	0	0	30	0	30	18	0	0	18	48
% Apr.	-	-	-	-	-	100.0	-	-	100.0	-	-	-	-
% Int.	-	-	-	-	-	62.5	-	-	37.5	-	-	-	-

O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA
Board :D4-2241
City/County:Falls Church/Arlington
Weather :Warm/Sunny/Dry

Study Name: WASH@MET
Site Code : 14172241
Start Date: 05/08/01
Page : 1

Buses

End Time	Metro Entrance From South Left	Right	U-Turn	Apprch. Total	Washington Boulevard From East Left	Thru	U-Turn	Apprch. Total	Washington Boulevard From West Thru	Right	U-Turn	Apprch. Total	Intrvl. Total
05/08/01													
07:15	0	0	0	0	0	1	0	1	0	0	0	0	1
07:30	0	0	0	0	0	2	0	2	1	0	0	1	3
07:45	0	0	0	0	0	2	0	2	0	0	0	0	2
08:00	0	0	0	0	0	1	0	1	1	0	0	1	2
Hour	0	0	0	0	0	6	0	6	2	0	0	2	8
08:15	0	0	0	0	0	3	0	3	2	0	0	2	5
08:30	0	0	0	0	0	1	0	1	3	0	0	3	4
08:45	0	0	0	0	0	0	0	0	1	0	0	1	1
09:00	0	0	0	0	0	1	0	1	0	0	0	0	1
Hour	0	0	0	0	0	5	0	5	6	0	0	6	11
09:15	0	0	0	0	0	0	0	0	2	0	0	2	2
09:30	0	0	0	0	0	2	0	2	1	0	0	1	3
[BREAK]													
Hour	0	0	0	0	0	2	0	2	3	0	0	3	5
[BREAK]													
16:45	0	0	0	0	0	1	0	1	3	0	0	3	4
17:00	0	0	0	0	0	3	0	3	1	0	0	1	4
Hour	0	0	0	0	0	4	0	4	4	0	0	4	8
17:15	0	0	0	0	0	1	0	1	3	0	0	3	4
17:30	0	0	0	0	0	1	0	1	0	0	0	0	1
17:45	0	0	0	0	0	4	0	4	3	0	0	3	7
18:00	0	0	0	0	0	0	0	0	1	0	0	1	1
Hour	0	0	0	0	0	6	0	6	7	0	0	7	13
18:15	0	0	0	0	0	3	0	3	3	0	0	3	6
18:30	0	0	0	0	0	1	0	1	0	0	0	0	1
18:45	0	0	0	0	0	2	0	2	3	0	0	3	5
19:00	0	0	0	0	0	2	0	2	2	0	0	2	4
Hour	0	0	0	0	0	8	0	8	8	0	0	8	16
[BREAK]													
Total	0	0	0	0	0	31	0	31	30	0	0	30	61
% Apr.	-	-	-	-	-	100.0	-	-	100.0	-	-	-	-
% Int.	-	-	-	-	-	50.8	-	-	49.1	-	-	-	-

O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA, LM
Board :D4-2240,2236
City/County:Washington/Falls Church
Weather :Warm/Clear/Dry

Study Name: WASH@SYC
Site Code : 20562240
Start Date: 05/09/01
Page : 1

Total Traffic

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From East Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
05/09/01																					
07:15	15	45	9	0	69	254	59	5	0	318	8	94	5	0	107	2	87	37	0	126	620
07:30	14	60	9	0	83	310	69	8	0	387	9	129	12	0	150	1	123	33	0	157	777
07:45	19	75	8	0	102	267	105	5	0	377	18	100	48	0	166	3	129	62	0	194	839
08:00	28	129	8	0	165	195	112	13	0	320	27	82	34	0	143	4	134	64	0	202	830
Hour	76	309	34	0	419	1026	345	31	0	1402	62	405	99	0	566	10	473	196	0	679	3066
08:15	16	107	8	0	131	173	117	14	0	304	29	66	27	0	122	1	128	64	0	193	750
08:30	16	85	10	0	111	146	131	7	0	284	36	77	25	0	138	1	169	71	0	241	774
08:45	18	88	11	0	117	180	121	10	0	311	34	67	19	0	120	2	125	62	0	189	737
09:00	17	86	4	0	107	205	107	21	0	333	35	67	24	0	126	1	113	80	0	194	760
Hour	67	366	33	0	466	704	476	52	0	1232	134	277	95	0	506	5	535	277	0	817	3021
09:15	15	89	9	0	113	160	97	16	0	273	21	50	23	0	94	2	71	114	0	187	667
09:30	11	91	8	0	110	152	66	16	0	234	25	68	23	0	116	3	92	130	0	225	685
[BREAK]																					
Hour	26	180	17	0	223	312	163	32	0	507	46	118	46	0	210	5	163	244	0	412	1352
[BREAK]																					
16:45	18	83	3	0	104	76	65	15	0	156	20	144	12	0	176	4	87	113	0	204	640
17:00	21	105	8	0	134	94	69	7	0	170	21	136	6	0	163	7	132	151	0	290	757
Hour	39	188	11	0	238	170	134	22	0	326	41	280	18	0	339	11	219	264	0	494	1397
17:15	12	84	3	0	99	154	51	14	0	219	22	139	5	0	166	8	192	175	0	375	859
17:30	21	91	6	0	118	143	45	16	0	204	22	184	9	0	215	7	178	176	0	361	898
17:45	31	111	2	0	144	219	77	8	0	304	16	166	16	0	198	2	206	171	0	379	1025
18:00	31	96	2	0	129	169	44	6	0	219	34	204	15	0	253	7	186	157	0	350	951
Hour	95	382	13	0	490	685	217	44	0	946	94	693	45	0	832	24	762	679	0	1465	3733
18:15	24	108	3	0	135	158	34	6	0	198	26	152	10	0	188	4	200	171	0	375	896
18:30	16	91	8	0	115	173	27	11	0	211	15	109	11	0	135	1	173	188	0	362	823
18:45	14	98	9	0	121	196	63	8	0	267	24	106	5	0	135	8	163	165	0	336	859
19:00	27	129	4	0	160	165	42	10	0	217	16	125	6	0	147	4	172	173	0	349	873
Hour	81	426	24	0	531	692	166	35	0	893	81	492	32	0	605	17	708	697	0	1422	3451
Total	384	1851	132	0	2367	3589	1501	216	0	5306	458	2265	335	0	3058	72	2860	2357	0	5289	16020
% Apr.	16.2	78.2	5.5	-	-	67.6	28.2	4.0	-	-	14.9	74.0	10.9	-	-	1.3	54.0	44.5	-	-	-
% Int.	2.3	11.5	0.8	-	-	22.4	9.3	1.3	-	-	2.8	14.1	2.0	-	-	0.4	17.8	14.7	-	-	-

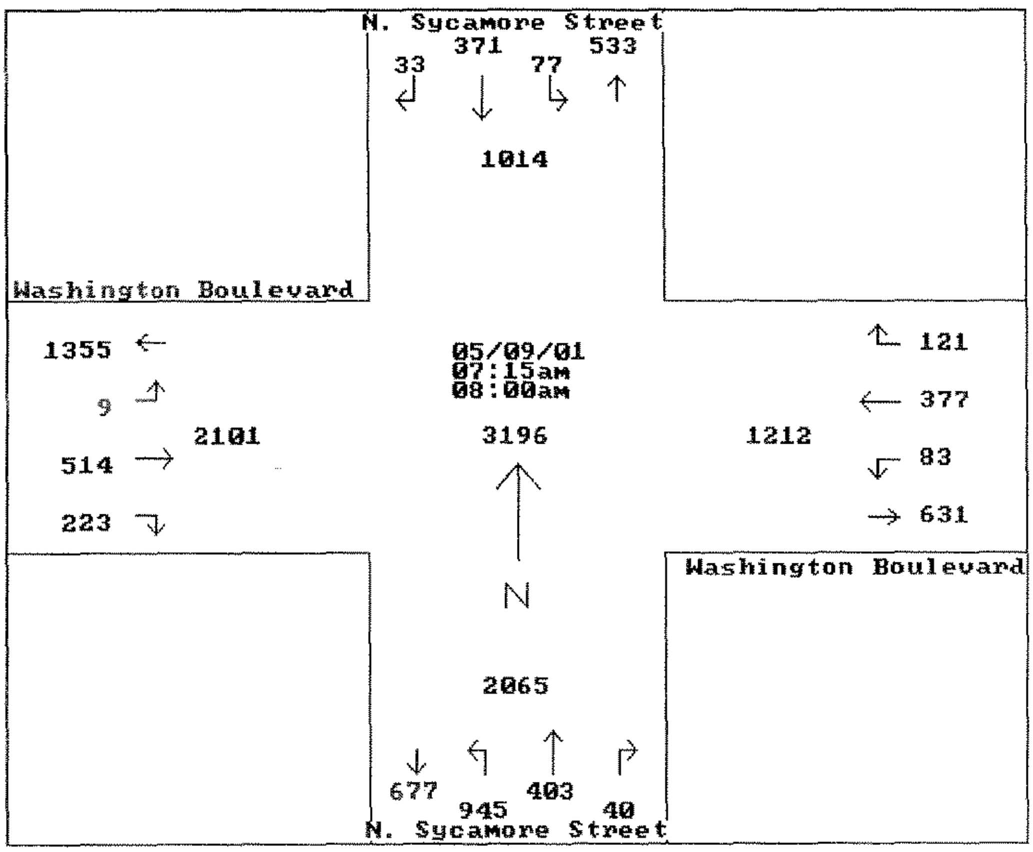
O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA, LM
Board :D4-2240,2236
City/County:Washington/Falls Church
Weather :Warm/Clear/Dry

Study Name: WASH@SYC
Site Code : 20562240
Start Date: 05/09/01
Page : 2

Total Traffic

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From East Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
Peak Hour Analysis By Entire Intersection for the Period: 07:00 on 05/09/01 to 08:45 on 05/09/01																					
Time	07:15					07:15					07:15					07:15					
Vol.	77	371	33	0		945	403	40	0		83	377	121	0		9	514	223	0		
Pct.	16.0	77.1	6.8	0.0		68.0	29.0	2.8	0.0		14.2	64.8	20.8	0.0		1.2	68.9	29.8	0.0		
Total	481					1388					581					746					
High	07:45					07:15					07:30					07:45					
Vol.	28	129	8	0		310	69	8	0		18	100	48	0		4	134	64	0		
Total	165					387					166					202					
PHF	0.728					0.896					0.875					0.923					



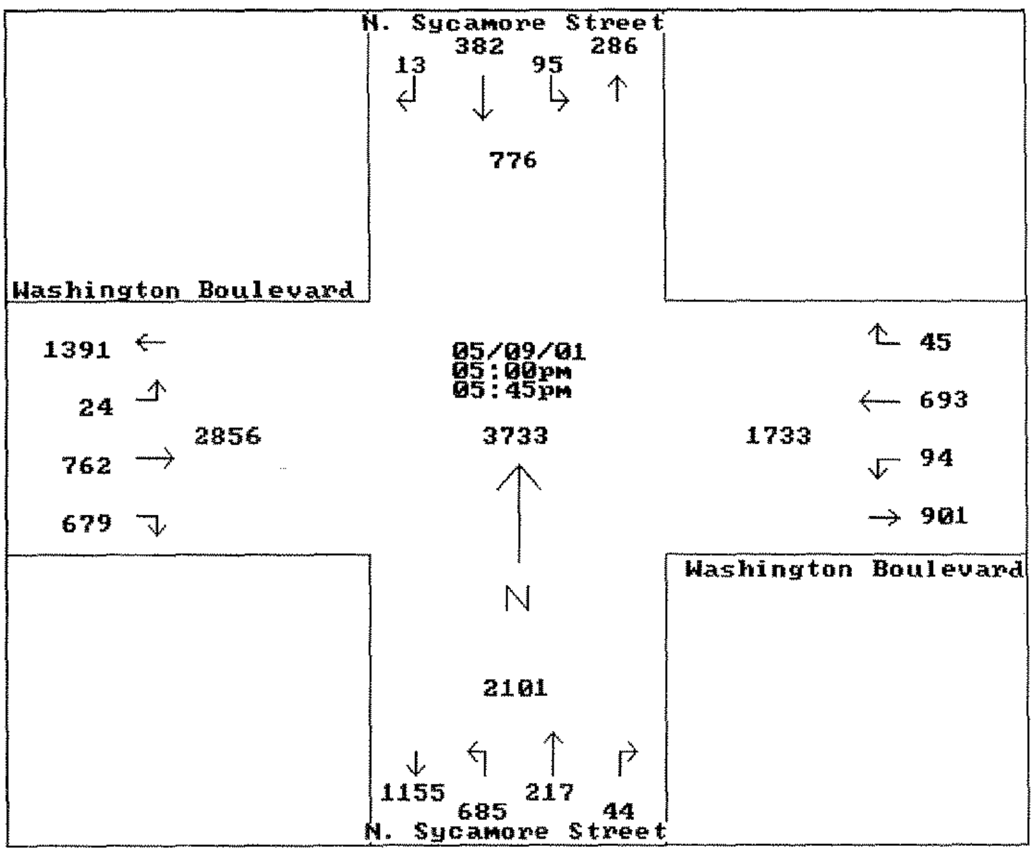
O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA, LM
Board :D4-2240,2236
City/County:Washington/Falls Church
Weather :Warm/Clear/Dry

Study Name: WASH@SYC
Site Code : 20562240
Start Date: 05/09/01

Total Traffic

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From East Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
Peak Hour Analysis By Entire Intersection for the Period: 16:00 on 05/09/01 to 17:45 on 05/09/01																					
Time	17:00					17:00					17:00					17:00					
Vol.	95	382	13	0		685	217	44	0		94	693	45	0		24	762	679	0		
Pct.	19.3	77.9	2.6	0.0		72.4	22.9	4.6	0.0		11.2	83.2	5.4	0.0		1.6	52.0	46.3	0.0		
Total	490					946					832					1465					
High	17:30					17:30					17:45					17:30					
Vol.	31	111	2	0		219	77	8	0		34	204	15	0		2	206	171	0		
Total	144					304					253					379					
PHF	0.850					0.777					0.822					0.966					



O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA, LM
Board :D4-2240,2236
City/County:Washington/Falls Church
Weather :Warm/Clear/Dry

Study Name: WASH@SYC
Site Code : 20562240
Start Date: 05/09/01
Page : 1

Passenger Vehicles

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From East Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
05/09/01																					
07:15	15	42	9	0	66	251	55	4	0	310	7	91	5	0	103	2	84	34	0	120	599
07:30	14	56	9	0	79	309	65	8	0	382	7	124	12	0	143	1	123	32	0	156	760
07:45	17	72	8	0	97	265	98	3	0	366	17	100	48	0	165	3	127	59	0	189	817
08:00	28	126	8	0	162	194	107	12	0	313	26	82	34	0	142	4	132	64	0	200	817
Hour	74	296	34	0	404	1019	325	27	0	1371	57	397	99	0	553	10	466	189	0	665	2993
08:15	16	105	7	0	128	170	114	13	0	297	29	66	25	0	120	1	127	62	0	190	735
08:30	16	82	10	0	108	145	126	7	0	278	34	77	25	0	136	1	168	68	0	237	759
08:45	17	82	11	0	110	177	118	9	0	304	33	67	19	0	119	2	120	61	0	183	716
09:00	17	83	4	0	104	204	101	20	0	325	34	67	24	0	125	1	105	79	0	185	739
Hour	66	352	32	0	450	696	459	49	0	1204	130	277	93	0	500	5	520	270	0	795	2949
09:15	15	86	9	0	110	160	92	16	0	268	20	49	23	0	92	2	70	112	0	184	654
09:30	10	88	8	0	106	149	63	15	0	227	24	67	23	0	114	3	86	125	0	214	661
BREAK																					
Hour	25	174	17	0	216	309	155	31	0	495	44	116	46	0	206	5	156	237	0	398	1315
BREAK																					
16:45	18	80	3	0	101	76	65	11	0	152	17	143	12	0	172	4	86	112	0	202	627
17:00	21	101	8	0	130	93	65	7	0	165	20	131	6	0	157	7	130	148	0	285	737
Hour	39	181	11	0	231	169	130	18	0	317	37	274	18	0	329	11	216	260	0	487	1364
17:15	12	80	3	0	95	151	48	12	0	211	21	139	5	0	165	8	190	171	0	369	840
17:30	21	89	6	0	116	142	43	16	0	201	22	184	9	0	215	7	178	176	0	361	893
17:45	31	106	2	0	139	215	74	8	0	297	15	165	16	0	196	2	205	167	0	374	1006
18:00	31	94	2	0	127	169	40	6	0	215	33	202	15	0	250	7	186	155	0	348	940
Hour	95	369	13	0	477	677	205	42	0	924	91	690	45	0	826	24	759	669	0	1452	3679
18:15	24	106	3	0	133	156	33	6	0	195	25	152	10	0	187	4	198	169	0	371	886
18:30	16	88	8	0	112	173	26	9	0	208	15	108	11	0	134	1	172	184	0	357	811
18:45	13	97	9	0	119	194	62	7	0	263	22	104	5	0	131	8	163	161	0	332	845
19:00	27	127	4	0	158	162	38	10	0	210	15	123	6	0	144	4	171	170	0	345	857
Hour	80	418	24	0	522	685	159	32	0	876	77	487	32	0	596	17	704	684	0	1405	3399
Total	379	1790	131	0	2300	3555	1433	199	0	5187	436	2241	333	0	3010	72	2821	2309	0	5202	15699
% Apr.	16.4	77.8	5.6	-	-	68.5	27.6	3.8	-	-	14.4	74.4	11.0	-	-	1.3	54.2	44.3	-	-	-
% Int.	2.4	11.4	0.8	-	-	22.6	9.1	1.2	-	-	2.7	14.2	2.1	-	-	0.4	17.9	14.7	-	-	-

O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA, LM
Board :D4-2240,2236
City/County:Washington/Falls Church
Weather :Warm/Clear/Dry

Study Name: WASH@SYC
Site Code : 20562240
Start Date: 05/09/01
Page : 1

Trucks

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From East Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
05/09/01																					
07:15	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	2	1	0	3	6
07:30	0	0	0	0	0	1	0	0	0	1	0	5	0	0	5	0	0	0	0	0	6
07:45	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3
08:00	0	0	0	0	0	1	3	1	0	5	0	0	0	0	0	0	2	0	0	2	7
Hour	0	0	0	0	0	2	4	1	0	7	0	8	0	0	8	0	6	1	0	7	22
08:15	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	3
08:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	4
08:45	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	5	0	0	5	7
09:00	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	8	0	0	8	10
Hour	0	0	1	0	1	3	4	0	0	7	0	0	1	0	1	0	15	0	0	15	24
09:15	0	0	0	0	0	0	2	0	0	2	1	1	0	0	2	0	1	0	0	1	5
09:30	1	0	0	0	1	3	1	0	0	4	0	1	0	0	1	0	6	0	0	6	12
[BREAK																					
Hour	1	0	0	0	1	3	3	0	0	6	1	2	0	0	3	0	7	0	0	7	17
[BREAK																					
16:45	0	0	0	0	0	0	0	1	0	1	1	1	0	0	2	0	1	0	0	1	4
17:00	0	0	0	0	0	0	2	0	0	2	0	4	0	0	4	0	2	2	0	4	10
Hour	0	0	0	0	0	0	2	1	0	3	1	5	0	0	6	0	3	2	0	5	14
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
[BREAK																					
17:45	0	2	0	0	2	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	4
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Hour	0	2	0	0	2	1	0	0	0	1	0	0	0	0	0	0	3	1	0	4	7
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
18:30	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	2	4
18:45	1	0	0	0	1	1	0	0	0	1	1	2	0	0	3	0	0	1	0	1	6
19:00	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
Hour	1	1	0	0	2	1	0	0	0	1	1	5	0	0	6	0	1	3	0	4	13
Total	2	3	1	0	6	10	13	2	0	25	3	20	1	0	24	0	35	7	0	42	97
% Apr.	33.3	50.0	16.6	-	-	40.0	52.0	8.0	-	-	12.5	83.3	4.1	-	-	-	83.3	16.6	-	-	-
% Int.	2.0	3.0	1.0	-	-	10.3	13.4	2.0	-	-	3.0	20.6	1.0	-	-	-	36.0	7.2	-	-	-

O.R.George & Associates, Inc
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA, LM
Board :D4-2240,2236
City/County:Washington/Falls Church
Weather :Warm/Clear/Dry

Study Name: WASH@SYC
Site Code : 20562240
Start Date: 05/09/01
Page : 1

Buses

End Time	N. Sycamore Street From North Left	Thru	Right	U-Turn	Aprch Total	N. Sycamore Street From South Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From East Left	Thru	Right	U-Turn	Aprch Total	Washington Boulevard From West Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
05/09/01																					
07:15	0	3	0	0	3	3	4	1	0	8	1	0	0	0	1	0	1	2	0	3	15
07:30	0	4	0	0	4	0	4	0	0	4	2	0	0	0	2	0	0	1	0	1	11
07:45	2	3	0	0	5	2	6	2	0	10	1	0	0	0	1	0	0	3	0	3	19
08:00	0	3	0	0	3	0	2	0	0	2	1	0	0	0	1	0	0	0	0	0	6
Hour	2	13	0	0	15	5	16	3	0	24	5	0	0	0	5	0	1	6	0	7	51
08:15	0	2	0	0	2	3	3	1	0	7	0	0	1	0	1	0	0	2	0	2	12
08:30	0	3	0	0	3	1	2	0	0	3	2	0	0	0	2	0	0	3	0	3	11
08:45	1	6	0	0	7	1	3	1	0	5	1	0	0	0	1	0	0	1	0	1	14
09:00	0	3	0	0	3	0	5	1	0	6	1	0	0	0	1	0	0	1	0	1	11
Hour	1	14	0	0	15	5	13	3	0	21	4	0	1	0	5	0	0	7	0	7	48
09:15	0	3	0	0	3	0	3	0	0	3	0	0	0	0	0	0	0	2	0	2	8
09:30	0	3	0	0	3	0	2	1	0	3	1	0	0	0	1	0	0	5	0	5	12
[BREAK]																					
Hour	0	6	0	0	6	0	5	1	0	6	1	0	0	0	1	0	0	7	0	7	20
[BREAK]																					
16:45	0	3	0	0	3	0	0	3	0	3	2	0	0	0	2	0	0	1	0	1	9
17:00	0	4	0	0	4	1	2	0	0	3	1	1	0	0	2	0	0	1	0	1	10
Hour	0	7	0	0	7	1	2	3	0	6	3	1	0	0	4	0	0	2	0	2	19
17:15	0	4	0	0	4	3	3	2	0	8	1	0	0	0	1	0	0	4	0	4	17
17:30	0	2	0	0	2	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	5
17:45	0	3	0	0	3	3	3	0	0	6	1	1	0	0	2	0	0	4	0	4	15
18:00	0	2	0	0	2	0	4	0	0	4	1	2	0	0	3	0	0	1	0	1	10
Hour	0	11	0	0	11	7	12	2	0	21	3	3	0	0	6	0	0	9	0	9	47
18:15	0	2	0	0	2	2	1	0	0	3	1	0	0	0	1	0	2	1	0	3	9
18:30	0	2	0	0	2	0	1	2	0	3	0	0	0	0	0	0	0	3	0	3	8
18:45	0	1	0	0	1	1	1	1	0	3	1	0	0	0	1	0	0	3	0	3	8
19:00	0	2	0	0	2	3	4	0	0	7	1	0	0	0	1	0	1	3	0	4	14
Hour	0	7	0	0	7	6	7	3	0	16	3	0	0	0	3	0	3	10	0	13	39
Total	3	58	0	0	61	24	55	15	0	94	19	4	1	0	24	0	4	41	0	45	224
% Apr.	4.9	95.0	-	-	-	25.5	58.5	15.9	-	-	79.1	16.6	4.1	-	-	-	8.8	91.1	-	-	-
% Int.	1.3	25.8	-	-	-	10.7	24.5	6.6	-	-	8.4	1.7	0.4	-	-	-	1.7	18.3	-	-	-

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... N. Sycamore St., S. of VA 237, NB
Location Code 401
County .... Arlington, VA
Recorder Set 06/27/01 15:15
Recording Start ... 06/28/01 00:00
Recording End 06/29/01 00:00
Sample Time .... 60 Minutes
Operator Number ... 16
Machine Number 17
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Thursday 06/28/01 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
83	49	25	33	52	330	979	1359	1204	1014	821	556	535	621	636	714	790	946	851	749	659	487	264	172	13929

AM Peak Hour .... 07:00 to 08:00 (1359 vehicles)
PM Peak Hour .... 17:00 to 18:00 (946 vehicles)

Volume Count Report

Location .... N. Sycamore St., S. of VA 237, SB
Location Code 503
County .... Arlington, VA
Recorder Set 06/27/01 15:17
Recording Start ... 06/27/ 1 16:00
Recording End 07/02/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 22
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Wednesday 06/27/ 1   Channel: 1   Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
																1134	1244	1288	1012	743	755	514	289	6979
																306	309	325	262	190	179	166	96	
																265	316	340	279	202	210	122	85	
																265	289	328	240	196	193	118	45	
																298	330	295	231	155	173	108	63	

AM Peak Hour .... Unavailable
AM Peak Hour Factor .... Unavailable
PM Peak Hour .... 17:45 to 18:45 (1323 vehicles)
PM Peak Hour Factor 97.3%

Thursday 06/28/01   Channel: 1   Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
179	71	29	31	57	181	337	540	785	827	842	812	879	808	931	1079	1177	1267	1277	1058	765	663	547	317	15459
57	24	9	6	7	19	89	121	200	230	225	199	225	206	243	279	285	325	350	272	197	202	176	122	
47	26	9	6	13	37	79	109	200	208	214	230	229	204	253	265	291	316	316	282	192	176	137	71	
41	12	9	9	18	63	87	151	184	197	203	203	229	180	211	271	303	313	307	260	188	159	120	69	
34	9	2	10	19	62	82	159	201	192	200	180	196	218	224	264	298	313	304	244	188	126	114	55	

AM Peak Hour .... 10:00 to 11:00 (842 vehicles)
AM Peak Hour Factor 93.6%
PM Peak Hour .... 17:15 to 18:15 (1292 vehicles)
PM Peak Hour Factor 92.3%

24-Hour Moving Total

01:00- N/A	02:00- N/A	03:00- N/A	04:00- N/A	05:00- N/A	06:00- N/A	07:00- N/A	08:00- N/A
09:00- N/A	10:00- N/A	11:00- N/A	12:00- N/A	13:00- N/A	14:00- N/A	15:00- N/A	16:00- N/A
17:00- 15367	18:00- 15410	19:00- 15433	20:00- 15422	21:00- 15468	22:00- 15490	23:00- 15398	24:00- 15431

Friday 06/29/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
160	83	52	32	47	184	337	513	733	859	832	812	896	873	1015	1154	1198	1247	1187	988	722	671	599	430	15624
43	21	21	11	8	30	63	100	180	207	202	212	255	216	245	272	304	329	318	274	186	170	182	125	
39	25	10	6	10	35	107	121	197	218	234	180	227	204	246	293	279	279	294	262	195	166	147	111	
48	18	4	5	17	61	74	140	167	235	201	198	221	232	262	298	301	329	290	237	171	165	141	100	
30	19	17	10	12	58	93	152	189	199	195	222	193	221	262	291	314	310	285	215	170	170	129	94	

AM Peak Hour .... 09:30 to 10:30 (870 vehicles)
AM Peak Hour Factor 92.6%
PM Peak Hour .... 16:45 to 17:45 (1251 vehicles)
PM Peak Hour Factor 95.1%

24-Hour Moving Total

01:00- 15440	02:00- 15452	03:00- 15475	04:00- 15476	05:00- 15466	06:00- 15469	07:00- 15469	08:00- 15442
09:00- 15390	10:00- 15422	11:00- 15412	12:00- 15412	13:00- 15429	14:00- 15494	15:00- 15578	16:00- 15653
17:00- 15674	18:00- 15654	19:00- 15564	20:00- 15494	21:00- 15451	22:00- 15459	23:00- 15511	24:00- 15624

Saturday 06/30/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
261	155	93	71	58	112	231	340	527	801	1090	1035	1093	1018	986	926	954	925	883	747	647	569	579	509	14610
64	43	23	22	8	24	36	74	96	155	278	229	248	268	238	218	254	224	233	225	159	147	180	125	
60	45	28	17	14	25	48	68	123	168	243	275	280	247	236	222	255	223	227	183	175	145	132	153	
77	33	28	15	16	36	76	83	154	223	278	273	275	241	262	256	236	243	221	172	157	149	135	132	
60	34	14	17	20	27	71	115	154	255	291	258	290	262	250	230	209	235	202	167	156	128	132	99	

AM Peak Hour .... 10:00 to 11:00 (1090 vehicles)
AM Peak Hour Factor 93.6%
PM Peak Hour .... 12:15 to 13:15 (1113 vehicles)
PM Peak Hour Factor 95.9%

24-Hour Moving Total

01:00- 15725	02:00- 15797	03:00- 15838	04:00- 15877	05:00- 15888	06:00- 15816	07:00- 15710	08:00- 15537
09:00- 15331	10:00- 15273	11:00- 15531	12:00- 15754	13:00- 15951	14:00- 16096	15:00- 16067	16:00- 15839
17:00- 15595	18:00- 15273	19:00- 14969	20:00- 14728	21:00- 14653	22:00- 14551	23:00- 14531	24:00- 14610

Sunday 07/01/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
302	196	116	61	50	64	92	196	337	552	794	955	965	1325	1222	1243	1009	905	757	597	506	387	341	271	13243
95	51	38	11	18	16	14	49	68	104	169	235	238	274	318	315	307	239	211	155	137	110	95	83	
76	51	23	21	12	12	24	37	70	132	209	249	239	300	314	313	255	211	175	148	114	92	79	78	
63	54	32	14	8	17	32	50	85	143	215	225	256	393	285	332	201	235	188	154	133	92	94	71	
68	40	23	15	12	19	22	60	114	173	201	246	232	358	305	283	246	220	183	140	122	93	73	39	

AM Peak Hour .... 11:00 to 12:00 (955 vehicles)
AM Peak Hour Factor 95.9%
PM Peak Hour .... 13:30 to 14:30 (1383 vehicles)
PM Peak Hour Factor 88.0%

24-Hour Moving Total

01:00- 14651	02:00- 14692	03:00- 14715	04:00- 14705	05:00- 14697	06:00- 14649	07:00- 14510	08:00- 14366
09:00- 14176	10:00- 13927	11:00- 13631	12:00- 13551	13:00- 13423	14:00- 13730	15:00- 13966	16:00- 14283
17:00- 14338	18:00- 14318	19:00- 14192	20:00- 14042	21:00- 13901	22:00- 13719	23:00- 13481	24:00- 13243

Volume Count Report

Location .... VA 237, W. of Sycamore St., EB
Location Code 72
County .... Arlington, VA
Recorder Set 06/27/01 14:36
Recording Start ... 06/27/ 1 15:00
Recording End 07/02/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 34
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Wednesday 06/27/ 1 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
															937	1031	1224	1265	926	653	689	490	268	7483
															207	254	275	326	205	149	165	146	90	
															243	255	321	339	260	161	183	129	79	
															238	262	290	290	255	188	172	107	42	
															249	260	338	310	206	155	169	108	57	

AM Peak Hour .... Unavailable
AM Peak Hour Factor .... Unavailable
PM Peak Hour .... 17:30 to 18:30 (1293 vehicles)
PM Peak Hour Factor 95.4%

Thursday 06/28/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
174	68	22	33	50	209	526	690	829	814	846	917	1046	966	919	872	870	1104	1022	727	497	442	313	214	14170
50	22	8	6	12	21	94	157	212	210	212	222	239	246	278	213	233	245	291	229	152	126	110	70	
46	25	4	6	13	45	125	180	191	197	192	230	283	227	252	234	188	251	246	180	139	125	77	60	
45	14	7	14	14	71	161	159	197	199	224	255	260	219	183	198	254	309	265	159	99	98	53	53	
33	7	3	7	11	72	146	194	229	208	218	210	264	274	206	227	195	299	220	159	107	93	73	31	

AM Peak Hour .... 10:45 to 11:45 (925 vehicles)
AM Peak Hour Factor 90.7%
PM Peak Hour .... 17:15 to 18:15 (1150 vehicles)
PM Peak Hour Factor 93.0%

24-Hour Moving Total

01:00- N/A	02:00- N/A	03:00- N/A	04:00- N/A	05:00- N/A	06:00- N/A	07:00- N/A	08:00- N/A
09:00- N/A	10:00- N/A	11:00- N/A	12:00- N/A	13:00- N/A	14:00- N/A	15:00- N/A	16:00- 15592
17:00- 15527	18:00- 15366	19:00- 15246	20:00- 15003	21:00- 14804	22:00- 14648	23:00- 14401	24:00- 14224

Friday 06/29/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
99	53	57	35	71	361	762	1222	1173	1126	876	940	1014	1120	1033	1250	1151	1347	1149	993	768	701	536	407	18244
31	13	15	10	7	49	143	235	275	333	242	244	240	310	242	332	286	316	286	283	208	174	167	129	
33	16	14	7	7	62	219	327	290	251	225	226	269	282	265	338	301	364	276	265	206	175	137	109	
25	14	12	11	29	119	208	352	310	313	223	237	253	256	281	291	262	342	326	231	186	182	124	73	
10	10	16	7	28	131	192	308	298	229	186	233	252	272	245	289	302	325	261	214	168	170	108	96	

AM Peak Hour .... 07:15 to 08:15 (1262 vehicles)
AM Peak Hour Factor 89.6%
PM Peak Hour .... 17:00 to 18:00 (1347 vehicles)
PM Peak Hour Factor 92.5%

24-Hour Moving Total

01:00- 14095	02:00- 14080	03:00- 14115	04:00- 14117	05:00- 14138	06:00- 14290	07:00- 14526	08:00- 15058
09:00- 15402	10:00- 15714	11:00- 15744	12:00- 15767	13:00- 15735	14:00- 15889	15:00- 16003	16:00- 16381
17:00- 16662	18:00- 16905	19:00- 17032	20:00- 17298	21:00- 17569	22:00- 17828	23:00- 18051	24:00- 18244

Saturday 06/30/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
263	185	138	122	92	187	369	417	543	607	656	705	822	713	666	620	607	547	532	381	462	350	298	253	10535
95	44	40	29	20	24	72	82	108	137	200	174	196	158	201	140	140	109	164	109	108	86	65	90	
49	47	36	37	18	43	97	130	124	157	152	186	200	180	170	154	163	113	155	114	110	111	71	62	
62	46	26	33	30	72	98	110	153	151	163	185	199	190	132	169	174	134	96	75	123	86	84	48	
57	48	36	23	24	48	102	95	158	162	141	160	227	185	163	157	130	191	117	83	121	67	78	53	

AM Peak Hour .... 11:00 to 12:00 (705 vehicles)
AM Peak Hour Factor 94.8%
PM Peak Hour .... 12:00 to 13:00 (822 vehicles)
PM Peak Hour Factor 90.5%

24-Hour Moving Total

01:00- 18408	02:00- 18540	03:00- 18621	04:00- 18708	05:00- 18729	06:00- 18555	07:00- 18162	08:00- 17357
09:00- 16727	10:00- 16208	11:00- 15988	12:00- 15753	13:00- 15561	14:00- 15154	15:00- 14787	16:00- 14157
17:00- 13613	18:00- 12813	19:00- 12196	20:00- 11584	21:00- 11278	22:00- 10927	23:00- 10689	24:00- 10535

Sunday 07/01/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
181	173	99	47	36	35	92	154	267	373	594	941	1080	1252	1050	1002	1006	860	762	547	523	472	293	193	12032
41	42	42	9	10	4	19	24	61	95	88	203	265	316	272	287	255	235	195	156	139	117	97	55	
52	37	19	13	5	8	23	30	42	77	135	236	263	314	256	222	289	225	195	119	123	126	79	42	
49	48	20	16	9	5	28	54	78	95	157	248	254	305	224	222	255	207	189	124	138	127	59	50	
39	46	18	9	12	18	22	46	86	106	214	254	298	317	298	271	207	193	183	148	123	102	58	46	

AM Peak Hour .... 11:00 to 12:00 (941 vehicles)
AM Peak Hour Factor 92.6%
PM Peak Hour .... 13:00 to 14:00 (1252 vehicles)
PM Peak Hour Factor 98.7%

24-Hour Moving Total

01:00- 10453	02:00- 10441	03:00- 10402	04:00- 10327	05:00- 10271	06:00- 10119	07:00- 9842	08:00- 9579
09:00- 9303	10:00- 9069	11:00- 9007	12:00- 9243	13:00- 9501	14:00- 10040	15:00- 10424	16:00- 10806
17:00- 11205	18:00- 11518	19:00- 11748	20:00- 11914	21:00- 11975	22:00- 12097	23:00- 12092	24:00- 12032

Volume Count Report

Generated by MSC3000 Version 2.01

```
Location .......... VA 237, W. of Sycamore St., WB
Location Code ..... 84
County ............ Arlington, VA
Recorder Set ...... 06/27/01 14:38
Recording Start ... 06/28/ 1 00:00
Recording End ..... 06/29/ 1 00:00
Sample Time ....... 60 Minutes
Operator Number ... 16
Machine Number .... 15
Channel ........... 1
Divide By ......... 2
Summation ......... No
Two-Way ........... No
```

Thursday 06/28/ 1 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
96	42	26	15	46	192	954	1481	1096	921	760	739	748	868	991	1183	1290	1386	1246	1044	699	742	269	176	17010

```
AM Peak Hour .................... 07:00 to 08:00 (1481 vehicles)
PM Peak Hour .................... 17:00 to 18:00 (1386 vehicles)
```

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... VA 237, E. of Sycamore St., EB
Location Code 202
County .... Arlington, VA
Recorder Set 06/27/01 13:16
Recording Start ... 06/27/ 1 14:00
Recording End 07/02/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 18
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Wednesday 06/27/ 1 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
														346	401	484	685	705	490	319	289	201	126	4046
														79	96	103	144	180	115	85	77	58	48	
														87	114	116	177	191	124	80	84	48	37	
														78	84	130	178	162	133	81	72	50	19	
														102	107	135	186	172	118	73	56	45	22	

AM Peak Hour .... Unavailable
AM Peak Hour Factor .... Unavailable
PM Peak Hour .... 17:30 to 18:30 (735 vehicles)
PM Peak Hour Factor 96.2%

Thursday 06/28/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
55	31	11	11	20	154	488	530	625	469	500	627	675	644	554	359	490	779	823	529	351	319	209	103	9356
20	11	4	1	9	7	124	107	161	122	110	150	136	162	161	74	106	152	188	166	90	85	68	36	
13	8	3	5	2	10	165	137	149	118	113	151	185	164	141	89	134	213	193	143	109	87	45	29	
15	8	2	4	4	27	105	132	145	122	144	170	172	141	87	93	106	208	177	118	79	75	50	17	
7	4	2	1	5	110	94	154	170	107	133	156	182	177	165	103	144	206	265	102	73	72	46	21	

AM Peak Hour .... 11:00 to 12:00 (627 vehicles)
AM Peak Hour Factor 92.2%
PM Peak Hour .... 18:00 to 19:00 (823 vehicles)
PM Peak Hour Factor 77.6%

24-Hour Moving Total

01:00-	N/A	02:00-	N/A	03:00-	N/A	04:00-	N/A	05:00-	N/A	06:00-	N/A	07:00-	N/A	08:00-	N/A
09:00-	N/A	10:00-	N/A	11:00-	N/A	12:00-	N/A	13:00-	N/A	14:00-	N/A	15:00-	8886	16:00-	9094
17:00-	9052	18:00-	9058	19:00-	9152	20:00-	9270	21:00-	9309	22:00-	9341	23:00-	9371	24:00-	9379

Friday 06/29/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
68	31	19	12	14	70	244	491	591	454	371	296	375	332	393	533	626	729	640	405	326	291	244	171	7726
21	9	6	1	3	10	32	100	133	107	90	65	86	93	78	132	161	178	154	101	86	75	68	50	
15	11	5	5	3	16	58	119	182	131	106	79	96	83	101	134	182	190	177	101	73	77	52	43	
24	5	6	2	6	20	58	125	138	112	87	84	86	78	96	117	128	173	154	90	90	68	53	45	
8	6	2	4	2	24	96	147	138	104	88	68	107	78	118	150	155	188	155	113	77	71	71	33	

AM Peak Hour .... 07:45 to 08:45 (600 vehicles)
AM Peak Hour Factor 82.4%
PM Peak Hour .... 17:00 to 18:00 (729 vehicles)
PM Peak Hour Factor 95.9%

24-Hour Moving Total

01:00-	9369	02:00-	9369	03:00-	9377	04:00-	9378	05:00-	9372	06:00-	9288	07:00-	9044	08:00-	9005
09:00-	8971	10:00-	8956	11:00-	8827	12:00-	8496	13:00-	8196	14:00-	7884	15:00-	7723	16:00-	7897
17:00-	8033	18:00-	7983	19:00-	7800	20:00-	7676	21:00-	7651	22:00-	7623	23:00-	7658	24:00-	7726

Saturday 06/30/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
104	59	41	25	18	26	49	111	205	311	332	416	431	396	383	389	488	574	509	257	256	212	202	145	5939
32	18	16	6	5	11	11	33	23	62	70	99	115	100	100	108	100	128	122	73	70	50	51	32	
25	14	10	9	4	2	8	23	50	90	94	107	114	101	91	90	120	160	128	62	60	49	44	47	
29	14	9	7	3	8	9	23	61	76	85	112	101	100	97	91	124	150	127	56	62	62	60	42	
18	13	6	3	6	5	21	32	71	83	83	98	101	95	95	100	144	136	132	66	64	51	47	24	

AM Peak Hour .... 11:00 to 12:00 (416 vehicles)
AM Peak Hour Factor 92.9%
PM Peak Hour .... 16:45 to 17:45 (582 vehicles)
PM Peak Hour Factor 90.9%

24-Hour Moving Total

01:00-	7762	02:00-	7790	03:00-	7812	04:00-	7825	05:00-	7829	06:00-	7785	07:00-	7590	08:00-	7210
09:00-	6824	10:00-	6681	11:00-	6642	12:00-	6762	13:00-	6818	14:00-	6882	15:00-	6872	16:00-	6728
17:00-	6590	18:00-	6435	19:00-	6304	20:00-	6156	21:00-	6086	22:00-	6007	23:00-	5965	24:00-	5939

Sunday 07/01/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
97	71	41	18	12	16	32	60	122	187	220	242	365	392	361	373	344	396	311	287	235	193	140	88	4603
29	15	17	3	1	1	5	13	18	42	53	51	76	87	104	86	96	108	81	78	57	68	45	31	
26	26	8	7	6	3	6	14	30	60	70	58	78	90	86	87	85	97	76	62	53	49	44	23	
19	18	9	6	3	9	7	18	27	48	47	67	90	111	78	101	80	100	84	75	58	34	27	18	
23	12	7	2	2	3	14	15	47	37	50	66	121	104	93	99	83	91	70	72	67	42	24	16	

AM Peak Hour .... 11:00 to 12:00 (242 vehicles)
AM Peak Hour Factor 90.3%
PM Peak Hour .... 12:45 to 13:45 (409 vehicles)
PM Peak Hour Factor 84.5%

24-Hour Moving Total

01:00-	5932	02:00-	5944	03:00-	5944	04:00-	5937	05:00-	5931	06:00-	5921	07:00-	5904	08:00-	5853
09:00-	5770	10:00-	5646	11:00-	5534	12:00-	5360	13:00-	5294	14:00-	5290	15:00-	5268	16:00-	5252
17:00-	5108	18:00-	4930	19:00-	4732	20:00-	4762	21:00-	4741	22:00-	4722	23:00-	4660	24:00-	4603

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... VA 237, E. of Sycamore St., WB
Location Code 304
County .... Arlington, VA
Recorder Set 06/27/01 13:11
Recording Start ... 06/27/ 1 14:00
Recording End 07/02/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 5
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Wednesday 06/27/ 1 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
														490	584	653	780	657	455	301	250	171	74	4415
														110	128	163	188	172	152	95	73	55	31	
														128	154	173	217	175	128	74	59	40	21	
														120	167	155	212	154	92	69	63	43	11	
														132	135	162	163	156	83	63	55	33	11	

AM Peak Hour .... Unavailable
AM Peak Hour Factor .... Unavailable
PM Peak Hour .... 17:00 to 18:00 (780 vehicles)
PM Peak Hour Factor 89.9%

Thursday 06/28/01 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
43	21	12	7	21	96	277	597	831	502	362	349	354	360	470	631	626	730	655	423	317	261	159	78	8182
8	7	3	1	1	12	49	107	203	143	98	90	79	117	95	145	145	165	174	140	91	69	38	23	
9	2	3	0	5	21	60	140	224	109	93	89	80	74	99	167	127	187	179	111	79	57	36	28	
13	6	3	3	9	29	86	184	213	140	92	80	91	90	124	158	198	205	150	83	65	69	38	18	
13	6	3	3	6	34	82	166	191	110	79	90	104	79	152	161	156	173	152	89	82	66	47	9	

AM Peak Hour .... 08:00 to 09:00 (831 vehicles)
AM Peak Hour Factor 92.7%
PM Peak Hour .... 17:15 to 18:15 (739 vehicles)
PM Peak Hour Factor 90.1%

24-Hour Moving Total

01:00- N/A	02:00- N/A	03:00- N/A	04:00- N/A	05:00- N/A	06:00- N/A	07:00- N/A	08:00- N/A
09:00- N/A	10:00- N/A	11:00- N/A	12:00- N/A	13:00- N/A	14:00- N/A	15:00- 8247	16:00- 8227
17:00- 8274	18:00- 8247	19:00- 8197	20:00- 8195	21:00- 8163	22:00- 8179	23:00- 8190	24:00- 8178

Friday 06/29/01 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
57	23	20	7	22	88	255	584	707	500	342	323	405	436	514	700	623	691	584	413	330	258	192	130	8204
15	4	4	2	0	20	43	95	150	154	98	85	89	110	120	185	159	172	152	126	117	58	51	35	
19	9	5	1	5	18	52	151	193	108	77	63	88	115	120	159	144	179	143	116	73	75	42	27	
14	5	7	4	7	26	73	167	200	139	96	102	116	104	140	181	160	183	142	85	63	58	50	31	
9	5	4	0	10	24	87	171	164	99	71	73	112	107	134	175	160	157	147	86	77	67	49	37	

AM Peak Hour .... 07:45 to 08:45 (714 vehicles)
AM Peak Hour Factor 89.3%
PM Peak Hour .... 15:00 to 16:00 (700 vehicles)
PM Peak Hour Factor 94.6%

24-Hour Moving Total

01:00-	8196	02:00-	8198	03:00-	8206	04:00-	8206	05:00-	8207	06:00-	8199	07:00-	8177	08:00-	8164
09:00-	8040	10:00-	8038	11:00-	8018	12:00-	7992	13:00-	8043	14:00-	8119	15:00-	8163	16:00-	8232
17:00-	8229	18:00-	8190	19:00-	8119	20:00-	8109	21:00-	8122	22:00-	8119	23:00-	8152	24:00-	8204

Saturday 06/30/01 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
70	60	42	35	28	35	115	230	335	431	434	459	445	484	432	372	399	386	381	270	237	218	156	127	6181
26	13	15	6	5	4	23	44	66	107	113	115	105	117	123	105	95	91	121	80	61	66	52	41	
11	12	10	10	10	9	23	43	85	107	101	119	107	132	108	95	112	80	112	79	62	55	35	19	
15	23	7	9	7	13	34	60	87	115	104	114	103	110	110	81	101	108	81	67	67	61	46	34	
18	12	10	10	6	9	35	83	97	102	116	111	130	125	91	91	91	107	67	44	47	36	23	33	

AM Peak Hour .... 10:45 to 11:45 (464 vehicles)
AM Peak Hour Factor 97.5%
PM Peak Hour .... 13:15 to 14:15 (490 vehicles)
PM Peak Hour Factor 92.8%

24-Hour Moving Total

01:00-	8217	02:00-	8254	03:00-	8276	04:00-	8304	05:00-	8310	06:00-	8257	07:00-	8117	08:00-	7763
09:00-	7391	10:00-	7322	11:00-	7414	12:00-	7550	13:00-	7590	14:00-	7638	15:00-	7556	16:00-	7228
17:00-	7004	18:00-	6699	19:00-	6496	20:00-	6353	21:00-	6260	22:00-	6220	23:00-	6184	24:00-	6181

Sunday 07/01/01 Channel: 1 Direction: W

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
93	57	37	17	18	29	53	88	132	248	304	380	434	454	359	379	402	306	324	251	189	169	99	52	4874
34	16	13	3	2	9	17	20	26	45	59	73	111	103	83	99	100	72	103	72	46	59	29	15	
25	17	11	6	5	3	10	15	36	53	87	97	109	119	98	87	105	76	83	52	48	41	25	13	
21	13	5	5	8	10	10	26	30	75	84	106	92	114	90	102	102	91	69	73	48	37	20	13	
13	11	8	3	3	7	16	27	40	75	74	104	122	118	88	91	95	67	69	54	47	32	25	11	

AM Peak Hour .... 11:00 to 12:00 (380 vehicles)
AM Peak Hour Factor 89.6%
PM Peak Hour .... 12:45 to 13:45 (458 vehicles)
PM Peak Hour Factor 93.9%

24-Hour Moving Total

01:00- 6204	02:00- 6201	03:00- 6196	04:00- 6178	05:00- 6168	06:00- 6162	07:00- 6100	08:00- 5958
09:00- 5755	10:00- 5572	11:00- 5442	12:00- 5363	13:00- 5352	14:00- 5322	15:00- 5249	16:00- 5256
17:00- 5259	18:00- 5179	19:00- 5122	20:00- 5103	21:00- 5055	22:00- 5006	23:00- 4949	24:00- 4874

Volume Count Report

Location .... N. Sycamore St., N. of VA 237, NB
Location Code 91
County .... Arlington, VA
Recorder Set 06/27/01 13:40
Recording Start ... 06/27/ 1 14:00
Recording End 07/02/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 31
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Wednesday 06/27/ 1   Channel: 1   Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
														292	264	337	427	385	301	236	235	198	72	2747
														74	58	74	115	129	83	55	65	66	30	
														73	55	97	97	63	82	56	57	53	13	
														76	68	82	117	116	59	62	64	43	17	
														69	83	84	98	77	77	63	49	36	12	

AM Peak Hour .... Unavailable
AM Peak Hour Factor .... Unavailable
PM Peak Hour .... 17:15 to 18:15 (441 vehicles)
PM Peak Hour Factor 85.5%

Thursday 06/28/01   Channel: 1   Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
52	22	11	8	13	41	149	349	517	326	304	300	299	311	298	280	348	421	350	281	281	238	162	81	5442
17	9	3	4	5	4	20	64	117	98	74	74	88	72	68	67	87	84	93	82	63	68	50	27	
10	9	3	1	3	6	25	84	132	85	77	54	61	78	64	57	84	96	94	70	64	58	34	23	
18	3	1	1	1	13	47	99	150	72	88	78	83	79	60	76	85	131	98	63	80	50	37	18	
7	1	4	2	4	18	57	102	118	71	65	94	67	82	106	80	92	110	65	66	74	62	41	13	

AM Peak Hour .... 08:00 to 09:00 (517 vehicles)
AM Peak Hour Factor 86.2%
PM Peak Hour .... 17:15 to 18:15 (430 vehicles)
PM Peak Hour Factor 82.1%

24-Hour Moving Total

01:00-	N/A	02:00-	N/A	03:00-	N/A	04:00-	N/A	05:00-	N/A	06:00-	N/A	07:00-	N/A	08:00-	N/A
09:00-	N/A	10:00-	N/A	11:00-	N/A	12:00-	N/A	13:00-	N/A	14:00-	N/A	15:00-	5449	16:00-	5455
17:00-	5471	18:00-	5482	19:00-	5476	20:00-	5441	21:00-	5421	22:00-	5466	23:00-	5469	24:00-	5433

Friday 06/29/01 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
54	28	19	11	14	28	128	297	494	297	287	296	317	331	294	330	384	362	319	286	264	200	175	89	5304
21	6	8	2	5	4	13	50	134	98	69	70	74	77	71	82	83	90	87	88	77	49	41	25	
16	9	5	3	5	3	22	73	120	82	74	68	80	73	63	83	87	79	92	68	59	57	45	30	
7	7	4	3	1	8	42	83	127	66	79	67	83	72	83	76	102	96	69	59	67	51	45	20	
10	6	2	3	3	13	51	91	113	51	65	91	80	109	77	89	112	97	71	71	61	43	44	14	

AM Peak Hour .... 08:00 to 09:00 (494 vehicles)
AM Peak Hour Factor 92.2%
PM Peak Hour .... 16:15 to 17:15 (391 vehicles)
PM Peak Hour Factor 87.3%

24-Hour Moving Total

01:00- 5444	02:00- 5450	03:00- 5458	04:00- 5461	05:00- 5462	06:00- 5449	07:00- 5428	08:00- 5376
09:00- 5353	10:00- 5324	11:00- 5307	12:00- 5303	13:00- 5321	14:00- 5341	15:00- 5337	16:00- 5387
17:00- 5423	18:00- 5364	19:00- 5333	20:00- 5338	21:00- 5321	22:00- 5283	23:00- 5296	24:00- 5304

Saturday 06/30/01 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
55	48	42	19	21	14	64	117	253	289	340	360	358	298	301	298	356	275	245	223	219	161	159	105	4620
16	9	11	6	4	2	6	21	46	66	75	93	96	68	79	74	92	78	64	72	58	43	40	33	
15	9	12	7	1	1	12	22	64	79	82	90	111	75	62	77	82	60	56	36	58	42	41	29	
9	15	11	5	8	7	22	33	68	59	78	85	84	76	72	81	89	57	56	58	57	43	40	19	
15	15	8	1	8	4	24	41	75	85	105	92	67	79	88	66	93	80	69	57	46	33	38	24	

AM Peak Hour .... 10:45 to 11:45 (373 vehicles)
AM Peak Hour Factor 88.8%
PM Peak Hour .... 12:00 to 13:00 (358 vehicles)
PM Peak Hour Factor 80.6%

24-Hour Moving Total

01:00- 5305	02:00- 5325	03:00- 5348	04:00- 5356	05:00- 5363	06:00- 5349	07:00- 5285	08:00- 5105
09:00- 4864	10:00- 4856	11:00- 4909	12:00- 4973	13:00- 5014	14:00- 4981	15:00- 4988	16:00- 4956
17:00- 4928	18:00- 4841	19:00- 4767	20:00- 4704	21:00- 4659	22:00- 4620	23:00- 4604	24:00- 4620

Sunday 07/01/01 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
65	60	51	23	9	13	37	56	116	139	193	239	292	333	363	375	312	334	264	179	142	128	101	73	3897
24	16	21	8	3	0	5	8	13	25	38	51	57	72	83	87	84	81	94	53	42	35	30	20	
18	13	8	5	3	4	4	13	35	39	57	58	68	82	87	86	67	84	53	41	30	28	30	22	
15	17	9	6	0	6	9	20	32	30	42	66	91	92	95	95	83	76	69	43	33	34	16	13	
8	14	13	4	3	3	19	15	36	45	56	64	76	87	98	107	78	93	48	42	37	31	25	18	

AM Peak Hour .... 11:00 to 12:00 (239 vehicles)
AM Peak Hour Factor 90.5%
PM Peak Hour .... 15:00 to 16:00 (375 vehicles)
PM Peak Hour Factor 87.6%

24-Hour Moving Total

01:00- 4630	02:00- 4642	03:00- 4651	04:00- 4655	05:00- 4643	06:00- 4642	07:00- 4615	08:00- 4554
09:00- 4417	10:00- 4267	11:00- 4120	12:00- 3999	13:00- 3933	14:00- 3968	15:00- 4030	16:00- 4107
17:00- 4063	18:00- 4122	19:00- 4141	20:00- 4097	21:00- 4020	22:00- 3987	23:00- 3929	24:00- 3897

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... N. Sycamore St., N. of VA 237, SB
Location Code 103
County .... Arlington, VA
Recorder Set 06/27/01 13:49
Recording Start ... 06/27/ 1 14:00
Recording End 07/02/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 3
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

Wednesday 06/27/ 1 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
														355	392	396	504	503	399	285	236	128	86	3284
														96	105	107	129	128	101	86	54	41	31	
														91	104	91	112	131	109	82	68	30	26	
														97	93	97	133	143	83	65	65	35	16	
														71	90	101	130	101	106	52	49	22	13	

AM Peak Hour .... Unavailable
AM Peak Hour Factor .... Unavailable
PM Peak Hour .... 17:45 to 18:45 (532 vehicles)
PM Peak Hour Factor 93.0%

Thursday 06/28/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
35	20	6	5	17	59	171	329	443	359	349	375	360	339	347	408	424	510	548	400	288	230	166	81	6269
15	9	1	0	4	5	38	65	125	108	85	102	86	86	81	118	102	126	167	105	81	68	47	38	
9	3	4	2	2	11	43	75	130	85	102	104	93	96	98	98	113	112	127	110	85	63	47	16	
5	4	1	0	6	22	41	88	86	83	81	73	107	71	83	108	117	137	127	96	59	51	47	15	
6	4	0	3	5	21	49	101	102	83	81	96	74	86	85	84	92	135	127	89	63	48	25	12	

AM Peak Hour .... 07:30 to 08:30 (444 vehicles)
AM Peak Hour Factor 85.4%
PM Peak Hour .... 17:30 to 18:30 (566 vehicles)
PM Peak Hour Factor 84.7%

24-Hour Moving Total

01:00-	N/A	02:00-	N/A	03:00-	N/A	04:00-	N/A	05:00-	N/A	06:00-	N/A	07:00-	N/A	08:00-	N/A
09:00-	N/A	10:00-	N/A	11:00-	N/A	12:00-	N/A	13:00-	N/A	14:00-	N/A	15:00-	6151	16:00-	6143
17:00-	6159	18:00-	6187	19:00-	6193	20:00-	6238	21:00-	6239	22:00-	6242	23:00-	6236	24:00-	6274

Friday 06/29/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
37	22	13	9	16	51	157	306	442	399	345	334	380	339	380	410	473	496	471	388	244	224	178	119	6233
9	4	3	1	2	7	25	66	108	94	82	95	90	86	89	108	125	129	127	116	75	64	61	39	
13	4	2	3	6	7	41	61	143	115	108	75	108	69	93	110	110	119	110	90	63	42	48	27	
12	7	1	2	4	15	43	88	85	96	76	75	87	100	105	108	110	136	114	99	59	59	39	31	
3	7	7	3	4	22	48	91	106	94	79	89	95	84	93	84	128	112	120	83	47	59	30	22	

AM Peak Hour .... 08:00 to 09:00 (442 vehicles)
AM Peak Hour Factor 77.3%
PM Peak Hour .... 16:45 to 17:45 (512 vehicles)
PM Peak Hour Factor 94.1%

24-Hour Moving Total

01:00- 6271	02:00- 6273	03:00- 6280	04:00- 6284	05:00- 6283	06:00- 6275	07:00- 6261	08:00- 6238
09:00- 6237	10:00- 6277	11:00- 6273	12:00- 6232	13:00- 6252	14:00- 6252	15:00- 6285	16:00- 6287
17:00- 6336	18:00- 6322	19:00- 6245	20:00- 6233	21:00- 6189	22:00- 6183	23:00- 6195	24:00- 6233

Saturday 06/30/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
66	46	35	14	14	29	77	138	241	354	417	459	436	385	371	370	365	346	342	257	233	178	164	124	5461
17	12	6	3	4	4	14	30	52	65	107	97	120	89	101	96	89	74	100	69	54	48	48	34	
21	17	13	3	2	8	17	23	56	88	93	129	128	94	86	90	91	90	73	77	58	45	45	34	
12	8	13	6	5	12	21	31	64	92	106	127	105	85	99	89	100	91	93	60	69	39	29	25	
16	9	3	2	3	5	25	54	69	109	111	106	83	117	85	95	85	91	76	51	52	46	42	31	

AM Peak Hour .... 10:45 to 11:45 (464 vehicles)
AM Peak Hour Factor 89.9%
PM Peak Hour .... 12:00 to 13:00 (436 vehicles)
PM Peak Hour Factor 85.2%

24-Hour Moving Total

01:00- 6262	02:00- 6286	03:00- 6308	04:00- 6313	05:00- 6311	06:00- 6289	07:00- 6209	08:00- 6041
09:00- 5840	10:00- 5795	11:00- 5867	12:00- 5992	13:00- 6048	14:00- 6094	15:00- 6085	16:00- 6045
17:00- 5937	18:00- 5787	19:00- 5658	20:00- 5527	21:00- 5516	22:00- 5470	23:00- 5456	24:00- 5461

Sunday 07/01/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
73	60	38	16	17	11	38	88	135	210	282	351	349	470	413	417	322	333	260	174	187	138	82	93	4557
24	16	11	1	9	0	4	23	29	43	53	90	80	93	116	109	80	102	63	48	61	37	27	29	
18	14	8	7	6	1	12	17	29	54	75	92	100	127	103	109	87	59	63	38	42	37	14	27	
16	21	10	3	0	6	10	26	33	54	87	82	91	151	98	112	78	112	68	51	33	32	21	20	
15	9	9	5	2	4	12	22	44	59	67	87	78	99	96	87	77	60	66	37	51	32	20	17	

AM Peak Hour .... 11:00 to 12:00 (351 vehicles)
AM Peak Hour Factor 95.4%
PM Peak Hour .... 13:15 to 14:15 (493 vehicles)
PM Peak Hour Factor 81.6%

24-Hour Moving Total

01:00- 5468	02:00- 5482	03:00- 5485	04:00- 5487	05:00- 5490	06:00- 5472	07:00- 5433	08:00- 5383
09:00- 5277	10:00- 5133	11:00- 4998	12:00- 4890	13:00- 4803	14:00- 4888	15:00- 4930	16:00- 4977
17:00- 4934	18:00- 4921	19:00- 4839	20:00- 4756	21:00- 4710	22:00- 4670	23:00- 4588	24:00- 4557

Volume Count Report

Location .... N. Roosevelt St., S. of 19th St, NB
Location Code 601
County .... Arlington, VA
Recorder Set 05/06/01 15:14
Recording Start ... 05/08/ 1 00:00
Recording End 05/10/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 12
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/ 1 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
54	29	22	26	54	370	857	1181	1130	824	543	576	657	613	644	646	626	718	762	702	509	413	299	137	12392
21	3	7	6	14	43	185	214	261	270	133	127	128	154	156	161	147	159	195	189	140	119	97	57	
12	11	6	8	9	82	219	322	298	193	133	130	169	151	161	161	171	180	193	156	116	96	74	31	
11	9	3	4	11	124	218	364	283	205	145	160	173	148	170	167	147	186	197	184	136	101	72	25	
10	6	6	8	20	121	235	281	288	156	132	159	187	160	157	157	161	193	177	173	117	97	56	24	

AM Peak Hour .... 07:15 to 08:15 (1228 vehicles)
AM Peak Hour Factor 84.3%
PM Peak Hour .... 17:45 to 18:45 (778 vehicles)
PM Peak Hour Factor 98.7%

05/09/01 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
70	27	32	16	67	384	898	1362	1164	780	535	565	642	601	685	686	633	707	708	674	519	430	290	158	12633
29	8	12	2	9	43	190	275	270	230	121	132	171	138	184	169	141	175	177	167	136	109	79	41	
21	8	4	6	15	73	214	339	318	213	150	135	121	171	132	192	132	178	200	159	139	129	86	45	
9	5	8	2	20	143	251	401	315	180	123	151	161	136	176	171	167	181	178	185	116	98	61	42	
11	6	8	6	23	125	243	347	261	157	141	147	189	156	193	154	193	173	153	163	128	94	64	30	

AM Peak Hour .... 07:00 to 08:00 (1362 vehicles)
AM Peak Hour Factor 84.9%
PM Peak Hour .... 17:30 to 18:30 (731 vehicles)
PM Peak Hour Factor 91.4%

24-Hour Moving Total

01:00- 12408	02:00- 12406	03:00- 12416	04:00- 12406	05:00- 12419	06:00- 12433	07:00- 12474	08:00- 12655
09:00- 12689	10:00- 12645	11:00- 12637	12:00- 12626	13:00- 12611	14:00- 12599	15:00- 12640	16:00- 12680
17:00- 12687	18:00- 12676	19:00- 12622	20:00- 12594	21:00- 12604	22:00- 12621	23:00- 12612	24:00- 12633

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... N. Roosevelt St., S. of 19th St., SB
Location Code 703
County .... Arlington, VA
Recorder Set 05/07/01 15:14
Recording Start ... 05/08/ 1 00:00
Recording End 05/10/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 36
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/ 1 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
84	45	21	20	34	66	212	427	523	498	567	589	597	615	698	946	969	1083	1158	802	594	525	374	188	11635
28	12	6	4	4	6	32	81	140	127	132	139	156	148	153	236	243	254	318	239	148	139	121	82	
21	15	9	5	10	17	55	92	147	108	152	150	155	167	137	222	228	262	317	207	172	113	99	49	
18	8	2	5	5	20	50	109	121	133	121	143	153	153	183	228	234	284	257	198	129	135	72	36	
17	10	4	6	15	23	75	145	115	130	162	157	133	147	225	260	264	283	266	158	145	138	82	21	

AM Peak Hour .... 10:45 to 11:45 (594 vehicles)
AM Peak Hour Factor 91.7%
PM Peak Hour .... 17:30 to 18:30 (1202 vehicles)
PM Peak Hour Factor 94.5%

(g|a 05/09/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
92	45	19	12	27	66	202	454	601	551	525	562	628	590	671	1006	1024	1042	1161	847	593	486	365	190	11759
38	16	1	2	2	11	47	80	164	111	123	125	163	140	138	253	254	245	278	244	146	134	116	63	
21	11	8	4	4	8	46	93	143	154	143	137	158	166	160	258	251	264	292	219	147	133	102	55	
19	8	5	2	9	20	51	125	155	145	113	139	157	135	163	241	255	280	308	191	172	117	73	39	
14	10	5	4	12	27	58	156	139	141	146	161	150	149	210	254	264	253	283	193	128	102	74	33	

AM Peak Hour .... 07:45 to 08:45 (618 vehicles)
AM Peak Hour Factor 94.2%
PM Peak Hour .... 18:00 to 19:00 (1161 vehicles)
PM Peak Hour Factor 94.2%

24-Hour Moving Total

01:00- 11643	02:00- 11643	03:00- 11641	04:00- 11633	05:00- 11626	06:00- 11626	07:00- 11616	08:00- 11643
09:00- 11721	10:00- 11774	11:00- 11732	12:00- 11705	13:00- 11736	14:00- 11711	15:00- 11684	16:00- 11744
17:00- 11799	18:00- 11758	19:00- 11761	20:00- 11806	21:00- 11805	22:00- 11766	23:00- 11757	24:00- 11759

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Van Buren St., S. of 19th St., NB
Location Code 401
County .... Arlington, VA
Recorder Set 05/06/01 15:35
Recording Start ... 05/08/ 1 00:00
Recording End 05/09/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 38
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/ 1 Channel: 1 Direction: N

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
0	0	0	0	1	3	7	36	76	31	18	12	4	3	10	23	43	66	65	30	12	8	2	1	451
0	0	0	0	0	0	1	5	24	20	2	3	3	1	1	4	11	11	21	5	1	5	2	1	
0	0	0	0	0	2	2	6	22	4	4	3	1	1	2	5	10	16	19	11	2	1	0	0	
0	0	0	0	1	0	3	10	16	4	6	1	0	0	5	7	4	15	13	9	5	2	0	0	
0	0	0	0	0	1	1	15	14	3	6	5	0	1	2	7	18	24	12	5	4	0	0	0	

AM Peak Hour .... 07:45 to 08:45 (77 vehicles)
AM Peak Hour Factor 80.2%
PM Peak Hour .... 17:30 to 18:30 (79 vehicles)
PM Peak Hour Factor 82.3%

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Van Buren St., S. of 19th St., SB
Location Code 503
County .... Arlington, VA
Recorder Set 05/07/01 15:39
Recording Start ... 05/08/ 1 00:00
Recording End 05/10/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 9
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/ 1 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
0	1	0	0	2	1	16	44	62	17	16	16	30	22	23	29	39	54	36	9	2	3	1	0	423
0	1	0	0	0	0	0	14	15	5	4	3	10	2	1	11	9	11	11	2	1	2	1	0	
0	0	0	0	0	0	1	9	25	7	0	5	6	5	7	2	9	16	12	4	0	0	0	0	
0	0	0	0	1	0	4	9	8	3	7	3	7	9	10	8	10	14	8	2	1	0	0	0	
0	0	0	0	1	1	11	12	14	2	5	5	7	6	5	8	11	13	5	1	0	1	0	0	

AM Peak Hour .... 08:00 to 09:00 (62 vehicles)
AM Peak Hour Factor 62.0%
PM Peak Hour .... 17:00 to 18:00 (54 vehicles)
PM Peak Hour Factor 84.4%

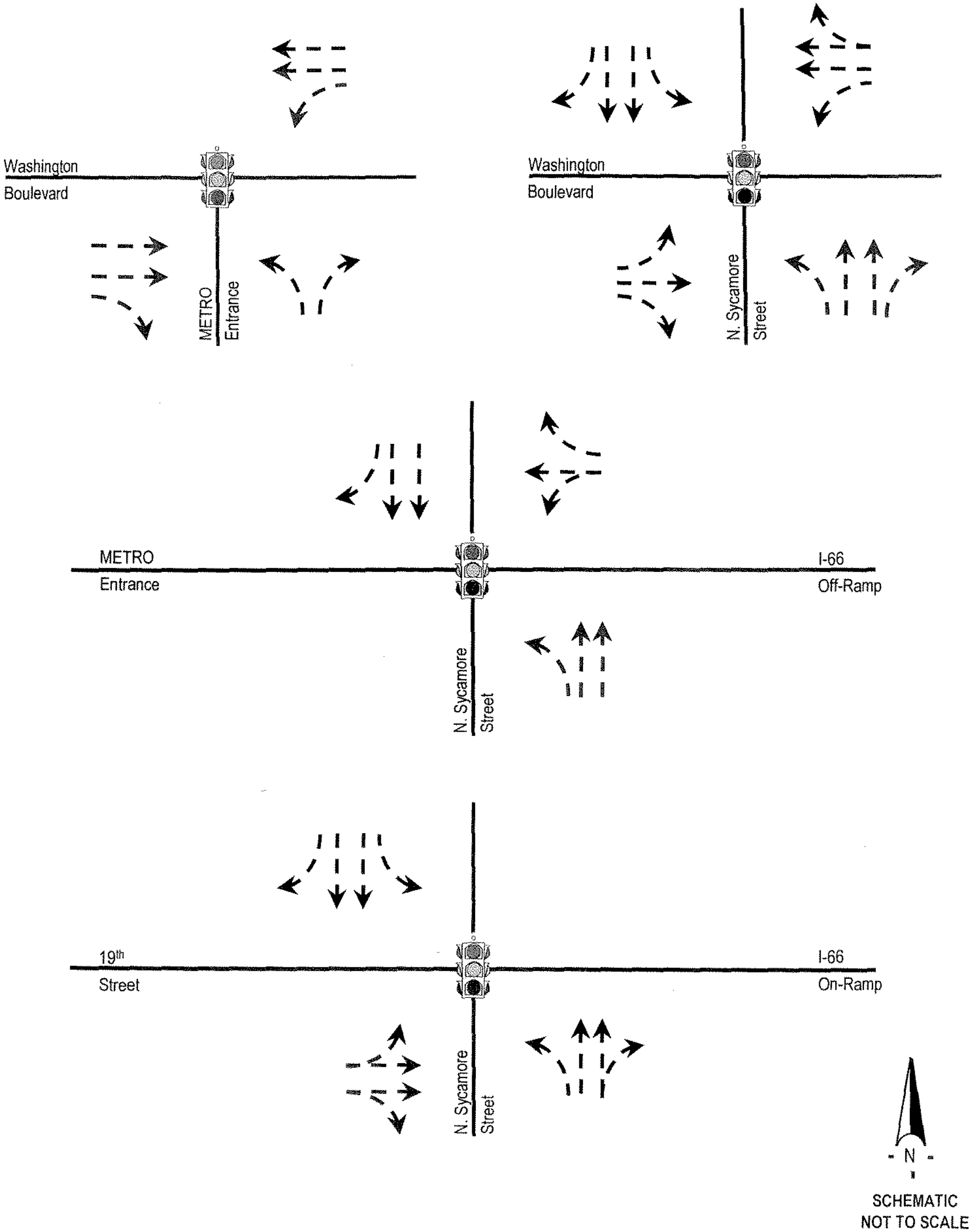
05/09/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
0	0	0	0	1	1	14	27	60	35	14	18	23	28	22	33	30	56	27	13	5	1	1	1	410
0	0	0	0	0	1	1	8	19	9	2	3	5	12	2	4	5	16	6	5	3	0	0	0	
0	0	0	0	0	0	2	5	17	9	4	8	3	3	12	9	6	18	10	4	1	0	0	1	
0	0	0	0	1	0	4	4	17	10	4	4	7	8	3	10	11	14	7	1	0	1	1	0	
0	0	0	0	0	0	7	10	7	7	4	3	8	5	5	10	8	8	4	3	1	0	0	0	

AM Peak Hour .... 07:45 to 08:45 (63 vehicles)
AM Peak Hour Factor 82.9%
PM Peak Hour .... 16:45 to 17:45 (56 vehicles)
PM Peak Hour Factor 77.8%

24-Hour Moving Total

01:00-	423	02:00-	422	03:00-	422	04:00-	422	05:00-	421	06:00-	421	07:00-	419	08:00-	402
09:00-	400	10:00-	418	11:00-	416	12:00-	418	13:00-	411	14:00-	417	15:00-	416	16:00-	420
17:00-	411	18:00-	413	19:00-	404	20:00-	408	21:00-	411	22:00-	409	23:00-	409	24:00-	410



O. R. GEORGE & ASSOCIATES, INC.

Contract No.: PARSONS IAWP Counts

LANE CONFIGURATION
East Falls Church Counts
ARLINGTON COUNTY

East Falls Church Station Access Study
Prepared by: Parsons Transportation Group
Date: April 4, 2001

Kiss and Ride Activity Summary

Time (A.M.)	Persons Leaving Vehicle	Persons Leaving Oakwood	Total Persons Leaving	Persons Entering Vehicle	Persons Entering Oakwood	Total Persons Entering
7:30-7:45	38	12	**50**	2	0	2
7:45-8:00	47	10	**57**	1	0	1
8:00-8:15	64	14	**78**	5	0	5
8:15-8:30	55	36	**91**	3	0	3
8:30-8:45	38	18	**56**	3	0	3
8:45-9:00	45	27	**72**	3	0	3
9:00-9:15	27	24	**51**	5	0	5
9:15-9:30	17	7	**24**	7	0	7
Totals	**331**	**148**	**479**	**29**	**0**	**29**

Time (P.M.)	Persons Leaving Vehicle	Persons Leaving Oakwood	Total Persons Leaving	Persons Entering Vehicle	Persons Entering Oakwood	Total Persons Entering
4:30-4:45	5	3	**8**	17	5	**22**
4:45-5:00	7	1	**8**	18	13	**31**
5:00-5:15	10	4	**14**	28	14	**42**
5:15-5:30	5	3	**8**	19	6	**25**
5:30-5:45	5	2	**7**	42	28	**70**
5:45-6:00	6	1	**7**	31	21	**52**
6:00-6:15	5	2	**7**	39	18	**57**
6:15-6:30	4	2	**6**	41	8	**49**
Totals	**47**	**18**	**65**	**235**	**113**	**348**

East Falls Church Station Access Study — Bus Ridership Summary
Prepared by: Parsons Transportation Group
Date: April 4, 2001

Time (A.M.)	Pedestrians on Bus	Pedestrians Off Bus	Total Bus Pedestrians
7:30-7:45	18	31	49
7:45-8:00	10	24	34
8:00-8:15	32	46	78
8:15-8:30	13	34	47
8:30-8:45	21	20	41
8:45-9:00	8	25	33
9:00-9:15	0	6	6
9:15-9:30	18	21	39
Totals	**120**	**207**	**327**

Time (P.M.)	Pedestrians on Bus	Pedestrians Off Bus	Total Bus Pedestrians
4:30-4:45	19	10	29
4:45-5:00	17	8	25
5:00-5:15	28	15	43
5:15-5:30	15	2	17
5:30-5:45	36	7	43
5:45-6:00	25	5	30
6:00-6:15	47	6	53
6:15-6:30	32	12	44
Totals	**219**	**65**	**284**

East Falls Church Station Access Study Prepared by: Parsons Transportation Group Date: April 4, 2001							Sycamore Street (North/South) Washington Blvd. (East/West) Pedestrian Counts Summary	
Time (A.M.)	Sycamore Northbound East Walk	Sycamore Northbound West Walk	Sycamore Southbound East Walk	Sycamore Southbound West Walk	Washington Eastbound North Walk	Washington Eastbound South Walk	Washington Westbound North Walk	Washington Westbound South Walk
7:00-7:15	0	0	1	19	0	0	2	4
7:15-7:30	0	0	3	22	0	0	1	5
7:30-7:45	0	2	5	25	0	0	2	6
7:45-8:00	0	3	4	32	0	0	2	6
8:00-8:15	1	0	3	44	0	0	1	12
8:15-8:30	0	1	4	46	0	0	1	9
8:30-8:45	0	0	2	38	0	1	0	10
8:45-9:00	3	1	6	37	0	1	2	14
Totals	**4**	**7**	**28**	**263**	**0**	**2**	**11**	**66**
Time (P.M.)	Sycamore Northbound East Walk	Sycamore Northbound West Walk	Sycamore Southbound East Walk	Sycamore Southbound West Walk	Washington Eastbound North Walk	Washington Eastbound South Walk	Washington Westbound North Walk	Washington Westbound South Walk
4:00-4:15	0	6	0	6	0	0	0	1
4:15-4:30	2	9	1	3	0	1	0	4
4:30-4:45	1	16	0	4	3	1	0	0
4:45-5:00	1	15	0	1	0	0	0	0
5:00-5:15	0	19	0	4	0	4	2	0
5:15-5:30	1	19	2	7	0	4	2	1
5:30-5:45	3	41	1	5	0	3	0	0
5:45-6:00	3	42	1	3	1	6	0	2
Totals	**11**	**167**	**5**	**33**	**4**	**19**	**4**	**8**

East Falls Church Station Access Study Prepared by: Parsons Transportation Group Date: April 4, 2001					Sycamore Street (North/South) 19th St. (East/West) Pedestrian Counts Summary			
Time (A.M.)	Sycamore Northbound		Sycamore Southbound		19th Street Eastbound		19th Street Westbound	
	East Walk	West Walk	East Walk	West Walk	North Walk	South Walk	North Walk	South Walk
7:00-7:15	1	5	0	2	0	1	1	0
7:15-7:30	4	9	0	2	0	0	4	0
7:30-7:45	7	15	0	0	0	0	7	0
7:45-8:00	3	20	0	0	0	0	7	2
8:00-8:15	8	19	0	1	0	0	8	5
8:15-8:30	7	34	0	1	0	0	9	4
8:30-8:45	4	25	0	2	0	0	3	3
8:45-9:00	8	26	0	1	0	1	8	6
Totals	**42**	**153**	**0**	**9**	**0**	**2**	**47**	**20**
Time (P.M.)	Sycamore Northbound		Sycamore Southbound		19th Street Eastbound		19th Street Westbound	
	East Walk	West Walk	East Walk	West Walk	North Walk	South Walk	North Walk	South Walk
4:00-4:15	0	1	1	4	1	0	0	0
4:15-4:30	1	4	0	10	0	1	1	0
4:30-4:45	1	0	1	10	0	1	0	0
4:45-5:00	0	0	0	9	0	1	0	0
5:00-5:15	0	1	1	12	2	1	0	1
5:15-5:30	0	2	2	16	2	1	1	0
5:30-5:45	0	0	0	36	0	16	0	0
5:45-6:00	1	0	2	18	1	4	0	0
Totals	**3**	**8**	**7**	**115**	**6**	**25**	**2**	**1**

East Falls Church Station Access Study Prepared by: Parsons Transportation Group Date: April 4, 2001			Pedestrian and Bicycle Counts Summary Tuckahoe Street at 19th Street Crossing	
Time (A.M.)	**Northbound Peds**	**Northbound Bikes**	**Southbound Peds**	**Southbound Bikes**
7:00-7:15	4	3	0	5
7:15-7:30	7	1	1	1
7:30-7:45	5	1	1	7
7:45-8:00	8	4	0	3
8:00-8:15	9	3	1	1
8:15-8:30	13	4	0	6
8:30-8:45	13	2	0	1
8:45-9:00	5	1	0	0
Totals	**64**	**19**	**3**	**24**
Time (P.M.)	**Northbound Peds**	**Northbound Bikes**	**Southbound Peds**	**Southbound Bikes**
4:00-4:15	3	0	1	1
4:15-4:30	0	3	6	3
4:30-4:45	1	1	7	4
4:45-5:00	1	1	6	5
5:00-5:15	1	3	13	5
5:15-5:30	3	3	4	5
5:30-5:45	4	5	5	2
5:45-6:00	0	2	13	3
Totals	**13**	**18**	**55**	**28**

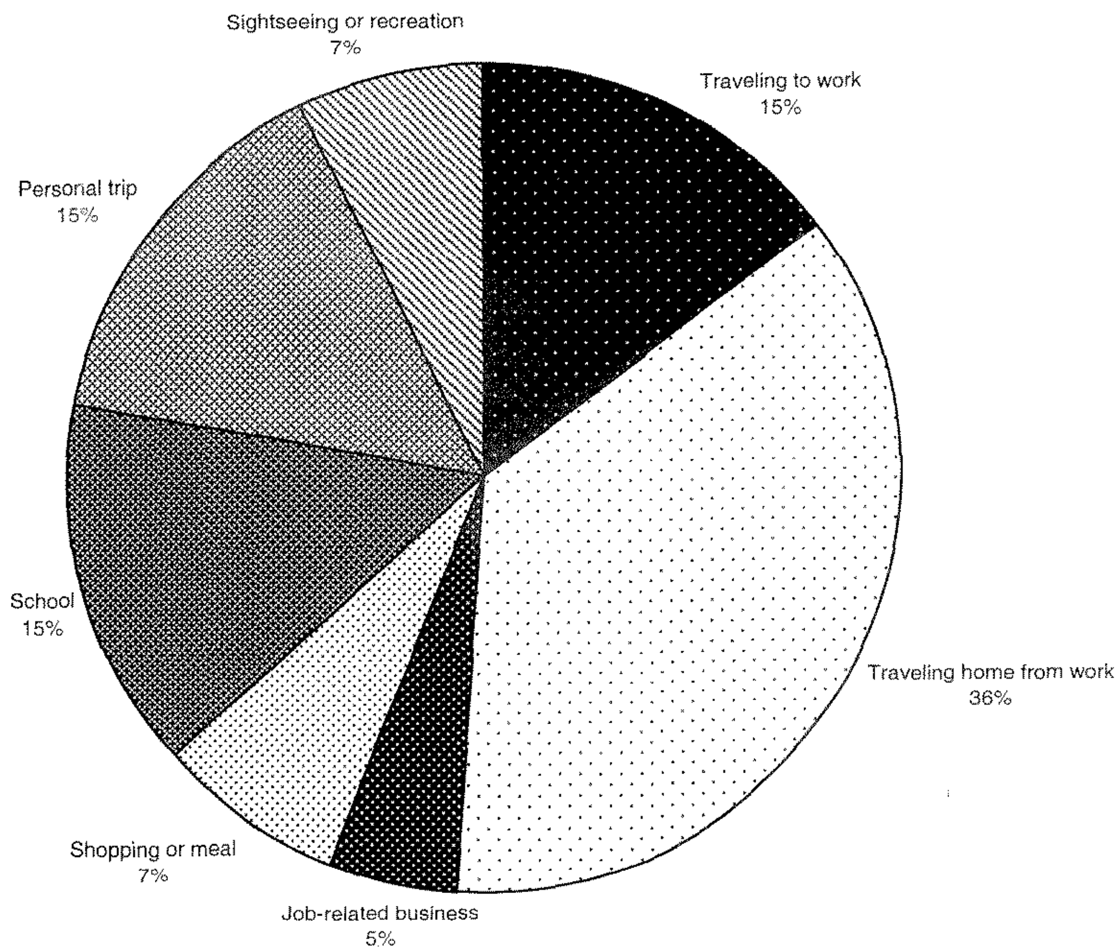
APPENDIX C

SURVEY DATA

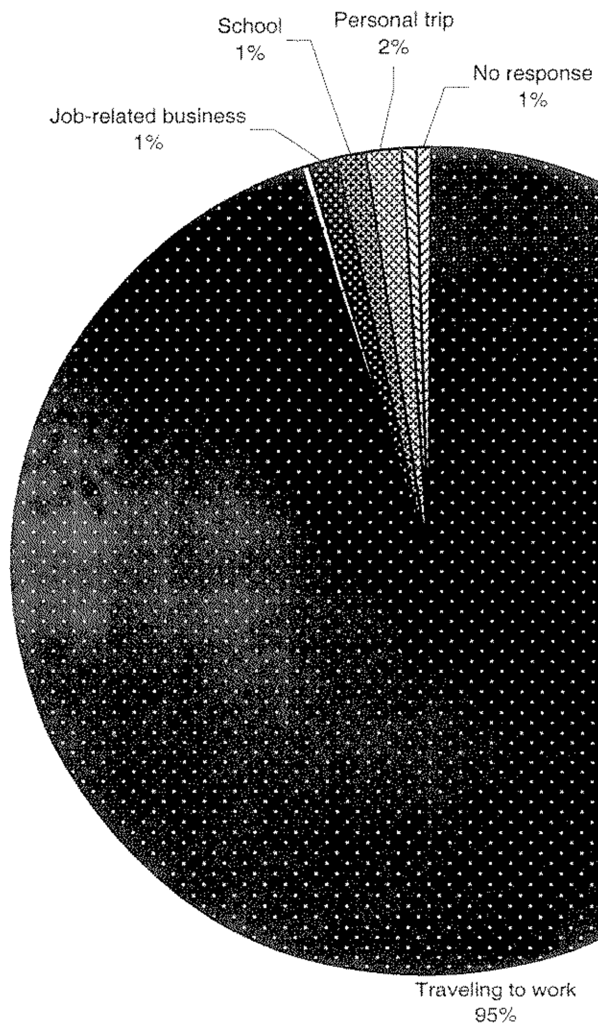
East Falls Church Passenger Survey Results

	AM	PM	AM	PM
Response				
Survey Date	9/19/01	9/19/01		
Number of surveys returned	304	41		
Peak period passenger volume entering station	2946	559		
Response rate	10.3%	7.3%		
90% Confidence Interval	5.3%	14.8%		
Transportation Mode used by Passengers to Reach the Station				
	Number of respondents		Percent of respondents	
Walk	108	9	36%	22%
Shuttle Bus	9	1	3%	2%
Bicycle	8	2	3%	5%
Taxi	1			
Metrobus	46	8	15%	20%
Fairfax Connector		1		2%
Dropped off by someone	60	7	20%	17%
Drove a car and parked	66	12	22%	29%
Rode with someone who parked	2		1%	
No response	4	1	1%	2%
Total Responses	**304**	**41**	**100%**	**100%**
Trip Purpose				
	Number of respondents		Percent of respondents	
Traveling to work	289	6	95%	15%
Traveling home from work	1	15		37%
Job-related business	3	2	1%	5%
Shopping or meal		3		7%
School	3	6	1%	15%
Personal trip	5	6	2%	15%
Sightseeing or recreation	1	3		7%
No response	2		1%	
Total Responses	**304**	**41**	**100%**	**100%**
Fairfax Connector Bus Passenger Routes Used				
	Number of respondents		Percent of respondents	
105		1		100%
Total Fairfax Connector	**0**	**1**		**100%**
Metrobus Passenger Routes Used				
	Number of respondents		Percent of respondents	
2	3		7%	
2B	3		7%	
2C	4	3	9%	38%
2G		1		13%
2L	1		2%	
3	1		2%	
3A	8	1	17%	13%
3B	4	1	9%	13%
10C	2		4%	
22	1		2%	
22A	2		4%	
22B	5		11%	
24T	9		20%	
29	1		2%	
123	1		2%	
1644		1		13%
Unspecified Route	1	1	2%	13%
Total Metrobus	**46**	**8**	**100%**	**100%**

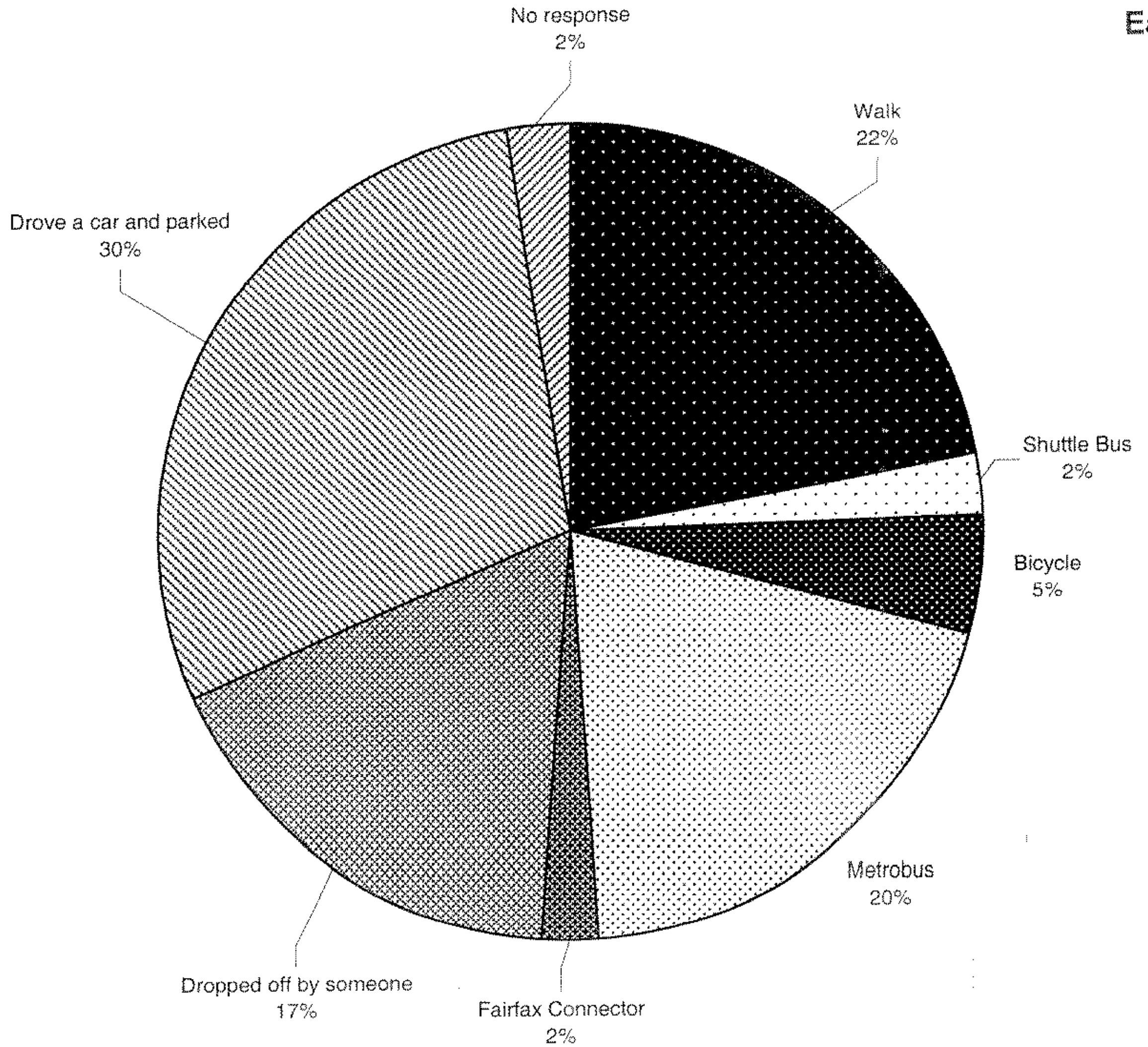
East Falls Church PM Trip Purpose



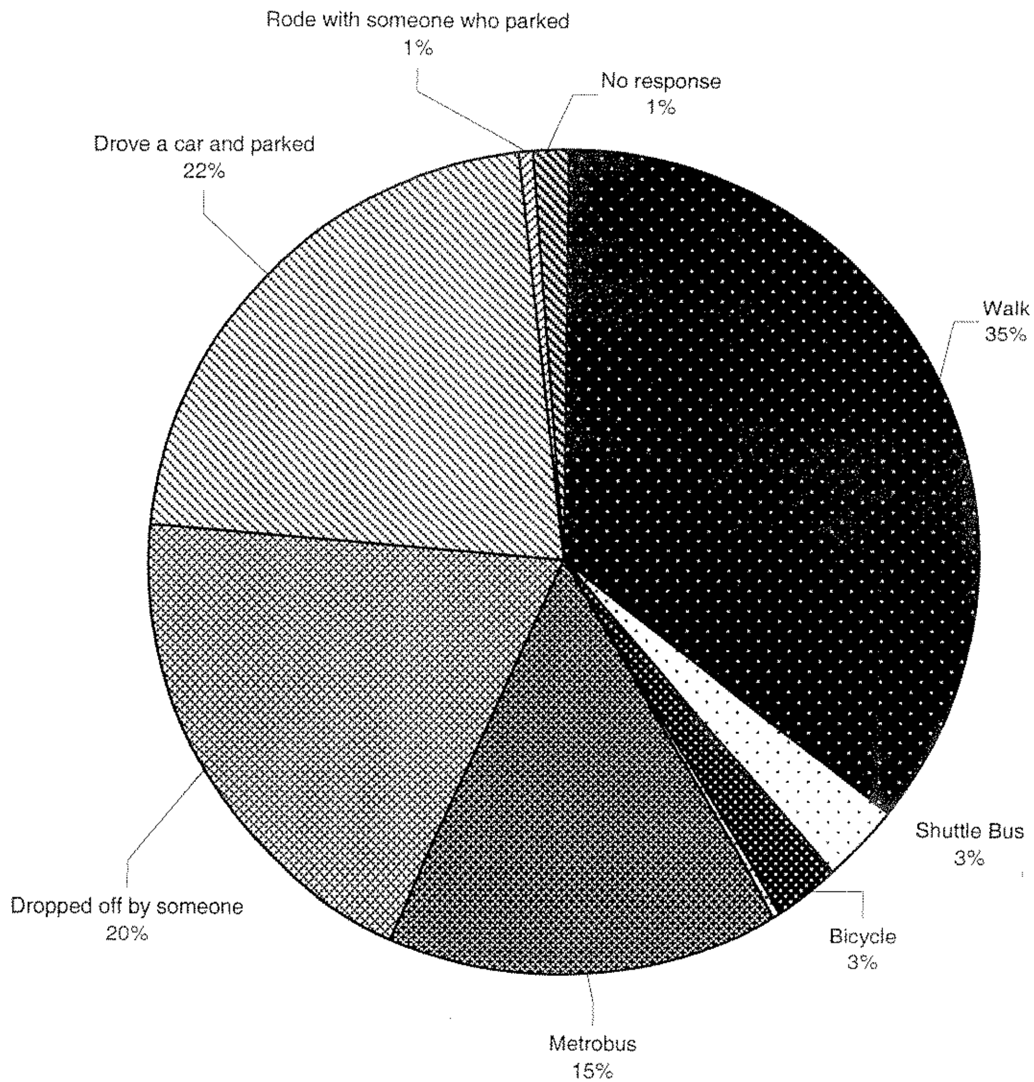
East Falls Church AM Trip Purpose



East Falls Church PM Mode Split



East Falls Church AM Mode Split



APPENDIX D

TRAFFIC SIMULATION DATA

Traffic Simulation of Development Scenarios

This appendix provides additional technical information about the traffic simulation modeling process used in the analysis of development scenarios near the East Falls Church Metrorail station.

Traffic Simulation Modeling Software

The analysis of the development alternatives was conducted using Synchro and SimTraffic Simulation Modeling Software. These two software programs collectively form a state-of-the-art traffic evaluation package for a network of intersections. Synchro implements the methods of Chapter 16 of the 2000 *Highway Capacity Manual* and SimTraffic implements the vehicle and driver performance characteristics developed for use in traffic modeling through research by the Federal Highway Administration.

Synchro is useful for the calculation of vehicle capacity of traffic systems and the optimization of signal timing networks based on minimizing the total delay across a given study area. SimTraffic is a microscopic traffic simulation modeling program that tracks the movements of individual vehicles which respond to surrounding circumstances such as traffic signals, the speed and location of other vehicles on the roadway network, pedestrian activity and driver behavior characteristics. Each vehicle represents an element on the roadway network that is affected by these internal and external factors. Synchro was used in this study to supply the data such as traffic volume, signal timing and roadway lane geometry necessary to run the SimTraffic microscopic model.

In the information that follows, level of service information from SimTraffic is provided in tables, and level of service calculations from Synchro are provided in network figures and timing sheets. The levels of service may not match, and where they do not, SimTraffic's values are of higher value. Since SimTraffic can consider the effects of multiple intersections, its level of service calculations better reflect actual operation than the formulas used by Synchro.

Existing Conditions Model

Three of the intersections included in the study are signalized. Existing traffic signal timings, provided by Arlington County and verified in the field, were used in the model to evaluate existing conditions.

Traffic signal timings, traffic volume data, and lane configuration data were coded into Synchro, and traffic simulation models were developed for existing conditions in SimTraffic. Queue counts were conducted during morning and afternoon peak hours to verify that queues generated by the computer models reflected actual traffic conditions. Once the existing condition models were shown to accurately portray field conditions, they were used as a baseline against which to compare the other alternatives.

Model Run Procedures

After coding new traffic volumes into Synchro, each scenario was modeled using SimTraffic. Since simulation models generate output that is affected by random processes, each scenario was run multiple times with different random number seeds. This process reduces the risk that a single simulation run was unusual, and allows for computation of an average value that lies within an acceptable confidence interval.

The confidence interval objective was set at a level of 90 percent certainty that the average value is within plus or minus 10 percent of variation. Usually this was achieved by performing between five and ten model runs. The average of these runs was used in the comparison of the alternatives.

EAST FALLS CHURCH POTENTIAL DEVELOPMENT SCENARIOS
ARLINGTON, VA

Scenario No.	Development Type	Allowable units/acre	Residential Units			1000 Square Footage		
			K&R Lot	P&R Lot	Palmer Lot	K&R Lot	P&R Lot	Palmer Lot
1	Residential	16	20	59	22	0	0	0
2	Residential/Retail	36	45	133	50	5*	5*	5*
3	Office/Retail	65.34	0	0	0	0	242**	0
4	Retail	43.56	0	0	0	0	161	61
5	No Build	—	0	0	0	0	0	0

Note: * Actual square footage will vary. ** Assume 93% office development and 7% retail development.

Lot	Lot Size (acres)
K&R	1.25
P&R	3.7
Palmer	1.4

TRIP GENERATION

Scenario No.	Development Type	Trip Generation															
		K&R Lot				P&R Lot				Palmer Lot				Total			
		AM In	AM Out	PM In	PM Out	AM In	AM Out	PM In	PM Out	AM In	AM Out	PM In	PM Out	AM In	AM Out	PM In	PM Out
1	Residential	1	5	4	2	2	11	11	5	1	5	5	2	4	21	20	9
2	Residential/Retail	2	9	9	4	4	21	21	10	2	10	9	5	8	40	39	19
3	Office/Retail	0	0	0	0	251	34	45	220	0	0	0	0	251	34	45	220
4	Retail	0	0	0	0	71	46	227	246	40	26	120	130	111	72	347	376
5	No Build																

422 Parking Spaces
Measures of Effectiveness
AM Peak Hour

Scenario No.	Development Type	Total Network Delay (hrs.)	Average Arterial Speed (mph)	
			Sycamore St.	Washington Blvd.
1	No Build	52.2	13.0	18.0
2	Residential	66.7	12.0	17.0
3	Residential/Retail	67.8	11.0	17.0
4	Office/Retail	100.5	9.0	16.0
5	Retail	66.7	12.0	17.0

Scenario No.	Development Type	Overall Level of Service			
		Sycamore St. @ 19th St.	Sycamore St. @ Bus Entrance	Sycamore St. @ Washington Blvd.	P&R Lot @ Washington Blvd.
1	No Build	C	B	C	A* (NBL)
2	Residential	C	B	C	A
3	Residential/Retail	C	B	C	A
4	Office/Retail	D* (NBL)	C	D	A
5	Retail	C	B	C	A* (SBL)

422 Parking Spaces
Measures of Effectiveness
PM Peak Hour

Scenario No.	Development Type	Total Network Delay (hrs.)	Average Arterial Speed (mph)	
			Sycamore St.	Washington Blvd.
1	No Build	58.9	14.0	17.0
2	Residential	82.9	12.0	14.0
3	Residential/Retail	86.0	12.0	14.0
4	Office/Retail	88.8	13.0	14.0
5	Retail	322.0	10.0	9.0
6	Retail (Pass-by)	202.4	11.0	10.0

Scenario No.	Development Type	Overall Level of Service			
		Sycamore St. @ 19th St.	Sycamore St. @ Bus Entrance	Sycamore St. @ Washington Blvd.	P&R Lot @ Washington Blvd.
1	No Build	B	A	C	A* (NBL)
2	Residential	C	B	D	B
3	Residential/Retail	C	B	D	B
4	Office/Retail	C	B	D* (EBL)	B
5	Retail	C	F* (EBL, WBL, WBR, NBL)	E* (WBL, WBT, WBR)	F* (EBL, EBT, EBR, NBL, NBR, SBL)
6	Retail (Pass-by)	C	F* (EBL, WBL, WBR)	D	D* (NBL, NBR, SBL)

1,000 Parking Spaces
Measures of Effectiveness
Base Conditions

Peak Period	Total Network Delay (hrs.)	Average Arterial Speed (mph)	
		Sycamore St.	Washington Blvd.
AM	150.5	7.0	17.0
PM	105.7	12.0	13.0

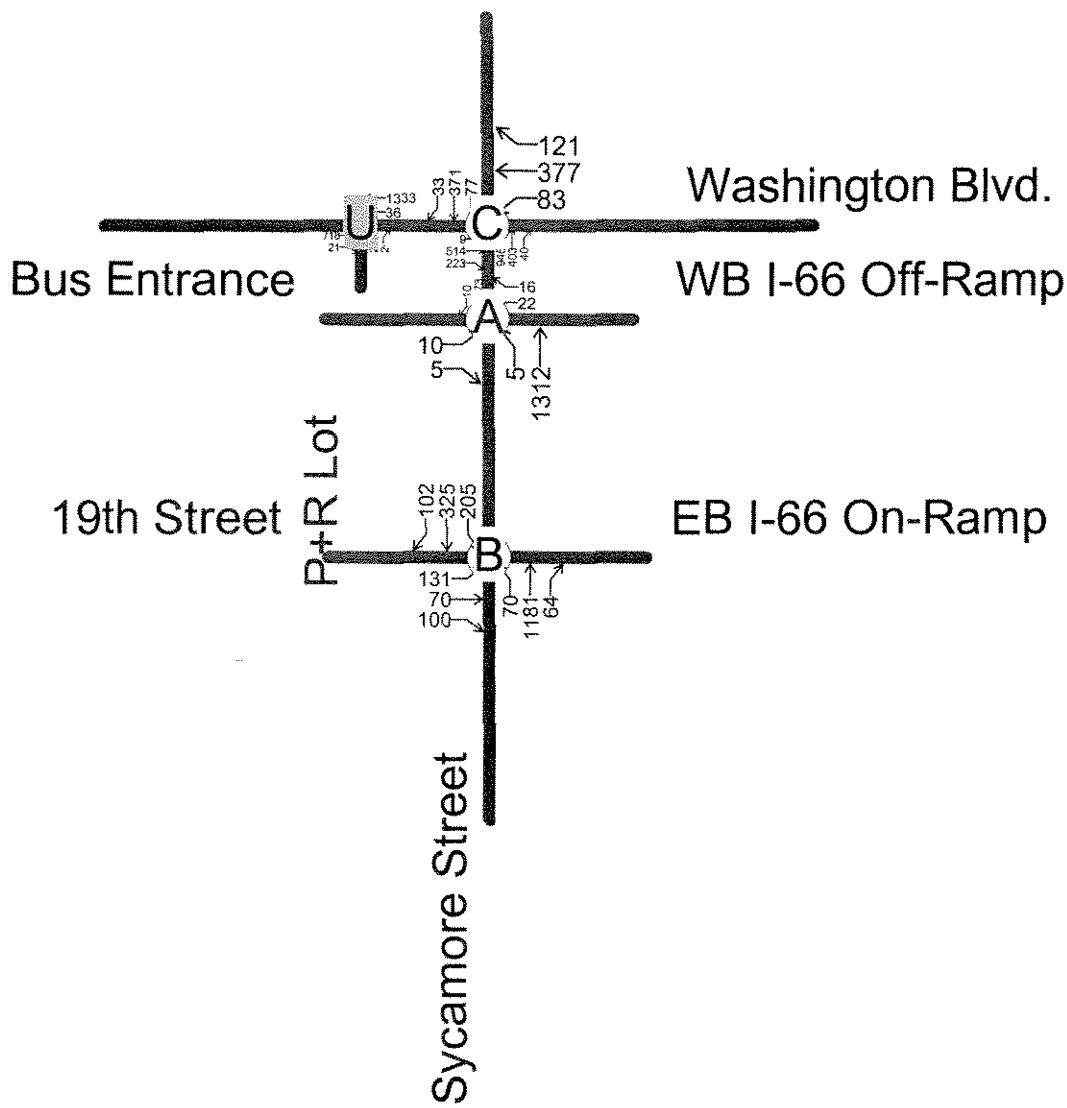
Peak Period	Overall Level of Service			
	Sycamore St. @ 19th St.	Sycamore St. @ Bus Entrance	Sycamore St. @ Washington Blvd.	P&R Lot @ Washington Blvd.
AM	F* (EBL, EBT, EBR, NBL, NBT, NBR)	E* (NBL, NBT)	D	A
PM	C	C* (EBL, WBR)	D	C* (NBR)

East Falls Church Station Access Study

Synchro Capacity Analysis Results

Existing 2001 Conditions: AM Peak Hour

Map - East Falls Church
Levels of Service 04/17/2002



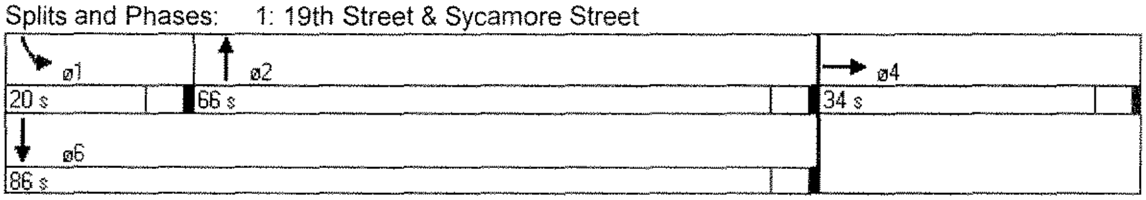
East Falls Church-Existing Conditions-AM / C:\CTD-WMATA\East Falls Church\Capacity Analysis\422 spaces\AM\Existing AM.sy6
Robert T. Kerns

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	131	70	70	1181	205	325	102
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	34.0	34.0	66.0	66.0	20.0	86.0	86.0
Total Split (%)	28%	28%	55%	55%	17%	72%	72%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	30.0	30.0	62.0	62.0	82.0	82.0	82.0
Actuated g/C Ratio	0.25	0.25	0.52	0.52	0.68	0.68	0.68
v/c Ratio	0.34	0.41	0.21	0.75	0.69	0.15	0.19
Uniform Delay, d1	36.9	25.4	15.7	22.7	19.4	6.7	0.0
Delay	37.5	26.0	16.4	23.1	22.0	2.1	0.0
LOS	D	C	B	C	C	A	A
Approach Delay		31.0		22.8		8.2	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 37 (31%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Pretimed
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 19.8 Intersection LOS: B
Intersection Capacity Utilization 73.5% ICU Level of Service C

Splits and Phases: 1: 19th Street & Sycamore Street

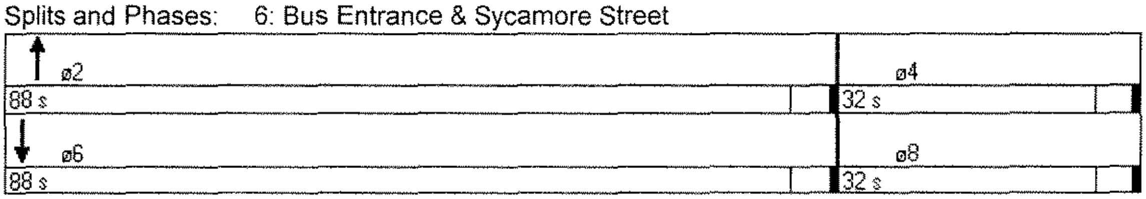


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	10	5	22	16	5	1312	673
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	32.0	32.0	32.0	32.0	88.0	88.0	88.0
Total Split (%)	27%	27%	27%	27%	73%	73%	73%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	28.0	28.0	28.0	28.0	84.0	84.0	84.0
Actuated g/C Ratio	0.23	0.23	0.23	0.23	0.70	0.70	0.70
v/c Ratio	0.03	0.01	0.03	0.05	0.01	0.58	0.30
Uniform Delay, d1	35.5	0.0	35.5	0.0	5.4	9.0	6.8
Delay	35.8	21.2	35.7	15.2	0.2	0.4	8.0
LOS	D	C	D	B	A	A	A
Approach Delay						0.4	8.0
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 51 (43%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 50
Control Type: Pretimed
Maximum v/c Ratio: 0.58
Intersection Signal Delay: 3.7 Intersection LOS: A
Intersection Capacity Utilization 66.1% ICU Level of Service B

Splits and Phases: 6: Bus Entrance & Sycamore Street

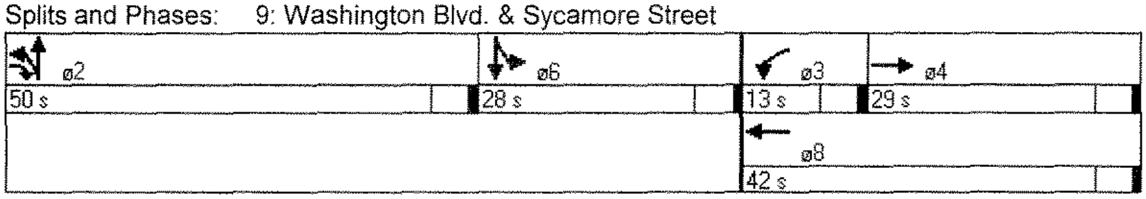


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	9	514	223	83	377	945	403	40	77	371	33
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	29.0	29.0	50.0	13.0	42.0	50.0	50.0	50.0	28.0	28.0	28.0
Total Split (%)	24%	24%	42%	11%	35%	42%	42%	42%	23%	23%	23%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	25.0	25.0	71.0	38.0	38.0	46.0	46.0	46.0	24.0	24.0	24.0
Actuated g/C Ratio	0.21	0.21	0.59	0.32	0.32	0.38	0.38	0.38	0.20	0.20	0.20
v/c Ratio	0.06	0.76	0.26	0.44	0.49	0.83	0.75	0.08	0.24	0.57	0.15
Uniform Delay, d1	38.0	44.6	5.3	29.5	30.7	33.5	32.0	12.4	40.3	43.3	0.0
Delay	38.7	45.1	5.5	29.9	31.0	22.0	16.1	4.1	40.9	43.7	12.6
LOS	D	D	A	C	C	C	B	A	D	D	B
Approach Delay		33.2			30.8		17.8			41.1	
Approach LOS		C			C		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 66 (55%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 80
Control Type: Pretimed
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 27.3 Intersection LOS: C
Intersection Capacity Utilization 75.6% ICU Level of Service C

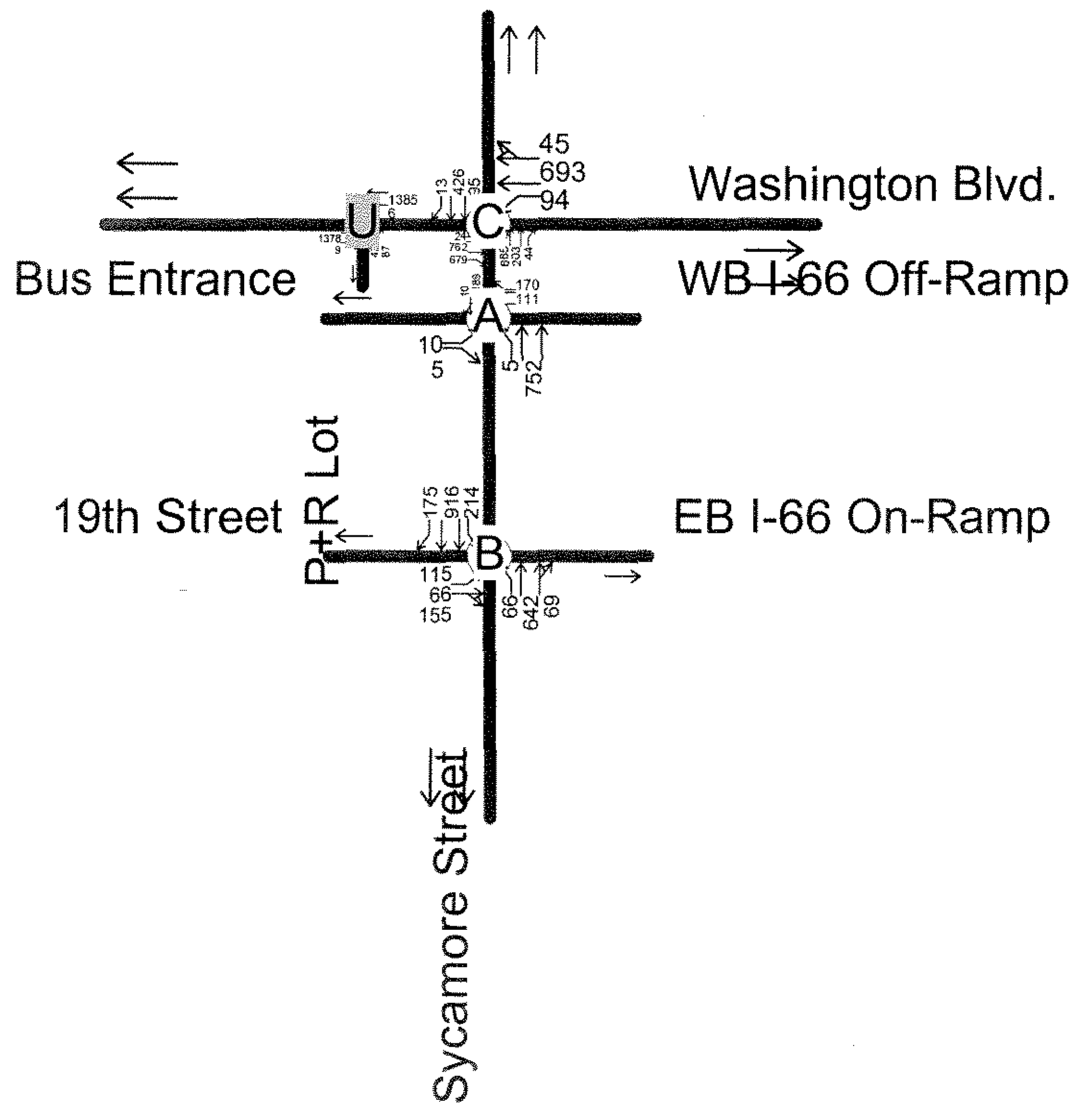
Splits and Phases: 9: Washington Blvd. & Sycamore Street



East Falls Church Station Access Study

Synchro Capacity Analysis Results

Existing 2001 Conditions: PM Peak Hour

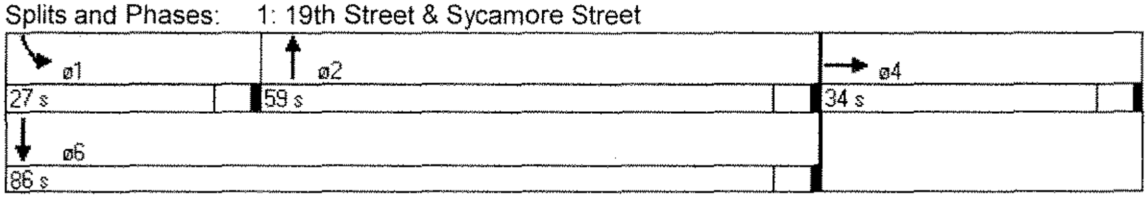

Washington Blvd.
Bus Entrance
WB I-66 Off-Ramp
19th Street
P+R Lot
EB I-66 On-Ramp
Sycamore Street
U
C
A
B
1385
6
1378
9
13
426
35
45
693
94
10
5
5
752
170
111
175
916
214
115
66
155
66
642
69

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	115	66	66	642	214	916	175
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	34.0	34.0	59.0	59.0	27.0	86.0	86.0
Total Split (%)	28%	28%	49%	49%	23%	72%	72%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	30.0	30.0	55.0	55.0	82.0	82.0	82.0
Actuated g/C Ratio	0.25	0.25	0.46	0.46	0.68	0.68	0.68
v/c Ratio	0.29	0.51	0.32	0.48	0.41	0.41	0.24
Uniform Delay, d1	36.3	22.9	20.6	22.2	6.9	8.4	0.0
Delay	36.9	23.6	21.9	22.4	6.6	5.3	0.2
LOS	D	C	C	C	A	A	A
Approach Delay		28.2		22.4		4.8	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 54 (45%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 13.7 Intersection LOS: B
Intersection Capacity Utilization 60.3% ICU Level of Service B

Splits and Phases: 1: 19th Street & Sycamore Street

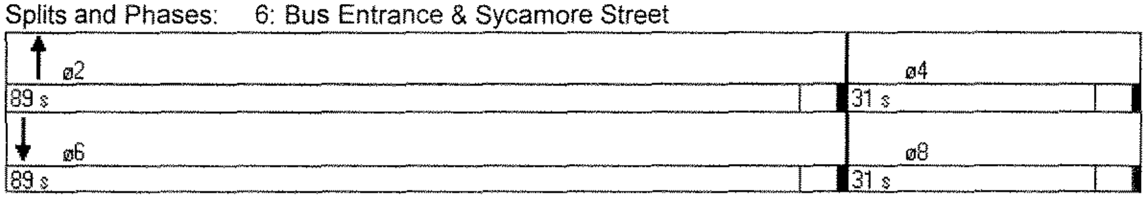


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	10	5	111	170	5	752	1189
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	31.0	31.0	31.0	31.0	89.0	89.0	89.0
Total Split (%)	26%	26%	26%	26%	74%	74%	74%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	27.0	27.0	27.0	27.0	85.0	85.0	85.0
Actuated g/C Ratio	0.23	0.23	0.23	0.23	0.71	0.71	0.71
v/c Ratio	0.04	0.01	0.16	0.44	0.02	0.33	0.52
Uniform Delay, d1	36.3	0.0	37.3	0.0	5.2	6.6	8.1
Delay	36.7	21.6	37.6	5.7	0.4	0.6	6.3
LOS	D	C	D	A	A	A	A
Approach Delay						0.6	6.3
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 62 (52%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 50
Control Type: Pretimed
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 6.0 Intersection LOS: A
Intersection Capacity Utilization 53.3% ICU Level of Service A

Splits and Phases: 6: Bus Entrance & Sycamore Street

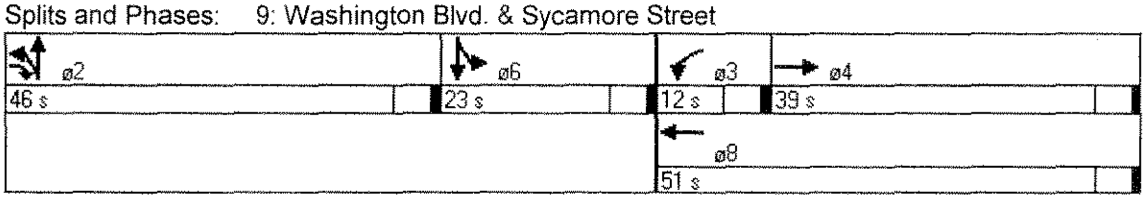


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	24	762	679	94	693	685	203	44	95	426	13
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	39.0	39.0	46.0	12.0	51.0	46.0	46.0	46.0	23.0	23.0	23.0
Total Split (%)	33%	33%	38%	10%	43%	38%	38%	38%	19%	19%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	35.0	35.0	77.0	47.0	47.0	42.0	42.0	42.0	19.0	19.0	19.0
Actuated g/C Ratio	0.29	0.29	0.64	0.39	0.39	0.35	0.35	0.35	0.16	0.16	0.16
v/c Ratio	0.17	0.80	0.72	0.57	0.58	0.66	0.52	0.09	0.37	0.83	0.08
Uniform Delay, d1	31.6	39.3	10.6	23.5	28.5	33.0	30.9	7.5	45.1	48.9	6.1
Delay	32.9	39.7	11.6	23.9	28.8	22.5	19.9	5.1	45.8	53.1	22.8
LOS	C	D	B	C	C	C	B	A	D	D	C
Approach Delay		26.6			28.3		20.2			51.0	
Approach LOS		C			C		C			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 80
Control Type: Pretimed
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 28.8 Intersection LOS: C
Intersection Capacity Utilization 76.6% ICU Level of Service C

Splits and Phases: 9: Washington Blvd. & Sycamore Street

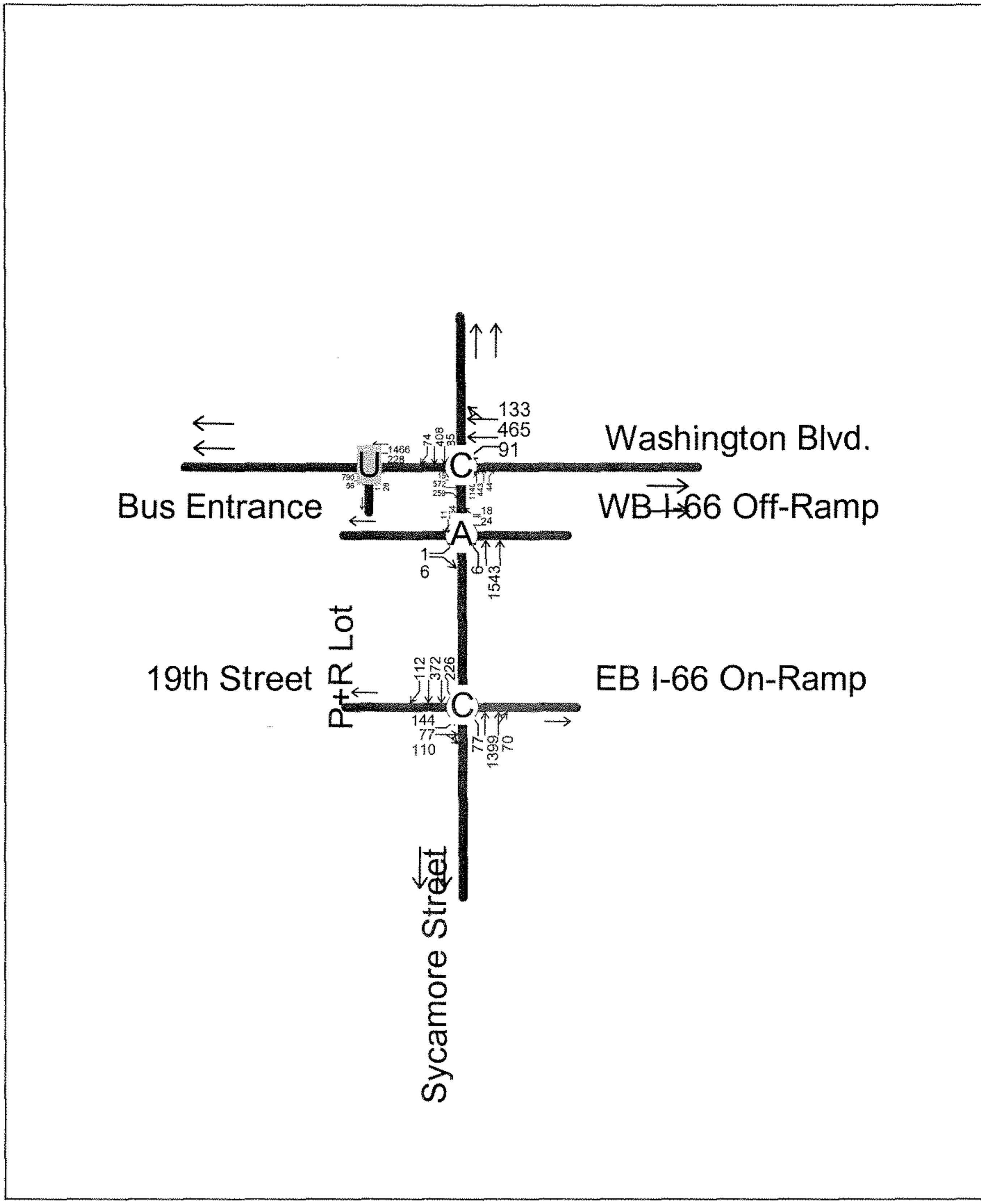


East Falls Church Station Access Study

Synchro Capacity Analysis Results

Office-Retail Scenario Conditions: AM Peak Hour

Map - East Falls Church
Levels of Service 04/17/2002



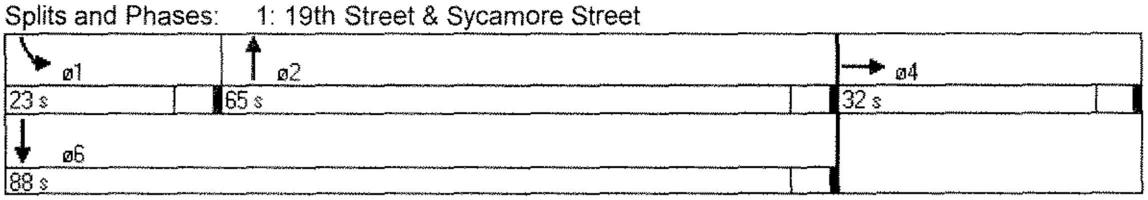
East Falls Church WMATA Station Access AM Peak Hour \Capacity Analysis\422 spaces\AM\Off_Retail-422 AM.sy6
Robert T. Kerns

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	144	77	77	1399	226	372	112
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	32.0	32.0	65.0	65.0	23.0	88.0	88.0
Total Split (%)	27%	27%	54%	54%	19%	73%	73%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	28.0	28.0	61.0	61.0	84.0	84.0	84.0
Actuated g/C Ratio	0.23	0.23	0.51	0.51	0.70	0.70	0.70
v/c Ratio	0.41	0.48	0.24	0.90	0.72	0.16	0.21
Uniform Delay, d1	38.9	28.2	16.5	26.6	28.5	6.1	0.0
Delay	39.6	28.9	17.2	29.2	19.3	1.9	0.0
LOS	D	C	B	C	B	A	A
Approach Delay		33.6		28.6		7.2	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Pretimed
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 23.4 Intersection LOS: C
Intersection Capacity Utilization 81.5% ICU Level of Service D

Splits and Phases: 1: 19th Street & Sycamore Street

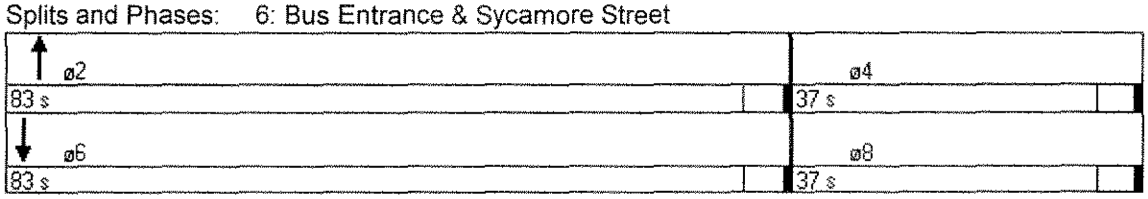


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations	↰	↱	↰↰	↱	↰	↑↑	↑↱
Volume (vph)	1	6	24	18	6	1543	754
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	37.0	37.0	37.0	37.0	83.0	83.0	83.0
Total Split (%)	31%	31%	31%	31%	69%	69%	69%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	33.0	33.0	33.0	33.0	79.0	79.0	79.0
Actuated g/C Ratio	0.28	0.28	0.28	0.28	0.66	0.66	0.66
v/c Ratio	0.00	0.02	0.03	0.05	0.02	0.72	0.36
Uniform Delay, d1	32.0	0.0	31.8	0.0	7.1	13.3	9.2
Delay	32.0	17.8	32.0	12.7	1.0	7.9	8.6
LOS	C	B	C	B	A	A	A
Approach Delay						7.9	8.6
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 77 (64%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 8.4 Intersection LOS: A
Intersection Capacity Utilization 73.0% ICU Level of Service C

Splits and Phases: 6: Bus Entrance & Sycamore Street

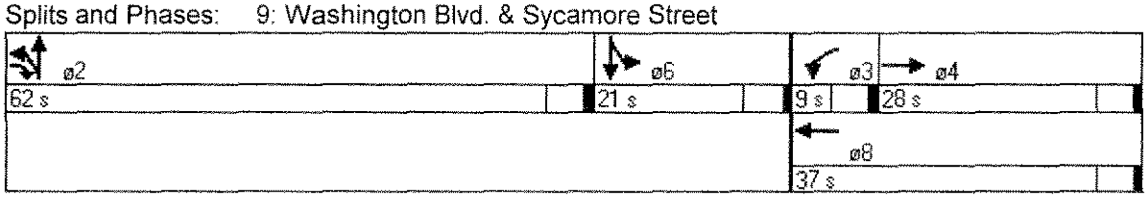


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	15	572	259	91	465	1140	443	44	85	408	74
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	28.0	28.0	62.0	9.0	37.0	62.0	62.0	62.0	21.0	21.0	21.0
Total Split (%)	23%	23%	52%	8%	31%	52%	52%	52%	18%	18%	18%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	24.0	24.0	82.0	33.0	33.0	58.0	58.0	58.0	17.0	17.0	17.0
Actuated g/C Ratio	0.20	0.20	0.68	0.28	0.28	0.48	0.48	0.48	0.14	0.14	0.14
v/c Ratio	0.15	0.88	0.27	0.73	0.68	0.80	0.69	0.07	0.37	0.88	0.41
Uniform Delay, d1	39.6	46.6	5.1	33.4	36.9	26.0	24.0	8.5	46.6	50.5	16.5
Delay	41.0	52.5	5.2	49.0	37.3	20.1	18.0	11.8	47.3	60.1	21.2
LOS	D	D	A	D	D	C	B	B	D	E	C
Approach Delay		37.8			38.8		18.6			53.1	
Approach LOS		D			D		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 31.9 Intersection LOS: C
Intersection Capacity Utilization 83.7% ICU Level of Service D

Splits and Phases: 9: Washington Blvd. & Sycamore Street

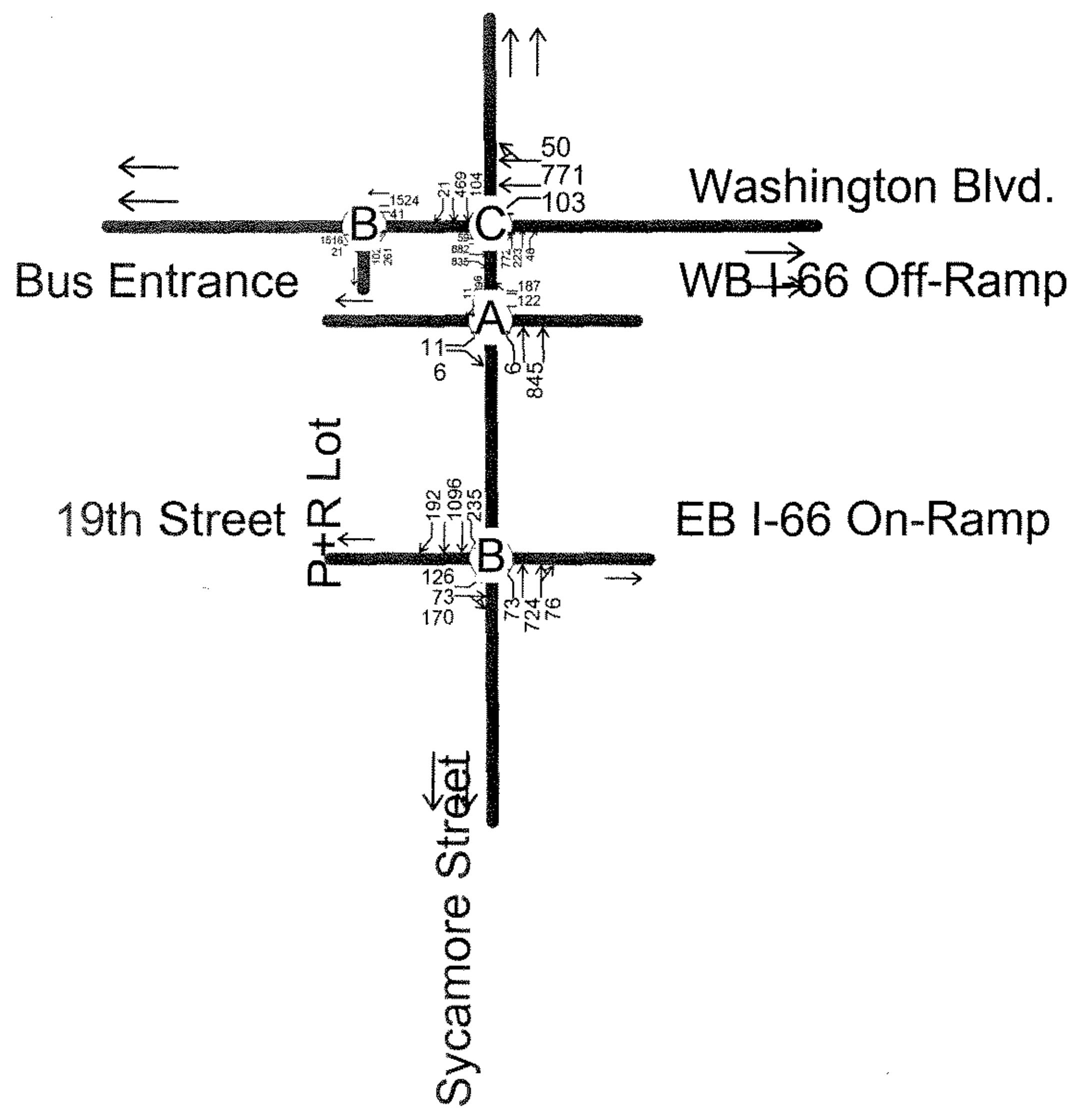


East Falls Church Station Access Study

Synchro Capacity Analysis Results

Office-Retail Scenario Conditions: PM Peak Hour

Map - East Falls Church
Levels of Service **04/17/2002**



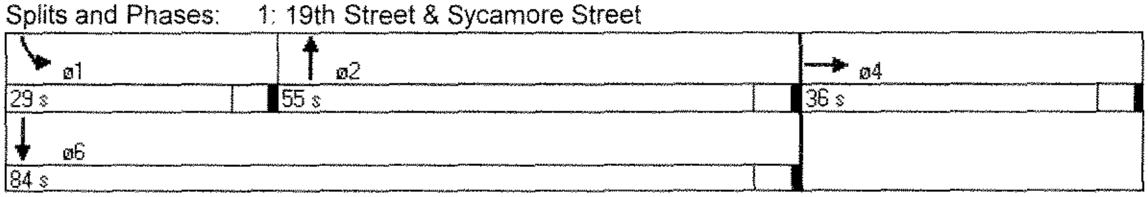
East Falls Church\Capacity Analysis\422 spaces\PM\Off_Retail-422 PM.sy6
Robert T. Kerns

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	126	73	73	724	235	1096	192
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	36.0	36.0	55.0	55.0	29.0	84.0	84.0
Total Split (%)	30%	30%	46%	46%	24%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	51.0	51.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.43	0.43	0.67	0.67	0.67
v/c Ratio	0.29	0.55	0.45	0.59	0.48	0.50	0.27
Uniform Delay, d1	35.0	27.0	24.5	26.0	7.8	10.0	0.0
Delay	35.5	27.7	26.6	26.3	14.7	8.6	0.9
LOS	D	C	C	C	B	A	A
Approach Delay		30.4		26.3		8.6	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 58 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 17.1 Intersection LOS: B
Intersection Capacity Utilization 65.6% ICU Level of Service B

Splits and Phases: 1: 19th Street & Sycamore Street

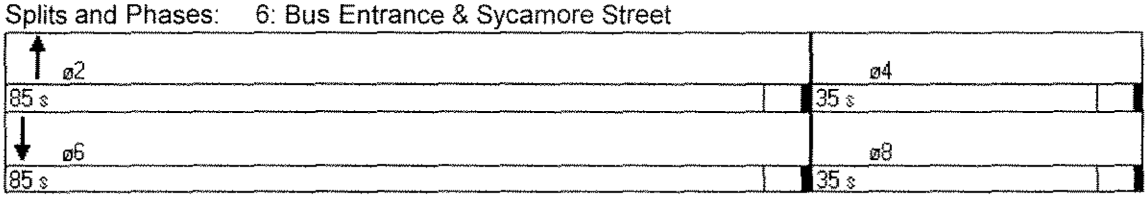


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	122	187	6	845	1396
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	35.0	35.0	35.0	35.0	85.0	85.0	85.0
Total Split (%)	29%	29%	29%	29%	71%	71%	71%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	31.0	31.0	31.0	31.0	81.0	81.0	81.0
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.68	0.68	0.68
v/c Ratio	0.03	0.02	0.15	0.45	0.05	0.38	0.64
Uniform Delay, d1	33.2	0.0	34.3	3.3	6.6	8.5	11.2
Delay	33.6	18.7	34.6	7.2	0.5	0.6	8.4
LOS	C	B	C	A	A	A	A
Approach Delay						0.6	8.4
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 68 (57%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 7.1 Intersection LOS: A
Intersection Capacity Utilization 59.5% ICU Level of Service A

Splits and Phases: 6: Bus Entrance & Sycamore Street

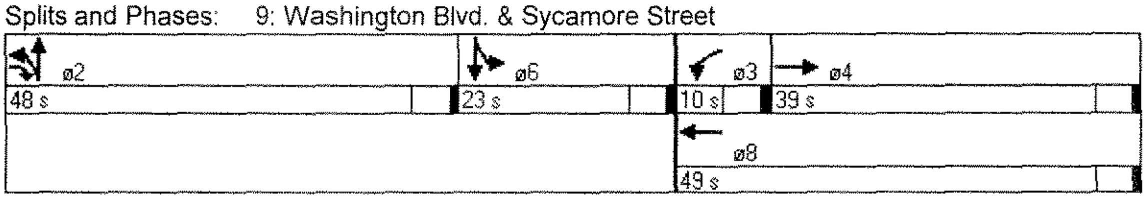


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	59	882	835	103	771	772	223	48	104	469	21
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	39.0	39.0	48.0	10.0	49.0	48.0	48.0	48.0	23.0	23.0	23.0
Total Split (%)	33%	33%	40%	8%	41%	40%	40%	40%	19%	19%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	35.0	35.0	79.0	45.0	45.0	44.0	44.0	44.0	19.0	19.0	19.0
Actuated g/C Ratio	0.29	0.29	0.66	0.38	0.38	0.37	0.37	0.37	0.16	0.16	0.16
v/c Ratio	0.58	0.93	0.88	0.74	0.68	0.71	0.55	0.09	0.40	0.91	0.12
Uniform Delay, d1	36.2	41.3	14.4	25.0	31.2	32.6	30.1	8.4	45.4	49.7	9.3
Delay	41.1	48.9	13.0	39.4	31.5	19.6	17.5	4.7	46.1	61.3	21.9
LOS	D	D	B	D	C	B	B	A	D	E	C
Approach Delay		31.8			32.4		17.7			57.2	
Approach LOS		C			C		B			E	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 32.0 Intersection LOS: C
Intersection Capacity Utilization 88.4% ICU Level of Service D

Splits and Phases: 9: Washington Blvd. & Sycamore Street

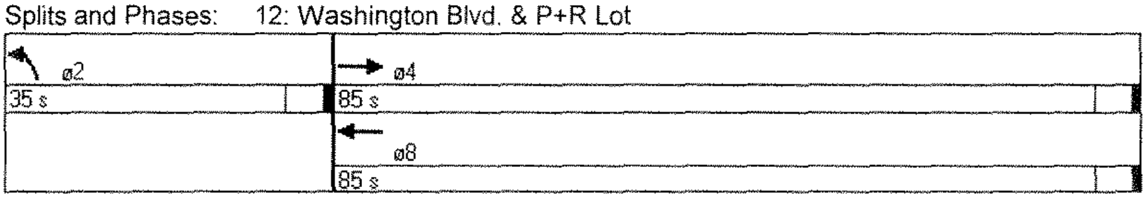


Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Volume (vph)	1516	41	1524	102	261
Turn Type		Perm			Perm
Protected Phases	4		8	2	
Permitted Phases		8		2	2
Detector Phases	4	8	8	2	2
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0
Total Split (s)	85.0	85.0	85.0	35.0	35.0
Total Split (%)	71%	71%	71%	29%	29%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Max	Max	Max	Max	Max
Act Effct Green (s)	81.0	81.0	81.0	31.0	31.0
Actuated g/C Ratio	0.68	0.68	0.68	0.26	0.26
v/c Ratio	0.70	0.42	0.69	0.24	0.65
Uniform Delay, d1	12.0	8.8	11.9	35.2	33.5
Delay	12.3	3.1	3.6	35.7	34.3
LOS	B	A	A	D	C
Approach Delay	12.3		3.6	34.7	
Approach LOS	B		A	C	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 40 (33%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 10.7 Intersection LOS: B
Intersection Capacity Utilization 70.5% ICU Level of Service C

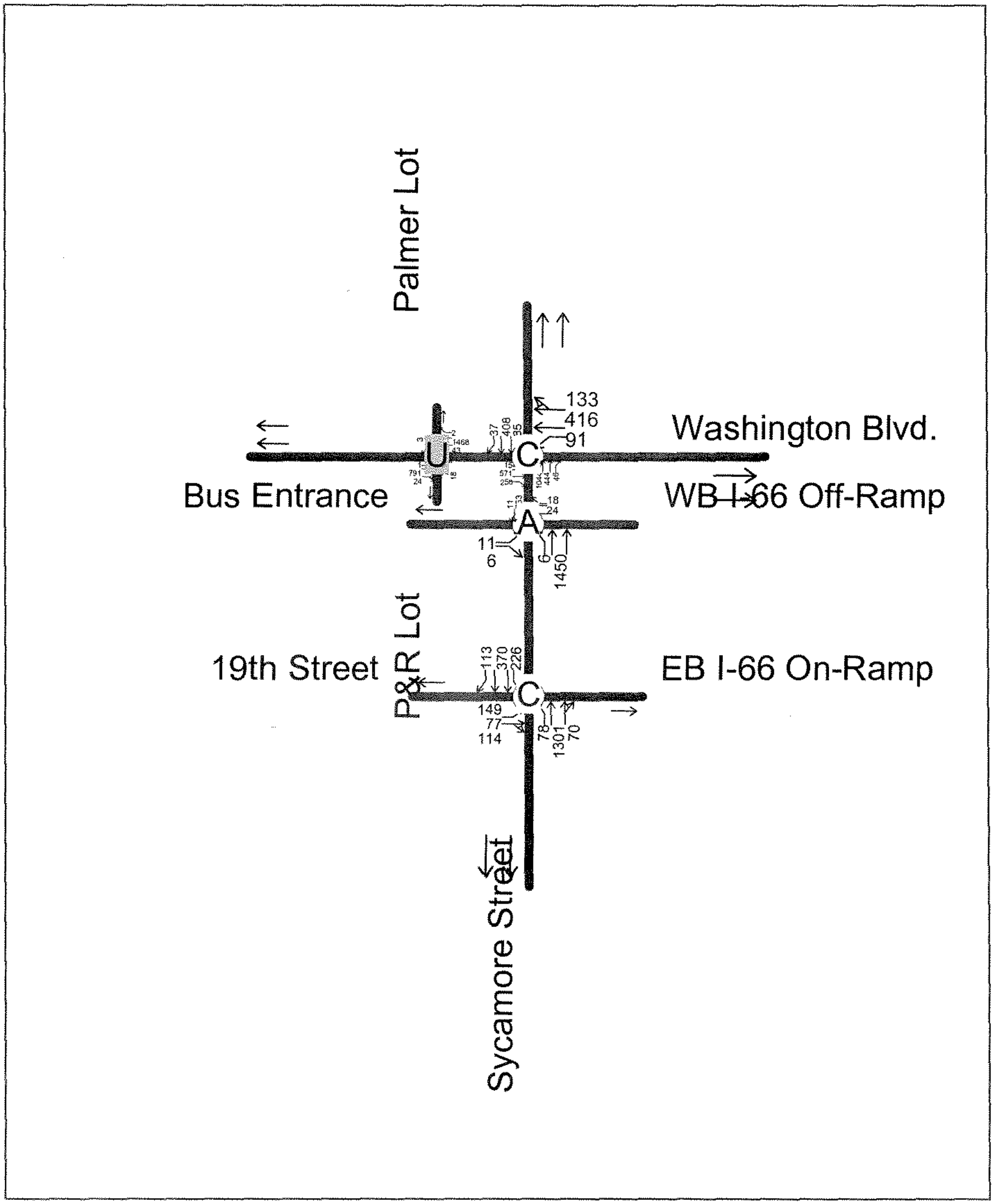
Splits and Phases: 12: Washington Blvd. & P+R Lot



East Falls Church Station Access Study

Synchro Capacity Analysis Results

Residential-Retail Scenario Conditions: AM Peak Hour

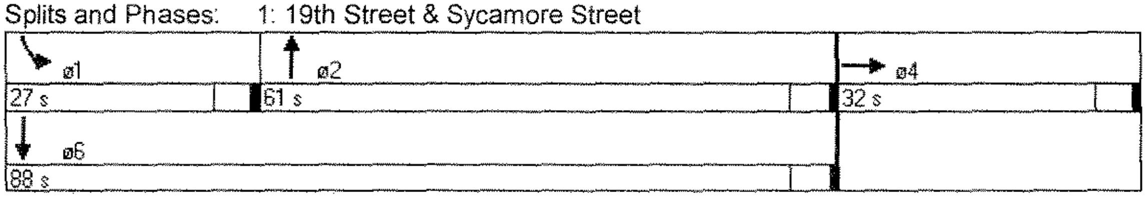

Palmer Lot
Washington Blvd.
Bus Entrance
WB I-66 Off-Ramp
P&R Lot
19th Street
EB I-66 On-Ramp
Sycamore Street
U
C
A
C
133
416
91
37
408
35
11
6
6
1450
113
370
226
149
77
114
78
1301
70
18
24

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	149	77	78	1301	226	370	113
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	32.0	32.0	61.0	61.0	27.0	88.0	88.0
Total Split (%)	27%	27%	51%	51%	23%	73%	73%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	28.0	28.0	57.0	57.0	84.0	84.0	84.0
Actuated g/C Ratio	0.23	0.23	0.48	0.48	0.70	0.70	0.70
v/c Ratio	0.42	0.49	0.26	0.90	0.61	0.16	0.21
Uniform Delay, d1	39.1	28.1	18.8	28.7	25.3	6.1	0.0
Delay	39.7	28.8	19.7	31.6	16.6	1.9	0.0
LOS	D	C	B	C	B	A	A
Approach Delay		33.6		30.9		6.3	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 45 (38%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Pretimed
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 24.3 Intersection LOS: C
Intersection Capacity Utilization 78.6% ICU Level of Service C

Splits and Phases: 1: 19th Street & Sycamore Street

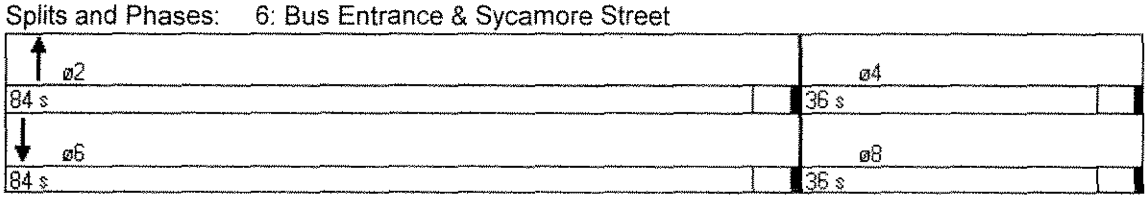


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	24	18	6	1450	753
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	36.0	36.0	36.0	36.0	84.0	84.0	84.0
Total Split (%)	30%	30%	30%	30%	70%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	32.0	32.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.67	0.67	0.67
v/c Ratio	0.03	0.02	0.03	0.05	0.02	0.67	0.36
Uniform Delay, d1	32.5	0.0	32.5	0.0	6.7	12.0	8.7
Delay	32.8	18.3	32.7	13.0	0.3	2.8	8.7
LOS	C	B	C	B	A	A	A
Approach Delay						2.8	8.7
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 66 (55%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 5.4 Intersection LOS: A
Intersection Capacity Utilization 70.2% ICU Level of Service C

Splits and Phases: 6: Bus Entrance & Sycamore Street

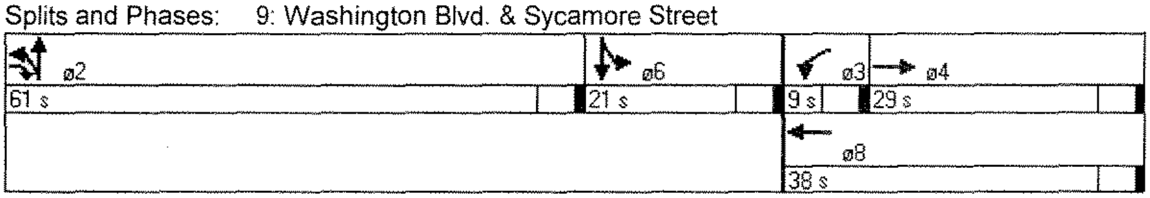


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	15	571	258	91	416	1044	444	46	85	408	37
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	29.0	29.0	61.0	9.0	38.0	61.0	61.0	61.0	21.0	21.0	21.0
Total Split (%)	24%	24%	51%	8%	32%	51%	51%	51%	18%	18%	18%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	25.0	25.0	82.0	34.0	34.0	57.0	57.0	57.0	17.0	17.0	17.0
Actuated g/C Ratio	0.21	0.21	0.68	0.28	0.28	0.48	0.48	0.48	0.14	0.14	0.14
v/c Ratio	0.12	0.84	0.26	0.73	0.61	0.74	0.67	0.07	0.37	0.88	0.22
Uniform Delay, d1	38.6	45.6	5.0	32.6	34.8	25.5	24.2	8.4	46.6	50.5	4.4
Delay	39.7	49.1	5.2	48.2	35.1	13.0	12.4	6.6	47.3	60.1	16.6
LOS	D	D	A	D	D	B	B	A	D	E	B
Approach Delay		35.5			37.0		12.4			55.0	
Approach LOS		D			D		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 60 (50%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 28.7 Intersection LOS: C
Intersection Capacity Utilization 80.7% ICU Level of Service D

Splits and Phases: 9: Washington Blvd. & Sycamore Street



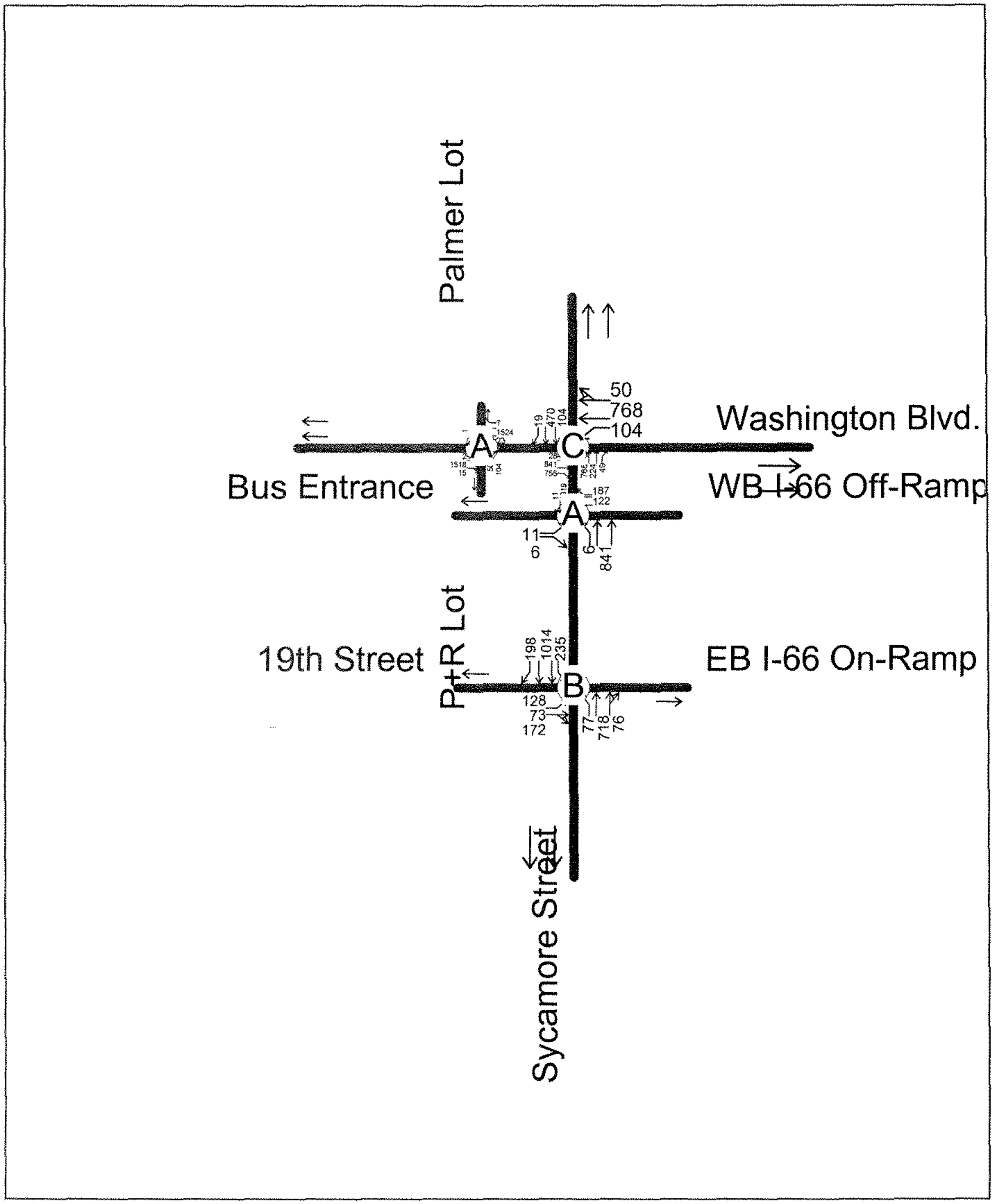
East Falls Church Station Access Study

Synchro Capacity Analysis Results

Residential-Retail Scenario Conditions: PM Peak Hour

Map - East Falls Church
Levels of Service

04/17/2002



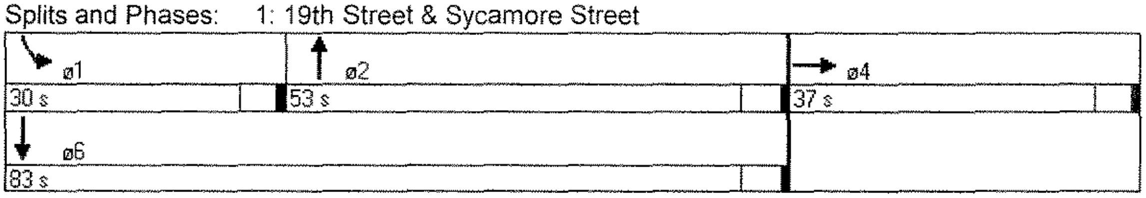
East Falls Church Existing Conditions PM Peak Hour I:\STC\WMATA\Existing Conditions\East Falls Church\Capacity Analysis\422 spaces\PM\Res_Retail-422 PM.sy6
Robert T. Kerns

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	128	73	77	718	235	1014	198
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	37.0	37.0	53.0	53.0	30.0	83.0	83.0
Total Split (%)	31%	31%	44%	44%	25%	69%	69%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	33.0	33.0	49.0	49.0	79.0	79.0	79.0
Actuated g/C Ratio	0.28	0.28	0.41	0.41	0.66	0.66	0.66
v/c Ratio	0.29	0.53	0.46	0.61	0.48	0.47	0.28
Uniform Delay, d1	34.3	24.7	25.8	27.5	8.2	10.2	0.0
Delay	34.8	25.4	27.9	27.8	18.3	8.0	0.9
LOS	C	C	C	C	B	A	A
Approach Delay		28.6		27.8		8.7	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 58 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 17.7 Intersection LOS: B
Intersection Capacity Utilization 65.6% ICU Level of Service B

Splits and Phases: 1: 19th Street & Sycamore Street

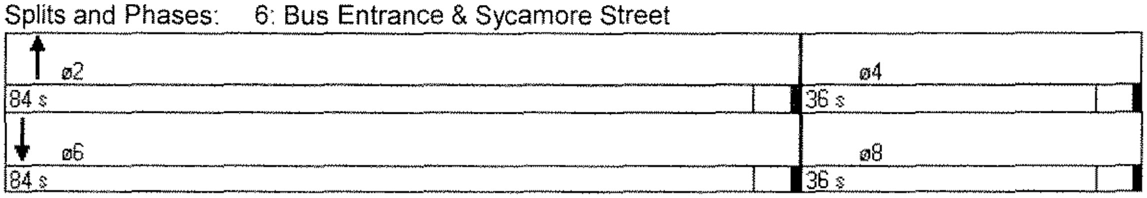


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	122	187	6	841	1319
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	36.0	36.0	36.0	36.0	84.0	84.0	84.0
Total Split (%)	30%	30%	30%	30%	70%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	32.0	32.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.67	0.67	0.67
v/c Ratio	0.03	0.02	0.15	0.44	0.05	0.39	0.62
Uniform Delay, d1	32.5	0.0	33.5	3.6	6.9	9.0	11.3
Delay	32.9	18.3	33.8	7.2	0.7	0.8	11.6
LOS	C	B	C	A	A	A	B
Approach Delay						0.8	11.6
Approach LOS						A	B

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 62 (52%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.62
Intersection Signal Delay: 8.8 Intersection LOS: A
Intersection Capacity Utilization 57.2% ICU Level of Service A

Splits and Phases: 6: Bus Entrance & Sycamore Street

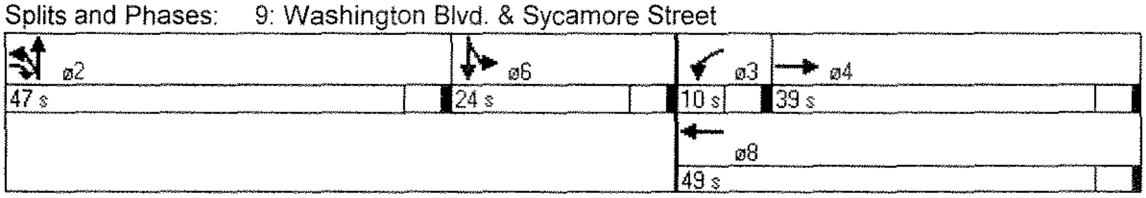


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	28	841	755	104	768	766	224	49	104	470	19
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	39.0	39.0	47.0	10.0	49.0	47.0	47.0	47.0	24.0	24.0	24.0
Total Split (%)	33%	33%	39%	8%	41%	39%	39%	39%	20%	20%	20%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	35.0	35.0	78.0	45.0	45.0	43.0	43.0	43.0	20.0	20.0	20.0
Actuated g/C Ratio	0.29	0.29	0.65	0.38	0.38	0.36	0.36	0.36	0.17	0.17	0.17
v/c Ratio	0.27	0.89	0.81	0.75	0.68	0.72	0.56	0.09	0.38	0.87	0.11
Uniform Delay, d1	32.6	40.6	12.9	25.0	31.1	33.3	30.9	9.0	44.5	48.7	8.0
Delay	38.0	44.1	7.5	40.4	31.5	19.7	17.7	5.0	45.2	55.0	21.0
LOS	D	D	A	D	C	B	B	A	D	D	C
Approach Delay		27.0			32.5		17.9			52.1	
Approach LOS		C			C		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 29.5 Intersection LOS: C
Intersection Capacity Utilization 83.1% ICU Level of Service D

Splits and Phases: 9: Washington Blvd. & Sycamore Street

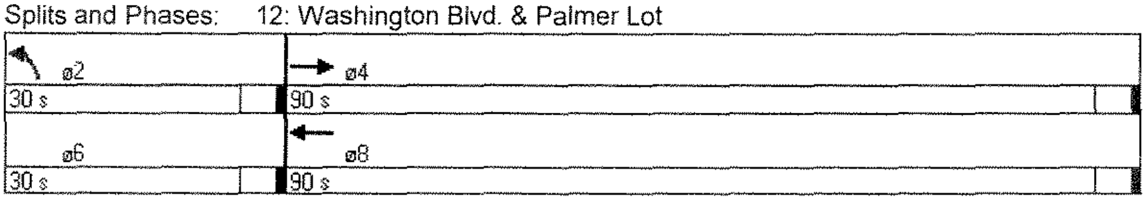


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	2	1518	23	1524	7	50	104	4	1
Turn Type	Perm		Perm		Perm	custom	custom	custom	custom
Protected Phases		4		8		2			
Permitted Phases	4		8		8	2	2	6	6
Detector Phases	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	90.0	90.0	90.0	90.0	90.0	30.0	30.0	30.0	30.0
Total Split (%)	75%	75%	75%	75%	75%	25%	25%	25%	25%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	86.0	86.0	86.0	86.0	86.0	26.0	26.0	26.0	26.0
Actuated g/C Ratio	0.72	0.72	0.72	0.72	0.72	0.22	0.22	0.22	0.22
v/c Ratio	0.02	0.66	0.19	0.65	0.01	0.14	0.30	0.01	0.00
Uniform Delay, d1	5.0	9.1	5.6	9.1	0.6	37.9	21.4	37.0	0.0
Delay	5.0	9.3	0.7	2.0	0.1	38.5	22.8	37.0	28.0
LOS	A	A	A	A	A	D	C	D	C
Approach Delay		9.3		1.9					
Approach LOS		A		A					

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 10 (8%), Referenced to phase 2:NBL and 6:SBL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 6.7 Intersection LOS: A
Intersection Capacity Utilization 66.5% ICU Level of Service B

Splits and Phases: 12: Washington Blvd. & Palmer Lot

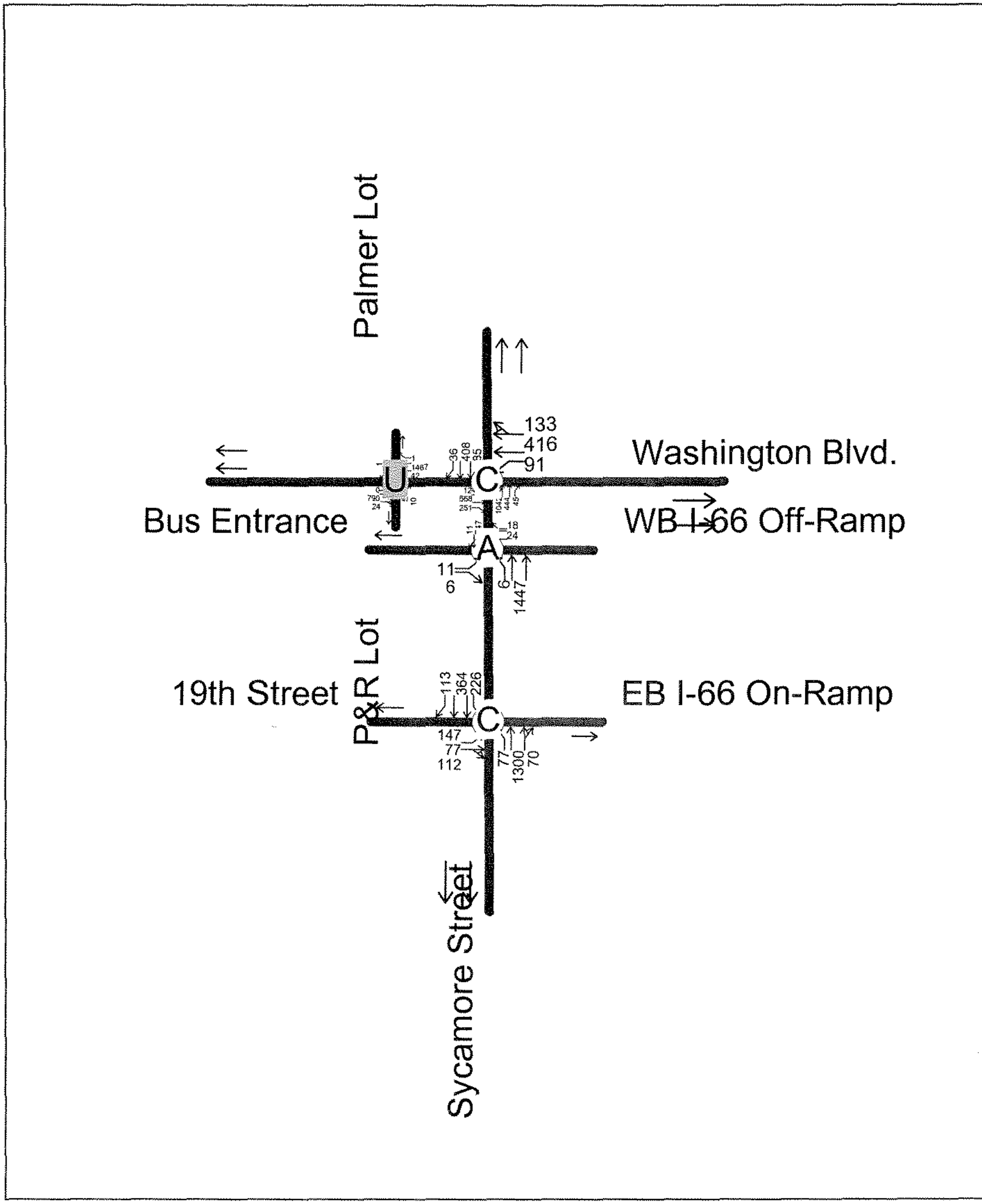


East Falls Church Station Access Study

Synchro Capacity Analysis Results

Residential Scenario Conditions: AM Peak Hour

Map - East Falls Church
Levels of Service **04/17/2002**

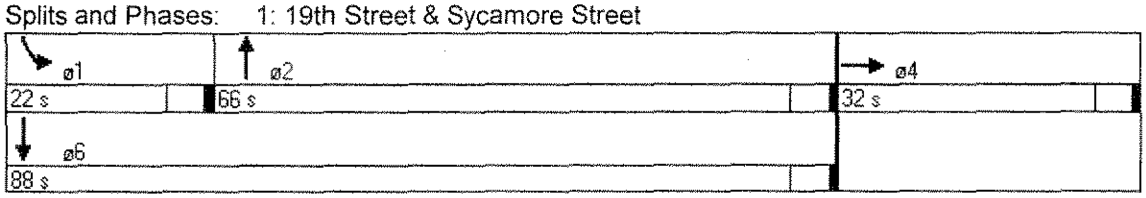


Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	147	77	77	1300	226	364	113
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	32.0	32.0	66.0	66.0	22.0	88.0	88.0
Total Split (%)	27%	27%	55%	55%	18%	73%	73%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	28.0	28.0	62.0	62.0	84.0	84.0	84.0
Actuated g/C Ratio	0.23	0.23	0.52	0.52	0.70	0.70	0.70
v/c Ratio	0.41	0.48	0.24	0.83	0.75	0.16	0.21
Uniform Delay, d1	39.0	28.1	16.0	24.3	29.2	6.1	0.0
Delay	39.7	28.8	16.6	24.8	26.7	3.0	1.1
LOS	D	C	B	C	C	A	A
Approach Delay		33.6		24.4		10.3	
Approach LOS		C		C		B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Pretimed
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 21.6 Intersection LOS: C
Intersection Capacity Utilization 78.6% ICU Level of Service C

Splits and Phases: 1: 19th Street & Sycamore Street

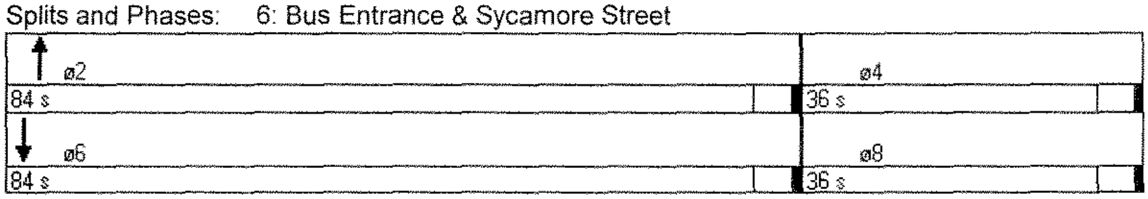


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	24	18	6	1447	747
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	36.0	36.0	36.0	36.0	84.0	84.0	84.0
Total Split (%)	30%	30%	30%	30%	70%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	32.0	32.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.67	0.67	0.67
v/c Ratio	0.03	0.02	0.03	0.05	0.02	0.67	0.35
Uniform Delay, d1	32.5	0.0	32.5	0.0	6.7	12.0	8.7
Delay	32.8	18.3	32.7	13.0	0.8	0.6	8.9
LOS	C	B	C	B	A	A	A
Approach Delay						0.6	8.9
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 66 (55%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 4.0 Intersection LOS: A
Intersection Capacity Utilization 70.1% ICU Level of Service C

Splits and Phases: 6: Bus Entrance & Sycamore Street

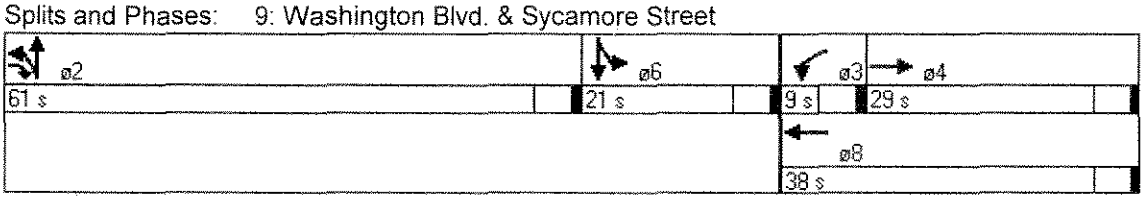


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	12	568	251	91	416	1042	444	45	85	408	36
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	29.0	29.0	61.0	9.0	38.0	61.0	61.0	61.0	21.0	21.0	21.0
Total Split (%)	24%	24%	51%	8%	32%	51%	51%	51%	18%	18%	18%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	25.0	25.0	82.0	34.0	34.0	57.0	57.0	57.0	17.0	17.0	17.0
Actuated g/C Ratio	0.21	0.21	0.68	0.28	0.28	0.48	0.48	0.48	0.14	0.14	0.14
v/c Ratio	0.10	0.84	0.26	0.73	0.61	0.74	0.67	0.07	0.37	0.88	0.21
Uniform Delay, d1	38.4	45.5	5.0	32.6	34.8	25.5	24.2	8.6	46.6	50.5	4.5
Delay	39.3	48.7	5.1	48.2	35.1	16.8	16.0	9.1	47.3	60.1	17.0
LOS	D	D	A	D	D	B	B	A	D	E	B
Approach Delay		35.4			37.0		16.1			55.1	
Approach LOS		D			D		B			E	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 58 (48%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 30.2 Intersection LOS: C
Intersection Capacity Utilization 80.6% ICU Level of Service D

Splits and Phases: 9: Washington Blvd. & Sycamore Street

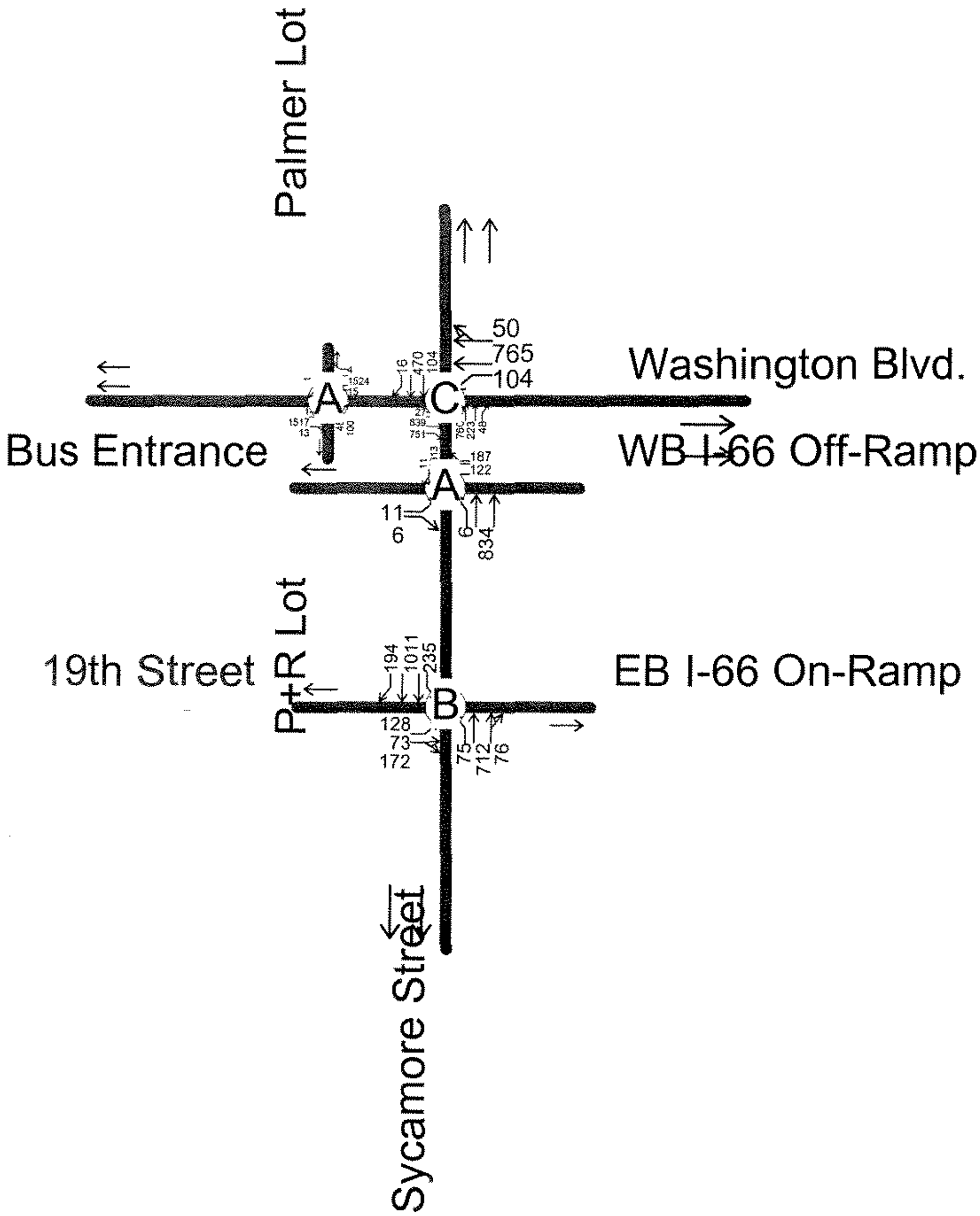


East Falls Church Station Access Study

Synchro Capacity Analysis Results

Residential Scenario Conditions: PM Peak Hour

Map - East Falls Church
Levels of Service 04/17/2002



East:F2TIG-WMATA-Existing Access\East Falls Church\Capacity Analysis\422 spaces\PM\Residential-422 PM.sy6
Robert T. Kerns

Timings
1: 19th Street & Sycamore Street

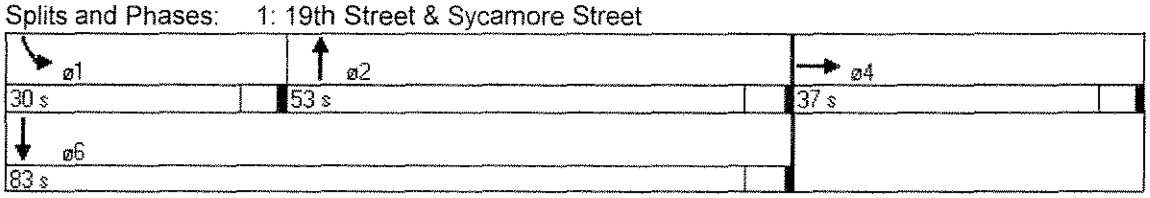
04/17/2002

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	128	73	75	712	235	1011	194
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	37.0	37.0	53.0	53.0	30.0	83.0	83.0
Total Split (%)	31%	31%	44%	44%	25%	69%	69%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	33.0	33.0	49.0	49.0	79.0	79.0	79.0
Actuated g/C Ratio	0.28	0.28	0.41	0.41	0.66	0.66	0.66
v/c Ratio	0.29	0.53	0.45	0.60	0.48	0.47	0.27
Uniform Delay, d1	34.3	24.5	25.6	27.4	8.2	10.1	0.0
Delay	34.8	25.2	27.7	27.8	15.4	9.5	0.8
LOS	C	C	C	C	B	A	A
Approach Delay		28.5		27.7		9.3	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 58 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.60
Intersection Signal Delay: 17.9 Intersection LOS: B
Intersection Capacity Utilization 65.4% ICU Level of Service B

Splits and Phases: 1: 19th Street & Sycamore Street

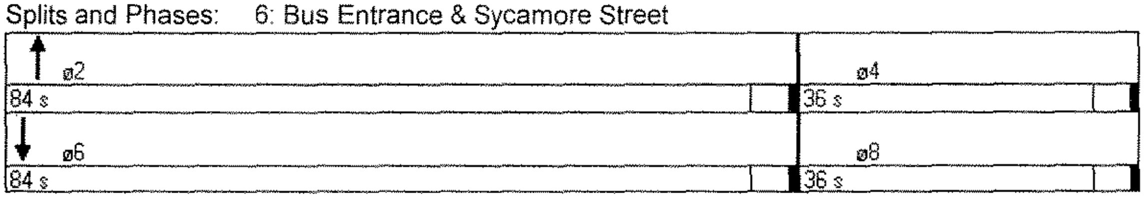


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	122	187	6	834	1313
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	36.0	36.0	36.0	36.0	84.0	84.0	84.0
Total Split (%)	30%	30%	30%	30%	70%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	32.0	32.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.67	0.67	0.67
v/c Ratio	0.03	0.02	0.15	0.44	0.04	0.38	0.61
Uniform Delay, d1	32.5	0.0	33.5	3.2	6.9	9.0	11.3
Delay	32.9	18.3	33.8	7.0	0.7	0.7	7.6
LOS	C	B	C	A	A	A	A
Approach Delay						0.7	7.6
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 66 (55%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 6.6 Intersection LOS: A
Intersection Capacity Utilization 57.0% ICU Level of Service A

Splits and Phases: 6: Bus Entrance & Sycamore Street

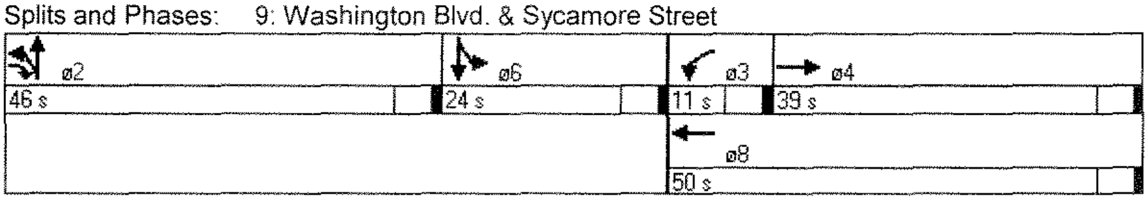


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	27	839	751	104	765	760	223	48	104	470	16
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	39.0	39.0	46.0	11.0	50.0	46.0	46.0	46.0	24.0	24.0	24.0
Total Split (%)	33%	33%	38%	9%	42%	38%	38%	38%	20%	20%	20%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	35.0	35.0	77.0	46.0	46.0	42.0	42.0	42.0	20.0	20.0	20.0
Actuated g/C Ratio	0.29	0.29	0.64	0.38	0.38	0.35	0.35	0.35	0.17	0.17	0.17
v/c Ratio	0.24	0.88	0.81	0.68	0.66	0.73	0.57	0.09	0.38	0.87	0.09
Uniform Delay, d1	32.4	40.6	13.1	24.4	30.3	34.1	31.7	9.4	44.5	48.7	7.4
Delay	44.9	52.8	9.7	32.3	30.6	20.4	18.3	5.2	45.2	55.0	22.0
LOS	D	D	A	C	C	C	B	A	D	D	C
Approach Delay		32.7			30.8		18.5			52.4	
Approach LOS		C			C		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 31.5 Intersection LOS: C
Intersection Capacity Utilization 82.9% ICU Level of Service D

Splits and Phases: 9: Washington Blvd. & Sycamore Street

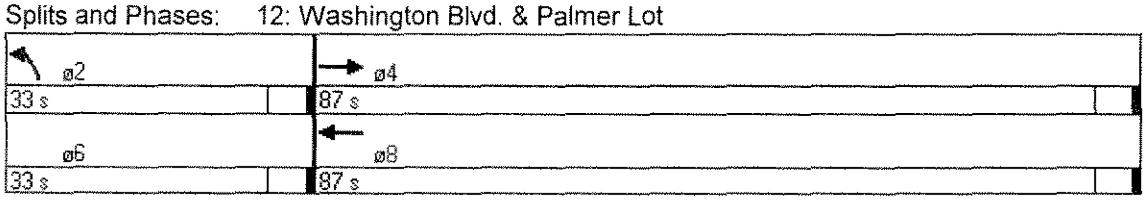


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	1	1517	15	1524	4	48	100	2	1
Turn Type	Perm		Perm		Perm	custom	custom	custom	custom
Protected Phases		4		8		2			
Permitted Phases	4		8		8	2	2	6	6
Detector Phases	4	4	8	8	8	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	87.0	87.0	87.0	87.0	87.0	33.0	33.0	33.0	33.0
Total Split (%)	73%	73%	73%	73%	73%	28%	28%	28%	28%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	83.0	83.0	83.0	83.0	83.0	29.0	29.0	29.0	29.0
Actuated g/C Ratio	0.69	0.69	0.69	0.69	0.69	0.24	0.24	0.24	0.24
v/c Ratio	0.01	0.68	0.14	0.68	0.00	0.12	0.26	0.00	0.00
Uniform Delay, d1	6.0	10.7	6.3	10.7	1.5	35.5	21.5	34.5	0.0
Delay	6.0	11.0	2.0	5.6	1.0	36.0	22.6	34.5	27.0
LOS	A	B	A	A	A	D	C	C	C
Approach Delay		11.0		5.5					
Approach LOS		B		A					

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 15 (13%), Referenced to phase 2:NBL and 6:SBL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 9.1 Intersection LOS: A
Intersection Capacity Utilization 66.1% ICU Level of Service B

Splits and Phases: 12: Washington Blvd. & Palmer Lot



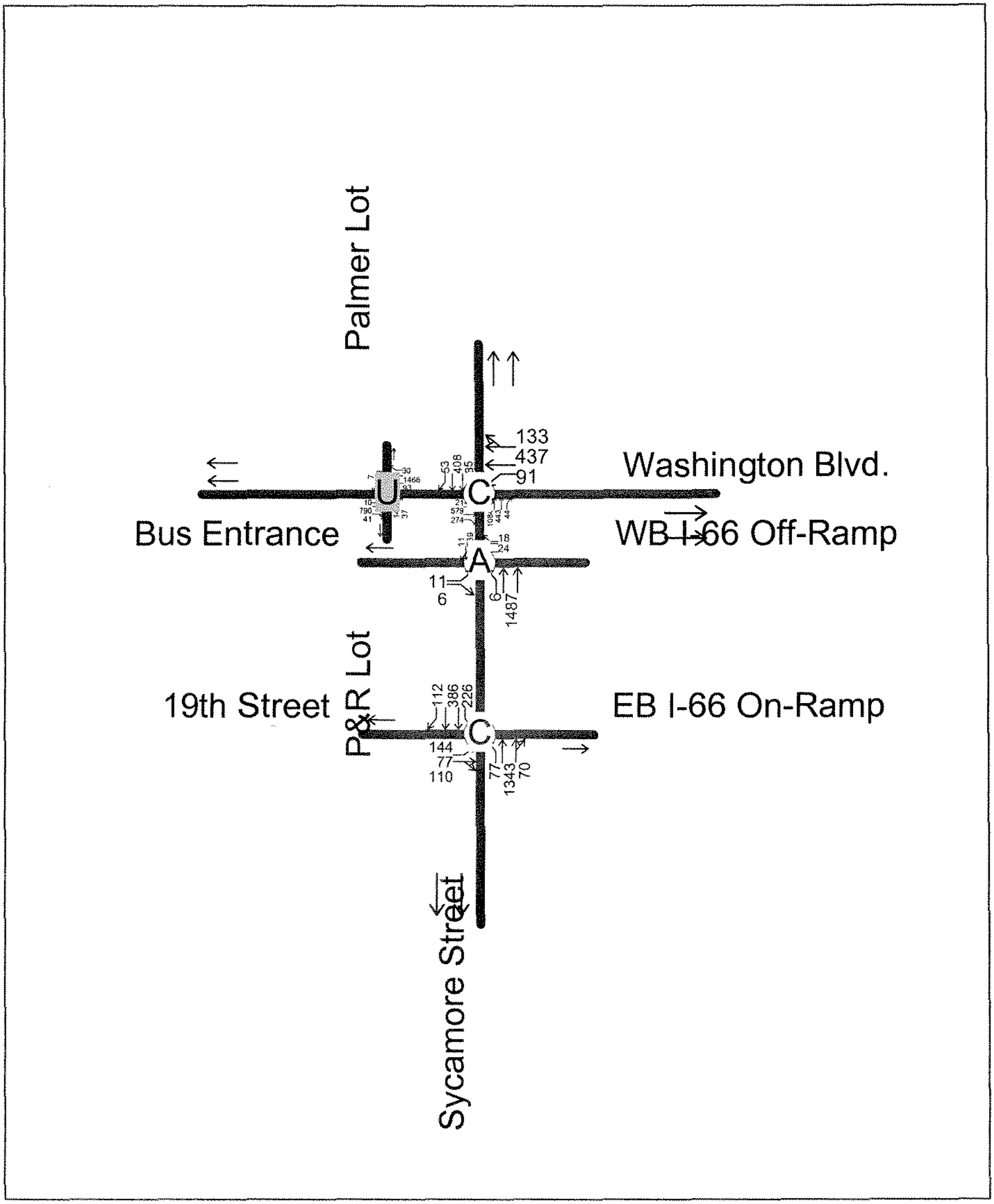
East Falls Church Station Access Study

Synchro Capacity Analysis Results

Retail Scenario Conditions: AM Peak Hour

Map - East Falls Church
Levels of Service

04/17/2002

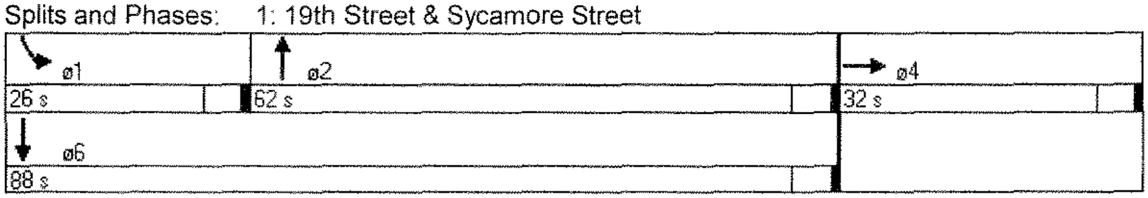


Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	144	77	77	1343	226	386	112
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	32.0	32.0	62.0	62.0	26.0	88.0	88.0
Total Split (%)	27%	27%	52%	52%	22%	73%	73%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	28.0	28.0	58.0	58.0	84.0	84.0	84.0
Actuated g/C Ratio	0.23	0.23	0.48	0.48	0.70	0.70	0.70
v/c Ratio	0.41	0.48	0.25	0.91	0.64	0.17	0.21
Uniform Delay, d1	38.9	28.2	18.2	28.4	26.0	6.1	0.0
Delay	39.6	28.9	19.0	31.8	17.2	2.0	0.0
LOS	D	C	B	C	B	A	A
Approach Delay		33.6		31.1		6.4	
Approach LOS		C		C		A	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Pretimed
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 24.4 Intersection LOS: C
Intersection Capacity Utilization 79.9% ICU Level of Service C

Splits and Phases: 1: 19th Street & Sycamore Street

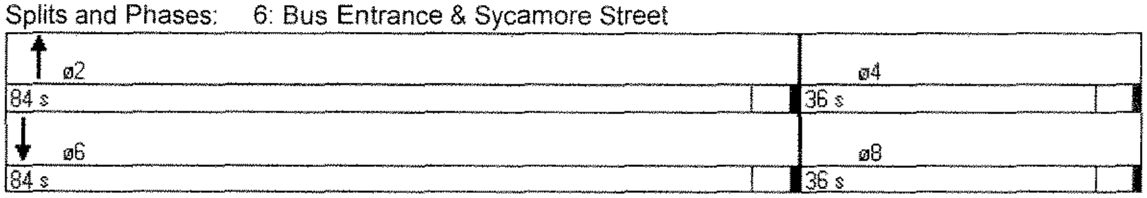


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	24	18	6	1487	769
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	36.0	36.0	36.0	36.0	84.0	84.0	84.0
Total Split (%)	30%	30%	30%	30%	70%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	32.0	32.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.67	0.67	0.67
v/c Ratio	0.03	0.02	0.03	0.05	0.02	0.69	0.36
Uniform Delay, d1	32.5	0.0	32.5	0.0	6.7	12.3	8.8
Delay	32.8	18.3	32.7	13.0	0.3	3.7	8.8
LOS	C	B	C	B	A	A	A
Approach Delay						3.7	8.8
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 72 (60%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 6.0 Intersection LOS: A
Intersection Capacity Utilization 71.3% ICU Level of Service C

Splits and Phases: 6: Bus Entrance & Sycamore Street



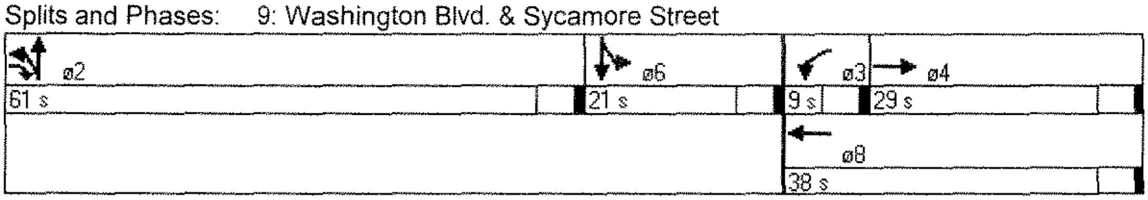
9: Washington Blvd. & Sycamore Street

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	21	579	274	91	437	1084	443	44	85	408	53
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	29.0	29.0	61.0	9.0	38.0	61.0	61.0	61.0	21.0	21.0	21.0
Total Split (%)	24%	24%	51%	8%	32%	51%	51%	51%	18%	18%	18%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	25.0	25.0	82.0	34.0	34.0	57.0	57.0	57.0	17.0	17.0	17.0
Actuated g/C Ratio	0.21	0.21	0.68	0.28	0.28	0.48	0.48	0.48	0.14	0.14	0.14
v/c Ratio	0.19	0.85	0.28	0.73	0.63	0.77	0.68	0.07	0.37	0.88	0.29
Uniform Delay, d1	39.1	45.7	5.2	32.6	35.3	26.1	24.5	8.8	46.6	50.5	4.6
Delay	40.5	49.7	5.3	48.2	35.7	14.7	13.9	8.2	47.3	60.1	14.8
LOS	D	D	A	D	D	B	B	A	D	E	B
Approach Delay		35.6			37.4		14.0			53.7	
Approach LOS		D			D		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 29.3 Intersection LOS: C
Intersection Capacity Utilization 82.2% ICU Level of Service D

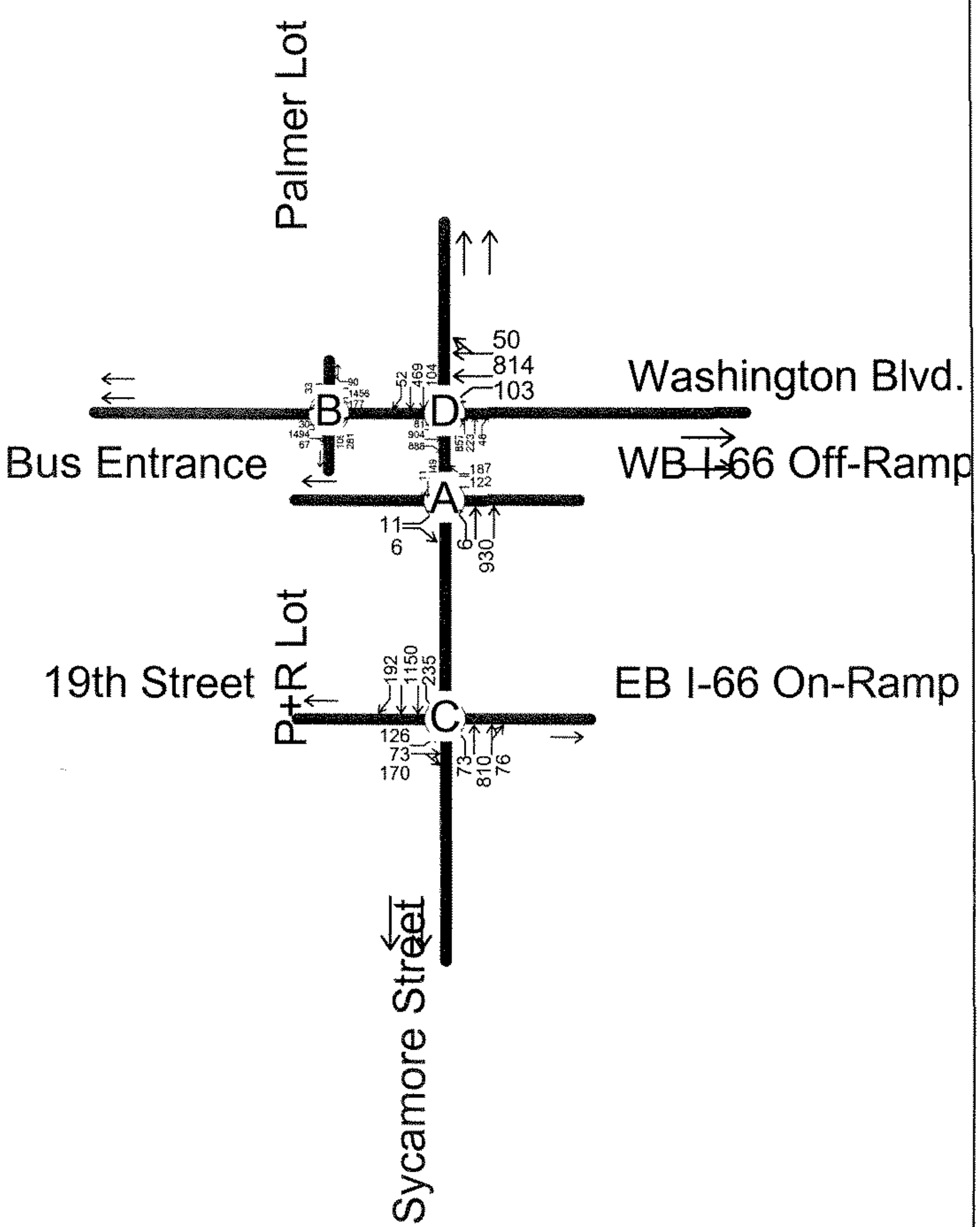
Splits and Phases: 9: Washington Blvd. & Sycamore Street



East Falls Church Station Access Study

Synchro Capacity Analysis Results

Retail (with-pass-by) Scenario Conditions: PM Peak Hour

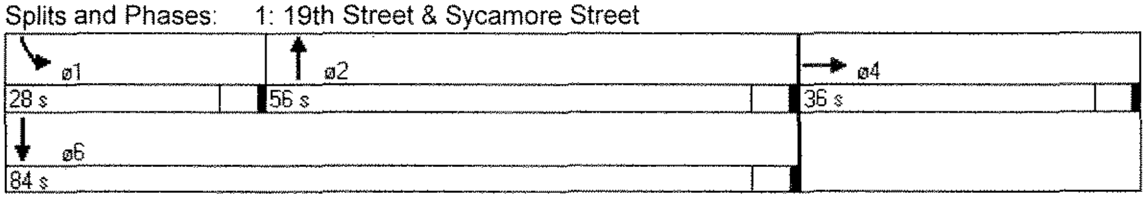

Palmer Lot
Washington Blvd.
50
814
103
B
D
Bus Entrance
WB I-66 Off-Ramp
A
187
122
11
6
6
930
19th Street
P+R Lot
EB I-66 On-Ramp
192
1150
235
C
126
73
170
73
810
76
Sycamore Street

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	126	73	73	810	235	1150	192
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	36.0	36.0	56.0	56.0	28.0	84.0	84.0
Total Split (%)	30%	30%	47%	47%	23%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	52.0	52.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.43	0.43	0.67	0.67	0.67
v/c Ratio	0.29	0.56	0.46	0.64	0.52	0.53	0.27
Uniform Delay, d1	35.0	28.2	24.1	26.3	7.8	10.3	0.0
Delay	35.5	29.0	26.4	26.6	17.6	14.3	3.0
LOS	D	C	C	C	B	B	A
Approach Delay		31.2		26.6		13.4	
Approach LOS		C		C		B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 58 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 20.0 Intersection LOS: C
Intersection Capacity Utilization 68.2% ICU Level of Service B

Splits and Phases: 1: 19th Street & Sycamore Street



Timings
6: Bus Entrance & Sycamore Street

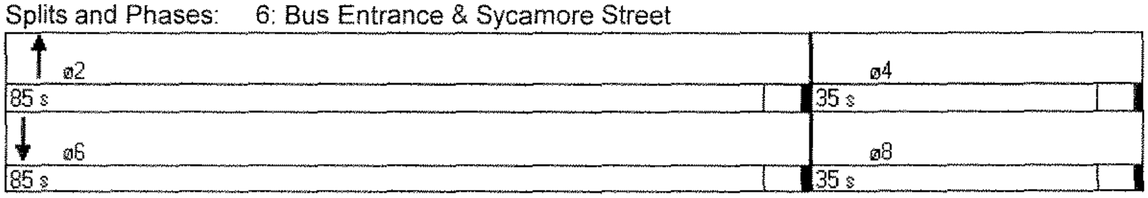
04/17/2002

Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	122	187	6	930	1449
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	35.0	35.0	35.0	35.0	85.0	85.0	85.0
Total Split (%)	29%	29%	29%	29%	71%	71%	71%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	31.0	31.0	31.0	31.0	81.0	81.0	81.0
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.68	0.68	0.68
v/c Ratio	0.03	0.02	0.15	0.48	0.06	0.42	0.67
Uniform Delay, d1	33.2	0.0	34.3	8.7	6.6	8.9	11.5
Delay	33.6	18.7	34.6	11.1	0.3	0.5	9.4
LOS	C	B	C	B	A	A	A
Approach Delay						0.5	9.4
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 7.7 Intersection LOS: A
Intersection Capacity Utilization 61.1% ICU Level of Service B

Splits and Phases: 6: Bus Entrance & Sycamore Street

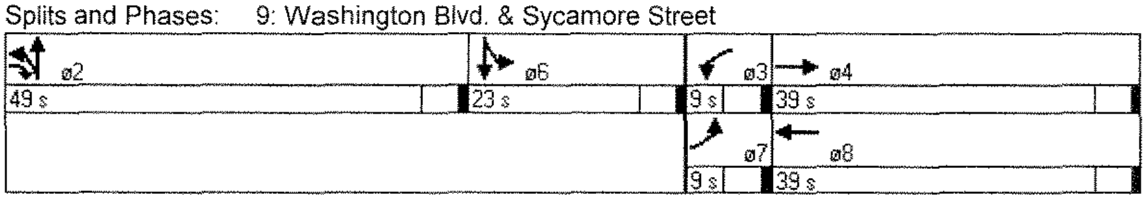


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	81	904	888	103	814	857	223	48	104	469	52
Turn Type	pm+pt		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases	7	4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	7	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	9.0	39.0	49.0	9.0	39.0	49.0	49.0	49.0	23.0	23.0	23.0
Total Split (%)	8%	33%	41%	8%	33%	41%	41%	41%	19%	19%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lead	Lag		Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	40.0	35.0	80.0	40.0	35.0	45.0	45.0	45.0	19.0	19.0	19.0
Actuated g/C Ratio	0.33	0.29	0.67	0.33	0.29	0.38	0.38	0.38	0.16	0.16	0.16
v/c Ratio	0.65	0.95	0.93	0.82	0.92	0.77	0.58	0.09	0.40	0.91	0.27
Uniform Delay, d1	25.4	41.7	15.7	26.0	40.8	33.0	29.9	9.1	45.4	49.7	9.1
Delay	31.5	52.5	17.6	53.9	47.2	19.8	16.3	4.4	46.1	61.3	17.4
LOS	C	D	B	D	D	B	B	A	D	E	B
Approach Delay		35.0			48.0		17.1			55.1	
Approach LOS		D			D		B			E	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 36.1 Intersection LOS: D
Intersection Capacity Utilization 92.0% ICU Level of Service E

Splits and Phases: 9: Washington Blvd. & Sycamore Street

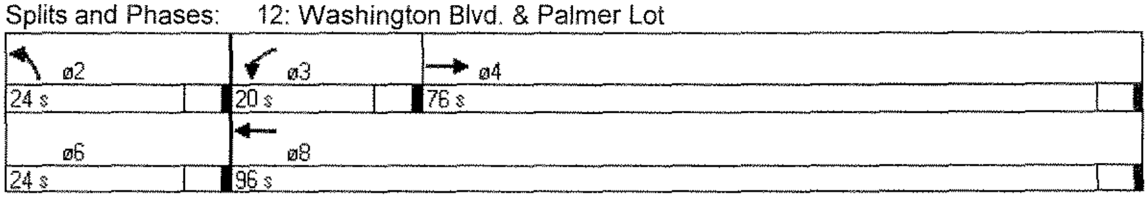


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	30	1494	177	1456	90	109	281	98	33
Turn Type	Perm		pm+pt		Perm	custom	custom	custom	custom
Protected Phases		4	3	8		2			
Permitted Phases	4		8		8	2	2	6	6
Detector Phases	4	4	3	8	8	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	76.0	76.0	20.0	96.0	96.0	24.0	24.0	24.0	24.0
Total Split (%)	63%	63%	17%	80%	80%	20%	20%	20%	20%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead						
Lead-Lag Optimize?									
Recall Mode	Coord	Coord	None	Coord	Coord	None	None	None	None
Act Effct Green (s)	79.4	79.4	97.3	97.3	97.3	14.7	14.7	14.7	14.7
Actuated g/C Ratio	0.66	0.66	0.81	0.81	0.81	0.12	0.12	0.12	0.12
v/c Ratio	0.17	0.73	0.70	0.55	0.08	0.54	0.80	0.49	0.16
Uniform Delay, d1	7.7	13.2	25.3	3.9	0.0	49.5	14.9	49.1	0.0
Delay	10.7	14.8	39.8	2.5	0.7	48.5	15.8	48.1	13.6
LOS	B	B	D	A	A	D	B	D	B
Approach Delay		14.7		6.3					
Approach LOS		B		A					

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 40 (33%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 12.8 Intersection LOS: B
Intersection Capacity Utilization 82.0% ICU Level of Service D

Splits and Phases: 12: Washington Blvd. & Palmer Lot

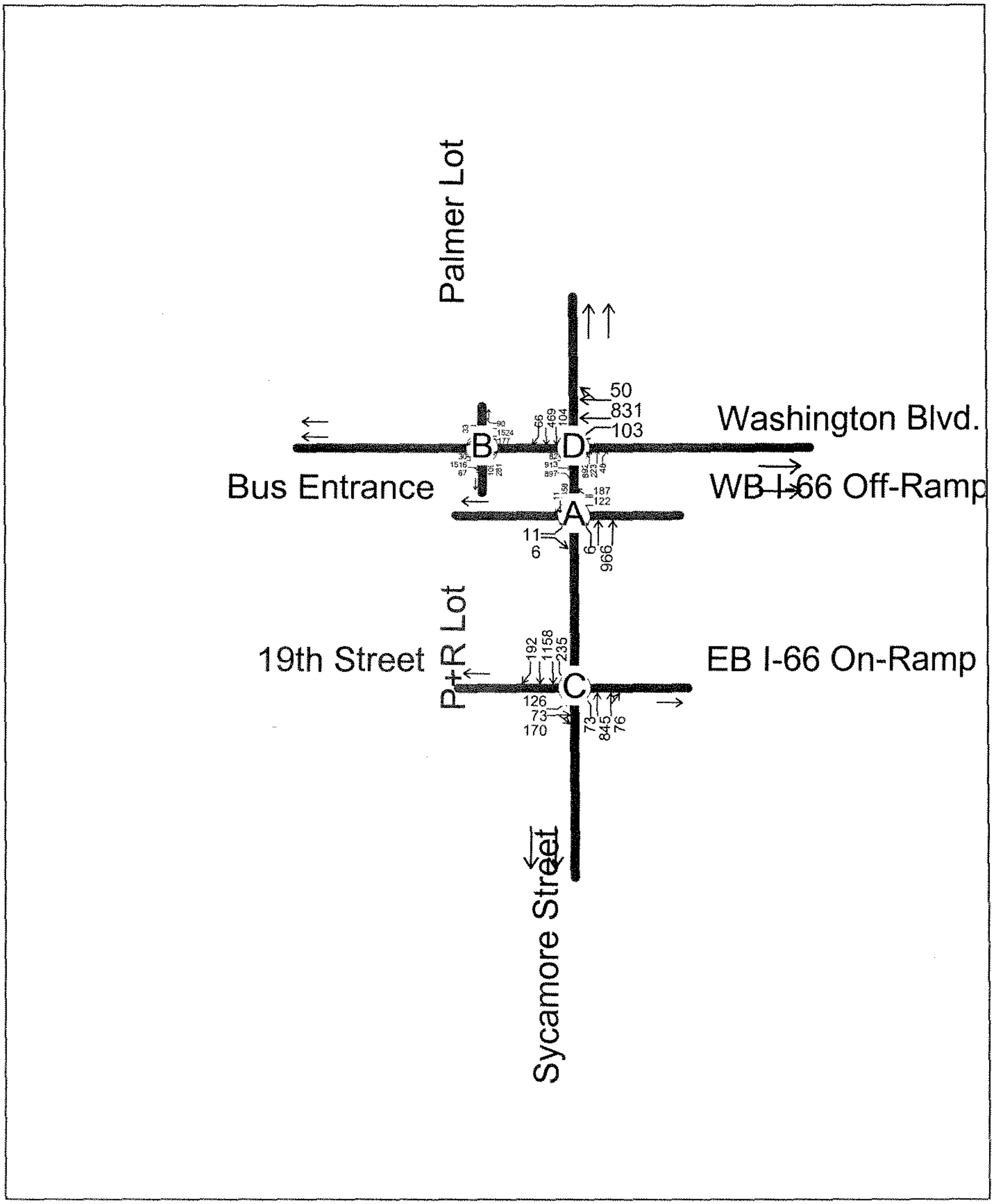


East Falls Church Station Access Study

Synchro Capacity Analysis Results

Retail (no-pass-by) Scenario Conditions: PM Peak Hour

Map - East Falls Church
Levels of Service 04/17/2002



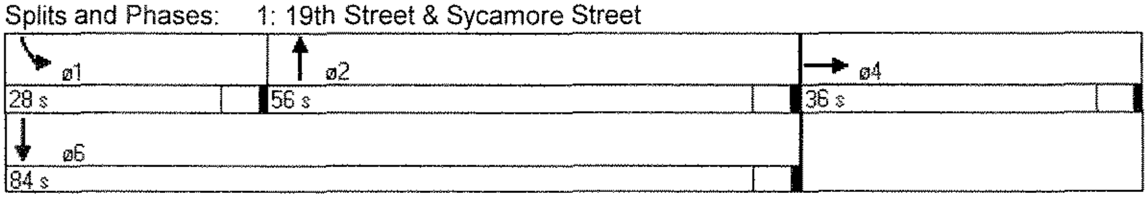
East Falls Church WMATA Station Access, PM Peak Hour I:\TC\WMATA\Station Access\East Falls Church\Capacity Analysis\422 spaces\PM\Retail-422 PM.sy6
Robert T. Kerns

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	126	73	73	845	235	1158	192
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	36.0	36.0	56.0	56.0	28.0	84.0	84.0
Total Split (%)	30%	30%	47%	47%	23%	70%	70%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	32.0	32.0	52.0	52.0	80.0	80.0	80.0
Actuated g/C Ratio	0.27	0.27	0.43	0.43	0.67	0.67	0.67
v/c Ratio	0.29	0.56	0.47	0.66	0.53	0.53	0.27
Uniform Delay, d1	35.0	28.4	24.2	26.7	7.8	10.3	0.0
Delay	35.5	29.2	26.5	27.0	18.5	14.6	3.1
LOS	D	C	C	C	B	B	A
Approach Delay		31.4		27.0		13.8	
Approach LOS		C		C		B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 58 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 20.4 Intersection LOS: C
Intersection Capacity Utilization 69.3% ICU Level of Service B

Splits and Phases: 1: 19th Street & Sycamore Street

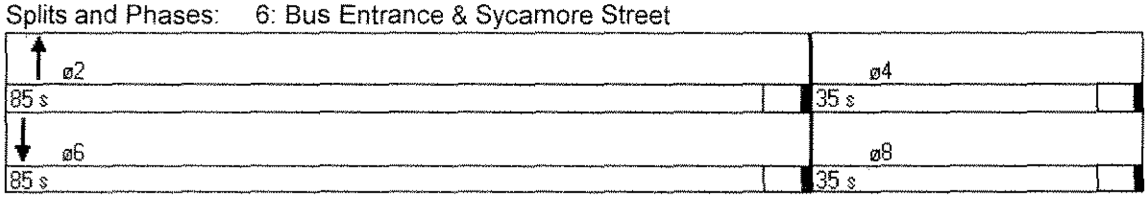


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	122	187	6	966	1458
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	35.0	35.0	35.0	35.0	85.0	85.0	85.0
Total Split (%)	29%	29%	29%	29%	71%	71%	71%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	31.0	31.0	31.0	31.0	81.0	81.0	81.0
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.68	0.68	0.68
v/c Ratio	0.03	0.02	0.15	0.49	0.06	0.44	0.67
Uniform Delay, d1	33.2	0.0	34.3	10.7	6.6	9.0	11.6
Delay	33.6	18.7	34.6	12.7	0.3	0.5	9.4
LOS	C	B	C	B	A	A	A
Approach Delay						0.5	9.4
Approach LOS						A	A

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 7.8 Intersection LOS: A
Intersection Capacity Utilization 61.4% ICU Level of Service B

Splits and Phases: 6: Bus Entrance & Sycamore Street

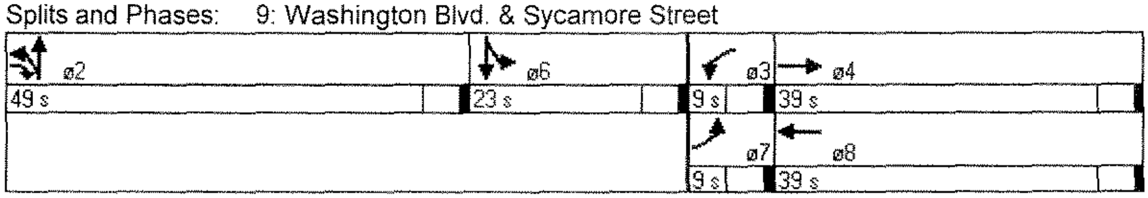


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↱	↰	↰↑	↱	↰	↑↑	↱
Volume (vph)	82	913	897	103	831	892	223	48	104	469	66
Turn Type	pm+pt		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases	7	4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	7	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	9.0	39.0	49.0	9.0	39.0	49.0	49.0	49.0	23.0	23.0	23.0
Total Split (%)	8%	33%	41%	8%	33%	41%	41%	41%	19%	19%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lead	Lag		Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	40.0	35.0	80.0	40.0	35.0	45.0	45.0	45.0	19.0	19.0	19.0
Actuated g/C Ratio	0.33	0.29	0.67	0.33	0.29	0.38	0.38	0.38	0.16	0.16	0.16
v/c Ratio	0.65	0.96	0.94	0.82	0.93	0.80	0.59	0.09	0.40	0.91	0.33
Uniform Delay, d1	25.4	41.8	16.0	26.0	41.1	33.5	30.1	9.6	45.4	49.7	9.0
Delay	31.8	54.3	18.8	53.9	49.6	21.3	16.1	4.4	46.1	61.3	16.1
LOS	C	D	B	D	D	C	B	A	D	E	B
Approach Delay		36.5			50.1		17.6			54.1	
Approach LOS		D			D		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 37.1 Intersection LOS: D
Intersection Capacity Utilization 92.6% ICU Level of Service E

Splits and Phases: 9: Washington Blvd. & Sycamore Street

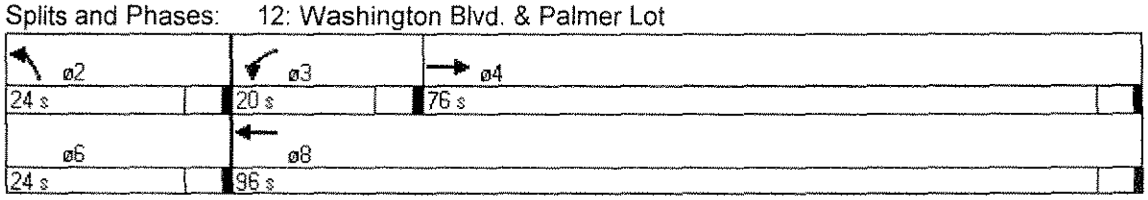


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	30	1516	177	1524	90	109	281	98	33
Turn Type	Perm		pm+pt		Perm	custom	custom	custom	custom
Protected Phases		4	3	8		2			
Permitted Phases	4		8		8	2	2	6	6
Detector Phases	4	4	3	8	8	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	76.0	76.0	20.0	96.0	96.0	24.0	24.0	24.0	24.0
Total Split (%)	63%	63%	17%	80%	80%	20%	20%	20%	20%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead						
Lead-Lag Optimize?									
Recall Mode	Coord	Coord	None	Coord	Coord	None	None	None	None
Act Effct Green (s)	79.3	79.3	97.2	97.2	97.2	14.8	14.8	14.8	14.8
Actuated g/C Ratio	0.66	0.66	0.81	0.81	0.81	0.12	0.12	0.12	0.12
v/c Ratio	0.19	0.74	0.70	0.58	0.08	0.54	0.80	0.49	0.16
Uniform Delay, d1	7.9	13.5	25.8	4.1	0.0	49.4	15.1	49.0	0.0
Delay	11.0	15.1	39.5	2.8	0.7	48.5	16.0	48.1	13.6
LOS	B	B	D	A	A	D	B	D	B
Approach Delay		15.0		6.3					
Approach LOS		B		A					

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 40 (33%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 12.8 Intersection LOS: B
Intersection Capacity Utilization 82.7% ICU Level of Service D

Splits and Phases: 12: Washington Blvd. & Palmer Lot

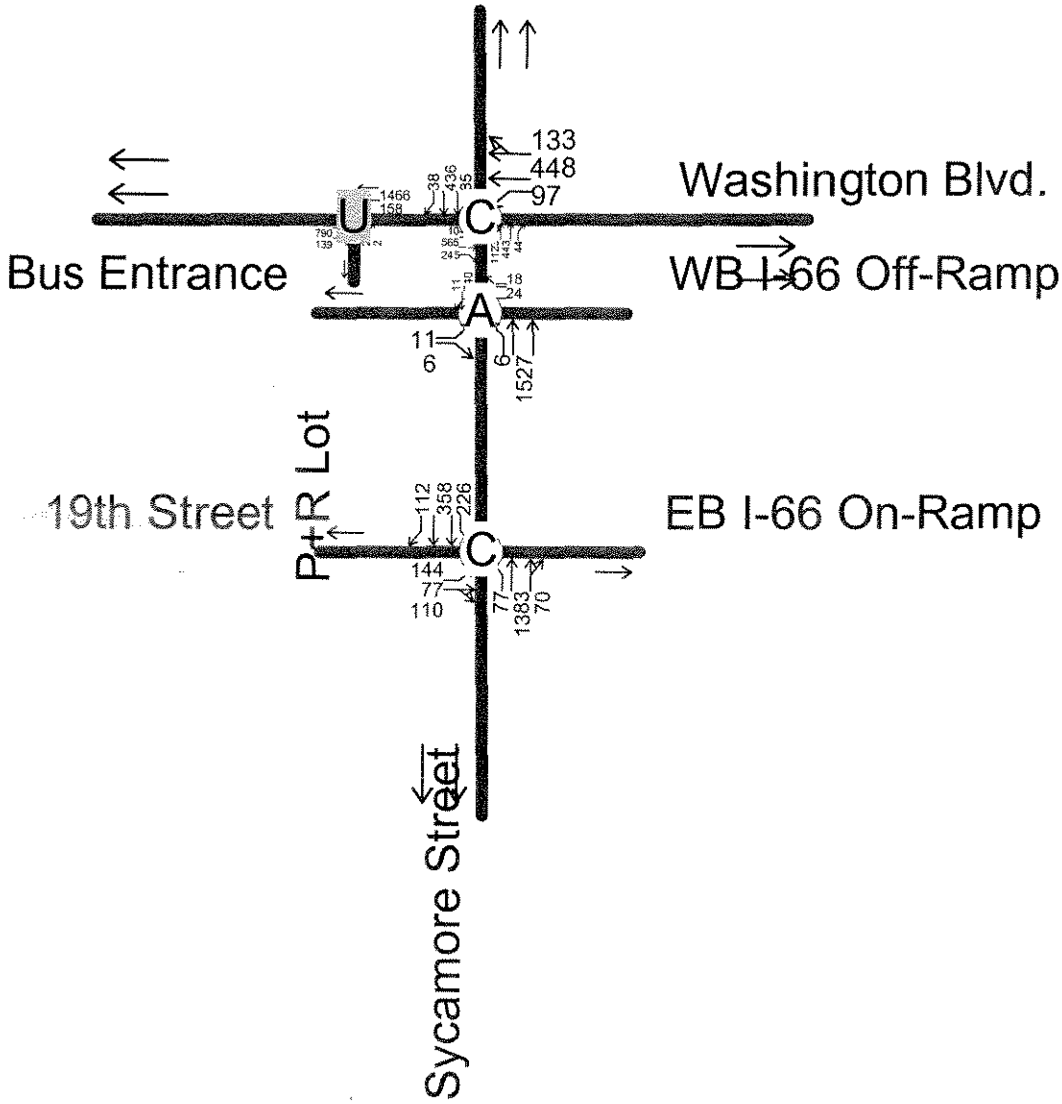


East Falls Church Station Access Study

Synchro Capacity Analysis Results

2001 Traffic Conditions with 1,000 Spaces: AM Peak Hour

Map - East Falls Church
Levels of Service 04/17/2002



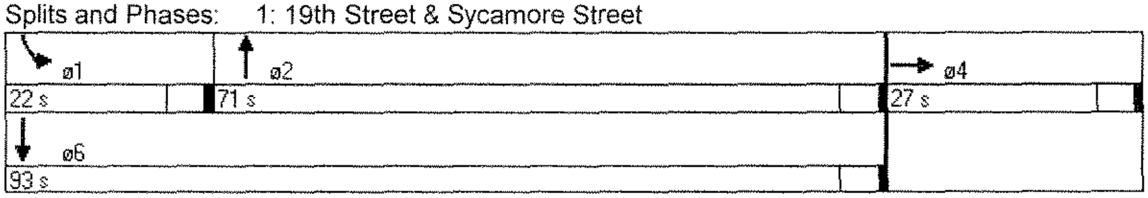
East Falls Church I:\CTC-WMATA\Existing Conditions\East Falls Church\Capacity Analysis\1000 spaces\AM\Base-1000 AM.sy6
Robert T. Kerns

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	144	77	77	1383	226	358	112
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	27.0	27.0	71.0	71.0	22.0	93.0	93.0
Total Split (%)	23%	23%	59%	59%	18%	78%	78%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	23.0	23.0	67.0	67.0	89.0	89.0	89.0
Actuated g/C Ratio	0.19	0.19	0.56	0.56	0.74	0.74	0.74
v/c Ratio	0.49	0.57	0.22	0.81	0.75	0.15	0.20
Uniform Delay, d1	43.3	32.0	13.3	21.2	29.4	4.5	0.0
Delay	44.0	32.8	13.9	21.7	34.4	1.3	0.0
LOS	D	C	B	C	C	A	A
Approach Delay		37.7		21.3		11.9	
Approach LOS		D		C		B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 33 (28%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Pretimed
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 20.9 Intersection LOS: C
Intersection Capacity Utilization 81.1% ICU Level of Service D

Splits and Phases: 1: 19th Street & Sycamore Street

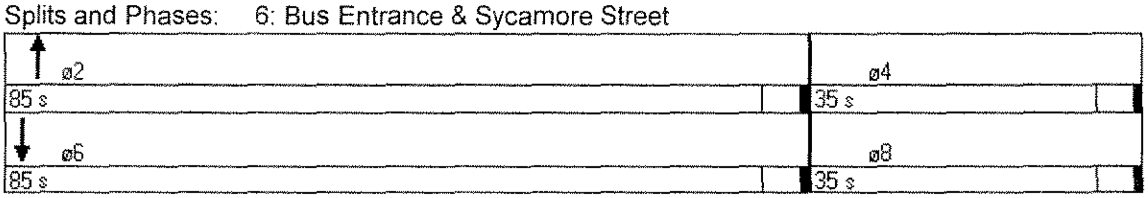


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	24	18	6	1527	740
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	35.0	35.0	35.0	35.0	85.0	85.0	85.0
Total Split (%)	29%	29%	29%	29%	71%	71%	71%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	31.0	31.0	31.0	31.0	81.0	81.0	81.0
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.68	0.68	0.68
v/c Ratio	0.03	0.02	0.03	0.05	0.02	0.69	0.34
Uniform Delay, d1	33.2	0.0	33.2	0.0	6.4	11.9	8.2
Delay	33.5	18.7	33.4	13.3	0.7	2.3	17.3
LOS	C	B	C	B	A	A	B
Approach Delay						2.3	17.3
Approach LOS						A	B

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 53 (44%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 7.7 Intersection LOS: A
Intersection Capacity Utilization 72.5% ICU Level of Service C

Splits and Phases: 6: Bus Entrance & Sycamore Street

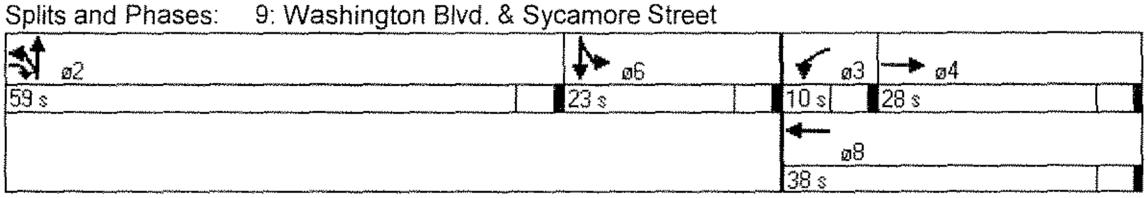


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	10	565	245	97	448	1123	443	44	85	436	38
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	28.0	28.0	59.0	10.0	38.0	59.0	59.0	59.0	23.0	23.0	23.0
Total Split (%)	23%	23%	49%	8%	32%	49%	49%	49%	19%	19%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	24.0	24.0	79.0	34.0	34.0	55.0	55.0	55.0	19.0	19.0	19.0
Actuated g/C Ratio	0.20	0.20	0.66	0.28	0.28	0.46	0.46	0.46	0.16	0.16	0.16
v/c Ratio	0.09	0.87	0.26	0.70	0.64	0.83	0.72	0.07	0.33	0.85	0.21
Uniform Delay, d1	39.1	46.4	5.6	32.8	35.6	28.4	26.3	9.7	44.8	49.1	6.2
Delay	40.1	51.5	5.8	43.3	36.0	15.7	11.1	3.3	45.5	54.4	17.1
LOS	D	D	A	D	D	B	B	A	D	D	B
Approach Delay		37.7			37.0		12.5			50.6	
Approach LOS		D			D		B			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 60 (50%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 28.5 Intersection LOS: C
Intersection Capacity Utilization 83.3% ICU Level of Service D

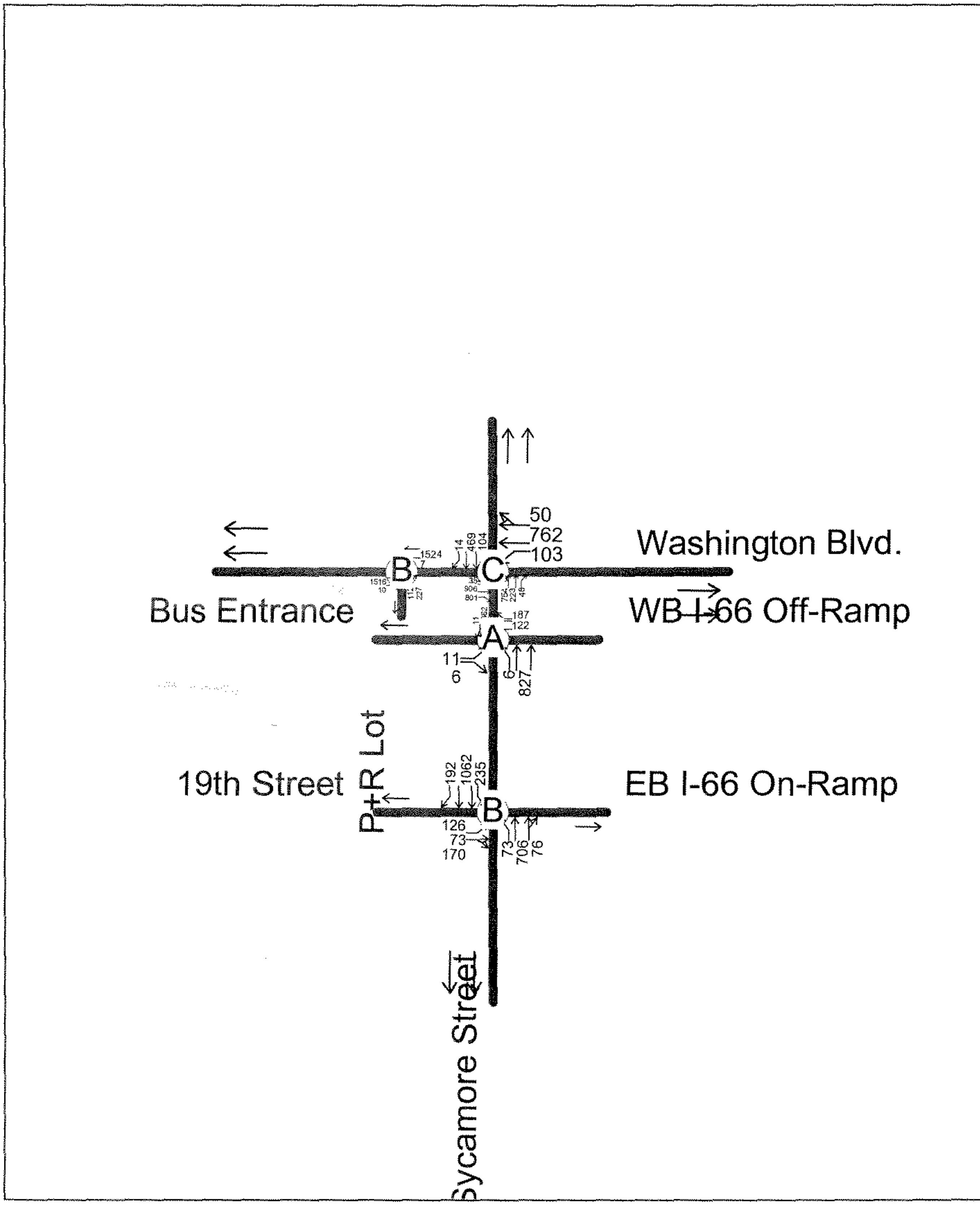
Splits and Phases: 9: Washington Blvd. & Sycamore Street



East Falls Church Station Access Study

Synchro Capacity Analysis Results

2001 Traffic Conditions with 1,000 Spaces: PM Peak Hour

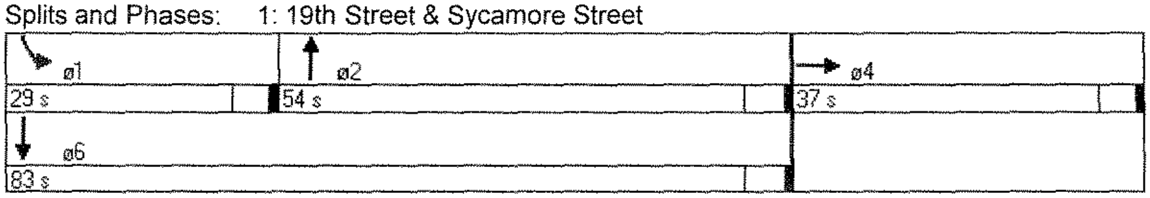

Washington Blvd.
Bus Entrance
WB I-66 Off-Ramp
19th Street
P+R Lot
EB I-66 On-Ramp
Sycamore Street
B
C
A
B
50
762
103
104
469
14
1524
187
122
11
6
6
827
192
1062
235
126
73
170
73
706
76

Lane Group	EBL	EBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations							
Volume (vph)	126	73	73	706	235	1062	192
Turn Type	Perm		Perm		pm+pt		Perm
Protected Phases		4		2	1	6	
Permitted Phases	4		2		6		6
Detector Phases	4	4	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	9.0	21.0	21.0
Total Split (s)	37.0	37.0	54.0	54.0	29.0	83.0	83.0
Total Split (%)	31%	31%	45%	45%	24%	69%	69%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	33.0	33.0	50.0	50.0	79.0	79.0	79.0
Actuated g/C Ratio	0.28	0.28	0.42	0.42	0.66	0.66	0.66
v/c Ratio	0.29	0.54	0.44	0.58	0.48	0.50	0.27
Uniform Delay, d1	34.2	25.9	25.0	26.5	8.2	10.4	0.0
Delay	34.7	26.6	27.1	26.9	18.2	11.6	2.5
LOS	C	C	C	C	B	B	A
Approach Delay		29.4		26.9		11.5	
Approach LOS		C		C		B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.58
Intersection Signal Delay: 18.8 Intersection LOS: B
Intersection Capacity Utilization 65.1% ICU Level of Service B

Splits and Phases: 1: 19th Street & Sycamore Street

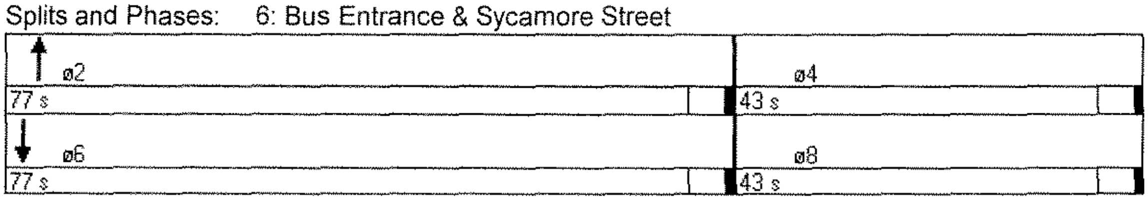


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	11	6	122	187	6	827	1362
Turn Type	custom	custom	custom	custom	Perm		
Protected Phases						2	6
Permitted Phases	4	4	8	8	2		
Detector Phases	4	4	8	8	2	2	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	43.0	43.0	43.0	43.0	77.0	77.0	77.0
Total Split (%)	36%	36%	36%	36%	64%	64%	64%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	39.0	39.0	39.0	39.0	73.0	73.0	73.0
Actuated g/C Ratio	0.33	0.33	0.33	0.33	0.61	0.61	0.61
v/c Ratio	0.03	0.01	0.12	0.41	0.06	0.42	0.70
Uniform Delay, d1	27.6	0.0	28.4	6.6	9.6	12.3	15.9
Delay	27.9	15.5	28.6	8.7	1.3	1.3	12.6
LOS	C	B	C	A	A	A	B
Approach Delay						1.3	12.6
Approach LOS						A	B

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 74 (62%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 9.5 Intersection LOS: A
Intersection Capacity Utilization 58.5% ICU Level of Service A

Splits and Phases: 6: Bus Entrance & Sycamore Street

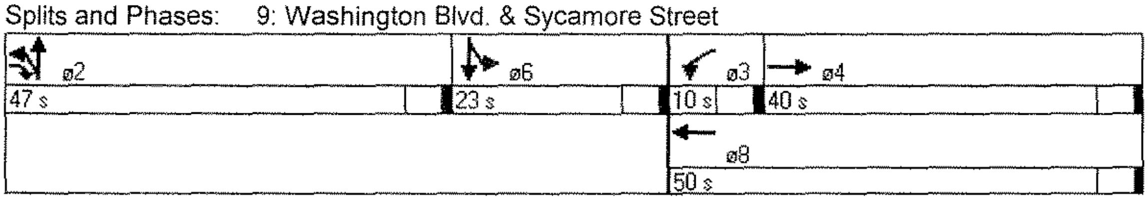


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	906	801	103	762	754	223	48	104	469	14
Turn Type	Perm		pm+ov	pm+pt		Split		Perm	Split		Perm
Protected Phases		4	2	3	8	2	2		6	6	
Permitted Phases	4		4	8				2			6
Detector Phases	4	4	2	3	8	2	2	2	6	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	9.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	40.0	40.0	47.0	10.0	50.0	47.0	47.0	47.0	23.0	23.0	23.0
Total Split (%)	33%	33%	39%	8%	42%	39%	39%	39%	19%	19%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag		Lead							
Lead-Lag Optimize?											
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	36.0	36.0	79.0	46.0	46.0	43.0	43.0	43.0	19.0	19.0	19.0
Actuated g/C Ratio	0.30	0.30	0.66	0.38	0.38	0.36	0.36	0.36	0.16	0.16	0.16
v/c Ratio	0.31	0.93	0.85	0.74	0.66	0.71	0.55	0.09	0.40	0.91	0.08
Uniform Delay, d1	32.4	40.7	13.4	24.3	30.2	33.1	30.8	8.7	45.4	49.7	8.5
Delay	36.4	46.2	9.0	38.7	30.6	20.0	19.2	5.8	46.1	61.3	23.4
LOS	D	D	A	D	C	C	B	A	D	E	C
Approach Delay		28.9			31.5		18.9			57.7	
Approach LOS		C			C		B			E	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 31.0 Intersection LOS: C
Intersection Capacity Utilization 86.1% ICU Level of Service D

Splits and Phases: 9: Washington Blvd. & Sycamore Street

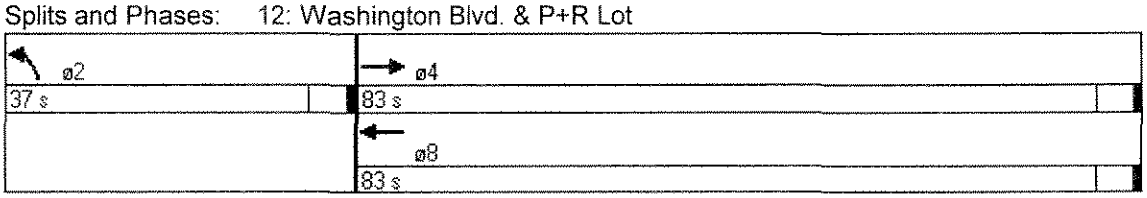


Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Volume (vph)	1516	7	1524	112	227
Turn Type		Perm			Perm
Protected Phases	4		8	2	
Permitted Phases		8			2
Detector Phases	4	8	8	2	2
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0
Total Split (s)	83.0	83.0	83.0	37.0	37.0
Total Split (%)	69%	69%	69%	31%	31%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Max	Max	Max	Max	Max
Act Effct Green (s)	79.0		79.0	33.0	33.0
Actuated g/C Ratio	0.66		0.66	0.28	0.28
v/c Ratio	0.71		0.76	0.25	0.53
Uniform Delay, d1	13.2		14.0	33.9	31.0
Delay	13.5		6.6	34.4	31.7
LOS	B		A	C	C
Approach Delay	13.5		6.6	32.6	
Approach LOS	B		A	C	

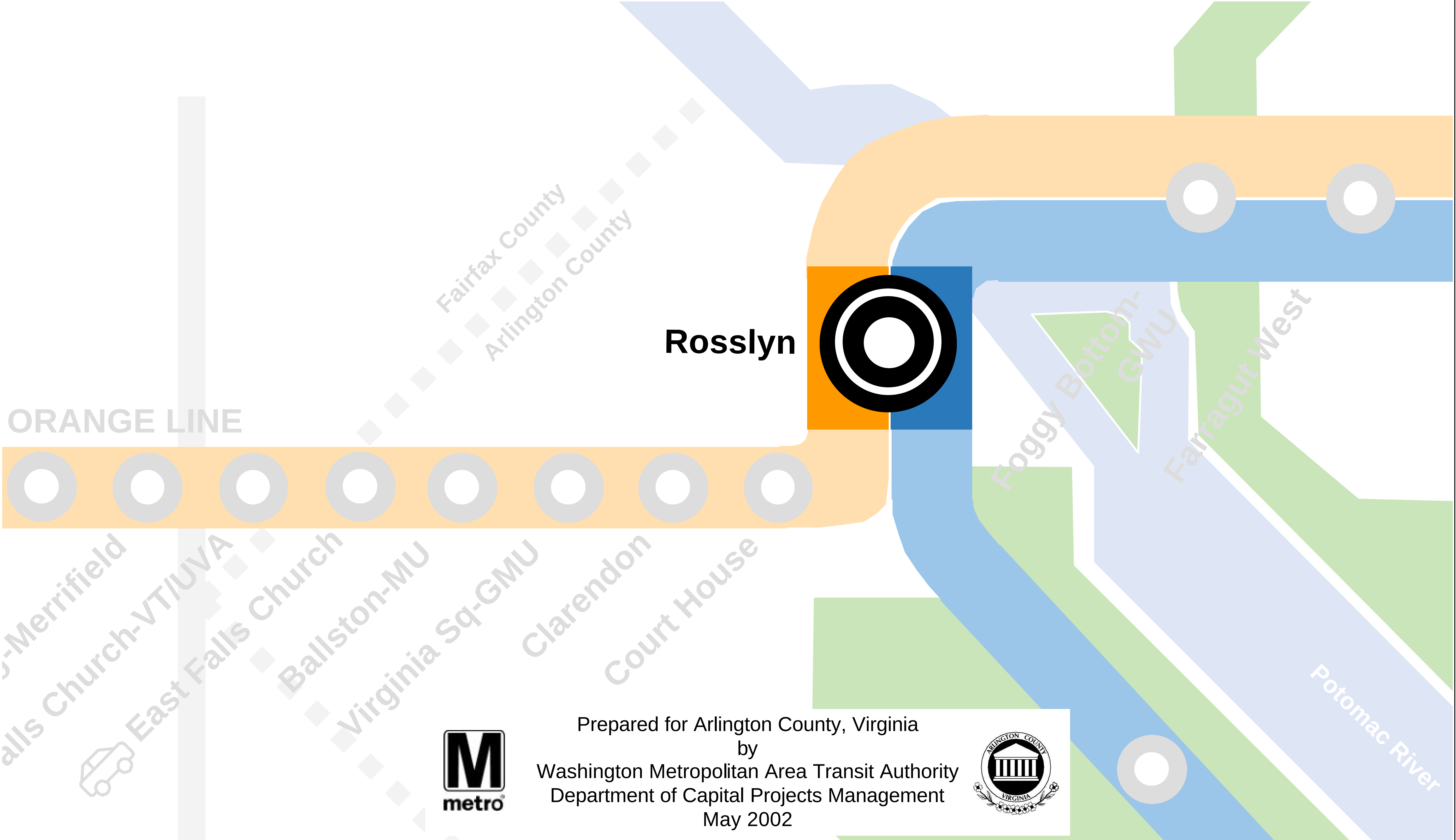
Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 37 (31%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 12.3 Intersection LOS: B
Intersection Capacity Utilization 67.8% ICU Level of Service B

Splits and Phases: 12: Washington Blvd. & P+R Lot



ROSSLYN METRORAIL STATION ACCESS STUDY



metro

Prepared for Arlington County, Virginia
by
Washington Metropolitan Area Transit Authority
Department of Capital Projects Management
May 2002

ROSSLYN METRORAIL STATION ACCESS STUDY

Contents

Note: The report has been prepared to demonstrate the feasibility of the concept presented. The concept is subject to further refinement and may be revised during future planning and/or engineering design phases of the project. The environmental planning process may include one or more of these alternatives along with others prior to any decision regarding implementation of a specific plan, which will be subject to professional engineering design principles.

Figures

Tables

ROSSLYN METRORAIL STATION ACCESS STUDY

Introduction

The Rosslyn Metrorail station is located in northeastern Arlington County, Virginia and serves the surrounding neighborhoods of mostly high-density, mixed commercial and residential land use. Rosslyn is home to about 11,000 residents and over 33,000 employees on weekdays.

The Metrorail station serves both Orange and Blue Line trains and is the westernmost transfer point between the two lines on the Metrorail system operated by the Washington Metropolitan Area Transit Authority (WMATA). Figure 1 depicts an aerial photograph of the station vicinity.

The study was conducted for WMATA and Arlington County to identify and evaluate potential access improvements to the Rosslyn station and generally maximize the attractiveness of Metrorail as a service to the northeastern portion of Arlington County. The study objective was to identify specific station and site improvements for pedestrian convenience and safety in accessing the station. The access improvements proposed in the study include additional station entrances and mezzanines, improved intermodal traffic conditions in the area surrounding the station, improved traffic operations on adjacent streets, and improved connections between Metrobus and Metrorail.

Existing Conditions

Transportation Facilities

The Rosslyn station is conveniently located near several major regional transportation corridors including Interstate 66, U.S. Route 50 (Arlington Boulevard), U.S. Route 29 (Lee Highway), and the George Washington Parkway.

Wilson Boulevard is a two-way, east-west arterial street near the Rosslyn station. Wilson Boulevard has two lanes in each direction and runs from near the Potomac River to the Fairfax County line. North Lynn Street and North Fort Myer Drive form a one-way, north-south arterial street pair connecting Rosslyn with Key Bridge and the District of Columbia. North Moore Street is a local two-way, north-south street connecting Wilson Boulevard and Lee Highway. Nash Street, 19th Street, Key Boulevard and Oak Street are other minor streets surrounding the station that provide local access.

Figure 1: Aerial photograph of Rosslyn Metrorail station and vicinity

The Rosslyn station has a single entrance, located within the Rosslyn Metro Center Building north of Wilson Boulevard between Fort Myer Drive and Moore Street. The station platform is under Lynn Street, but because the Metrorail line is in a deep tunnel through Rosslyn, the slope of the escalators between the platform level and the surface required the entrance to be west of the platform location. Metrorail customers can reach this entrance from Moore Street, by a narrow stair from Fort Myer Drive, by a set of escalators from the skywalk system, and from the retail area within Rosslyn Metro Center. The entrance has four escalators between the surface and platform level and an elevator that reaches the surface on the east side of Moore Street. A diagram of the station area is shown in Figure 2.

Figure 2: Schematic diagram of Rosslyn Metrorail station and vicinity

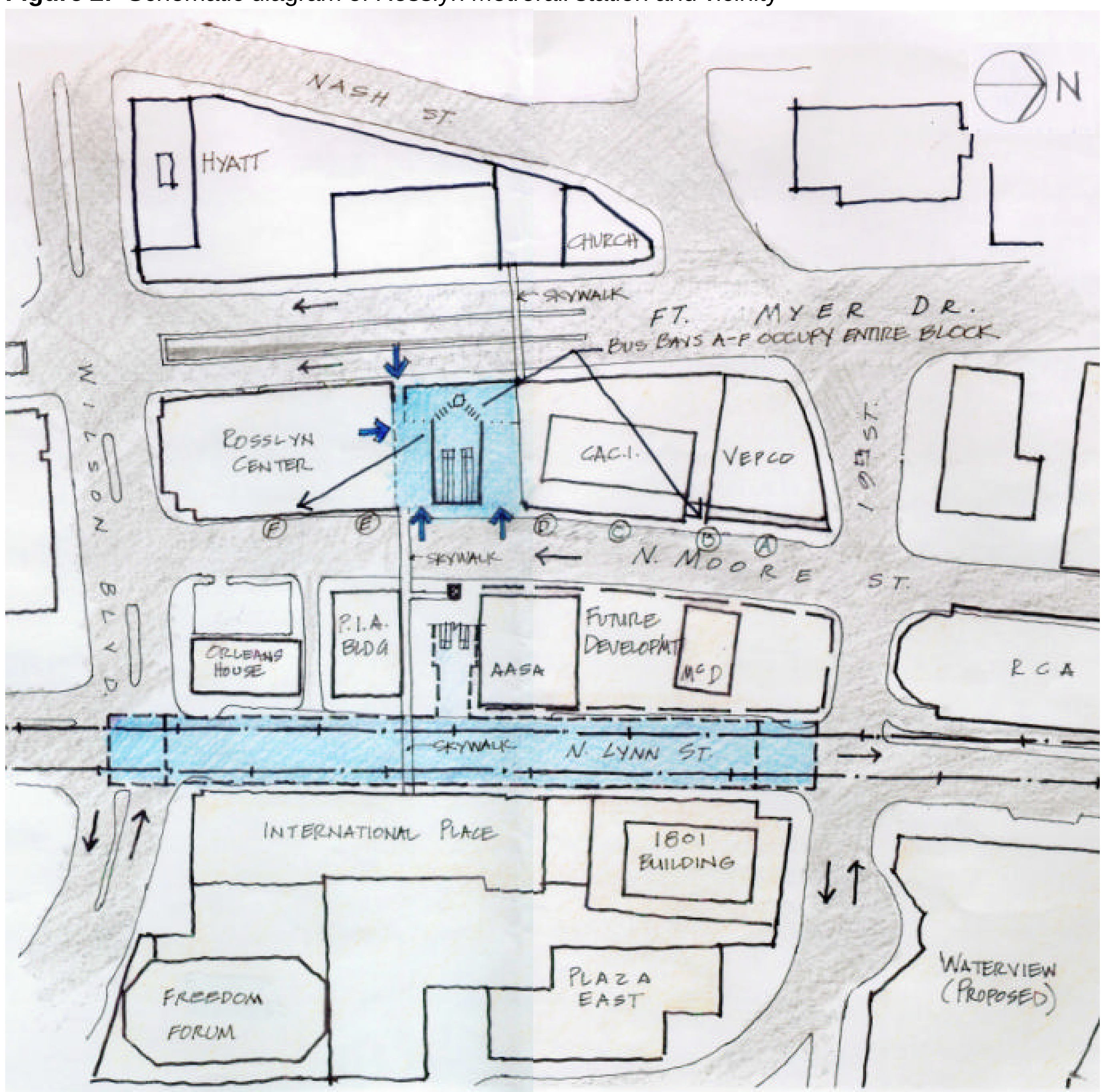
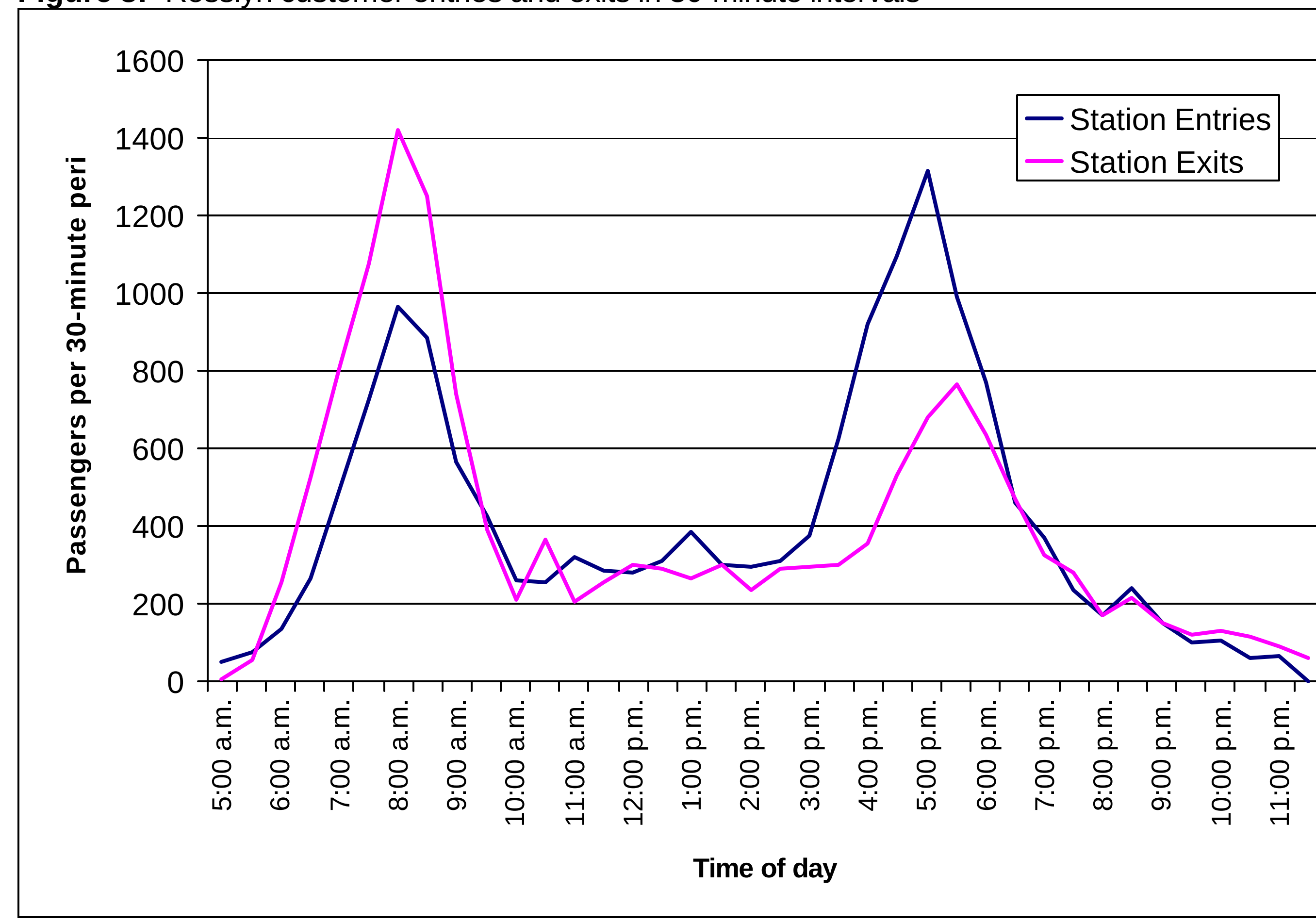


Figure 3: Rosslyn customer entries and exits in 30-minute intervals



Source: WMATA, Faregate data, May 9, 2001

The Rosslyn Metrorail station currently averages about 15,300 customers per day, which means that about 15,300 customers enter the system at the station and about the same number exit the system at the station. In addition, about 8,100 customers per day transfer between the Orange and Blue lines at the station. During the morning peak period, 5:30 to 9:30 a.m., about 38,900 customers pass through the station on either the Orange or Blue lines in the peak, inbound, direction. Of the 83 stations in the Metrorail system, Rosslyn ranks 11th by daily customer entries and exits.

Customer traffic is highly directional at the Rosslyn station, with about twice as many customers entering the station in the evening peak as in the morning peak. Figure 3 shows customer entries and exits in half-hour intervals.

The Rosslyn Kiss & Ride area is limited to a relatively small curbside length at the secondary entrance to the station on Fort Myer Drive. Like most urban stations, Rosslyn has no Kiss & Ride parking spaces.

Bus Facilities

Buses serve the Rosslyn station from the west curbside of Moore Street along the station entrance frontage. The station is a stop for seven Metrobus lines, one Fairfax Connector line, and various shuttle buses, including the Georgetown Metro Connection, Georgetown University Shuttle (GUTS), and State Department shuttles. About 25 shuttles per hour access the Rosslyn station during morning and evening peak hours.

Six bus bays along the west side of Moore Street serve all the Metrobus routes and most of the shuttle routes. The Metrobus bays were recently equipped with real-time customer information displays, providing customers with information about expected wait times.

Figure 4: Bus alley between Moore and Lynn Streets

Figure 5: Congestion on Moore Street

Table 1: Results of 24-hour directional traffic volume counts

Study location	*Number of vehicles during peak hour*						*Number of vehicles per day*		
	8:00 – 9:00 a.m.			*5:00 – 6:00 p.m.*					
	EB	***WB***	***Total***	***EB***	***WB***	***Total***	***EB***	***WB***	***Total***
Wilson Blvd. west of Lynn St.	1,254	833	2,087	1,200	768	1,968	14,450	10,171	24,621
	NB	***SB***	***Total***	***NB***	***SB***	***Total***	***NB***	***SB***	***Total***
Lynn Street north of Wilson Blvd.	2,192	NA	2,192	1,735	NA	1,735	24,830	NA	24,830
Fort Myer Dr. south of 19th St.	NA	1,141	1,141	NA	1,464	1,464	NA	16,500	16,500

Bus circulation is aided by a bus alley connecting Moore and Lynn Streets north of Wilson Boulevard (Figure 4). Use of the alley is prohibited by all vehicles except eastbound buses, which use the route to avoid left turns and congestion on Wilson Boulevard.

There is considerable congestion on Moore Street during peak periods (Figure 5), especially during the evening peak period. The combined activities of buses, pedestrians, taxis, slugs[*] and customer drop-off and pick-up exchanges contribute to the constrained operating conditions throughout the length of Moore Street between Wilson Boulevard and 19th Street.

Traffic and Pedestrian Studies

As part of the study, vehicle and pedestrian travel patterns were documented through several different types of studies. Table 1 summarizes results of 24-hour directional volume counts conducted in the vicinity of the Rosslyn station.

[*] "Slugs" are people who form impromptu carpools with motorists bound for similar destinations. Slugs form lines in designated locations throughout the metropolitan area and wait for motorists to pick them up. Slugs get a free ride to their destination, and motorists get the benefit of a faster trip on a high-occupancy vehicle (HOV) facility. In Rosslyn, slugs may or may not be Metrorail customers. Some slugs ride Metrorail to the Rosslyn station, exit there, and wait for a ride to their final destination. Other slugs are Rosslyn-area employees who may use Metrorail only when unable to catch a ride as a slug. About 75 slugs enter vehicles during the evening peak hour, with the slug queue reaching a peak of about 20. The designated slug line in Rosslyn was moved in March 2002 from Moore Street to Lee Highway, helping to reduce demands for vehicles on Moore Street.

Table 2: Number of peak-hour vehicles making each traffic movement at three station-area intersections; levels of service

Intersection	Morning peak hour												Evening peak hour												Level of service	
	Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound				
	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	AM	PM
Wilson Blvd. and Nash St.	7	31	25	81	55	176	103	1,018	3	54	783	88	11	24	50	104	15	329	66	916	2	18	618	156	A	A
Wilson Blvd. and Fort Myer Dr.	NA	NA	NA	151	126	28	NA	970	172	128	931	NA	NA	NA	NA	102	123	86	NA	906	179	179	730	NA	B	B
Wilson Blvd. and Moore St.	NA	NA	NA	53	NA	110	115	1,004	NA	NA	950	162	NA	NA	NA	174	NA	178	98	886	NA	NA	724	88	Unsignalized	
Wilson Blvd. and Lynn St.	216	1,738	140	NA	NA	NA	379	812	NA	NA	659	151	396	1,180	165	NA	NA	NA	318	872	NA	NA	543	172	D	C
Key Blvd. and Nash St.	41	153	NA	NA	196	244	326	NA	131	NA	NA	NA	129	166	NA	NA	280	284	92	NA	69	NA	NA	NA	Unsignalized	
19th St. and Fort Myer Dr.	NA	NA	NA	154	710	232	NA	400	148	120	204	44	NA	NA	NA	53	1,038	252	NA	205	100	219	216	2	B	B
19th St. and Moore St.	66	48	60	7	13	6	60	342	52	36	225	55	91	70	77	6	39	53	32	175	86	93	326	38	A	B
19th St. and Lynn St.	151	1,801	31	NA	NA	NA	242	186	NA	NA	272	216	157	1,749	24	NA	NA	NA	279	51	NA	NA	239	484	C	B

Table 2 summarizes results of manual turning movement counts conducted at eight nearby intersections. Detailed capacity analysis was conducted at these intersections following procedures outlined in the *Highway Capacity Manual*. The analysis showed that overall traffic conditions are fair at these intersections during the morning peak period, with severe capacity limitations at the intersection of Wilson Boulevard and Lynn Street, primarily the eastbound left-turn movement. The analysis also shows that afternoon peak-period traffic conditions are also fair, with the same constraint for the eastbound Wilson Boulevard to Lynn Street left turn.

Table 3 summarizes the results of supplementary counts of customers accessing the station.

Table 3: Supplementary customer counts near the Rosslyn station

Pattern	Proceeding toward station entrance		Proceeding away from station entrance	
	Morning peak hour	Evening peak hour	Morning peak hour	Evening peak hour
Customers transferring between Metrorail and Metrobus	125	29	74	104
Customers transferring between Metrorail and taxis (at cab stand)	2	0	9	19
Customers transferring between Metrorail and shuttle buses	51	116	163	50
Customers using the skywalk east of the station entrance	24	102	168	9
Customers using the skywalk west of the station entrance	131	89	82	67
Customers using the street-to-platform Metrorail elevator	27	83	80	78

Customer Survey

In an effort to learn about customers' travel patterns, a customer survey was conducted at the Rosslyn station on September 20, 2001. All customers entering the station that day from 6:30 to 8:30 a.m. and 4:00 to 6:00 p.m. were offered a survey card, which asked several questions about customers' trips to the station. The survey card is shown in Figure 6. The survey posed questions about mode of travel to the station, trip purpose, and origin of the trip to the station.

Customers exiting the station were not surveyed; it was assumed that customers entering the station during the morning peak would likely exit the station during the evening peak, and vice-versa.

Of those customers who received survey cards in the morning, 385 filled out and returned the cards. The response represents a 10.1 percent sample of the total morning peak station volume of 3,820 customers. The response rate results in a confidence interval of 5 percentage points at the 95 percent confidence level. Based on the results of the survey, one can be 95 percent confident that the percentages from the morning survey are within 5 percentage points of their true values. The level of uncertainty generated by the morning-peak survey is sufficiently low for analysis.

Of customers who received survey cards in the evening, 319 filled out and returned the cards. Nearly 7,400 customers enter the station during the evening peak period, about twice as many as in the morning peak. As such, the response rate in the evening peak was only 4.3 percent. The evening peak survey's confidence interval is 6 percentage points at the 95 percent confidence level. Although a confidence interval of 5 percentage points or less would have been ideal, a 6-point interval is sufficient for analysis.

Figure 6: Survey card distributed to customers entering the station

ARLINGTON METRO STATION SURVEY

Please take a few moments to help plan for your transit needs by completing this survey and dropping it in any mailbox. No postage is required. Thank you.

A. How did you get to the Metrorail station where you received this card?

1 ☐ VRE
2 ☐ Walk
3 ☐ Shuttle bus
4 ☐ Bicycle
5 ☐ Tour bus
6 ☐ Taxi
7 ☐ ART bus
8 ☐ Metrobus (Route: _____)
9 ☐ Fairfax Connector (Route: ____)
10 ☐ Dropped off by someone
11 ☐ Drove a car and parked
12 ☐ Rode with someone who parked

B. What is the purpose of your Metrorail trip today?

metro

1 ☐ Traveling to work
2 ☐ Traveling home from work
3 ☐ Job-related business
4 ☐ Shopping or meal
5 ☐ School
6 ☐ Personal trip
7 ☐ Sightseeing or recreation

C. Where did you start your trip to the Metrorail station today?

Address ____________________

OR Street & block no. ____________________

OR Nearest intersection ____________________

OR Building name ____________________

Table 4: Respondents' transportation modes. (Rounding may affect sums.)

Transportation Mode	***Morning Peak*** Percent of respondents	***Morning Peak*** Number of customers*	***Evening Peak*** Percent of respondents	***Evening Peak*** Number of customers*
Walk	45%	1,716	68%	5,052
Shuttle Bus	3%	129	8%	626
Tour Bus	0%	10	0%	0
Metrobus	16%	615	11%	834
Dropped off by someone	19%	744	4%	324
Drove and parked	8%	298	5%	348
Rode with someone who parked	1%	40	0%	23
No response	7%	268	3%	185
Total	**100%**	**3,819**	**100%**	**7,392**

* Calculated by applying the survey results to the total number of customers entering the station during morning (5:30 to 9:30 a.m.) and evening (3:00 to 7:00 p.m.) peak periods.

Table 5: Respondents' trip purposes. (Rounding may affect sums.)

Trip Purpose	***Morning Peak*** Percent of respondents	***Morning Peak*** Number of customers*	***Evening Peak*** Percent of respondents	***Evening Peak*** Number of customers*
Traveling to work	94%	3,581	30%	2,225
Traveling home from work	2%	79	61%	4,495
Job-related business	1%	50	3%	232
Shopping or meal	0%	0	2%	116
School	0%	10	1%	93
Personal trip	1%	20	3%	209
Sightseeing or recreation	0%	10	0%	23
No response	2%	69	0%	0
Total	**100%**	**3,819**	**100%**	**7,392**

* Calculated by applying the survey results to the total number of customers entering the station during morning (5:30 to 9:30 a.m.) and evening (3:00 to 7:00 p.m.) peak periods.

Customer Patterns

The data collection efforts revealed numerous patterns about customers' trips to and from the station.

The first question on the survey asked customers about the mode of transportation they used to arrive at the station. In both the morning and evening periods, survey results indicated that walking is the mode of choice. More customers walk to and from the station than use any other single mode. Metrobuses carry 16 percent of rail customers in the morning and 11 percent in the evening. The only other mode with more than ten percent share was the drop-off mode, accounting for nearly one-fifth of customers in the morning peak but few customers in the evening. Very few respondents, less than one percent in both time periods, indicated that they traveled to the station by bicycle. Detailed results of this question are shown in Table 4.

The second survey question asked about customers' trip purposes. Here, a clear differentiation exists between morning and evening periods. In the morning period, 94 percent of respondents were traveling to work, with other trip purposes garnering negligible responses. In the evening, 60 percent of respondents were traveling home from work, and another 30 percent indicated that they were traveling to work. Few respondents identified other trip purposes. Table 5 shows detailed results of this question.

Finally, the third question on the survey asked customers where they began their trips to the Metrorail station. Customers were given the option to respond with a specific street address, a street and block number, the nearest intersection, or a building name. Although results are available to this question from all respondents, respondents who walk to the station are particularly important for planning pedestrian improvements.

In the morning peak period, when most customers entering the station are area residents enroute to work, 173 respondents (45 percent) indicated that they walk to the station. Figure 7 shows in map form the origins of these pedestrian customers' trips to the station. The trips are summarized by distance and direction in Table 6.

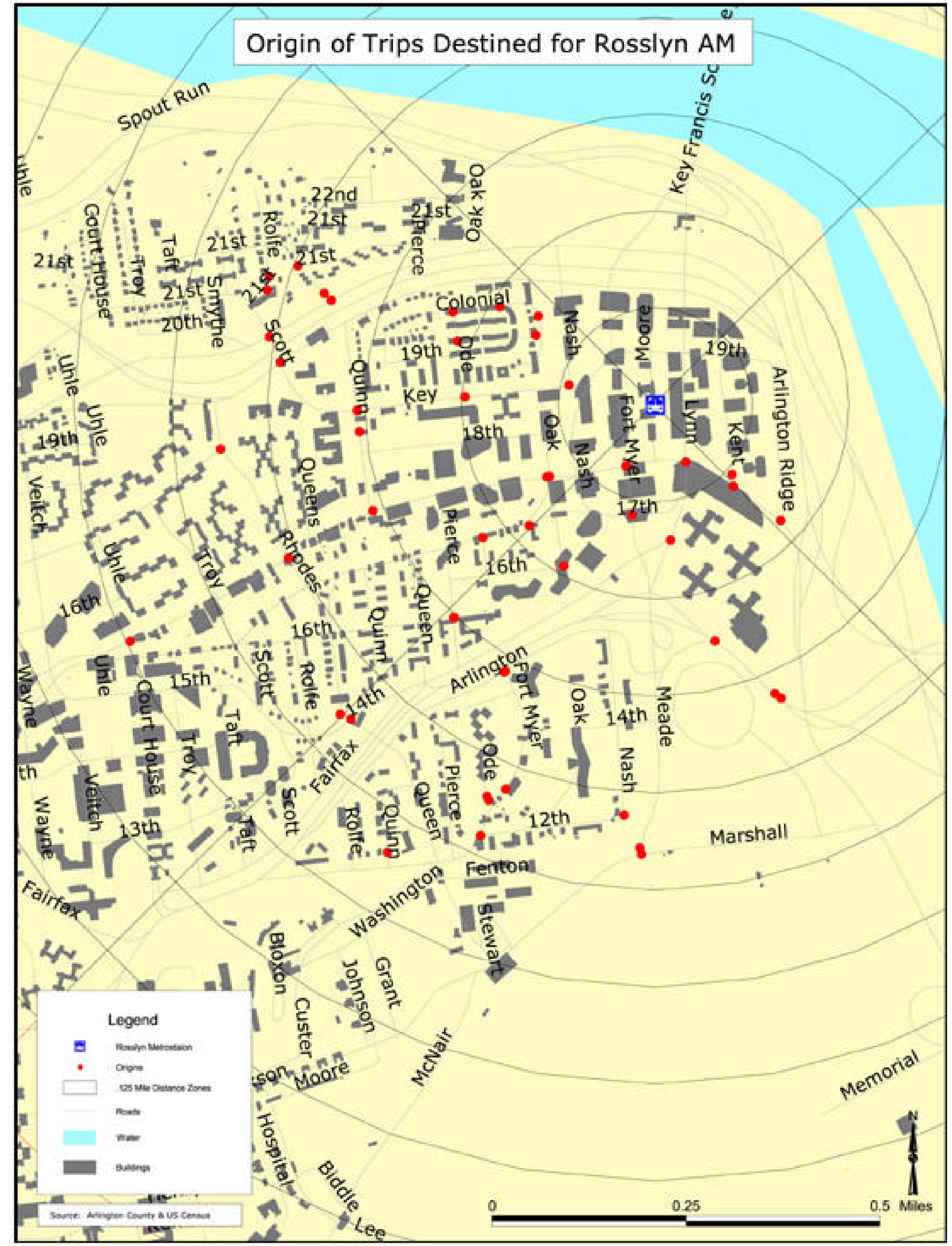
Analyzing the results by distance shows that 80 percent of pedestrians walk less than a half-mile to reach the Metrorail station, and that 90 percent walk less than one mile. From a directional standpoint, the results show that over 90 percent of pedestrians arrive from the south and west of the station, with very few from the north and east.

Table 6: Origins of Morning Peak Walking Trips. Pedestrians whose morning-peak trips to the station originate from each of the zones shown in Figure 7. (Rounding may affect sums.)

Distance from station	*Percent of respondents*					*Number of customers**				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	0%	2%	0%	1%	**3%**	0	38	0	13	**51**
1/8 to 1/4 mile	0%	16%	3%	6%	**24%**	0	267	51	102	**419**
1/4 to 3/8 mile	0%	13%	0%	11%	**23%**	0	216	0	191	**407**
3/8 to 1/2 mile	0%	22%	0%	8%	**30%**	0	381	0	140	**521**
1/2 to 5/8 mile	0%	7%	0%	1%	**7%**	0	114	0	13	**127**
5/8 to 3/4 mile	0%	1%	0%	0%	**1%**	0	13	0	0	**13**
3/4 to 7/8 mile	0%	0%	0%	0%	**0%**	0	0	0	0	**0**
7/8 to 1 mile	0%	0%	0%	0%	**0%**	0	0	0	0	**0**
1 to 1-1/8 miles	1%	0%	0%	0%	**1%**	13	0	0	0	**13**
Over 1-1/8 miles	2%	3%	1%	3%	**10%**	38	51	25	51	**165**
Total	**3%**	**63%**	**4%**	**30%**	**100%**	**51**	**1,080**	**76**	**508**	**1,716**

* Calculated by applying the survey results to the number of customers who walk to the station during the morning peak period (5:30 to 9:30 a.m.), as determined in Table 4.

Figure 7: Origins of morning peak pedestrian trips to the Rosslyn station



In the evening peak period, when most customers entering the station are area employees enroute home from work, 218 respondents (68 percent) indicated that they walk to the station. Figure 8 shows in map form the origins of evening peak pedestrian customer trips to the station, and Table 7 reports the results in tabular form. In the evening peak period, customers approached the station nearly uniformly from the south, east, and west, but few customers approached from the north. From a distance standpoint, over two-thirds of respondents walked less than one-fourth mile to reach the station.

Data from non-pedestrian customers was analyzed for both morning and evening peak periods, but no significant pattern of trip origins was found.

Figure 8: Origins of evening peak pedestrian trips to the Rosslyn station

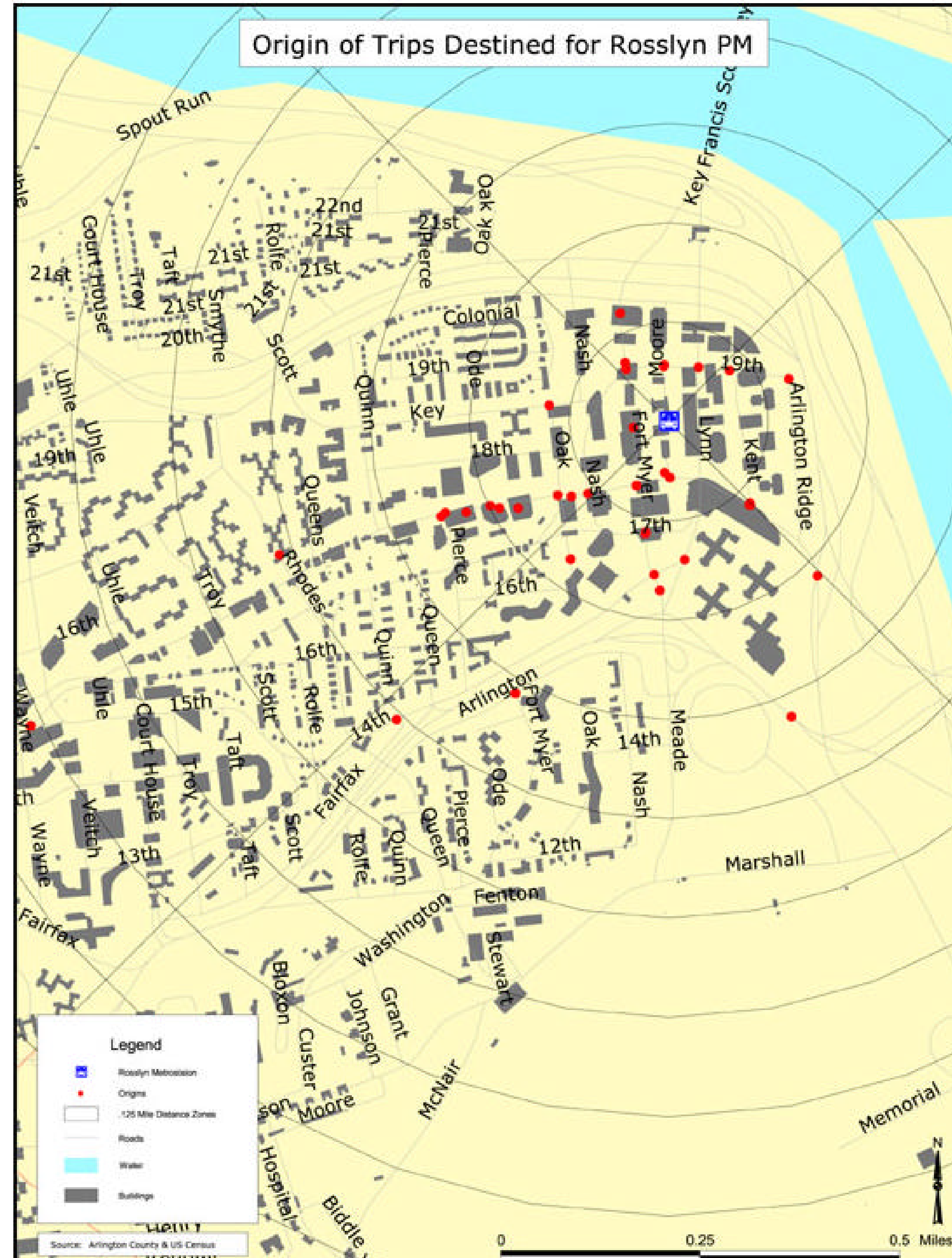


Table 7: Origins of Evening Peak Walking Trips. Pedestrians whose evening-peak trips to the station originate from each of the zones shown in Figure 8. (Rounding may affect sums.)

Distance from station	*Percent of respondents*					*Number of customers**				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	5%	3%	7%	1%	**15%**	231	144	346	29	**751**
1/8 to 1/4 mile	1%	21%	17%	15%	**53%**	29	1,039	847	751	**2,656**
1/4 to 3/8 mile	0%	4%	0%	8%	**12%**	0	202	0	404	**606**
3/8 to 1/2 mile	0%	2%	0%	0%	**2%**	0	115	0	0	**115**
1/2 to 5/8 mile	0%	1%	0%	1%	**2%**	0	58	0	29	**87**
5/8 to 3/4 mile	0%	0%	0%	0%	**0%**	0	0	0	0	**0**
3/4 to 7/8 mile	0%	0%	0%	0%	**0%**	0	0	0	0	**0**
7/8 to 1 mile	1%	0%	0%	1%	**1%**	29	0	0	29	**58**
1 to 1-1/8 miles	1%	0%	1%	0%	**2%**	29	0	58	0	**87**
Over 1-1/8 miles	2%	3%	5%	3%	**14%**	87	173	260	173	**693**
Total	**8%**	**34%**	**30%**	**28%**	**100%**	**404**	**1,732**	**1,501**	**1,415**	**5,052**

* Calculated by applying the survey results to the number of customers who walk to the station during the morning peak period (5:30 to 9:30 a.m.), as determined in Table 4.

Development Forecast

Development Sites

The Rosslyn neighborhood features a mix of uses in a community of over 6,000 residential units, 2,000 hotel rooms, 700,000 square feet of retail space, and more than 9 million square feet of office space. With a state-of-the-art communications infrastructure and one of the region's largest concentrations of high-quality, high-density office space, Rosslyn offers tremendous opportunities for business growth. Growth in Metrorail ridership by 2020 will depend largely on development changes in the immediate vicinity of the station.

The following procedures and general assumptions were pursued in projecting net development changes in the next two decades:

- Sites with development built prior to 1970 were considered prime redevelopment candidates and, in many cases, demolition and rebuilding these sites was assumed to occur.
- The focus of the redevelopment was assumed to be the C-O Rosslyn zoning district.
- Properties in the C-O Rosslyn zoning area were assumed to develop/redevelop at 10 FAR.
- New development on Office/Residential development sites was assumed to be equally split between those two uses.
- Ground floor retail was assumed to occupy 7 percent of all new developments.

Development in the Metro Corridors 2000, a report published by the Arlington County Department of Community Planning, Housing and Development, was utilized to determine the existing development on the parcels near the Rosslyn station. Table 9 summarizes the specific development and redevelopment assumptions for parcels that are likely for change in net development to occur prior to 2020. Future Metrorail trips were projected according to these development assumptions.

Metrorail Customer Forecast

Preliminary indications from the Core Capacity Study suggest that Metrorail volume at Rosslyn will reach about 22,000 entries per weekday by the year 2020, a 44 percent increase over 2001 volumes. Existing and future customer volume forecasts are shown in Table 8.

Table 8: Customer entries, 2001 and 2020

	Entering Customers	
	2001	***2020***
AM Peak period (5:30 – 9:30 a.m.)	4,200	5,900
PM Peak period (3:00 – 7:00 p.m.)	6,500	9,300
Daily	15,300	22,000

Sources: Core Capacity Study, WMATA faregate data

Two sources of information were used to forecast the numbers of Metrorail customers who would walk from future developments. One was the results of the survey in the current study; the other was *Development Related Ridership Survey II*, a 1989 study that estimated transit mode share based on a larger sample of Metrorail customers.

The survey data collected for this report were used to relate present customers to existing buildings. For each 1/8-mile distance from the station, a ratio of peak-period customers per 1,000 square feet of building size was developed. The ratios were generally similar to those produced by the 1989 survey. For each 1/8-mile distance, a ratio to be used in the study was determined by drawing a best-fitting line between the means of the ratios calculated from the two surveys.

The final ratio would produce an estimate of additional customers from new developments, given assumptions about the sizes of the developments drawn from *Development in the Metro Corridors 2000.*

Direction from the station was also considered. At the Rosslyn station, the significant grade west of the station is a large impediment to pedestrian use of Metrorail; as such, fewer customers are likely to walk to the Metrorail station than the ratio suggests. Directional factors were likewise assigned for each of the four cardinal directions.

The methodology produced a single value for pedestrian customers approaching the station from each new development during the four-hour morning peak period and the four-hour evening peak period combined. These values were allocated to the morning versus evening peak periods using ratios from ITE's *Trip Generation*, 6th edition. Specifically, 85 percent of trips generated by office developments were assumed to enter the station during the evening peak period, while only 15 percent of these trips were assumed to enter during the morning peak period. Likewise, 73 percent of residential trips were assumed to enter the station during the morning peak period, and the remaining 27 percent were assumed to enter during the evening peak period. Retail and hotel land uses were assumed to be equally split between morning and evening peak periods.

Metrobus Customer Forecast

WMATA does not have specific projections for future bus ridership at the Rosslyn Station. However, the Core Capacity Study forecasts a three percent annual growth rate in Metrobus ridership. To meet demand for both current and new Metrobus routes in the immediate future, WMATA recommends adding three new bus bays at the Rosslyn station.

Table 9: 2020 development forecast for Rosslyn station area

Project Name	Location	New Development Type	Zone*	Net Change in Development				Net Change in Pedestrian Entries		
				Office sq. feet	Retail sq. feet	Res. units	Hotel rooms	Both peaks	AM peak	PM peak
Rosslyn Metro Center	1800 N. Moore St.	Office/Retail	E1	255,000	12,000			207	36	171
1801 N. Lynn St.	1801 N. Lynn St.	Office/Retail	E1	347,000	7,000			271	43	228
Rosslyn Plaza	1601-1701 N. Kent St.	Office/Retail/Residential	E1/E2	608,000	84,000	269		705	223	481
Central Place	1801 N. Moore St.	Office/Retail/Hotel	E1	73,000	1,000		150	201	81	120
Waterview	1111 N. 19th St.	Office/Retail/Residential/Hotel	N1	411,000	3,000	65	220	538	172	366
Colonial Heights	1555 N. Colonial Ter.	Residential	N1			14		7	5	2
Rosslyn Bldgs./RCA Bldg.	1901-11 N. Ft. Myer Dr.	Office/Retail	N1	553,000	47,000			453	85	368
1881 Nash	1881 N. Nash St.	Residential/Retail	N1		4,000	173	-178	-66	-12	-54
CACI Bldg.	1815 N. Ft. Myer Dr.	Office/Retail	N1	340,000	22,000			271	49	222
Westpark Hotel	1900 N. Ft. Myer Dr.	Residential	N2			282	-300	-96	-17	-79
Key Bldg./Berkeley Bldg.	1200 N. Wilson Blvd.	Office/Retail	S1	556,000	57,000			446	87	359
River Place	1011 N. Arlington Blvd.	Office/Residential	S2/S3	930,000	-69,000	-633		17	-303	320
Monument Place	1400 N. Meade St.	Residential	S3			17		7	5	2
Bromptons, Potomac Hgts.	1320 N. Oak St.	Residential	S3			3		1	1	0
Bromptons, Monument Pl.	N. Nash St.	Residential	S3			15		6	4	2
North Meade St.	1201 N. Nash St.	Residential	S3			40		16	12	4
Art Assoc. Bldg.	1501 N. Wilson Blvd.	Residential	W1	-108,000	-18,000	140		-19	27	-45
Oak Hills	1401 N. Wilson Blvd.	Office/Retail	W1	320,000	34,000			218	43	175
Nash St. Office Bldg.	1400 N. Key Blvd.	Hotel	W1	-146,000	-12,000		350	162	111	51
Christiana House	1509 N. Key Blvd.	Residential	W1			4		2	1	0
Twin Oak Apartments	1800 N. Oak St.	Residential	W1		4,000	317		140	101	39
Undesignated (Site G)		Residential	W2			236		92	67	25
Colonial Heights	1597 N. Colonial Ter.	Residential	W2			3		1	1	0
1600 Bldg.	1600 N. Wilson Blvd.	Residential	W3	-175,000	-8,000	263		22	54	-32
Total				**3,963,000**	**170,000**	**1,208**	**242**	**3,745**	**1,004**	**2,741**

Sources: *Development in the Metro Corridors 2000*, discussions with Arlington County Public Works and Planning staff
* Zone letter indicates direction from station; zone number indicates distance from station: value 1 indicates distance from 0 to 1/8 mile, value 2 indicates distance from 1/8 to 1/4 mile, etc.

The final columns of Table 9 indicate the number of new pedestrian Metrorail customers forecast to enter the Rosslyn station during morning and evening peak periods for each new development. Table 10 aggregates the values from these two columns by 1/8-mile distance away from the station and by direction from the station.

Table 11 shows the total number of pedestrian customer entries expected in the year 2020. These values were computed by adding current pedestrian flows (Tables 6 and 7) to pedestrian flows generated by new development (Table 10).

The forecast calls for an increase of about 1,000 pedestrian trips entering the station during the morning peak period, about 59 percent more pedestrian trips than in 2001. In the evening peak period, about 2,700 pedestrian trips entering the station will be generated by new development, an increase of about 54 percent over existing pedestrian trips.

About 95 percent of new pedestrian trips are attributable to new development within ¼ mile of the station. New development farther than 3/8 mile from the station generally falls outside the limits of the Rosslyn station area; these developments would be unlikely to generate significant additional pedestrian trips at the Rosslyn station.

New development is distributed in all four compass directions from the station, but new development is concentrated more heavily north and east of the station. Most existing pedestrian customers come from the south and west, so new development will result in additional pedestrian travel from areas where little currently exists. The study's recommendations account for this propensity.

Table 10: Net change in pedestrian station entries attributable to 2020 development

Distance from station	*Morning peak-period entries*					*Evening peak-period entries*				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	300	87	306	283	**976**	904	359	838	220	**2,322**
1/8 to 1/4 mile	-17	-303	79	68	**-173**	-79	320	161	25	**427**
1/4 to 3/8 mile	0	147	0	54	**200**	0	24	0	-32	**-8**
Over 3/8 mile	0	0	0	0	**0**	0	0	0	0	**0**
Total	**283**	**-70**	**386**	**405**	**1,004**	**825**	**704**	**999**	**213**	**2,741**

Source: Aggregated data from Table 9.

Table 11: Predicted 2020 pedestrian customer station entries

Distance from station	*Morning peak-period entries*					*Evening peak-period entries*				
	North	*South*	*East*	*West*	*Total*	*North*	*South*	*East*	*West*	*Total*
0 to 1/8 mile	300	125	306	296	1,027	1,135	503	1,184	249	**3,073**
1/8 to 1/4 mile	0	0	130	170	246	0	1,359	1,008	776	**3,083**
1/4 to 3/8 mile	0	363	0	245	607	0	226	0	372	**598**
3/8 to 1/2 mile	0	381	0	140	521	0	115	0	0	**115**
1/2 to 5/8 mile	0	114	0	13	127	0	58	0	29	**87**
5/8 to 3/4 mile	0	13	0	0	13	0	0	0	0	**0**
3/4 to 7/8 mile	0	0	0	0	0	0	0	0	0	**0**
7/8 to 1 mile	0	0	0	0	0	29	0	0	29	**58**
1 to 1-1/8 miles	13	0	0	0	13	29	0	58	0	**87**
Over 1-1/8 miles	38	51	25	51	165	87	173	260	173	**693**
Total	**334**	**1,010**	**462**	**913**	**2,720**	**1,229**	**2,436**	**2,500**	**1,628**	**7,793**
Increase from 2001	**555%**	**0%**	**508%**	**78%**	**59%**	**204%**	**41%**	**67%**	**15%**	**54%**

Source: Sum of existing trips (Tables 6 and 7) and new trips (Table 10).
Note: Negative numbers were set to zero without adjusting marginal sums.

Planned Station-Area Improvements

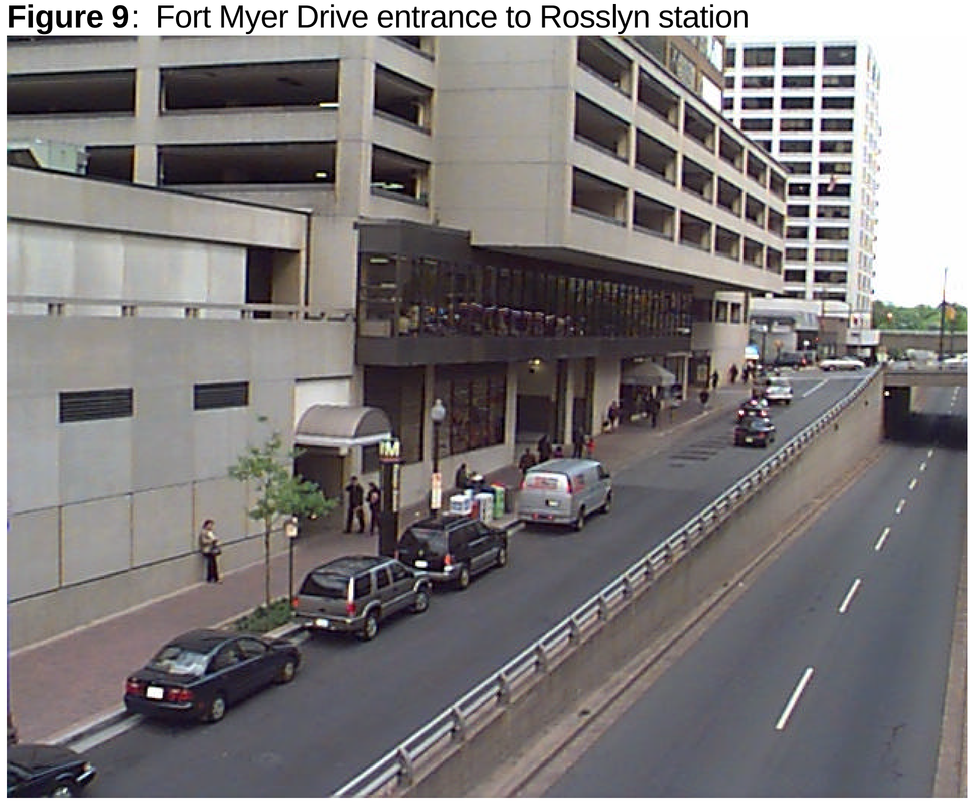
Some improvements that would enhance station access are already planned to be built by other parties.

Plans for the renovation and expansion of the Rosslyn Metro Center Building, which is located above the present station entrance, include improvements to the station lobby and faregate area. The improvements include the modification of the building structure over the lobby to make it more open and the installation of windows in the wall along Fort Myer Drive (Figure 9) to increase natural light. A second entrance and stairway into the lobby from Fort Myer Drive is to be added at the northwest corner of the lobby; the existing entrances from Fort Myer Drive and Moore Street would remain and be protected by canopies. Within the lobby, the escalator to the skywalk level is to be reconstructed so that the street-level end faces Moore Street. Arlington County's approval of these plans for the Rosslyn Metro Center Building is effective through January 2005. The developer has not yet begun construction.

The block across Moore Street is also planned for new construction, although the plans are less well defined. That construction would affect the area surrounding the top of the existing elevator into the station from street level.

As part of an ongoing project, Arlington County is installing traffic enforcement and parking identifier signs in the Rosslyn Station block area.

Figure 9: Fort Myer Drive entrance to Rosslyn station



Community Involvement

A meeting was held with residents and business owners in the area surrounding the Metrorail station to allow the community to be involved in the planning process. The meeting was held on February 20, 2002, with the goal of soliciting suggestions for station-area improvements from the community.

Recommended Operational Improvements

The following operational changes are recommended to improve motor vehicle circulation near the station:

Reversal of Traffic Direction on Fort Myer Drive East Ramp

Fort Myer Drive is a one-way, southbound arterial street that runs from Key Bridge and the intersection with Lee Highway to the southern portion of Rosslyn. The center lanes of Fort Myer Drive pass under Wilson Boulevard at a grade-separated interchange. South of 19th Street, the left and right lanes of Fort Myer Drive ramp up to intersect Wilson Boulevard at grade. The east ramp is restricted to left turns and through movements (to return down the ramp to Fort Myer Drive), while the west ramp is limited to right turns and through movements. Figure 10 displays the current configuration.

A potentially significant access improvement, presented in Figure 11, would be to reverse the direction of flow on the east ramp from southbound to northbound between Wilson Boulevard and 19th Street. Such a modification would facilitate several issues related to station access:

- Traffic circulation on the block bound by Moore Street, Wilson Boulevard, Fort Myer ramp and 19th Street would have a continuously clockwise flow. The current counterclockwise direction of flow is problematic since it requires a series of often-difficult left turns.
- The customer drop-off and pick-up exchanges on the Fort Myer ramp would be made with vehicle passengers opening their car doors on the curbside, the ideal operation. Currently, vehicle passengers must open their doors on the travel lane side of the ramp.
- An additional left turn opportunity would be created at the east Fort Myer ramp for eastbound Wilson Boulevard to points north, thus avoiding the left turn from Wilson Boulevard to Lynn Street northbound, which is presently over capacity during peak traffic periods.

Other related measures required in conjunction with the reversal of the Fort Myer Ramp include the following:

- Modification of the eastbound Wilson Boulevard approach to Fort Myer Drive to include a left-turn arrow phase to operate concurrently with the existing westbound left-turn arrow phase. The signal timings for the intersection would also require adjustments.
- The lane use would change from a through lane to a left-only lane in the eastbound direction on Wilson Boulevard.

Figure 10: Existing Fort Myer Drive traffic circulation

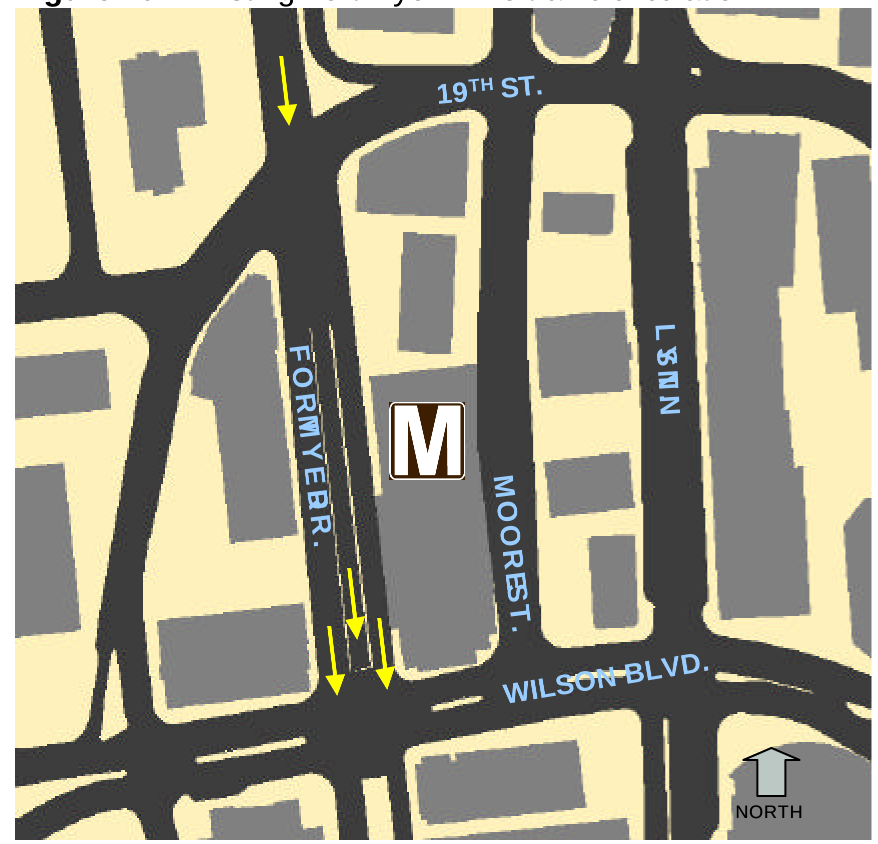
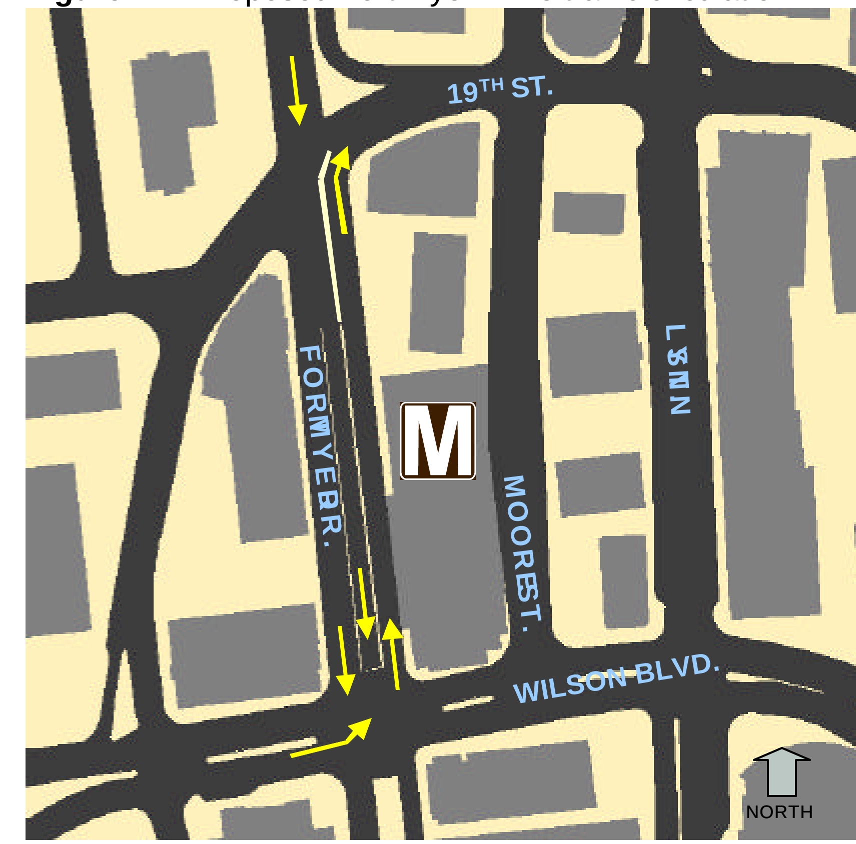


Figure 11: Proposed Fort Myer Drive traffic circulation



- Construction of a concrete median to divide the directions of flow on Fort Myer Drive. The median would extend the length of the counter-flow ramp and channelize motorists around the corner onto eastbound 19th Street.
- Retiming of signals in the vicinity to accommodate modified traffic patterns.

A cost estimate for the changes is shown in Table 12.

Table 12: Order of magnitude cost estimate for Fort Myer Drive ramp reversal

Element	***Approximate Cost (FY 2002 dollars)***
Left-turn lane, traffic signal modifications, new curbs	$500,000
Planning, design, construction management, agency costs, and contingencies	$500,000
Total Cost	**$1,000,000**

Moore Street Curbside Utilization

Moore Street is the location of the primary Rosslyn station entrance and serves a variety of transportation functions including pedestrian, bus, taxi, shuttle, loading and, unofficially, customer drop-off and pick-up activity. The block of Moore Street between Wilson Boulevard and 19th Street often becomes congested in the morning and evening peak periods due to these competing vehicular activities, as well as to pedestrians using the mid-block crosswalk in front of the station entrance.

On March 17, 2002, several changes were instituted to facilitate transportation operations on Moore Street. Figure 12 illustrates the newly instituted curbside strategy, which includes the following changes:

- The Georgetown University Shuttle (GUTS) stops on the west side of Moore Street, north of 19th Street.
- The Georgetown Connector stops on the west side of Moore Street at the first stop south of 19th Street.
- The slug line was moved several blocks to the north adjacent to Lee Highway.
- Layovers of ten minutes or less continue to be taken at the designated bus bays for Moore Street routes.
- Layovers longer than ten minutes, including meal layovers, discharge customers at a designated bus bay on Moore Street, continue on Moore Street, turn left on the alley to Lynn Street, turn left on Lynn Street, turn left on 19th Street, turn right on Moore Street, turn right on the eastbound service roadway of Lee Highway, turn right on southbound service roadway of Lynn Street to the layover area on the left curb.
- Routes 5A and 5B (formerly served by Bay D) and new route B11 stop at the second stop south of 19th Street. Bay D will serve only Route 38B.

Figure 12: Existing station area curbside use

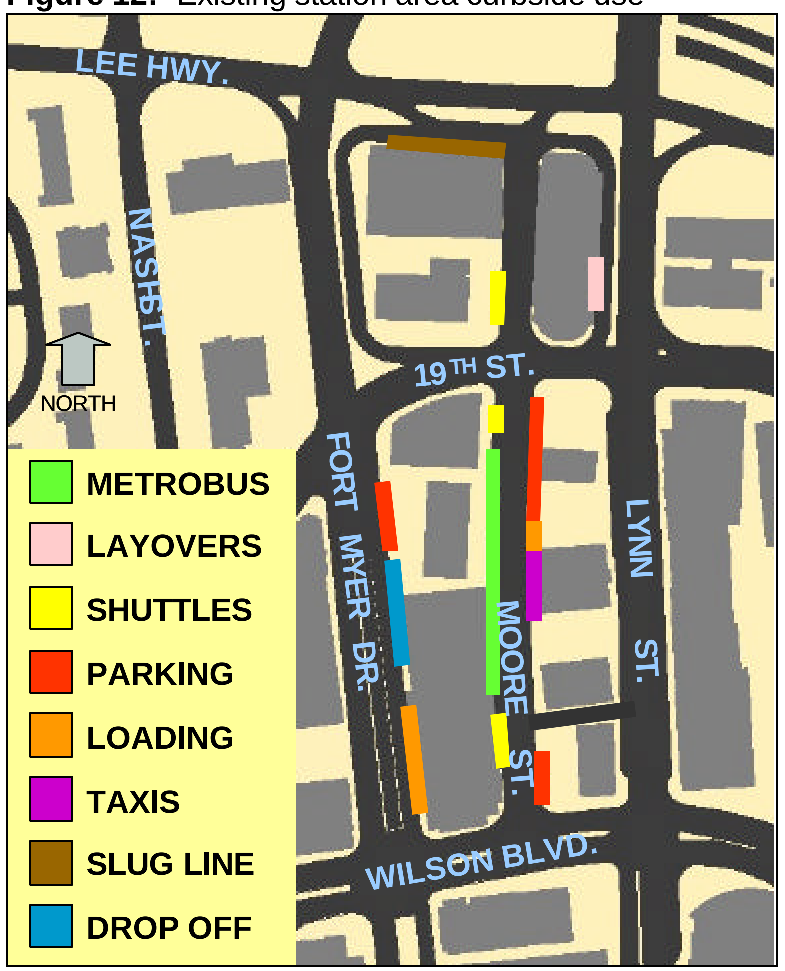
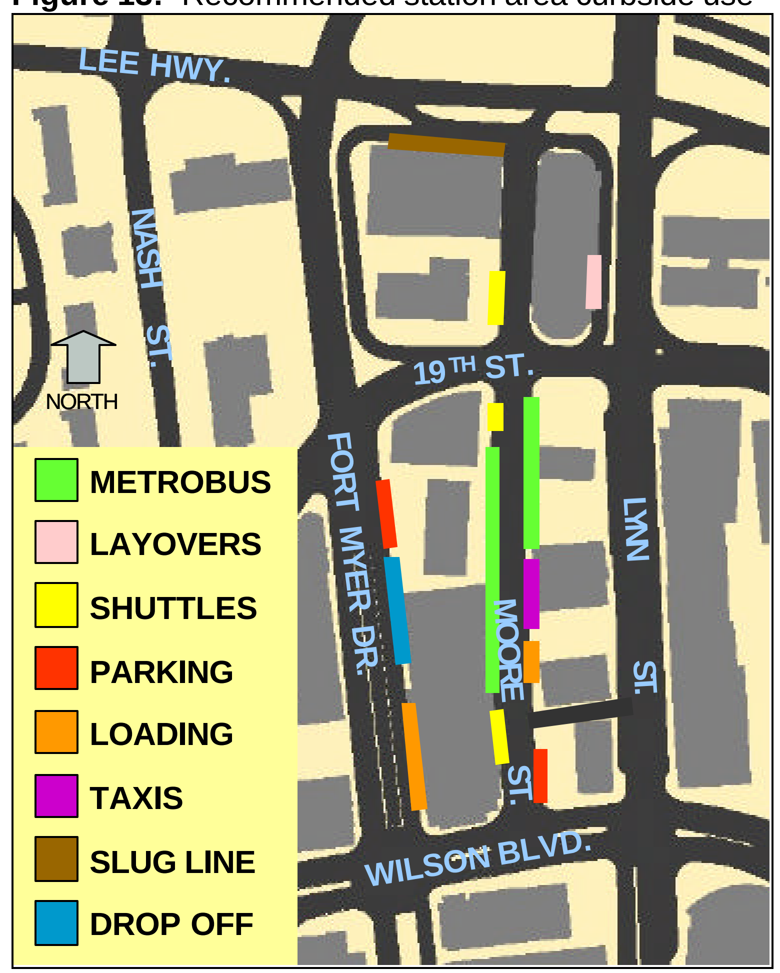


Figure 13: Recommended station area curbside use



The following improvements are recommended in addition to these operational changes:

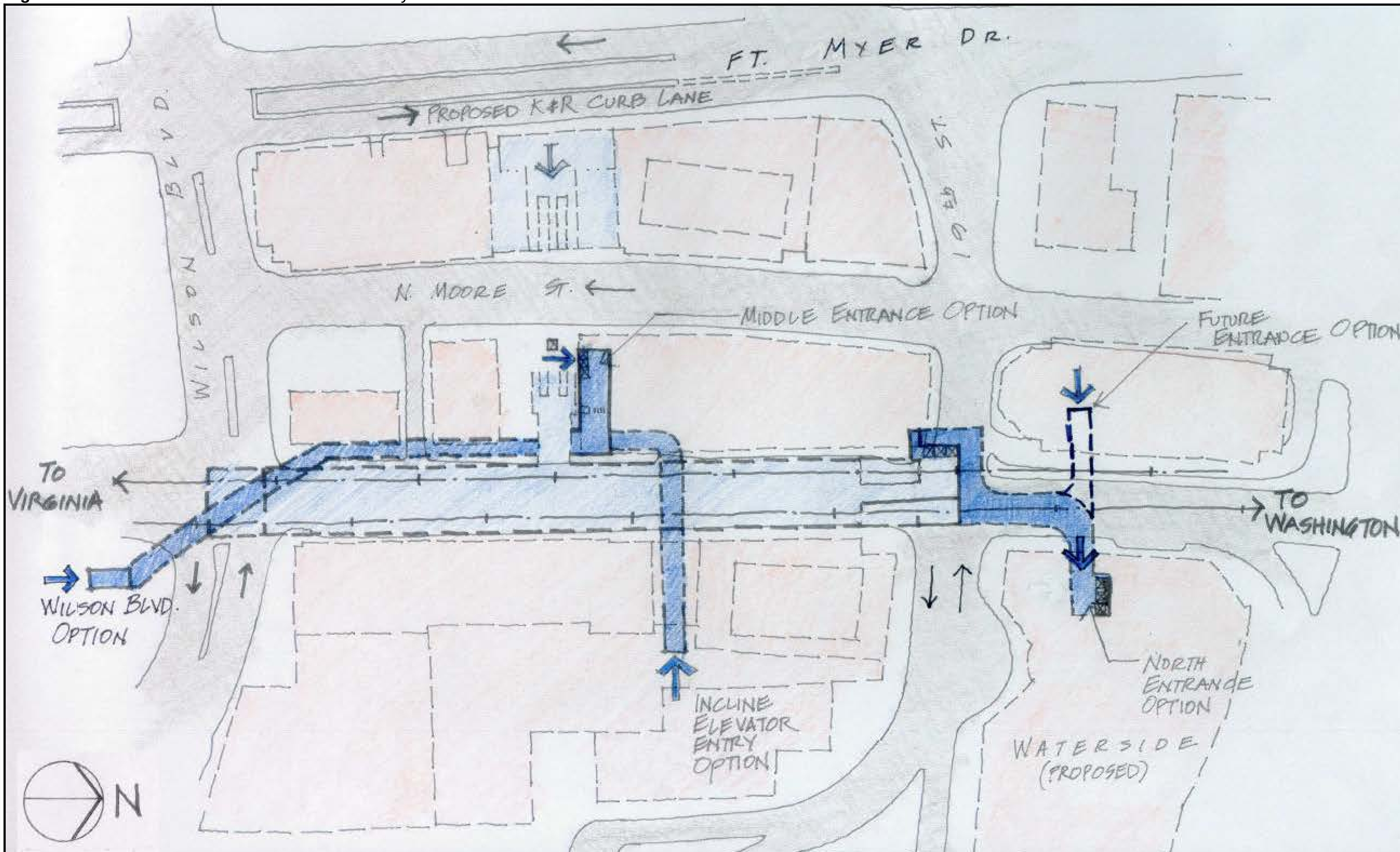
- Remove the parking meters along the east side of Moore Street south of 19th Street.
- Shift the loading area to just north of the crosswalk.
- Add three bus bays at the curbside area on Moore Street formerly occupied by on-street parking and loading.

The recommended curbside use is illustrated in Figure 13.

Potential Station Entrance Locations

Figure 14 depicts potential new station entrance locations designed to improve access. Each suggested improvement is discussed in further detail below.

Figure 14: Potential entrance locations for the Rosslyn Metrorail Station



North Entrance Option

A new development, Waterview, is planned to be built on the block north of 19th Street and east of Lynn Street. Arlington County's approval of the building included the requirement for access to a new Metrorail station entrance. The North Entrance option configuration includes new pedestrian access at the northeast corner of Lynn and 19th Streets. Three elevators would connect the Waterview street level with an underground concourse to a mezzanine built beneath Lynn Street and 19th Street. The new mezzanine would be at the same elevation as the P1 level of the Waterview development. The new mezzanine would connect to the upper platform level with a bank of three elevators. A new emergency egress stairway from the upper platform level to the street could be converted to an alternative station entrance with a straight stair run from the free area of the mezzanine to the street. A new faregate array would be installed in the new mezzanine between the platform elevators and the street elevators. The existing upper platform would be extended to the north, and vertical circulation between the upper and lower platforms would be expanded with one new elevator, one new escalator, and one new stairway. Figures 15 and 16 present diagrams of this option.

The North Entrance option would promote pedestrian safety by diverting pedestrians into the station where they would not have to cross the intersection of Lynn and 19th Streets. Vehicular traffic may also improve because of the reduction in Metrorail-bound pedestrians crossing Lynn and 19th Streets.

The North Entrance option would serve the projected growth in pedestrian traffic particularly well. About two-thirds of pedestrian trips generated by future development will have origins north and east of the station, which is precisely the location of the North Entrance option. Customers approaching the station from north of 19th Street and east of Lynn Street would reduce their walking trip lengths by about 1/8 mile. The trip-length reduction is significant enough that it would encourage additional pedestrian Metrorail customers. Fewer than 50 customers would be attracted during the morning peak period, but about 350 additional customers could be attracted during the evening peak period. On a daily basis, the North Entrance would be likely to attract about 600 additional customers.

Table 13: Forecast of station entries in 2020 under North Entrance scenario

	No new entrance constructed	***North Entrance constructed***	
	Customers using existing entrance	***Customers using existing entrance***	***Customers using North Entrance***
AM Peak Period	5,900	3,400	2,600
PM Peak Period	9,300	5,100	4,600
Daily	22,000	12,200	10,400

Figure 15: Potential north entrance, mezzanine level

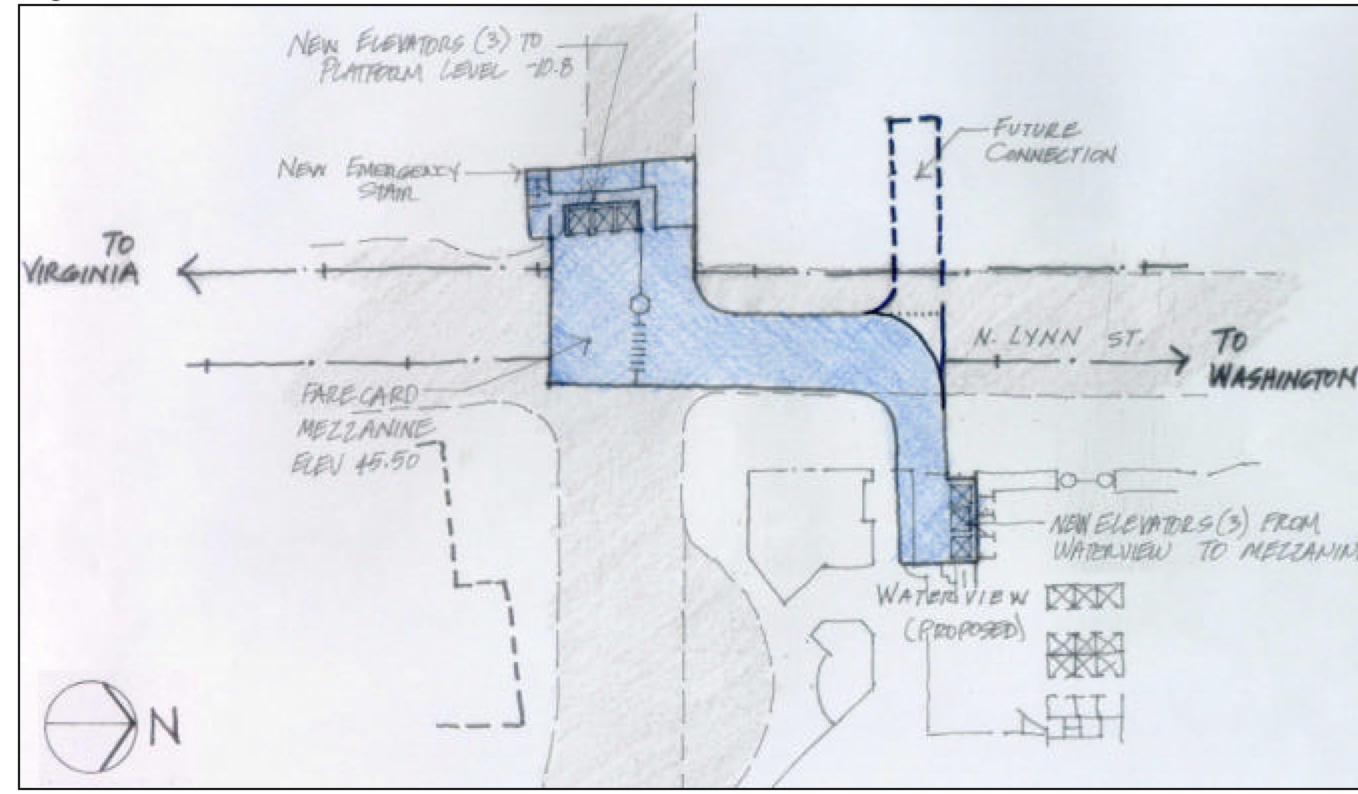


Figure 16: Potential north entrance, upper platform level

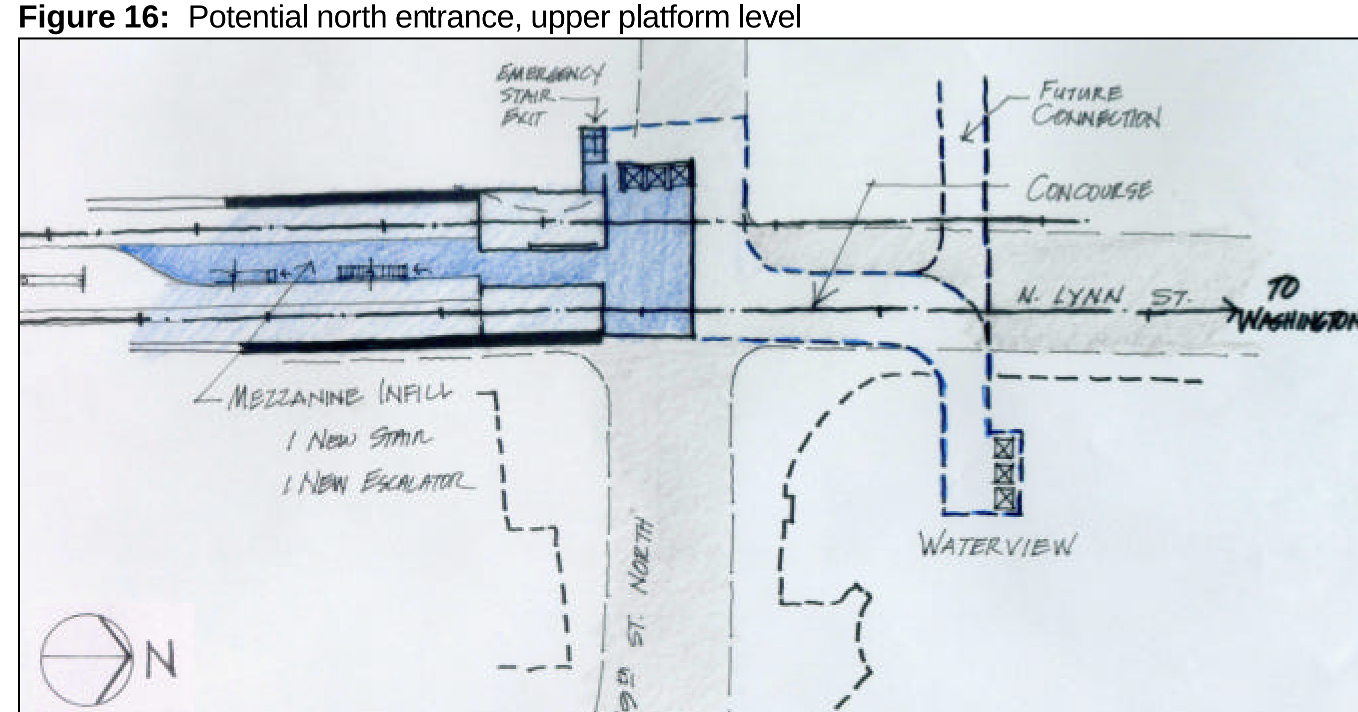


Table 13 presents customer forecasts for the North Entrance if constructed. Pedestrian customers whose trips originate north of the station would likely use the new entrance, and customers to the south would likely use the existing entrance. For analysis purposes, one-third of pedestrian customers to the west and two-thirds of pedestrian customers to the east were assumed to shift to the new entrance Half of non-pedestrian customers were assumed to shift to the new entrance.

Based on the forecasted customer volume, elevator capacity requirements were calculated. In order to serve peak 30-minute customer demand, three street-to-mezzanine elevators and three mezzanine-to-platform elevators would be required.

Table 13 forecasts 10,400 weekday customer entries for the North Entrance if constructed. The entrance would serve a similar number of customer exits, for a total annual customer volume of approximately 4 million.

A cost estimate for the North Entrance option is shown in Table 14.

The North Entrance's new mezzanine would require operating and maintenance costs ranging from $250,000 to $400,000 per year. These costs include new Station Manager staff.

A future connection is a potential additional feature of the North Entrance option. An underground tunnel originating at an undetermined point in the west would connect to the new mezzanine underneath Lynn Street and thus provide direct access to the new faregates and elevators that lead to the upper platform. If implemented, the future connection would further enhance the desirability of the North Entrance option by offering access to the station from additional locations north of the existing station entrance.

Table 14: Order of magnitude cost estimate for North Entrance

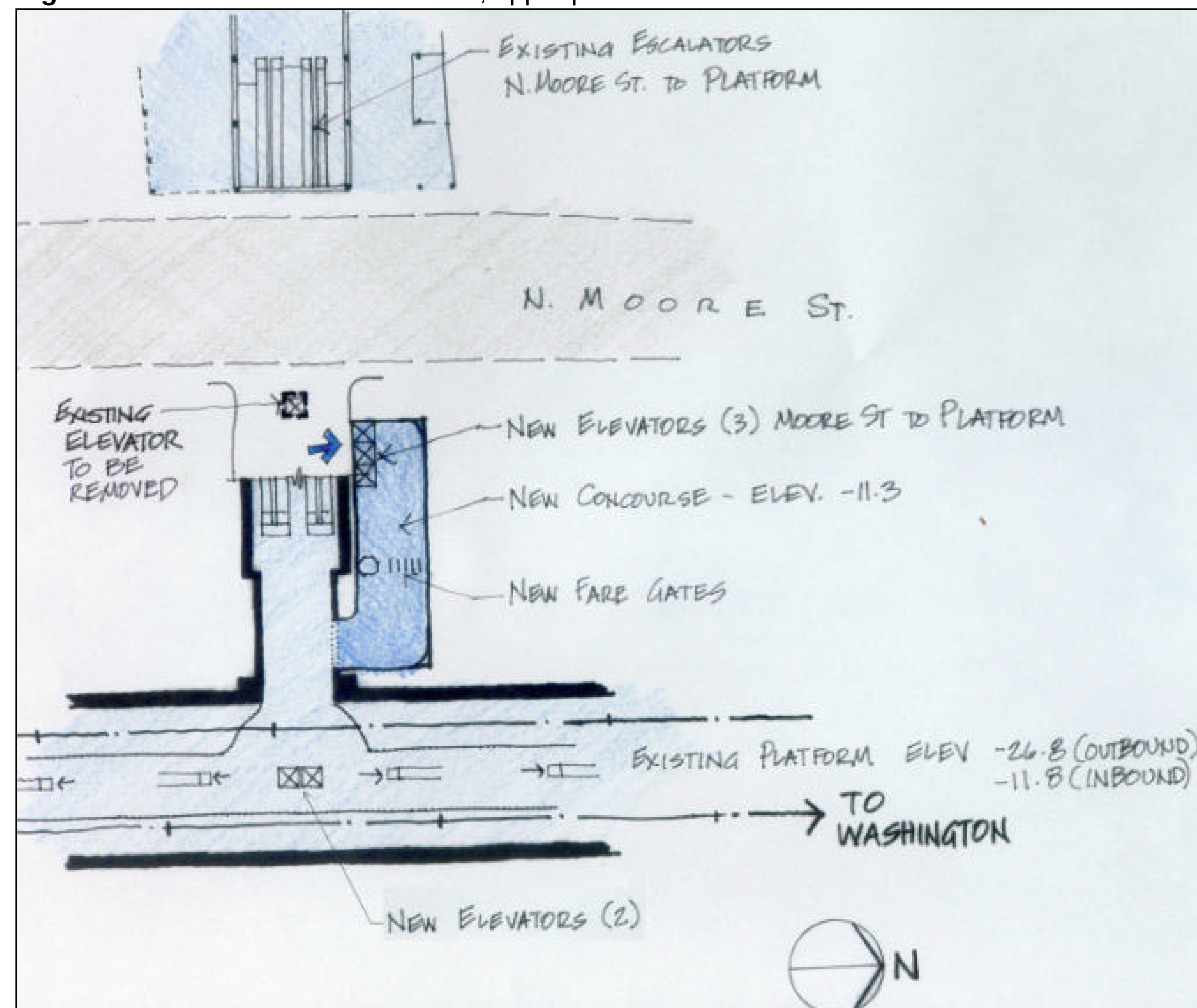
Element	*Approximate Cost (FY 2002 dollars)*
Entry, passageway and platform extension	$9,000,000
Platform extension, internal capacity enhancement	$5,000,000
Planning, design, construction management, agency costs, and contingencies*	$14,000,000
Total Cost	**$28,000,000**

* Excludes right-of-way costs

Middle Entrance Option

The Middle Entrance option includes a new bank of three elevators on the east side of Moore Street, slightly north and east of the existing elevator. These elevators would connect the street level with the upper platform level. A new faregate array would be provided outside of the elevators at the platform level. Figure 17 gives an illustration of the Middle Entrance option.

Figure 17: Potential Middle Entrance, upper platform level



The middle entrance provides additional capacity near the location of the existing station escalators, but because it is so near the existing entrance, it would reduce customers' walking distances by no further than 150 feet. It would thus not be expected to attract significant numbers of new customers to Metrorail. However, some Metrorail customers have reported that Rosslyn's long escalators are uncomfortable to ride. A reliable and high-speed elevator option would improve station access for these individuals.

Table 15 presents customer forecasts for the Middle Entrance if constructed. Pedestrian customers whose trips originate east of the station would likely use the new entrance, and customers to the west would likely use the existing entrance. For analysis purposes, half of pedestrian customers to the north and south of the station were assumed to shift to the new entrance In addition, half of non-pedestrian customers were assumed to shift to the new entrance.

Based on the forecasted customer volume, elevator capacity requirements were calculated. In order to serve peak 30-minute customer demand, three elevators would be required at the Middle Entrance.

Table 15 forecasts 11,200 weekday customer entries for the Middle Entrance if constructed. The entrance would serve a similar number of customer exits, for a total annual customer volume of approximately 4 million.

A primary advantage of the Middle Entrance option is that it would greatly improve the existing street elevator service. Wait times at the single existing street elevator are beyond comfortable limits. In addition, the Middle Entrance option would provide redundant street elevator service, virtually eliminating service interruptions caused when the existing street elevator is out of service.

If the Moore Street curbside use is revised as recommended earlier, the Middle Entrance option offers excellent connectivity to relocated Metrobus stops. By using the new elevators, Metrobus customers who use bus stops on the east side of Moore Street could transfer between Metrobus and Metrorail without having to cross vehicular traffic at the mid-block crosswalk on Moore Street. Furthermore, pedestrians could access services on the east side of Moore Street, such as the taxi stand, without crossing Moore Street, reducing pedestrian-vehicle conflicts.

Inside the station, the Middle Entrance option features vertical circulation improvements similar to the North Entrance option: one new platform-to-platform elevator, one new escalator, and one new stairway.

The Middle Entrance would require operating and maintenance costs at about the same level as the North Entrance option if a kiosk located in that area is determined to be necessary.

A cost estimate for the Middle Entrance option is shown in Table 16.

Table 15: Forecast of station entries in 2020 under Middle Entrance scenario

	No new entrance constructed	***Middle Entrance constructed***	
	Customers using existing entrance	***Customers using existing entrance***	***Customers using Middle Entrance***
AM Peak Period	5,900	3,200	2,700
PM Peak Period	9,300	4,200	5,100
Daily	22,000	10,800	11,200

Table 16: Order of magnitude cost estimate for Middle Entrance

Element	***Approximate Cost (FY 2002 dollars)***
Street elevators, passageway, faregates	$4,000,000
Internal station improvements: elevator, escalator, stairway	$5,000,000
Planning, design, construction management, agency costs, and contingencies*	$9,000,000
Total Cost	**$18,000,000**

* Excludes right-of-way costs

Inclined Elevator Entry Option

The Inclined Elevator Entry Option was conceived in an earlier WMATA/Arlington County study that featured an inclined elevatorway with an entrance location east of the existing station entrance on the east side of Lynn Street. The concept for using inclined elevators was to provide customers a direct route to the station's upper platform level from a Lynn Street entrance, traveling over the existing train room. A new faregate array, similar to the Middle Entrance Option, would control access to and from the upper platform level.

The Inclined Elevator option would benefit customers approaching the station from the east, reducing walking trips by as much as 400 feet. Such a reduction in walking distance would be likely to attract additional pedestrian customers to Metrorail: less than 50 customers during the morning peak period and about 250 customers during the evening peak period. Over a typical weekday, about 450 new customers would be attracted.

Table 17 presents customer forecasts for the Inclined Elevator Entry if constructed. Like the Middle Entrance, pedestrian customers whose trips originate east of the station would likely use the new entrance, and customers to the west would likely use the existing entrance. For analysis purposes, half of pedestrian customers to the north and south of the station were assumed to shift to the new entrance Because the Inclined Elevator Entry is not conveniently located near the roadway network, two-thirds of non-pedestrian customers are assumed to continue to use the existing entrance.

Table 17 forecasts 10,100 weekday customer entries for the Middle Entrance if constructed. The entrance would serve a similar number of customer exits, for a total annual customer volume of approximately 4 million.

Although the Inclined Elevator Entry Option presents the most direct route for customers to access the upper station platform from the east, this option has several disadvantages:

- In order to serve the number of customers using the entrance during the peak period, approximately 17 inclined elevators would have to be installed due to their slow rate of travel.
- Elevator manufacturers report that inclined elevators experience frequent breakdowns and have higher maintenance requirements than standard elevator systems.

Inclined elevators are produced for specialized applications and are not designed for the heavy use associated with a transit station entrance. The only known transit uses of inclined elevators in the U.S. are at the Huntington Station in the WMATA system and at the City Place LRT Station in the Dallas Area Rapid Transit (DART) system. Both installations experience frequent service disruptions from recurring break downs.

The use of escalators was considered for this option, but new WMATA design criteria limit the vertical rise for escalators to thirty feet, which would require numerous landings between banks of escalators where, in this option, the bottom landing would be extended a considerable distance beyond the upper platform.

Because of their slow rate of speed, high maintenance requirements, and the large number of inclined elevators that would be required to serve an entrance, the Inclined Elevator Entry Option is not recommended for further consideration.

Table 17: Forecast of station entries in 2020 under Inclined Elevator Entry scenario

	No new entrance constructed	***Inclined Elevator Entry constructed***	
	Customers using existing entrance	***Customers using existing entrance***	***Customers using Inclined Elevators***
AM Peak Period	5,900	3,700	2,200
PM Peak Period	9,300	4,500	5,000
Daily	22,000	12,300	10,100

Wilson Boulevard Entrance Option

The Wilson Boulevard Entrance Option features a station entrance at the southwest corner of Wilson Boulevard and Lynn Street. A new mezzanine-level tunnel would run northbound from the new entrance and would connect with the elevator bank proposed as part of the Middle Entrance option. Customers would use these elevators to access the upper platform.

Customers using the Wilson Boulevard Entrance would use the Middle Entrance elevators, so the Wilson Boulevard Entrance option can be considered only if the Middle Entrance option is constructed. Furthermore, the benefit provided by the Wilson Boulevard Entrance is small: Customers approaching the station from the south could use an underground walkway, approximately 400 feet long, to reach the Middle Entrance’s elevator bank.

The Wilson Boulevard Entrance option would not significantly change the walking distance for pedestrian customers over the Middle Entrance option. However, some customers south of the station may perceive that they have a shorter walk, because they would enter the station sooner and walk in a passageway protected from traffic and the elements. Some new Metrorail trips from the south may be attracted by this advantage, but any increase in trips would likely be minor.

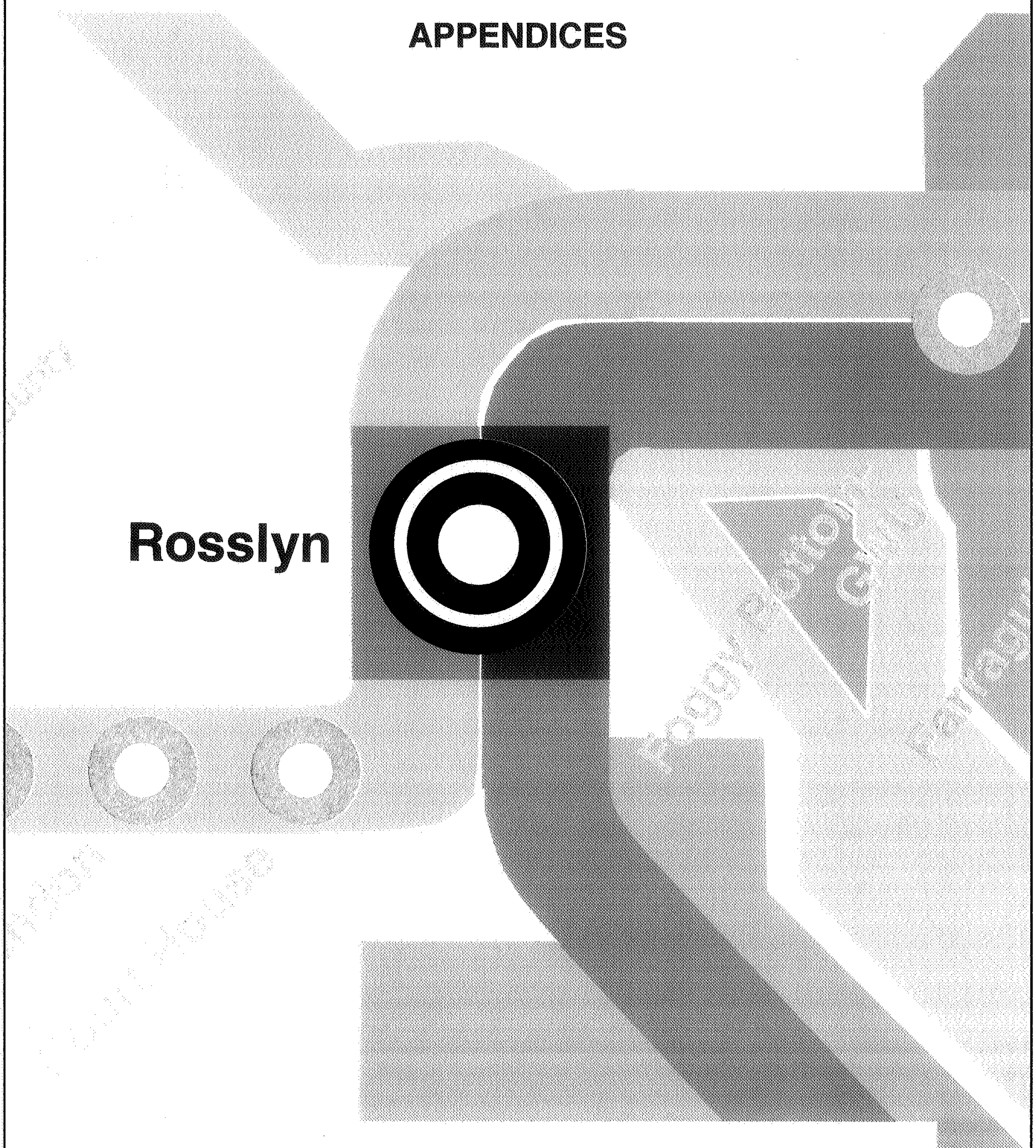
The Wilson Boulevard Entrance option is not as convenient to construct as the North Entrance option, because there is no planned redevelopment at the location of the proposed entrance portal. Retrofitting an entrance portal in an existing development may be feasible, but it would not be as easy to construct as the North Entrance option because of the planned Waterview development on that site.

Another disadvantage of the Wilson Boulevard Entrance option is that it would reduce the effectiveness of the Middle Entrance elevators. If the Middle Entrance were constructed alone, its elevators would stop at street level and at the upper platform level, a one-stop configuration that would maximize speed and capacity. The Wilson Boulevard Entrance would require the elevators to make an additional stop just below street level, delaying other customers. More elevators would be required with the additional stop.

Because of the limited benefit and the significant disadvantages, the Wilson Boulevard Entrance Option is not recommended for further consideration.

ROSSLYN METRORAIL STATION ACCESS STUDY

APPENDICES



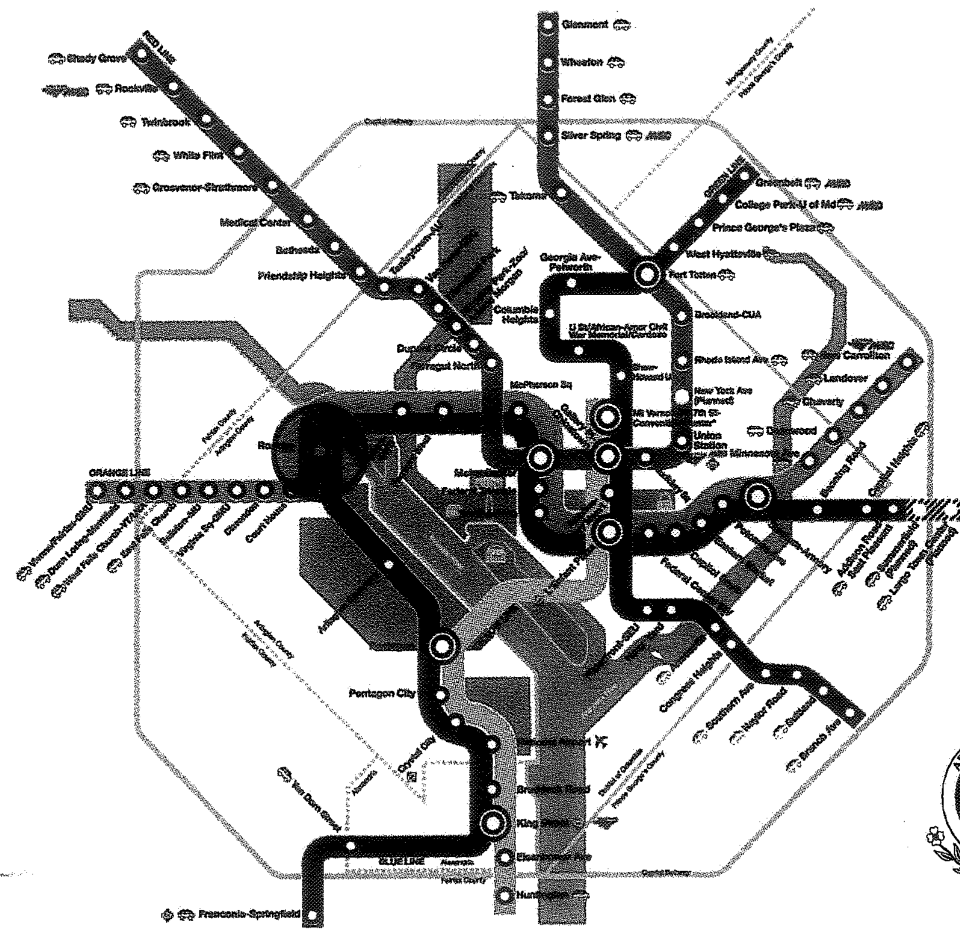
Prepared for Arlington County, Virginia
by
Washington Metropolitan Area Transit Authority
Department of Capital Projects Management
May 2002

CONTENTS

APPENDIX A

PRESENTATION GIVEN AT PUBLIC MEETING ON FEBRUARY 20, 2002

Rosslyn Metrorail Station Access Study



Capital Transit Consultants

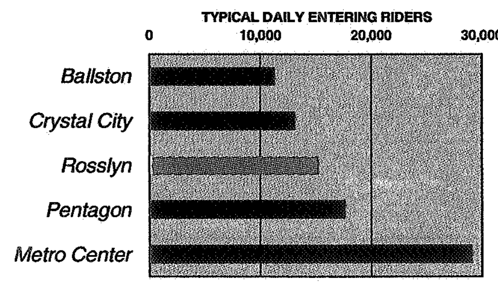
ARLINGTON COUNTY VIRGINIA

metro

Study Purpose

- Pedestrian & vehicle access patterns
- Future development forecast
- Station access improvements

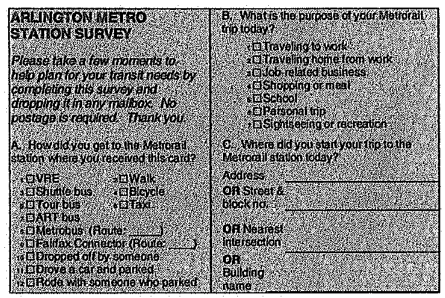
Metrorail Station Passenger Volumes



Data Collected

- Traffic on adjacent streets
- Nearby intersection turn counts
- Pedestrian street crossings
- Pedestrian arrival patterns
- Development forecast near station

Passenger Survey



ARLINGTON METRO STATION SURVEY

Please take a few moments to help plan for your transit needs by completing this survey and dropping it in any mailbox. No postage is required. Thank you.

A. How did you get to the Metrorail station where you received this card?

1 ☐ VRE
2 ☐ Walk
3 ☐ Shuttle bus
4 ☐ Bicycle
5 ☐ Tour bus
6 ☐ Taxi
7 ☐ ART bus
8 ☐ Metrobus (Route: ____)
9 ☐ Fairfax Connector (Route: ____)
10 ☐ Dropped off by someone
11 ☐ Drove a car and parked
12 ☐ Rode with someone who parked

B. What is the purpose of your Metrorail trip today?

1 ☐ Traveling to work
2 ☐ Traveling home from work
3 ☐ Job-related business
4 ☐ Shopping or meal
5 ☐ School
6 ☐ Personal trip
7 ☐ Sightseeing or recreation

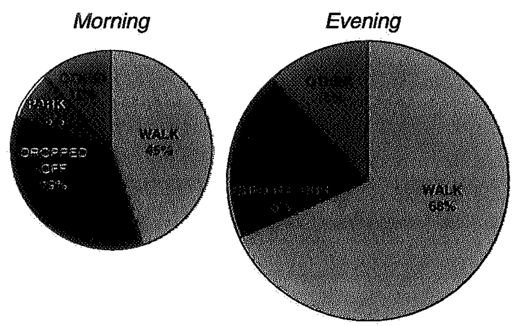
C. Where did you start your trip to the Metrorail station today?

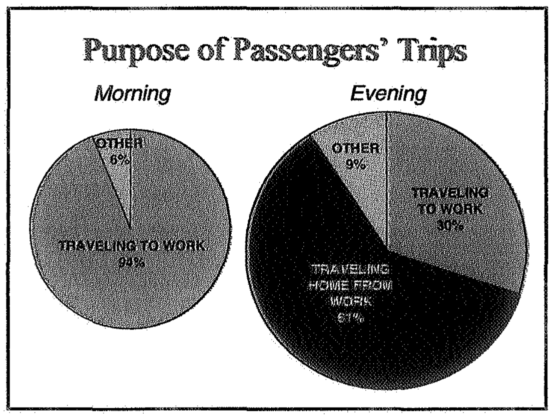
Address ____
OR Street & block no. ____
OR Nearest intersection ____
OR Building name ____

Passenger Survey

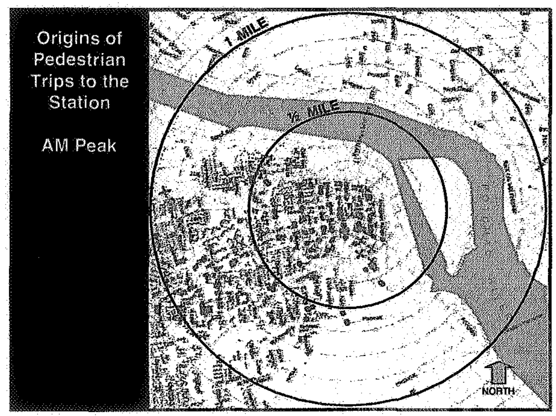
- Passengers offered a card while entering the station
- Survey date: September 26, 2001
- Survey response:
  - AM: 385 cards (10% of peak period)
  - PM: 319 cards (4% of peak period)

How Do Passengers Get to the Station?

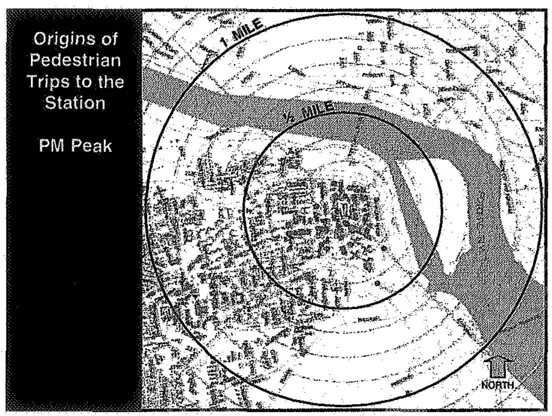




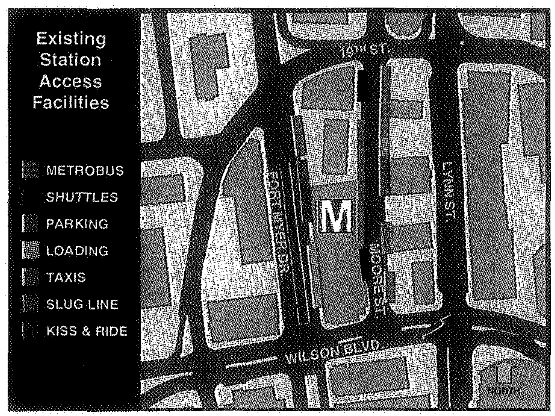
Purpose of Passengers' Trips
Morning
Evening
OTHER 6%
TRAVELING TO WORK 94%
OTHER 9%
TRAVELING TO WORK 30%
TRAVELING HOME FROM WORK 61%



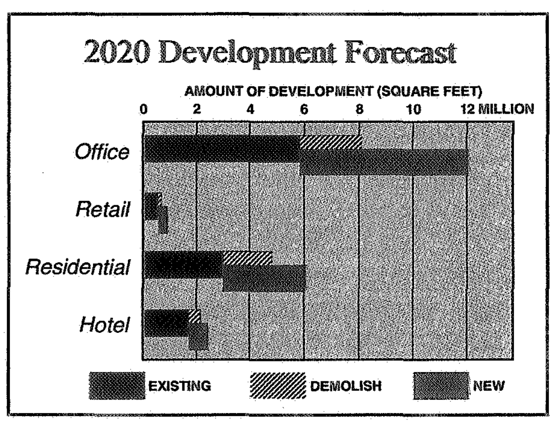
Origins of Pedestrian Trips to the Station
AM Peak
1 MILE
½ MILE
NORTH



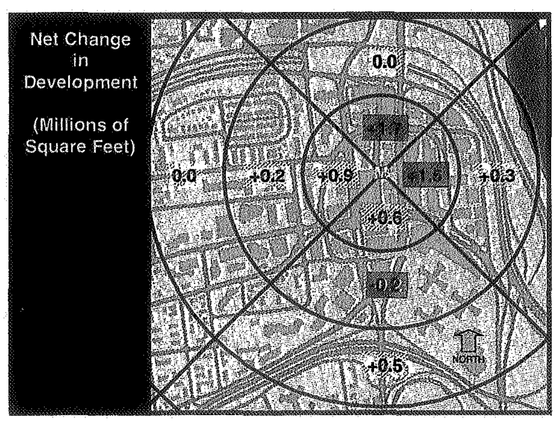
Origins of Pedestrian Trips to the Station
PM Peak
1 MILE
½ MILE
NORTH



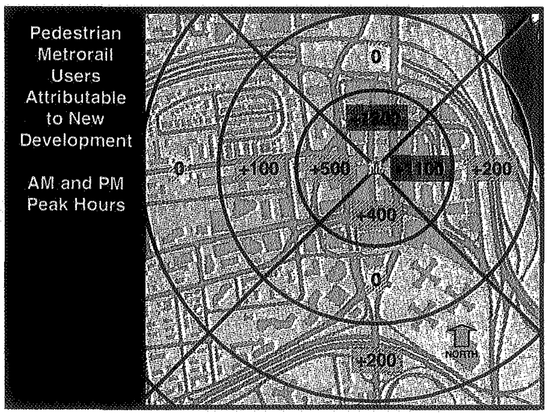
Existing Station Access Facilities
METROBUS
SHUTTLES
PARKING
LOADING
TAXIS
SLUG LINE
KISS & RIDE
19TH ST.
FORT MYER DR.
M
MOORE ST.
LYNN ST.
WILSON BLVD.
NORTH



2020 Development Forecast
AMOUNT OF DEVELOPMENT (SQUARE FEET)
0
2
4
6
8
10
12 MILLION
Office
Retail
Residential
Hotel
EXISTING
DEMOLISH
NEW



Net Change in Development
(Millions of Square Feet)
0.0
0.0
+0.2
+0.9
+0.3
+0.6
+0.5
NORTH

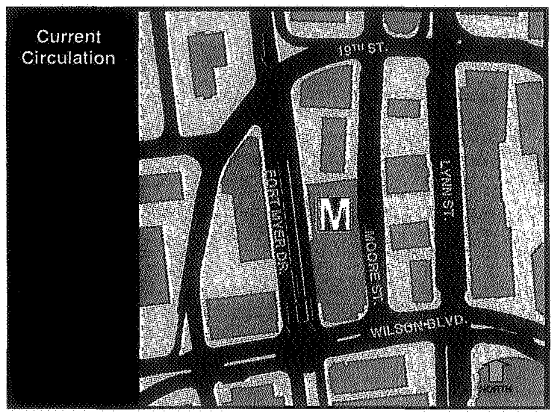


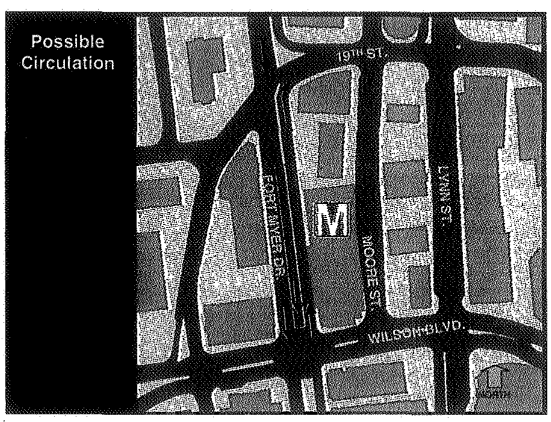
Station Access Priorities

1. Pedestrians and bicyclists
2. Disabled-accessible
3. Bus passengers
4. Dropped off passengers and motorcyclists
5. Passengers who drive and park

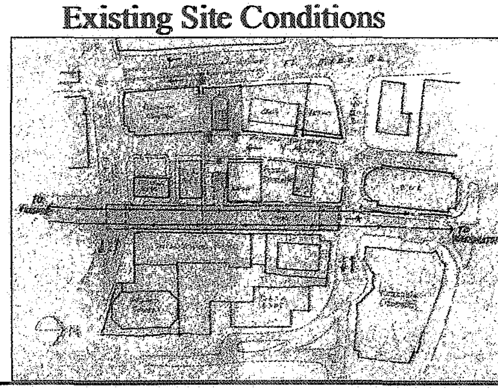
Potential Circulation Changes

- No change to Metrobus location
- No change to taxi location
- Future: reconsider curbside parking on Moore Street
- Reverse direction of Fort Myer ramp

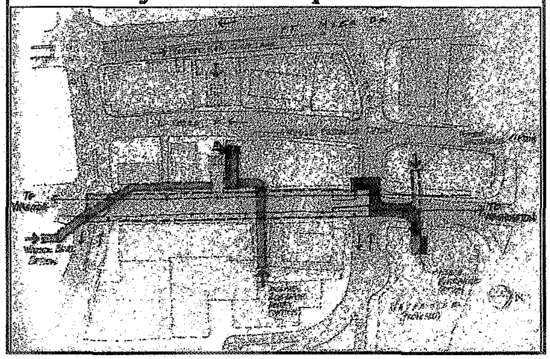




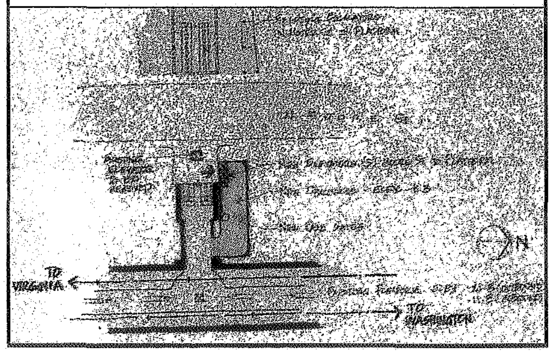
Existing Site Conditions



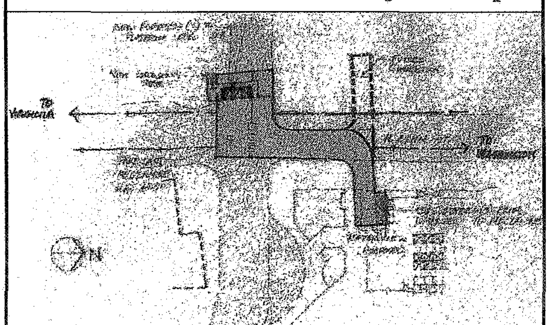
Entry Location Options



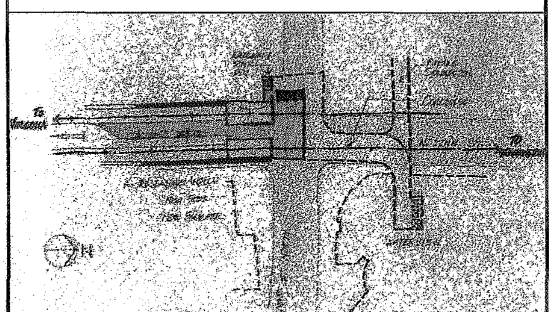
Mid-Point Entry Concept



Waterview: North Entry Concept



Upper Level Mezzanine Extension



Comments by March 1

- By mail:
  - Capital Transit Consultants
    1133 15th St., N.W., Suite 700
    Washington, DC 20005
    Attn: Rob Kerns
- By e-mail:
  - Robert.Kerns@Parsons.com

Schedule

- Final report completed by end of March

APPENDIX B

TRAFFIC AND PEDESTRIAN DATA

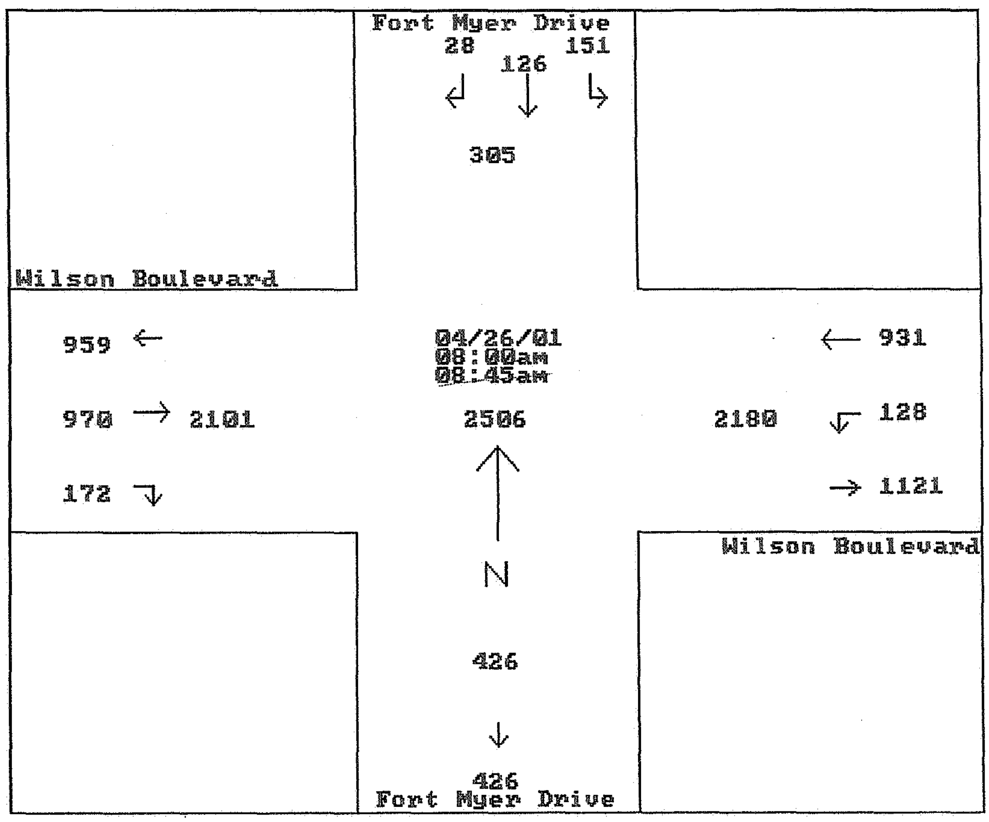
O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AA, LM
Board :D4-2237, 1910
City/County:Rosslyn/Arlington
Weather :Warm/Clear/Dry

Study Name: FORT@WIL
Site Code : 35562237
Start Date: 04/26/01
Page : 2

Total Traffic

	Fort Myer Drive From North					Fort Myer Drive From South					Wilson Boulevard From East					Wilson Boulevard From West					
End Time	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
Peak Hour Analysis By Entire Intersection for the Period: 07:00 on 04/26/01 to 08:45 on 04/26/01																					
Time	08:00					08:00					08:00					08:00					
Vol.	151	126	28	0		0	0	0	0		128	931	0	0		0	970	172	0		
Pct.	49.5	41.3	9.1	0.0		0.0	0.0	0.0	0.0		12.0	87.9	0.0	0.0		0.0	84.9	15.0	0.0		
Total	305					0					1059					1142					
High	08:00					08:15					08:15					08:30					
Vol.	50	37	7	0		0	0	0	0		31	256	0	0		0	258	45	0		
Total	94					0					287					303					
PHF	0.811					0.000					0.922					0.942					



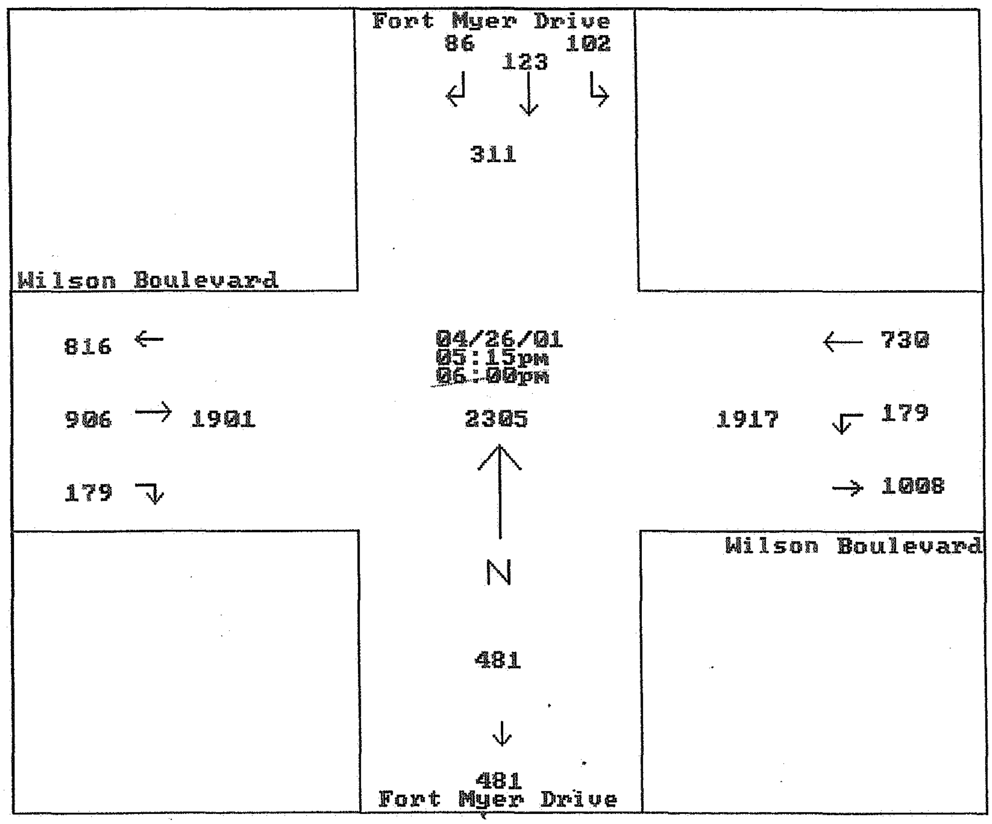
Counted by :ORGA-AA, LM
Board :D4-2237, 1910
City/County:Rosslyn/Arlington
Weather :Warm/Clear/Dry

O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Study Name: FORT@WIL
Site Code : 35562237
Start Date: 04/26/01
Page : 3

Total Traffic

	Fort Myer Drive From North					Fort Myer Drive From South					Wilson Boulevard From East					Wilson Boulevard From West					
End Time	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Left	Thru	Right	U-Turn	Aprch Total	Intvl Total
Peak Hour Analysis By Entire Intersection for the Period: 16:00 on 04/26/01 to 18:45 on 04/26/01																					
Time	17:15					17:15					17:15					17:15					
Vol.	102	123	86	0		0	0	0	0		179	730	0	0		0	906	179	0		
Pct.	32.7	39.5	27.6	0.0		0.0	0.0	0.0	0.0		19.6	80.3	0.0	0.0		0.0	83.5	16.4	0.0		
Total	311					0					909					1085					
High	17:45					17:30					17:30					18:00					
Vol.	23	43	25	0		0	0	0	0		43	208	0	0		0	246	46	0		
Total	91					0					251					292					
PHF	0.854					0.000					0.905					0.928					



9

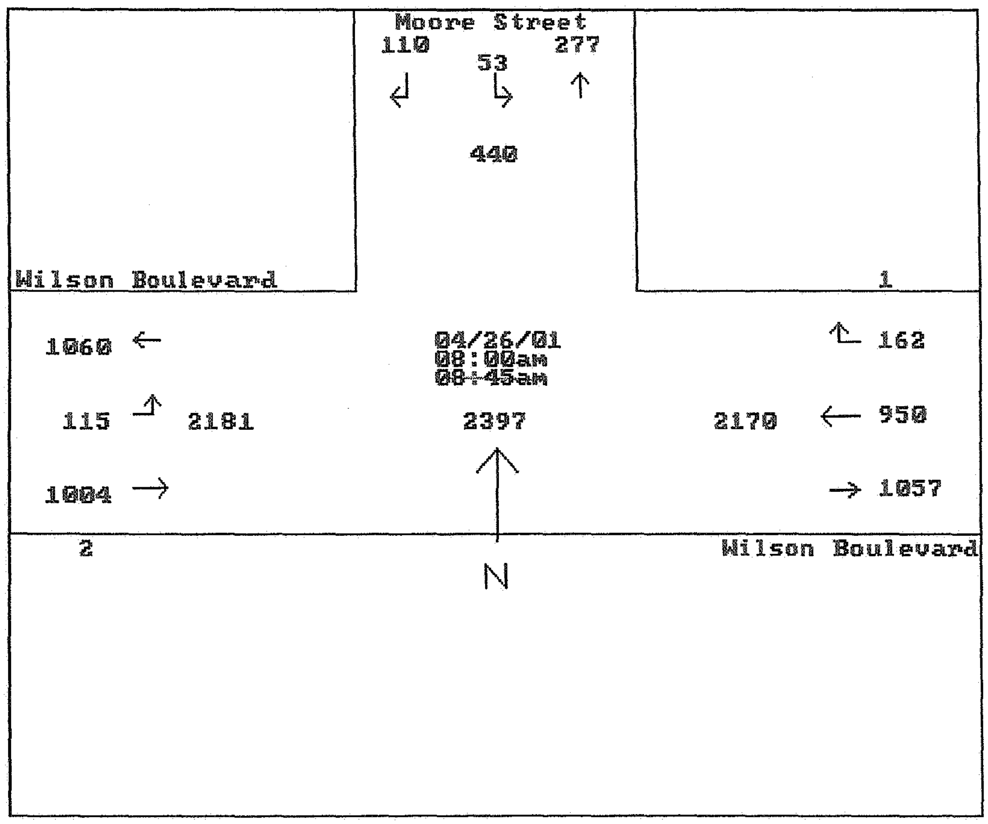
O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-MS
Board :D4-2238
City/County:Rosslyn/Arlington
Weather :Warm/Clear/Dry

Study Name: WIL@MOOR
Site Code : 32552238
Start Date: 04/26/01

Total Traffic

	Moore Street From North				Wilson Boulevard From East				Wilson Boulevard From West				
End Time	Left	Right	U-Turn	Apprch. Total	Thru	Right	U-Turn	Apprch. Total	Left	Thru	U-Turn	Apprch. Total	Intrvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 07:00 on 04/26/01 to 08:45 on 04/26/01													
Time	08:00				08:00				08:00				
Vol.	53	110	0:00		950	162	1		115	1004	2		
Pct.	32.5	67.4	0.0		85.3	14.5	8.9		10.2	89.5	0.1		
Total	163				1113				1121				
High	08:00				08:15				08:15				
Vol.	10	36	0		257	44	0		30	264	0		
Total	46				301				294				
PHF	0.885				0.924				0.953				



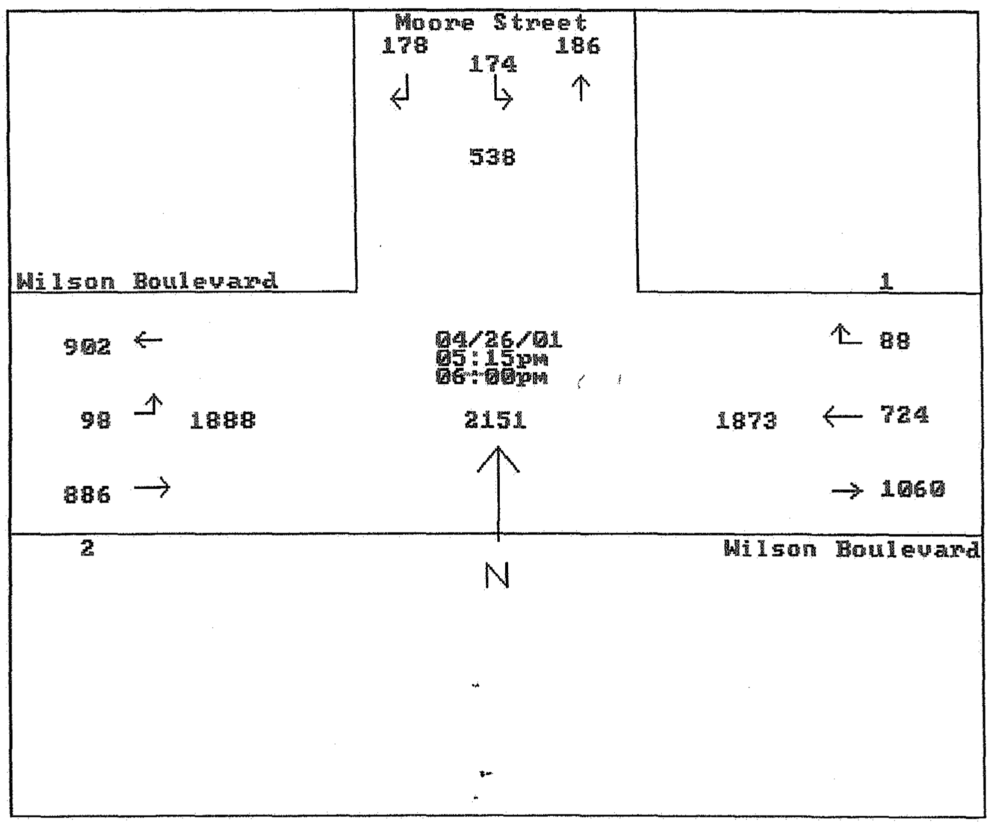
O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-MS
Board :D4-2238
City/County:Rosslyn/Arlington
Weather :Warm/Clear/Dry

Study Name: WIL@MOOR
Site Code : 32552238
Start Date: 04/26/01
Page : 3

Total Traffic

	Moore Street From North				Wilson Boulevard From East				Wilson Boulevard From West				
End Time	Left	Right	U-Turn	Apprch. Total	Thru	Right	U-Turn	Apprch. Total	Left	Thru	U-Turn	Apprch. Total	Intrvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 16:00 on 04/26/01 to 18:45 on 04/26/01													
Time	17:15				17:15				17:15				
Vol.	174	178	0:15		724	88	1		98	886	2		
Pct.	49.4	50.5	0.0		89.0	10.8	0.1		9.9	89.8	0.2		
Total	352				813				986				
High	17:15				17:15				18:00				
Vol.	47	51	0		193	30	1		30	230	1		
Total	98				224				261				
PHF	0.897				0.907				0.944				



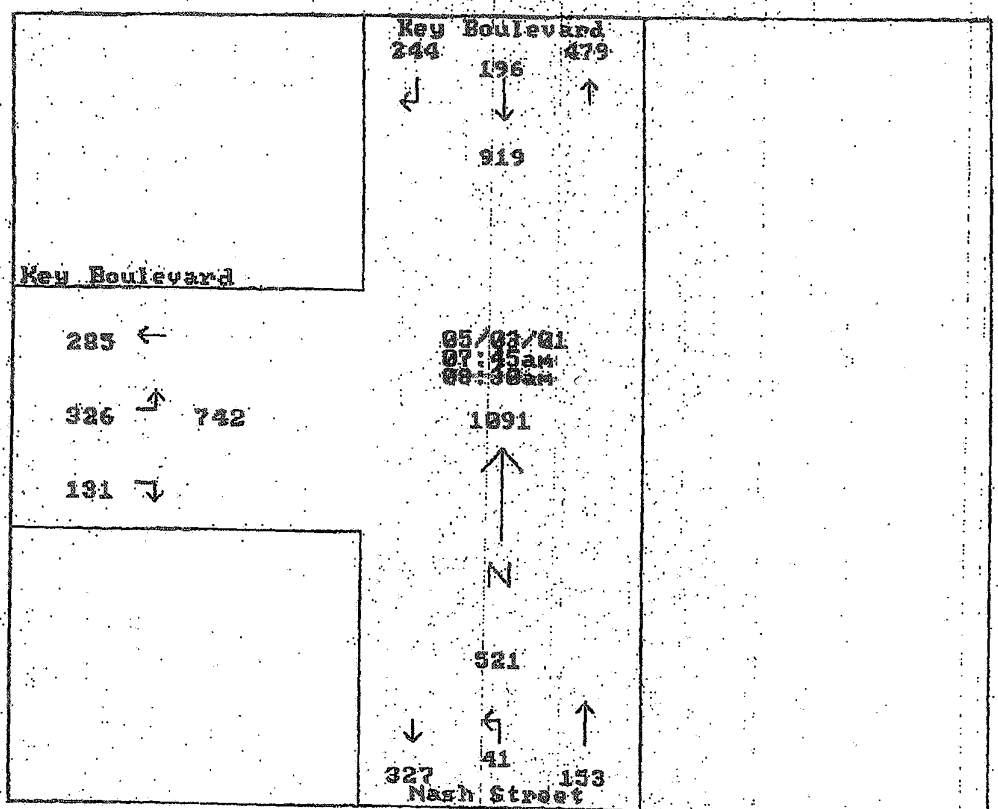
O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AS, MS
Board :D4-1908, D4-3240
City/County:Rosslyn/Arlington County
Weather :Warm/Cloudy/Dry

Study Name: KEY@NASH
Site Code : 22171910
Start Date: 05/03/01
Page : 2

Total Traffic

	Key Boulevard From North				Nash Street From South				Key Boulevard From West				
End Time	Thru	Right	U-Turn	Apprch. Total	Left	Thru	U-Turn	Apprch. Total	Left	Right	U-Turn	Apprch. Total	Intrvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 07:00 on 05/03/01 to 09:15 on 05/03/01													
Time	07:45				07:45				07:45				
Vol.	196	244	0:45		41	153	0		326	131	0		
Pct.	44.5	55.4	0.0		21.1	78.8	0.0		71.3	28.6	0.0		
Total	440				194				457				
High	08:00				07:45				08:30				
Vol.	61	69	0		15	48	0		110	27	0		
Total	130				63				137				
PHF	0.846				0.769				0.833				



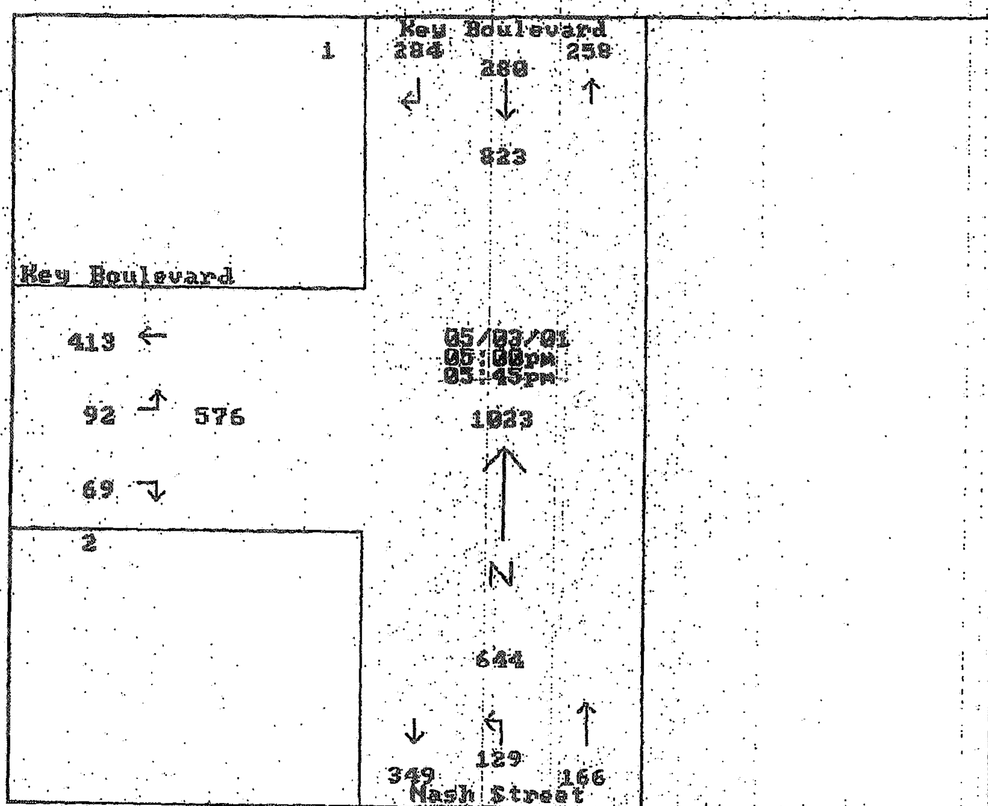
O.R. George & Associates, Inc.
1738 Elton Road, Suite 321
Silver Spring, MD 20903
Tel: (301)439-7722 Fax: (301)439-7759

Counted by :ORGA-AS, MS
Board :D4-1908, D4-2240
City/County:Rosslyn/Arlington County
Weather :Warm/Cloudy/Dry

Study Name: KEY@NASH
Site Code : 22171910
Start Date: 05/03/01
Page : 3

Total Traffic

End Time	Key Boulevard From North Thru	Right	U-Turn	Apprch. Total	Nash Street From South Left	Thru	U-Turn	Apprch. Total	Key Boulevard From West Left	Right	U-Turn	Apprch. Total	Intrvl. Total
Peak Hour Analysis By Entire Intersection for the Period: 16:00 on 05/03/01 to 18:45 on 05/03/01													
Time	17:00				17:00				17:00				
Vol.	280	284	1		129	166	0		92	69	2		
Pct.	49.5	50.2	0.1		43.7	56.2	0.0		56.4	42.3	1.2		
Total	565				295				163				
High	17:30				17:00				17:15				
Vol.	69	80	0		40	39	0		29	17	1		
Total	149				79				47				
PHF	0.947				0.933				0.867				



Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Ft. Myer Dr., S. of 19th St.,Right Turns
Location Code 63
County .... Arlington, VA
Recorder Set 05/07/01 14:20
Recording Start ... 05/08/01 00:00
Recording End 05/11/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 11
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
12	9	4	4	7	19	56	148	209	167	130	111	183	173	129	110	131	156	110	107	79	76	51	23	2204
5	0	0	1	0	3	5	28	46	48	33	19	39	54	49	28	31	29	29	24	27	17	16	7	
2	5	0	0	0	3	10	29	50	36	28	31	47	48	28	25	36	41	26	27	17	17	10	6	
2	4	1	1	4	7	15	39	57	43	33	25	56	36	28	31	23	43	20	28	19	18	17	5	
3	0	3	2	3	6	26	52	56	40	36	36	41	35	24	26	41	43	35	28	16	24	8	5	

AM Peak Hour .... 08:15 to 09:15 (211 vehicles)
AM Peak Hour Factor 92.5%
PM Peak Hour .... 12:30 to 13:30 (199 vehicles)
PM Peak Hour Factor 88.8%

05/09/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
11	8	7	3	3	14	36	158	194	162	138	158	175	134	131	131	104	153	135	114	92	63	52	20	2196
5	2	3	1	0	1	4	26	41	58	27	32	46	36	28	28	27	33	38	31	25	21	24	6	
1	0	0	1	1	2	6	32	46	41	26	37	50	25	35	38	26	33	36	23	10	17	13	7	
2	1	1	0	2	6	10	47	44	33	32	44	36	35	38	39	19	52	33	43	31	11	11	4	
3	5	3	1	0	5	16	53	63	30	53	45	43	38	30	26	32	35	28	17	26	14	4	3	

AM Peak Hour .... 08:15 to 09:15 (211 vehicles)
AM Peak Hour Factor 83.7%
PM Peak Hour .... 12:00 to 13:00 (175 vehicles)
PM Peak Hour Factor 87.5%

24-Hour Moving Total

01:00-	2203	02:00-	2202	03:00-	2205	04:00-	2204	05:00-	2200	06:00-	2195	07:00-	2175	08:00-	2185
09:00-	2170	10:00-	2165	11:00-	2173	12:00-	2220	13:00-	2212	14:00-	2173	15:00-	2175	16:00-	2196
17:00-	2169	18:00-	2166	19:00-	2191	20:00-	2198	21:00-	2211	22:00-	2198	23:00-	2199	24:00-	2196

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... N. Lynn St., N. of Wilson Blvd.,NB
Location Code 11
County .... Arlington, VA
Recorder Set 05/06/01 12:55
Recording Start ... 05/08/ 1 00:00
Recording End 05/09/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 21
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/ 1 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
184	92	66	36	52	224	944	2119	2192	1861	1635	1426	1410	1447	1400	1450	1656	1735	1774	1143	703	574	474	333	24830
69	25	21	8	9	33	133	481	615	535	425	311	369	389	381	341	391	401	461	346	198	154	129	95	
35	29	18	11	10	46	152	486	568	419	447	340	328	360	316	375	418	438	470	291	174	152	116	89	
44	24	16	8	8	60	220	567	527	432	401	372	389	352	348	338	395	411	445	274	171	138	122	77	
36	14	11	9	25	85	339	585	482	476	362	403	324	346	355	396	452	485	398	232	160	130	107	72	

AM Peak Hour .... 07:30 to 08:30 (2335 vehicles)
AM Peak Hour Factor 94.9%
PM Peak Hour .... 17:45 to 18:45 (1861 vehicles)
PM Peak Hour Factor 95.9%

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Wilson Blvd., W. of N. Lynn St, EB
Location Code 32
County .... Arlington, VA
Recorder Set 05/06/02 12:55
Recording Start ... 05/07/01 00:00
Recording End 05/10/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 20
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/07/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
72	28	25	17	65	291	713	988	1280	983	681	779	901	728	774	735	955	1228	917	687	471	445	306	170	14239
33	6	9	5	4	19	122	221	296	266	168	204	218	197	233	167	229	347	280	195	119	115	90	63	
17	8	7	4	18	49	162	222	342	271	172	172	210	177	139	190	206	278	233	182	124	109	71	27	
10	8	4	3	13	86	183	268	324	236	186	171	227	189	175	208	253	297	225	169	100	126	69	38	
12	6	5	5	30	137	246	277	318	210	155	232	246	165	227	170	267	306	179	141	128	95	76	42	

AM Peak Hour .... 08:00 to 09:00 (1280 vehicles)
AM Peak Hour Factor 93.6%
PM Peak Hour .... 17:00 to 18:00 (1228 vehicles)
PM Peak Hour Factor 88.5%

05/08/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
110	44	21	13	61	310	679	1016	1227	1034	731	822	865	839	759	764	874	1173	974	755	547	482	379	183	14662
27	13	6	4	12	20	141	248	322	284	186	184	196	204	185	187	190	313	253	237	157	114	110	62	
40	11	3	3	4	59	148	227	345	277	185	199	204	217	187	162	236	296	251	208	137	134	92	58	
23	11	7	2	17	96	176	256	281	246	187	226	222	228	201	219	203	285	244	169	131	112	85	39	
20	9	5	4	28	135	214	285	279	227	173	213	243	190	186	196	245	279	226	141	122	122	92	24	

AM Peak Hour .... 07:45 to 08:45 (1233 vehicles)
AM Peak Hour Factor 89.3%
PM Peak Hour .... 17:00 to 18:00 (1173 vehicles)
PM Peak Hour Factor 93.7%

24-Hour Moving Total

01:00- 14277	02:00- 14293	03:00- 14289	04:00- 14285	05:00- 14281	06:00- 14300	07:00- 14266	08:00- 14294
09:00- 14241	10:00- 14292	11:00- 14342	12:00- 14385	13:00- 14349	14:00- 14460	15:00- 14445	16:00- 14474
17:00- 14393	18:00- 14338	19:00- 14395	20:00- 14463	21:00- 14539	22:00- 14576	23:00- 14649	24:00- 14662

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Wilson Blvd., W. of N. Lynn St, WB
Location Code 44
County .... Arlington, VA
Recorder Set 05/06/01 12:55
Recording Start ... 05/07/01 00:00
Recording End 05/08/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 21
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/07/01 Channel: 1 Direction: E

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
74	38	27	21	32	204	498	696	833	664	510	564	651	635	573	573	672	768	589	492	308	324	260	165	10171
25	12	10	8	6	14	101	156	218	194	113	152	158	153	148	135	149	183	197	118	80	102	71	53	
21	11	7	5	7	41	106	162	202	165	142	118	180	153	121	149	133	203	138	138	83	66	65	49	
14	7	2	3	9	63	133	183	223	181	114	146	145	173	180	144	193	185	121	129	72	70	73	38	
14	8	8	5	10	86	158	195	190	124	141	148	168	156	124	145	197	197	133	107	73	86	51	25	

AM Peak Hour .... 07:45 to 08:45 (838 vehicles)
AM Peak Hour Factor 93.9%
PM Peak Hour .... 17:15 to 18:15 (782 vehicles)
PM Peak Hour Factor 96.3%

Volume Count Report

Generated by MSC3000 Version 2.01

Location .... Ft Myer Drive, S. of 19th st.,Left Turns
Location Code 6333
County .... Arlington County, VA
Recorder Set 05/06/01 14:20
Recording Start ... 05/08/ 1 00:00
Recording End 05/10/ 1 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 29
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/ 1 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
13	4	4	4	15	40	130	257	349	304	232	172	181	202	137	127	148	193	161	99	72	56	39	17	2956
4	1	2	0	0	2	22	58	86	89	72	37	42	54	47	34	45	50	47	32	16	13	13	7	
3	1	1	2	6	8	29	63	86	72	62	43	50	53	21	37	29	47	43	19	25	16	11	7	
5	1	0	0	2	16	39	65	85	62	53	40	50	60	33	22	42	55	40	30	13	11	6	1	
1	1	1	2	7	14	40	71	92	81	45	52	39	35	36	34	32	41	31	18	18	16	9	2	

AM Peak Hour .... 08:15 to 09:15 (352 vehicles)
AM Peak Hour Factor 95.7%
PM Peak Hour .... 12:45 to 13:45 (206 vehicles)
PM Peak Hour Factor 85.8%

05/09/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
13	3	3	5	14	52	151	329	364	383	244	241	162	194	188	169	141	166	135	107	85	51	46	29	3275
3	1	0	3	2	5	28	63	101	107	59	54	38	52	41	52	30	45	33	23	30	20	10	7	
5	1	3	0	5	10	26	70	77	97	70	53	41	56	44	36	35	45	36	23	22	11	14	7	
3	0	0	0	2	16	33	80	105	102	71	55	39	49	46	42	31	39	33	27	19	17	15	5	
2	1	0	2	5	21	64	116	81	77	44	79	44	37	57	39	45	37	33	34	14	3	7	10	

AM Peak Hour .... 07:45 to 08:45 (399 vehicles)
AM Peak Hour Factor 86.0%
PM Peak Hour .... 12:45 to 13:45 (201 vehicles)
PM Peak Hour Factor 89.7%

24-Hour Moving Total

01:00-	2956	02:00-	2955	03:00-	2954	04:00-	2955	05:00-	2954	06:00-	2966	07:00-	2987	08:00-	3059
09:00-	3074	10:00-	3153	11:00-	3165	12:00-	3234	13:00-	3215	14:00-	3207	15:00-	3258	16:00-	3300
17:00-	3293	18:00-	3266	19:00-	3240	20:00-	3248	21:00-	3261	22:00-	3256	23:00-	3263	24:00-	3275

Volume Count Report

Location .... Ft. Myer Dr., S. of 19th St., Through
Location Code 633
County .... Arlington, VA
Recorder Set 05/07/01 14:27
Recording Start ... 05/08/01 00:00
Recording End 05/11/01 00:00
Sample Time .... 15 Minutes
Operator Number ... 16
Machine Number 18
Channel 1
Divide By 2
Summation .... No
Two-Way .... No

05/08/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
146	76	62	23	26	110	244	515	628	441	448	483	457	506	663	815	1032	1115	945	675	495	435	369	280	10989
54	24	23	5	8	20	47	114	162	109	106	98	127	135	162	205	228	254	268	192	134	116	115	86	
30	21	17	8	3	21	48	112	160	125	143	105	95	124	155	203	260	300	242	164	116	111	85	68	
33	19	16	6	2	31	71	116	163	101	92	144	123	126	171	184	272	294	231	169	129	97	88	64	
29	12	6	4	13	38	78	173	143	106	107	136	112	121	175	223	272	267	204	150	116	111	81	62	

AM Peak Hour .... 07:45 to 08:45 (658 vehicles)
AM Peak Hour Factor 95.1%
PM Peak Hour .... 17:15 to 18:15 (1129 vehicles)
PM Peak Hour Factor 94.1%

05/09/01 Channel: 1 Direction: S

0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Totals
176	98	72	34	29	144	235	510	665	537	447	480	476	534	573	783	996	1145	1021	645	552	506	426	294	11378
60	27	18	13	6	27	41	114	177	138	110	109	118	133	140	209	238	303	293	176	151	144	112	112	
49	33	19	9	5	23	48	123	157	136	110	130	118	129	125	168	243	286	255	166	137	136	109	61	
41	25	20	3	7	45	63	126	167	130	128	113	125	143	162	187	292	264	256	172	149	106	109	60	
26	13	15	9	11	49	83	147	164	133	99	128	115	129	146	219	223	292	217	131	115	120	96	61	

AM Peak Hour .... 08:00 to 09:00 (665 vehicles)
AM Peak Hour Factor 93.9%
PM Peak Hour .... 17:00 to 18:00 (1145 vehicles)
PM Peak Hour Factor 94.5%

24-Hour Moving Total

01:00- 11019	02:00- 11041	03:00- 11051	04:00- 11062	05:00- 11065	06:00- 11099	07:00- 11090	08:00- 11085
09:00- 11122	10:00- 11218	11:00- 11217	12:00- 11214	13:00- 11233	14:00- 11261	15:00- 11171	16:00- 11139
17:00- 11103	18:00- 11133	19:00- 11209	20:00- 11179	21:00- 11236	22:00- 11307	23:00- 11364	24:00- 11378

Rosslyn Pedestrian Counts, Thursday 4/26/2001

start time	Entering faregates			Exiting faregates		
	From Skywalk	From Street	Other	To Skywalk	To Street	Other
7:00 a.m.	1	78	0	38	74	3
7:15 a.m.	4	52	1	39	100	2
7:30 a.m.	9	79	2	39	122	4
7:45 a.m.	6	94	0	73	161	2
8:00 a.m.	4	80	0	38	150	2
8:15 a.m.	3	106	0	41	122	5
8:30 a.m.	12	70	0	44	145	3
8:45 a.m.	8	79	0	44	185	6
TOTAL	47	638	3	356	1059	27

Tuesday, 5/1/2001

start time	Entering faregates			Exiting faregates		
	From Skywalk	From Street	Other	To Skywalk	To Street	Other
4:30 p.m.	51	113	0	4	50	2
4:45 p.m.	55	87	0	2	68	1
5:00 p.m.	62	173	0	6	75	0
5:15 p.m.	42	144	0	9	74	0
5:30 p.m.	28	118	0	5	85	2
5:45 p.m.	17	98	1	8	96	0
6:00 p.m.	23	109	0	4	57	0
6:15 p.m.	10	91	0	3	56	0
TOTAL	288	933	1	41	561	5

Rosslyn Access Study - Summary of Pedestrian Counts CTC/WMATA Date: May 1, 2001				
Time (A.M.)	**Peds entering station from:**		**Peds exiting station to:**	
Location	**2-Hour Vol.**	**% of Total**	**2-Hour Vol.**	**% of Total**
Ft. Myer Drive	1233	42	1418	34
Mall	132	5	698	17
Moore St. - SB entrance	864	30	658	16
Skywalk	47	2	356	8
Moore St. - NB entrance	638	22	1059	25
TOTALS	2914	100	4189	100
Time (P.M.)	**Peds entering station from:**		**Peds exiting station to:**	
Location	**2-Hour Vol.**	**% of Total**	**2-Hour Vol.**	**% of Total**
Ft. Myer Drive	1290	33	836	33
Mall	363	9	309	12
Moore St. - SB entrance	988	26	800	31
Skywalk	288	7	41	2
Moore St. - NB entrance	933	24	561	22
TOTALS	3862	100	2547	100

Rosslyn Access Study
CTC/WMATA
Date: May 1, 2001

Time	Northbound In	Southbound In	Total In	Northbound Out	Southbound Out	Total Out	K+R to Train
(A.M.)							
7:00-7:15	48	52	100	13	97	110	3
7:30-7:45	48	59	107	15	88	103	2
7:30-7:45	67	62	129	36	108	144	3
7:45-8:00	82	50	132	47	170	217	8
8:00-8:15	93	70	163	36	190	226	5
8:15-8:30	107	61	168	29	142	171	4
8:30-8:45	136	84	220	25	192	217	6
8:45-9:00	134	80	214	20	210	230	2
Totals	715	518	1233	221	1197	1418	33
Time	Northbound In	Southbound In	Total In	Northbound Out	Southbound Out	Total Out	K+R to Train
(P.M.)							
4:30-4:45	68	21	89	17	11	28	2
4:45-5:00	116	27	143	29	48	77	1
5:00-5:15	174	28	202	38	55	93	3
5:15-5:30	212	36	248	69	78	147	1
5:30-5:45	180	23	203	39	86	125	5
5:45-6:00	165	36	201	45	105	150	2
6:00-6:15	67	18	85	24	96	120	5
6:15-6:30	101	18	119	40	56	96	2
Totals	1083	207	1290	301	535	836	21

Rosslyn Access Study
CTC/WMATA
Date: May 1, 2001

Time (A.M.)	In from Ft. Myer	In from Moore	In from Mall	Total In	Out to Ft. Myer	Out to Moore	Out to Mall	Total Out
7:00-7:15	72	71	10	153	138	42	50	230
7:30-7:45	78	62	18	158	148	43	75	266
7:30-7:45	135	123	15	273	188	57	87	332
7:45-8:00	155	93	17	265	209	100	126	435
8:00-8:15	200	124	18	342	230	109	100	439
8:15-8:30	234	126	20	380	217	92	90	399
8:30-8:45	240	138	20	398	185	125	81	391
8:45-9:00	236	127	14	377	213	90	89	392
Totals	1350	864	132	2346	1528	658	698	2884

Time (P.M.)	In from Ft. Myer	In from Moore	In from Mall	Total In	Out to Ft. Myer	Out to Moore	Out to Mall	Total Out
4:30-4:45	164	128	47	339	76	90	35	201
4:45-5:00	216	127	47	390	100	80	24	204
5:00-5:15	302	155	57	514	94	73	30	197
5:15-5:30	262	172	62	496	99	108	36	243
5:30-5:45	220	137	40	397	121	101	63	285
5:45-6:00	159	103	35	297	148	130	40	318
6:00-6:15	178	87	39	304	131	100	51	282
6:15-6:30	151	79	36	266	105	118	30	253
Totals	1652	988	363	3003	874	800	309	1983

Rosslyn Access Study: Metrobus transfers
CTC/WMATA
Date: April 4, 2001

Time (A.M.)	Peds on Bus	Peds Off Bus	Total Bus Peds
7:30-7:45	18	31	49
7:45-8:00	10	24	34
8:00-8:15	32	46	78
8:15-8:30	13	34	47
8:30-8:45	21	20	41
8:45-9:00	8	25	33
9:00-9:15	0	6	6
9:15-9:30	18	21	39
Totals	120	207	327

Time (P.M.)	Peds on Bus	Peds Off Bus	Total Bus Peds
4:30-4:45	19	10	29
4:45-5:00	17	8	25
5:00-5:15	28	15	43
5:15-5:30	15	2	17
5:30-5:45	36	7	43
5:45-6:00	25	5	30
6:00-6:15	47	6	53
6:15-6:30	32	12	44
Totals	219	65	284

							all elevator users				elevator users with "need"			
movement:	1	2	3	4	5	6	7	8	9	10	7	8	9	10
	down escalator from plaza	bypass escalator, up steps	up escalator, then right	up escalator, up steps	down steps, down escalator	down steps, bypass escalator	skywalk		street		skywalk		street	
							on elevator	off elevator	on elevator	off elevator	on elevator	off elevator	on elevator	off elevator
7:00 a.m.	2	2	41	16	5	1	1	10	2	6	1	0	0	0
7:15 a.m.	0	4	36	44	16	3	1	11	2	12	0	1	1	1
7:30 a.m.	2	3	32	22	26	1	0	9	7	1	0	3	0	0
7:45 a.m.	1	13	55	33	30	6	3	14	8	14	0	0	1	0
8:00 a.m.	7	7	49	29	36	8	1	5	6	12	0	0	0	0
8:15 a.m.	5	5	42	16	52	8	1	8	3	7	0	0	0	0
8:30 a.m.	6	5	39	14	30	4	1	9	7	17	1	1	0	0
8:45 a.m.	6	9	38	23	13	9	0	3	8	19	0	0	1	2
4:30 p.m.	37	4	4	11	27	4	5	1	19	13	0	1	2	0
4:45 p.m.	43	0	9	5	22	2	5	1	9	15	1	1	2	1
5:00 p.m.	43	7	0	11	40	5	4	0	27	15	0	0	3	0
5:15 p.m.	20	6	1	16	21	3	7	2	16	21	0	0	0	1
5:30 p.m.	23	8	4	17	13	4	1	1	17	17	0	0	1	0
5:45 p.m.	16	5	4	23	15	2	4	0	7	22	1	0	0	1
6:00 p.m.	18	2	2	14	8	3	1	0	9	15	0	0	2	1
6:15 p.m.	11	6	4	21	13	2	3	1	15	5	0	0	0	0

Note: During the PM study, the "down" escalator was out of service for maintenance. The "up" escalator served as 2-way stairs. During the 2-hour study, at least 8 pedestrians appeared to reject use of the escalator after observing that it was out of service. Most of these pedestrians entered the Rosslyn Metro Mall, where they presumably found an elevator or escalator to get them to ground level. It was not clear how many pedestrians at ground level may have chosen not to ride the escalator since it was not operational.

Rosslyn Pedestrian Counts, Thursday 4/26/2001						
	Entering faregates			Exiting faregates		
start time	From Skywalk	From Street	Other	To Skywalk	To Street	Other
7:00 a.m.	1	78	0	38	74	3
7:15 a.m.	4	52	1	39	100	2
7:30 a.m.	9	79	2	39	122	4
7:45 a.m.	6	94	0	73	161	2
8:00 a.m.	4	80	0	38	150	2
8:15 a.m.	3	106	0	41	122	5
8:30 a.m.	12	70	0	44	145	3
8:45 a.m.	8	79	0	44	185	6
Tuesday, 5/1/2001						
	Entering faregates			Exiting faregates		
start time	From Skywalk	From Street	Other	To Skywalk	To Street	Other
4:30 p.m.	51	113	0	4	50	2
4:45 p.m.	55	87	0	2	68	1
5:00 p.m.	62	173	0	6	75	0
5:15 p.m.	42	144	0	9	74	0
5:30 p.m.	28	118	0	5	85	2
5:45 p.m.	17	98	1	8	96	0
6:00 p.m.	23	109	0	4	57	0
6:15 p.m.	10	91	0	3	56	0

Traffic using the Bus Alley between Moore and Lynn Streets north of Wilson Blvd.

Bus	Time
GUTS	8:00
GMC	8:02
GUTS	8:08
GMC	8:10
3B	8:12
5B	8:15
GUTS	8:19
GMC	8:19
15K	8:21
Out of service Metrobus	8:24
GUTS	8:27
38B	8:28
Metrobus	8:29
GMC	8:31
Metrobus	8:32
GUTS	8:40
3B	8:41
38B	8:43
GMC	8:43
GUTS	8:50
Metrobus	8:53
Out of service Metrobus	8:54
GMC	8:55
3A	8:57
GUTS	8:59
AM Sum	**25**
GUTS	5:00
GMC	5:01
GMC	5:03
3A	5:05
GMC	5:08
GUTS	5:08
GMC	5:14
15K	5:11
38B	5:15
3B	5:19
GMC	5:20
5B	5:21
GUTS	5:22
3A	5:28
5B	5:28
GUTS	5:30
GUTS	5:33
38B	5:37
GMC	5:38
15K	5:39
3B	5:41
GUTS	5:42
GUTS	5:50
38B	5:49
GMC	5:48
Metrobus	5:54
GMC	5:56
PM Sum	**27**

Shuttles stopping on Moore St. south of the Metro station entrance							
	Arrival			Passengers		Departure	
Shuttle	Time	Direction	Bay	boarding	alighting	Time	Notes
GUTS	8:00	SB	C.5	1	0		Stopped briefly to pick up one straggler. Also stopped north end.
MFATC	8:00	SB	E	9	0	8:04	Arrived ~7:58; 9 passengers boarded after 8:00.
GMC	8:02	SB	D	7	4		Bay E occupied
MFATC	8:05	SB	E	4	0		
NFATC	8:05	NB		5	1	8:17	
GMC	8:06	SB	D	8	2	8:11	Blocks bay D for Metrobus.
Sequoia	8:11	SB	E	12	0		
GMC	8:13	SB	D	2	4	8:19	
VCS	8:16	NB		0	2		
Main State - NFATC	8:18	SB	E	34	0	8:24	
VCS	8:26	NB		1	8		Blocks NB traffic.
GMC	8:30	SB	C	10	5	8:31	Bay D occupied, but E free.
State	8:30	NB		4	0		
VCS	8:37	NB		0	2		
State	8:37	SB	E	21	0		
State	8:38	NB		1	0	8:40	
Potomac Towers	8:36	SB	E	0	0	8:53	Occupied bay E for 17 minutes with no boardings or alightings.
State	8:41	SB	D	2	0		
GMC	8:42	SB	D	12	2		
VCS	8:45	NB		0	2		Blocks NB traffic.
State	8:49	NB		1	0		
VCS	8:49	NB		0	5		Blocks NB traffic.
GMC	8:52	SB	D	17	6	8:55	
Sequoia	8:53	SB	E	1	0		
VCS	8:56	SB	C	0	6		
GMC	8:58	SB	D	3	2		
NFATC	8:59	SB	E	8	0		
AM Sum	**27**			**163**	**51**		
GMC	5:00	SB	D	0	0	5:01	Present at 5:00 p.m.
GMC	5:00	SB	D.5	0	0	5:03	Present at 5:00 p.m.
NFATC	5:02	SB	E	0	3		Bay E blocked by Kiss & Ride activity; delayed shuttle.
State	5:02	NB		1	0		
VCS	5:04	SB	C	2	3		Blocks SB traffic.
GMC	5:06	SB	C	2	3	5:07	Stops in street and converses with 5:07 GMC, blocking SB traffic.
GMC	5:07	SB	D	0	3	5:14	
Potomac Towers	5:09	SB	C	0	1		

Shuttles stopping on Moore St. south of the Metro station entrance							
	Arrival			Passengers		Departure	
Shuttle	Time	Direction	Bay	boarding	alighting	Time	Notes
VCS	5:15	SB	C	1	0		
GMC	5:16	SB	C.5	0	4	5:20	Partially blocks SB traffic during entire dwell time. Bay D occupied.
Executive Club Suites	5:18	SB	C.5	1	0		Blocks SB traffic.
Sequoia	5:18	SB	E	0	5	5:22	
VCS	5:20	SB	C.5	0	0		
NFATC - State	5:23	NB		1	43	5:26	Stops in slug line; blocks all NB traffic.
State	5:27	NB		0	1		
VCS	5:30	SB	C	3	0		
Marriott - GUTS	5:33	SB	C	4	1		Also stopped north end?
State	5:34	NB		0	5		Blocks NB traffic.
GMC	5:36	SB	C.5	12	18		
VCS	5:39	SB	C.5	4	0		
GUTS	5:43	SB	B.5	3	15		
GMC	5:47	SB	C.5	5	2	5:49	Blocks bay C for Metrobus. Moves to bay D before departing.
VCS	5:51	NB		8	0		
GMC	5:55	SB	C.5	5	8		
Sequoia	5:58	SB	E	0	1		
PM Sum	**25**			**52**	**116**		

General Notes

Shuttle types:	GMC	Georgetown Metro Connection. Designated to stop in Bay E, but cannot use bus alley when stopping in Bay E. Appears to prefer to stop in Bay D when not in use. Often blocks other buses/shuttles from using their designated bays. Blocks NB traffic when bay D is occupied.
	GUTS	Georgetown University Transportation Shuttle. Designated to stop in Bay A, but occasionally stops further south when bay A is occupied or when flagged down by a passenger.
	VCS	Virginia Corporate Suites. Observed using both directions of Moore St. Usually stops in street to load/unload passengers. However, stops are usually brief enough that Moore Street traffic is not delayed.
	State	Also labeled MFATC or NFATC. Observed using both directions of Moore St.
	Sequoia	One of the few obedient users of bay E.

Departure times are indicated for shuttles that dwell after handling passengers.

Bays ending with ".5" indicate that a shuttle did not stop in a bay, but stopped between bays, likely blocking or partially restricting SB Moore Street traffic.

Pedestrian count at intersection of Wilson Blvd. & Lynn St.															
	Peds Crossing Wilson Blvd.							Peds Crossing Lynn St.							
Start	In East Crosswalk			In West Crosswalk				In North Crosswalk			In South Crosswalk				**Total**
Time	NB	SB	Both dir.	NB	SB	Both dir.	**Subtotal**	EB	WB	Both dir.	EB	WB	Both dir.	**Subtotal**	**all peds**
8:00 a.m.	45	34	**79**	54	24	**78**	**157**	68	52	**120**	38	45	**83**	**203**	**360**
8:15 a.m.	48	28	**76**	70	40	**110**	**186**	67	71	**138**	43	64	**107**	**245**	**431**
8:30 a.m.	72	37	**109**	76	31	**107**	**216**	72	66	**138**	39	59	**98**	**236**	**452**
8:45 a.m.	68	33	**101**	67	29	**96**	**197**	90	69	**159**	36	60	**96**	**255**	**452**
AM Sum	**233**	**132**	**365**	**267**	**124**	**391**	**756**	**297**	**258**	**555**	**156**	**228**	**384**	**939**	**1695**
5:00 p.m.	32	38	**70**	42	28	**70**	**140**	30	110	**140**	28	34	**62**	**202**	**342**
5:15 p.m.	38	44	**82**	39	38	**77**	**159**	40	104	**144**	32	49	**81**	**225**	**384**
5:30 p.m.	29	48	**77**	28	32	**60**	**137**	44	63	**107**	29	30	**59**	**166**	**303**
5:45 p.m.	39	46	**85**	31	59	**90**	**175**	65	82	**147**	53	28	**81**	**228**	**403**
PM Sum	**138**	**176**	**314**	**140**	**157**	**297**	**611**	**179**	**359**	**538**	**142**	**141**	**283**	**821**	**1432**

Pedestrian count at Custis Bike Path near Key Bridge																	
	Activity from Custis Trail								Activity on Key Bridge Sidewalks								
Start	Eastbound and Westbound Direction								Northbound Direction				Southbound Direction				
Time	WBL		WBT		WBR		EBT		NBT		NBR		SBL		SBT		Grand
	Bikes	Peds	Bikes	Peds	Bikes	Peds	Bikes *	Peds *	Bikes	Peds	Bikes	Peds	Bikes	Peds	Bikes	Peds	Total
8:00 AM	1	1	2	1	0	6	31	6	2	27	0	0	0	1	5	5	88
8:15 AM	1	0	1	4	3	3	25	6	2	13	1	2	1	3	5	7	77
8:30 AM	0	0	1	2	1	1	25	10	1	25	1	0	3	0	2	11	83
8:45 AM	1	0	0	1	2	3	30	10	9	12	1	0	1	2	3	9	84
AM Sum	**3**	**1**	**4**	**8**	**6**	**13**	**111**	**32**	**14**	**77**	**3**	**2**	**5**	**6**	**15**	**32**	**332**
5:00 PM	0	4	10	3	4	5	4	4	2	9	4	0	1	2	1	11	64
5:15 PM	3	0	16	7	0	1	12	6	8	10	2	4	2	6	2	14	93
5:30 PM	0	0	24	13	2	2	17	4	6	4	0	1	2	1	1	8	85
5:45 PM	0	0	21	11	1	0	15	5	7	6	0	1	0	3	0	12	82
PM Sum	**3**	**4**	**71**	**34**	**7**	**8**	**48**	**19**	**23**	**29**	**6**	**6**	**5**	**12**	**4**	**45**	**324**

* Note: A few bikes and pedestrians (10-15%) turned towards Key Bridge, most went to Custis Trail

Count of Slugs, Taxis and Deliveries on Moore Street

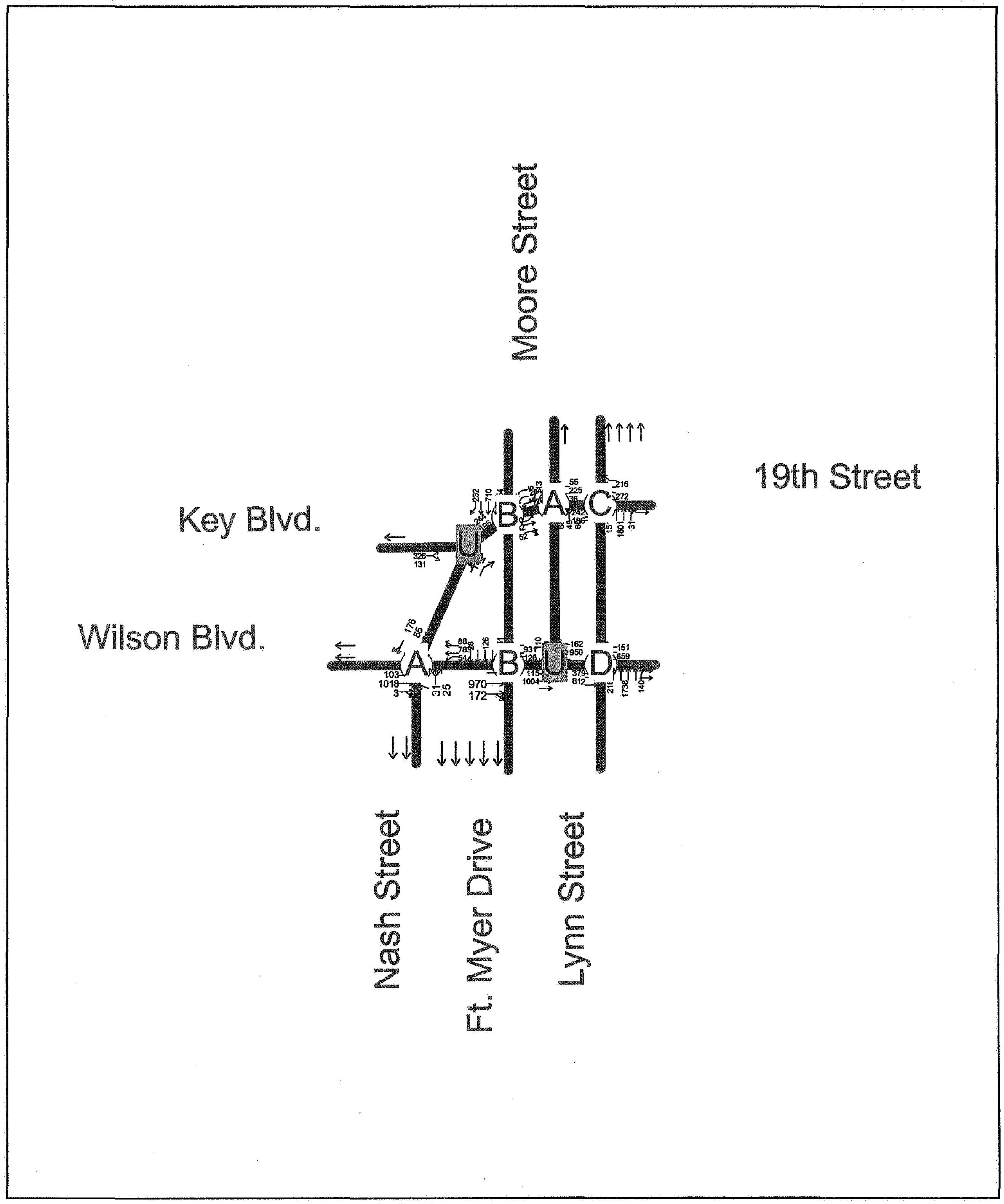
Start Time	Slug Departures	Taxi * Departures	Taxi * Arrivals	Loading Activity
8:00 AM	N/A	3	0	1
8:15 AM	N/A	1	1	0
8:30 AM	N/A	3	1	1
8:45 AM	N/A	2	0	1
AM Sum	**N/A**	**9**	**2**	**3**
5:00 PM	18	4	0	0
5:15 PM	16	5	0	0
5:30 PM	12	3	0	0
5:45 PM	7	7	0	0
PM Sum	**53**	**19**	**0**	**0**

* Taxi Departures and Arrivals with Passenger already inside of Cab

Rosslyn Station Access Study

Synchro Capacity Analysis Results

Existing 2001 Traffic Conditions: AM Peak Hour

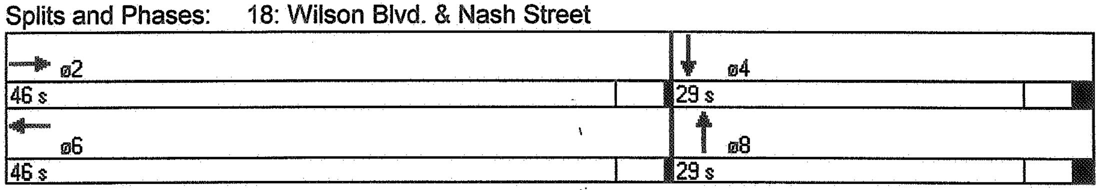

Moore Street
19th Street
Key Blvd.
Wilson Blvd.
Nash Street
Ft. Myer Drive
Lynn Street

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	103	1018	54	783	7	31	81	55
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phases	2	2	6	6	8	8	4	4
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	46.0	46.0	46.0	46.0	29.0	29.0	29.0	29.0
Total Split (%)	61%	61%	61%	61%	39%	39%	39%	39%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	1.5	1.5	1.5	1.5
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)		42.0	42.0	42.0		25.0		25.0
Actuated g/C Ratio		0.56	0.56	0.56		0.33		0.33
v/c Ratio		0.64	0.35	0.54		0.13		0.36
Uniform Delay, d1		11.3	9.0	10.0		10.4		10.2
Delay		11.6	1.2	1.1		12.2		13.4
LOS		B	A	A		B		B
Approach Delay		11.6		1.1		12.2		13.4
Approach LOS		B		A		B		B

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 40 (53%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 7.8 Intersection LOS: A
Intersection Capacity Utilization 80.8% ICU Level of Service D

Splits and Phases: 18: Wilson Blvd. & Nash Street



Lane Group	EBT	WBL	WBT	SBT
Lane Configurations				
Volume (vph)	970	128	931	126
Turn Type		Prot		
Protected Phases	2	1	6	4
Permitted Phases				
Detector Phases	2	1	6	4
Minimum Initial (s)	4.0	1.0	4.0	4.0
Minimum Split (s)	21.0	6.0	21.0	21.0
Total Split (s)	36.0	11.0	47.0	28.0
Total Split (%)	48%	15%	63%	37%
Yellow Time (s)	3.5	3.0	3.5	3.5
All-Red Time (s)	1.5	1.0	1.5	1.5
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			
Recall Mode	Max	Max	Max	Max
Act Effct Green (s)	32.0	7.0	43.0	24.0
Actuated g/C Ratio	0.43	0.09	0.57	0.32
v/c Ratio	0.64	0.93	0.55	0.16
Uniform Delay, d1	16.0	33.8	10.0	16.5
Delay	10.1	64.9	3.9	10.8
LOS	B	E	A	B
Approach Delay	10.1		11.3	10.8
Approach LOS	B		B	B

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 75

Offset: 40 (53%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 60

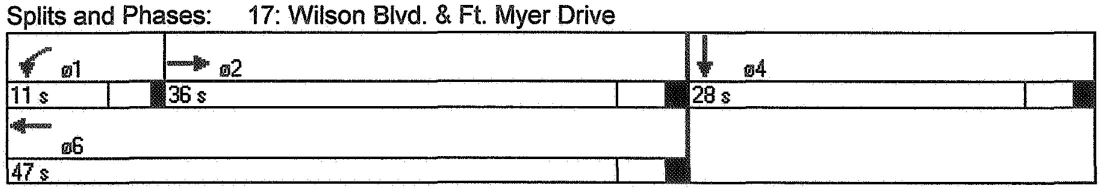
Control Type: Pretimed

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 10.7 Intersection LOS: B

Intersection Capacity Utilization 55.9% ICU Level of Service A

Splits and Phases: 17: Wilson Blvd. & Ft. Myer Drive

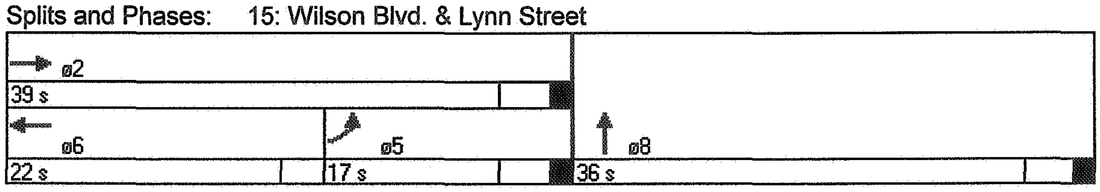


Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Configurations							
Volume (vph)	379	812	659	151	216	1738	140
Turn Type	Prot			Perm	Perm		Perm
Protected Phases	5	2	6			8	
Permitted Phases				6	8		8
Detector Phases	5	2	6	6	8	8	8
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	21.5	21.5	21.5	21.5	21.5	21.5
Total Split (s)	17.0	39.0	22.0	22.0	36.0	36.0	36.0
Total Split (%)	23%	52%	29%	29%	48%	48%	48%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.5	1.5	0.0	0.0	1.5	1.5	1.5
Lead/Lag	Lag		Lead	Lead			
Lead-Lag Optimize?	Yes		Yes	Yes			
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	13.0	35.0	18.0	18.0	32.0	32.0	32.0
Actuated g/C Ratio	0.17	0.47	0.24	0.24	0.43	0.43	0.43
v/c Ratio	1.49	0.59	0.94	0.46	0.35	0.77	0.23
Uniform Delay, d1	31.0	14.7	27.9	22.1	14.4	18.3	5.4
Delay	185.0	6.7	42.6	23.0	14.9	18.6	6.6
LOS	F	A	D	C	B	B	A
Approach Delay		63.4	38.9			17.4	
Approach LOS		E	D			B	

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 44 (59%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Pretimed
Maximum v/c Ratio: 1.49
Intersection Signal Delay: 35.0 Intersection LOS: D
Intersection Capacity Utilization 87.8% ICU Level of Service D

Splits and Phases: 15: Wilson Blvd. & Lynn Street

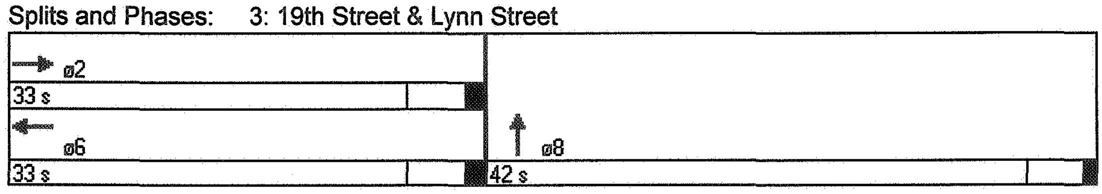


Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Configurations					
Volume (vph)	242	186	272	216	1801
Turn Type	Perm			Perm	
Protected Phases		2	6		8
Permitted Phases	2			6	
Detector Phases	2	2	6	6	8
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.0
Total Split (s)	33.0	33.0	33.0	33.0	42.0
Total Split (%)	44%	44%	44%	44%	56%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.5	1.5	1.5	1.5	1.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Max	Max	Max	Max	Max
Act Effct Green (s)	29.0	29.0	29.0	29.0	38.0
Actuated g/C Ratio	0.39	0.39	0.39	0.39	0.51
v/c Ratio	0.72	0.31	0.24	0.24	0.74
Uniform Delay, d1	19.5	16.0	15.5	14.9	14.6
Delay	30.7	16.9	15.8	15.2	24.4
LOS	C	B	B	B	C
Approach Delay		24.7	15.5		24.4
Approach LOS		C	B		C

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 22 (29%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 22.9 Intersection LOS: C
Intersection Capacity Utilization 70.2% ICU Level of Service C

Splits and Phases: 3: 19th Street & Lynn Street



6: 19th Street & Moore Street

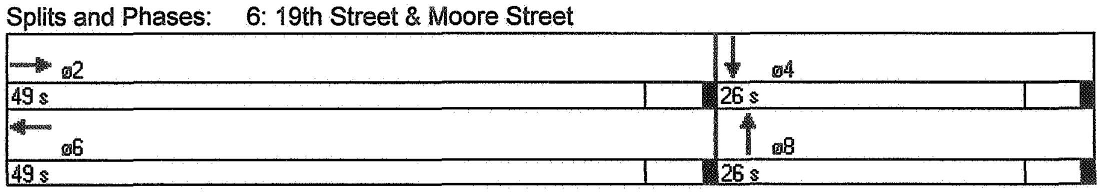
04/17/2002

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	342	36	225	66	48	7	13
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phases	2	2	6	6	8	8	4	4
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	49.0	49.0	49.0	49.0	26.0	26.0	26.0	26.0
Total Split (%)	65%	65%	65%	65%	35%	35%	35%	35%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	45.0	45.0		45.0		22.0		22.0
Actuated g/C Ratio	0.60	0.60		0.60		0.29		0.29
v/c Ratio	0.12	0.23		0.21		0.43		0.04
Uniform Delay, d1	6.4	6.2		5.5		17.0		14.3
Delay	3.1	3.1		8.0		16.5		15.8
LOS	A	A		A		B		B
Approach Delay		3.1		8.0		16.5		15.8
Approach LOS		A		A		B		B

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 42 (56%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.43
Intersection Signal Delay: 7.4 Intersection LOS: A
Intersection Capacity Utilization 52.9% ICU Level of Service A

Splits and Phases: 6: 19th Street & Moore Street

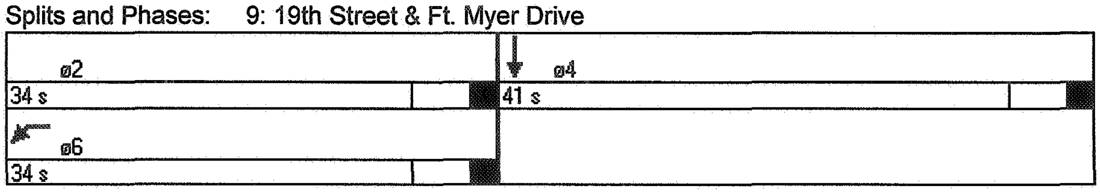


Lane Group	WBL2	WBL	SBL	SBT	SBR	NER
Lane Configurations						
Volume (vph)	120	204	154	710	232	400
Turn Type	Perm		Perm		Perm	
Protected Phases		6		4		
Permitted Phases	6		4		4	2
Detector Phases	6	6	4	4	4	2
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	29.0	29.0
Total Split (s)	34.0	34.0	41.0	41.0	41.0	34.0
Total Split (%)	45%	45%	55%	55%	55%	45%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	30.0	30.0	37.0	37.0	37.0	30.0
Actuated g/C Ratio	0.40	0.40	0.49	0.49	0.49	0.40
v/c Ratio	0.61	0.18	0.21	0.34	0.30	0.57
Uniform Delay, d1	17.8	14.5	10.7	11.6	0.0	15.1
Delay	15.9	9.6	11.1	11.7	1.7	18.3
LOS	B	A	B	B	A	B
Approach Delay		12.0		9.5		
Approach LOS		B		A		

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 31 (41%), Referenced to phase 2:NER and 6:WBL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 12.4 Intersection LOS: B
Intersection Capacity Utilization 57.7% ICU Level of Service A

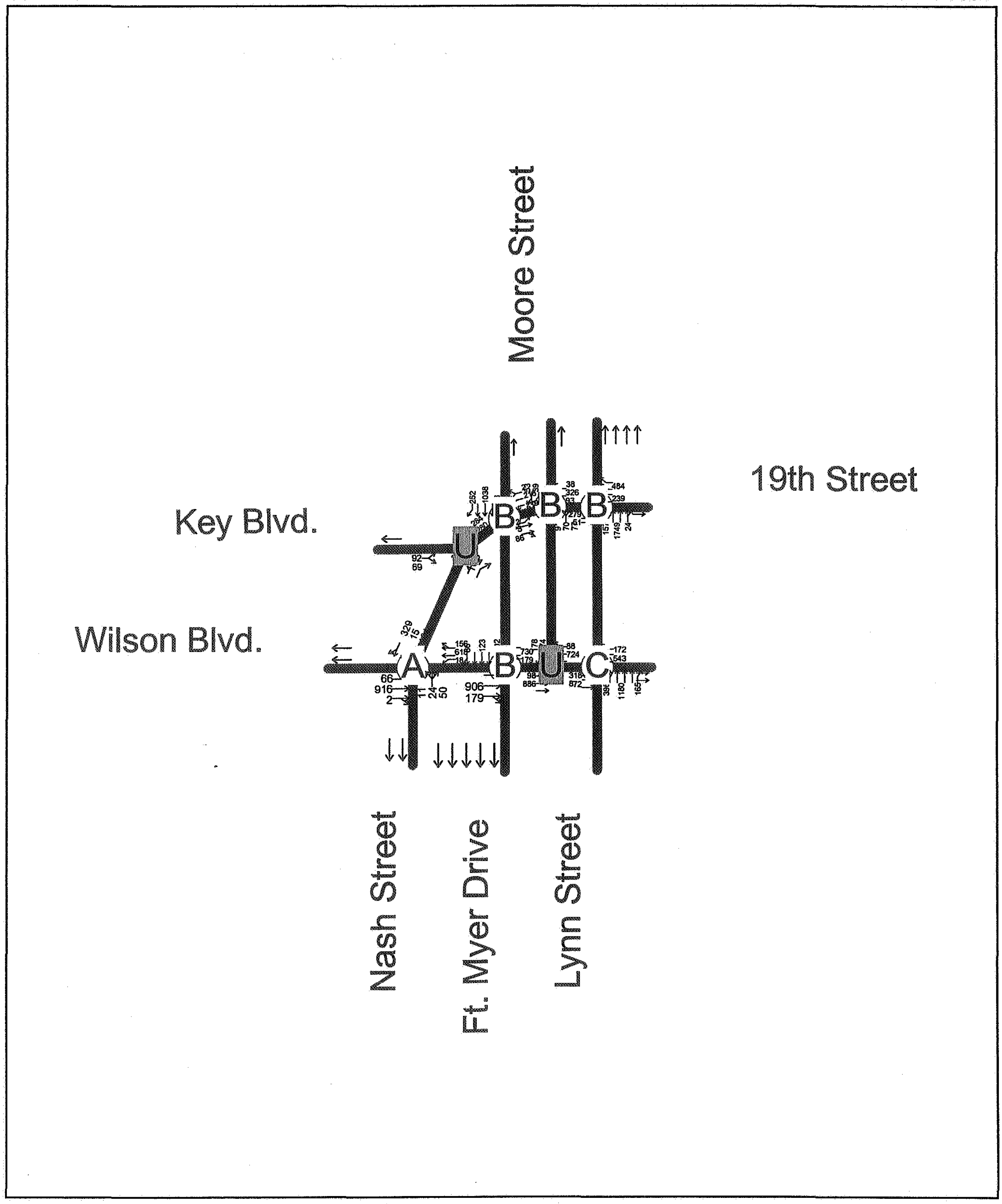
Splits and Phases: 9: 19th Street & Ft. Myer Drive



Rosslyn Station Access Study

Synchro Capacity Analysis Results

Existing 2001 Traffic Conditions: PM Peak Hour


Moore Street
19th Street
Key Blvd.
Wilson Blvd.
Nash Street
Ft. Myer Drive
Lynn Street

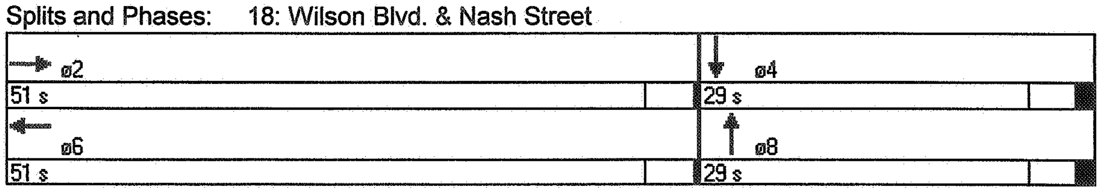
18: Wilson Blvd. & Nash Street

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	66	916	18	618	11	24	104	15
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phases	2	2	6	6	8	8	4	4
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	51.0	51.0	51.0	51.0	29.0	29.0	29.0	29.0
Total Split (%)	64%	64%	64%	64%	36%	36%	36%	36%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	1.5	1.5	1.5	1.5
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)		47.0	47.0	47.0		25.0		25.0
Actuated g/C Ratio		0.59	0.59	0.59		0.31		0.31
v/c Ratio		0.48	0.09	0.46		0.19		0.52
Uniform Delay, d1		9.5	7.2	8.4		8.0		10.5
Delay		9.6	1.8	1.3		10.3		12.5
LOS		A	A	A		B		B
Approach Delay		9.6		1.3		10.3		12.5
Approach LOS		A		A		B		B

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 37 (46%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 7.4 Intersection LOS: A
Intersection Capacity Utilization 80.1% ICU Level of Service D

Splits and Phases: 18: Wilson Blvd. & Nash Street

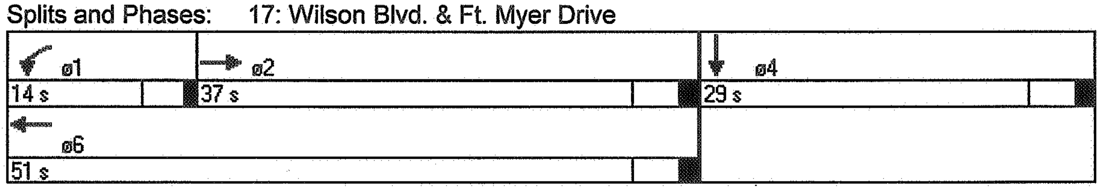


Lane Group	EBT	WBL	WBT	SBT
Lane Configurations				
Volume (vph)	906	179	730	123
Turn Type		Prot		
Protected Phases	2	1	6	4
Permitted Phases				
Detector Phases	2	1	6	4
Minimum Initial (s)	4.0	1.0	4.0	4.0
Minimum Split (s)	21.0	10.0	21.0	21.0
Total Split (s)	37.0	14.0	51.0	29.0
Total Split (%)	46%	18%	64%	36%
Yellow Time (s)	3.5	3.0	3.5	3.5
All-Red Time (s)	1.5	1.0	1.5	1.5
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			
Recall Mode	Max	Max	Max	Max
Act Effct Green (s)	33.0	10.0	47.0	25.0
Actuated g/C Ratio	0.41	0.13	0.59	0.31
v/c Ratio	0.63	0.98	0.42	0.16
Uniform Delay, d1	17.5	34.9	9.1	14.3
Delay	10.4	82.9	5.9	8.7
LOS	B	F	A	A
Approach Delay	10.4		21.1	8.7
Approach LOS	B		C	A

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 43 (54%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 14.4 Intersection LOS: B
Intersection Capacity Utilization 54.8% ICU Level of Service A

Splits and Phases: 17: Wilson Blvd. & Ft. Myer Drive

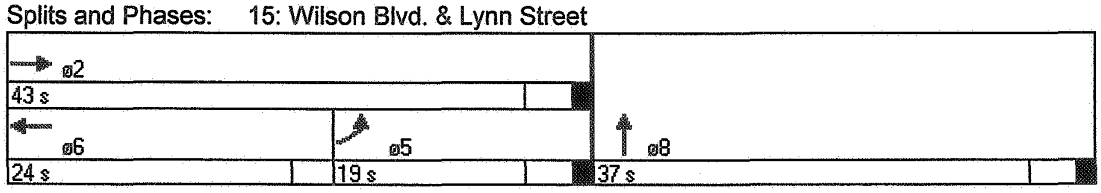


Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Configurations							
Volume (vph)	318	872	543	172	396	1180	165
Turn Type	Prot			Perm	Perm		Perm
Protected Phases	5	2	6			8	
Permitted Phases				6	8		8
Detector Phases	5	2	6	6	8	8	8
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	21.5	21.5	21.5	21.5	21.5	21.5
Total Split (s)	19.0	43.0	24.0	24.0	37.0	37.0	37.0
Total Split (%)	24%	54%	30%	30%	46%	46%	46%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.5	1.5	0.0	0.0	1.5	1.5	1.5
Lead/Lag	Lag		Lead	Lead			
Lead-Lag Optimize?	Yes		Yes	Yes			
Recall Mode	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	15.0	39.0	20.0	20.0	33.0	33.0	33.0
Actuated g/C Ratio	0.19	0.49	0.25	0.25	0.41	0.41	0.41
v/c Ratio	1.16	0.61	0.74	0.48	0.65	0.54	0.28
Uniform Delay, d1	32.5	14.9	27.6	19.8	18.9	17.7	8.1
Delay	108.4	7.8	28.2	20.6	19.7	17.9	8.8
LOS	F	A	C	C	B	B	A
Approach Delay		34.7	26.3			17.5	
Approach LOS		C	C			B	

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 37 (46%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 70
Control Type: Pretimed
Maximum v/c Ratio: 1.16
Intersection Signal Delay: 24.8 Intersection LOS: C
Intersection Capacity Utilization 75.9% ICU Level of Service C

Splits and Phases: 15: Wilson Blvd. & Lynn Street



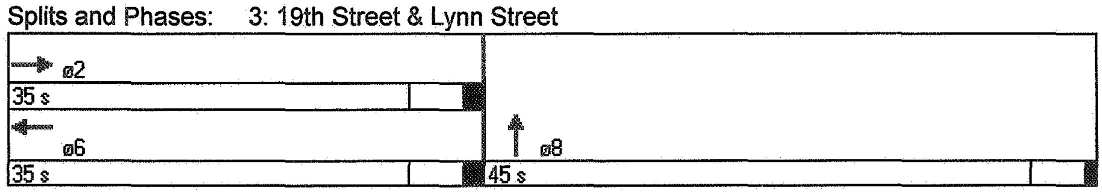
parsonlvl7-ff51

Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Configurations					
Volume (vph)	279	51	239	484	1749
Turn Type	Perm			Perm	
Protected Phases		2	6		8
Permitted Phases	2			6	
Detector Phases	2	2	6	6	8
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.0
Total Split (s)	35.0	35.0	35.0	35.0	45.0
Total Split (%)	44%	44%	44%	44%	56%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.5	1.5	1.5	1.5	1.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Max	Max	Max	Max	Max
Act Effct Green (s)	31.0	31.0	31.0	31.0	41.0
Actuated g/C Ratio	0.39	0.39	0.39	0.39	0.51
v/c Ratio	0.79	0.08	0.21	0.54	0.71
Uniform Delay, d1	21.6	15.5	16.3	18.5	14.9
Delay	34.6	21.3	16.5	18.9	16.7
LOS	C	C	B	B	B
Approach Delay		32.6	18.1		16.7
Approach LOS		C	B		B

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 28 (35%), Referenced to phase 2:EBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 18.8 Intersection LOS: B
Intersection Capacity Utilization 83.1% ICU Level of Service D

Splits and Phases: 3: 19th Street & Lynn Street



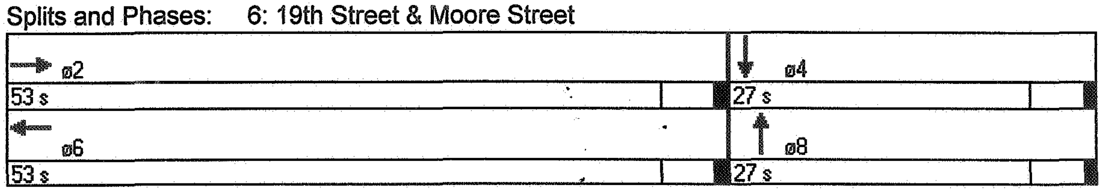
6: 19th Street & Moore Street

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	32	175	93	326	91	70	6	39
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phases	2	2	6	6	8	8	4	4
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	53.0	53.0	53.0	53.0	27.0	27.0	27.0	27.0
Total Split (%)	66%	66%	66%	66%	34%	34%	34%	34%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	49.0	49.0		49.0		23.0		23.0
Actuated g/C Ratio	0.61	0.61		0.61		0.29		0.29
v/c Ratio	0.07	0.15		0.31		0.64		0.13
Uniform Delay, d1	6.3	4.3		7.0		21.7		9.5
Delay	13.1	11.1		4.3		25.6		11.2
LOS	B	B		A		C		B
Approach Delay		11.3		4.3		25.6		11.2
Approach LOS		B		A		C		B

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 72 (90%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 11.5 Intersection LOS: B
Intersection Capacity Utilization 57.7% ICU Level of Service A

Splits and Phases: 6: 19th Street & Moore Street

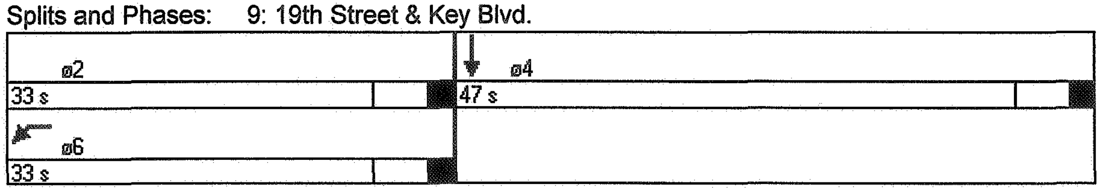


Lane Group	WBL2	WBL	SBL	SBT	SBR	NER
Lane Configurations						
Volume (vph)	219	216	53	1038	252	205
Turn Type	Perm		Perm		Perm	
Protected Phases		6		4		
Permitted Phases	6		4		4	2
Detector Phases	6	6	4	4	4	2
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	29.0	29.0
Total Split (s)	33.0	33.0	47.0	47.0	47.0	33.0
Total Split (%)	41%	41%	59%	59%	59%	41%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	29.0	29.0	43.0	43.0	43.0	29.0
Actuated g/C Ratio	0.36	0.36	0.54	0.54	0.54	0.36
v/c Ratio	0.78	0.21	0.07	0.46	0.31	0.35
Uniform Delay, d1	22.7	17.5	8.9	11.4	0.0	14.6
Delay	33.1	17.5	9.1	11.5	1.4	15.2
LOS	C	B	A	B	A	B
Approach Delay		25.3		9.5		
Approach LOS		C		A		

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 40 (50%), Referenced to phase 2:NER and 6:WBL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 13.7 Intersection LOS: B
Intersection Capacity Utilization 61.8% ICU Level of Service B

Splits and Phases: 9: 19th Street & Key Blvd.



APPENDIX C

SURVEY DATA

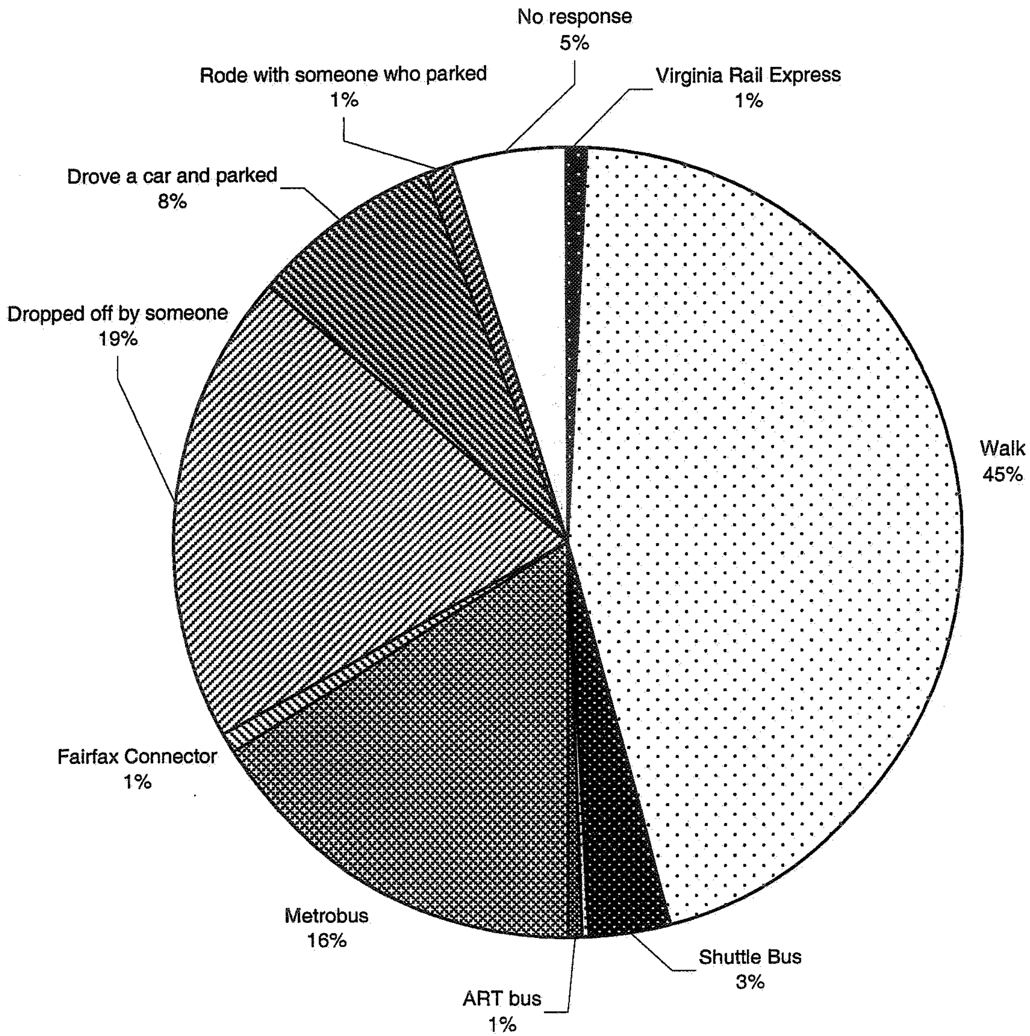
Rosslyn Passenger Survey Results

	AM	PM	AM	PM
Response				
Survey Date	9/20/01	9/20/01		
Number of surveys returned	385	319		
Peak period passenger volume entering station	3819	7392		
Response rate	10.1%	4.3%		
90% Confidence Interval	4.7%	5.4%		
Transportation Mode used by Passengers to Reach the Station				
	Number of respondents		Percent of respondents	
Virginia Rail Express	3	2	0.78%	0.63%
Walk	173	218	44.94%	68.34%
Shuttle Bus	13	27	3.38%	8.46%
Tour Bus	1			
ART bus	2		0.52%	
Metrobus	62	36	16.10%	11.29%
Fairfax Connector	4		1.04%	
Dropped off by someone	75	14	19.48%	4.39%
Drove a car and parked	30	15	7.79%	4.70%
Rode with someone who parked	4	1	1.04%	
No response	18	6	4.68%	1.88%
Total Responses	**385**	**319**	**100%**	**100%**
Trip Purpose				
	Number of respondents		Percent of respondents	
Traveling to work	361	96	93.77%	30.09%
Traveling home from work	8	194	2.08%	60.82%
Job-related business	5	10	1.30%	3.13%
Shopping or meal		5		1.57%
School	1	4		1.25%
Personal trip	2	9	0.52%	2.82%
Sightseeing or recreation	1	1		
No response	7		1.82%	
Total Responses	**385**	**319**	**100%**	**100%**

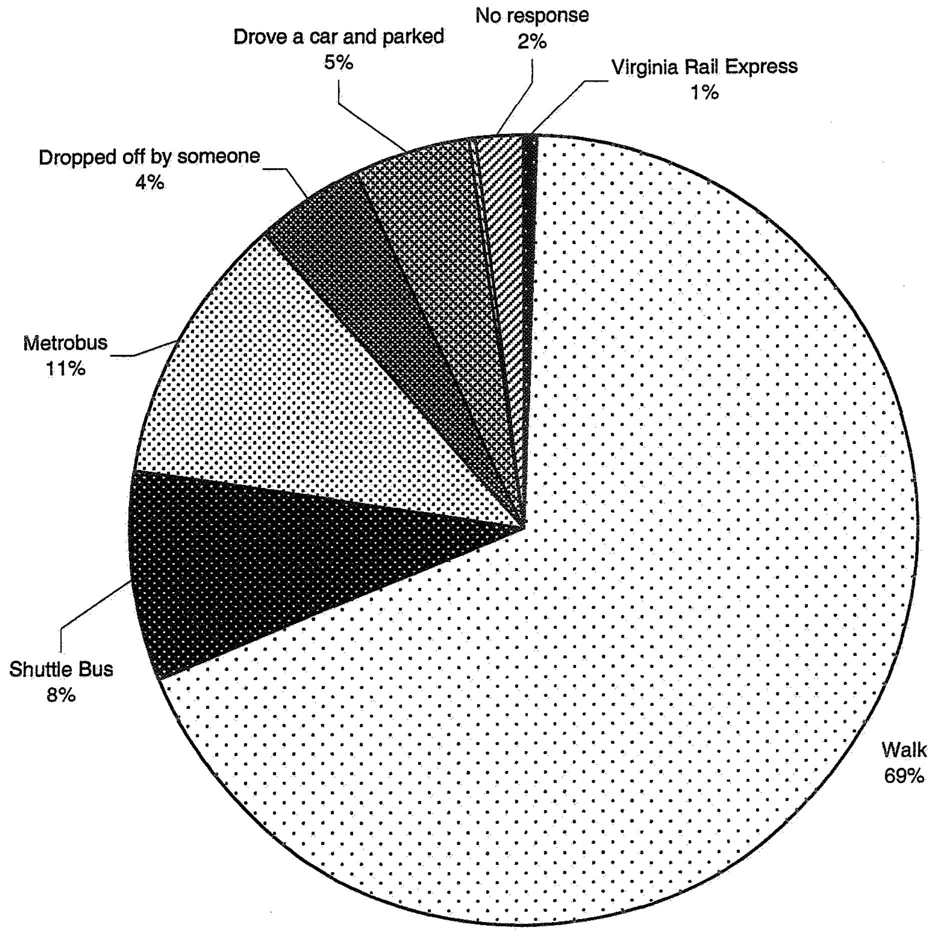
Rosslyn Passenger Survey Results

	AM	PM	AM	PM
Fairfax Connector Bus Passenger Routes Used				
	Number of respondents		Percent of respondents	
110	1		25%	
385	1		25%	
552	1		25%	
980	1		25%	
Total Fairfax Connector	**4**	**0**	**100%**	
Metrobus Passenger Routes Used				
	Number of respondents		Percent of respondents	
2B		1		3%
2C		1		3%
3	9	2	15%	6%
3A	9	2	15%	6%
3B	1	2	2%	6%
3F	2		3%	
3N	1		2%	
4	6	2	10%	6%
4A	3	2	5%	6%
4B	2		3%	
4E	1		2%	
4S	3		5%	
5A	3	3	5%	8%
5V	1		2%	
7B	1		2%	
7X		1		3%
8D		1		3%
8W	1		2%	
8X		1		3%
12E	1		2%	
15	4		6%	
15K	1	4	2%	11%
15L	3		5%	
16		2		6%
16G		1		3%
17H		2		6%
18R		1		3%
19	1		2%	
20X		1		3%
22		2		6%
25B	1		2%	
38B	2	1	3%	3%
210	1		2%	
L		1		3%
Omniride	1		2%	
Unspecified Route	4	3	6%	8%
Total Metrobus	**62**	**36**	**100%**	**100%**

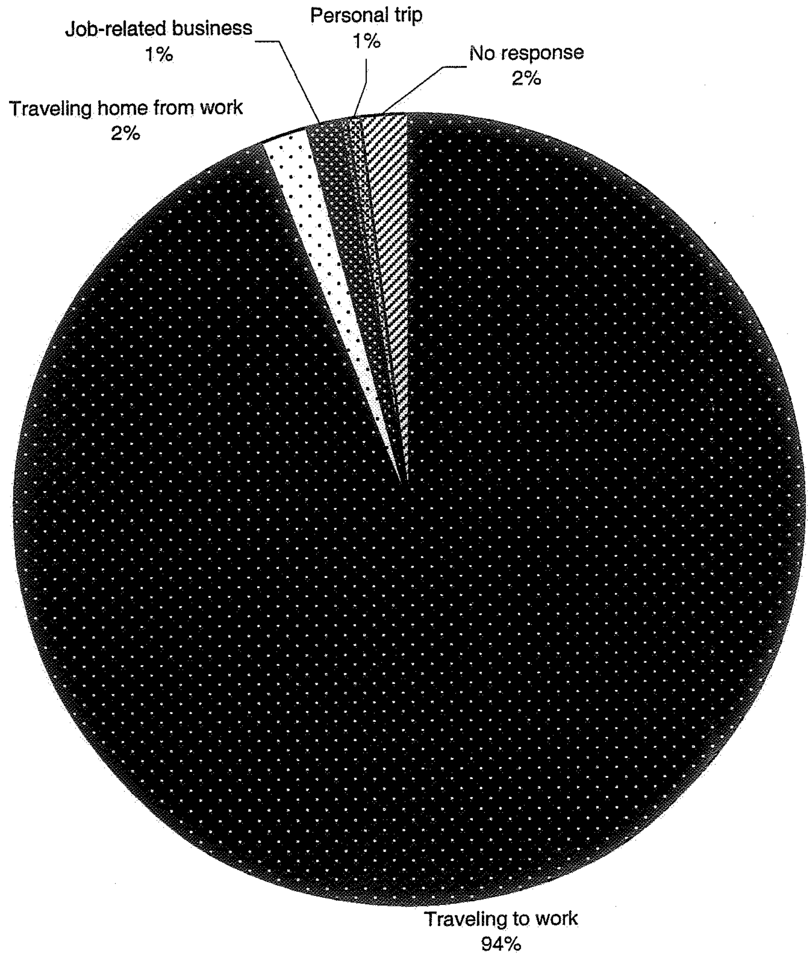
Rosslyn AM Mode Split



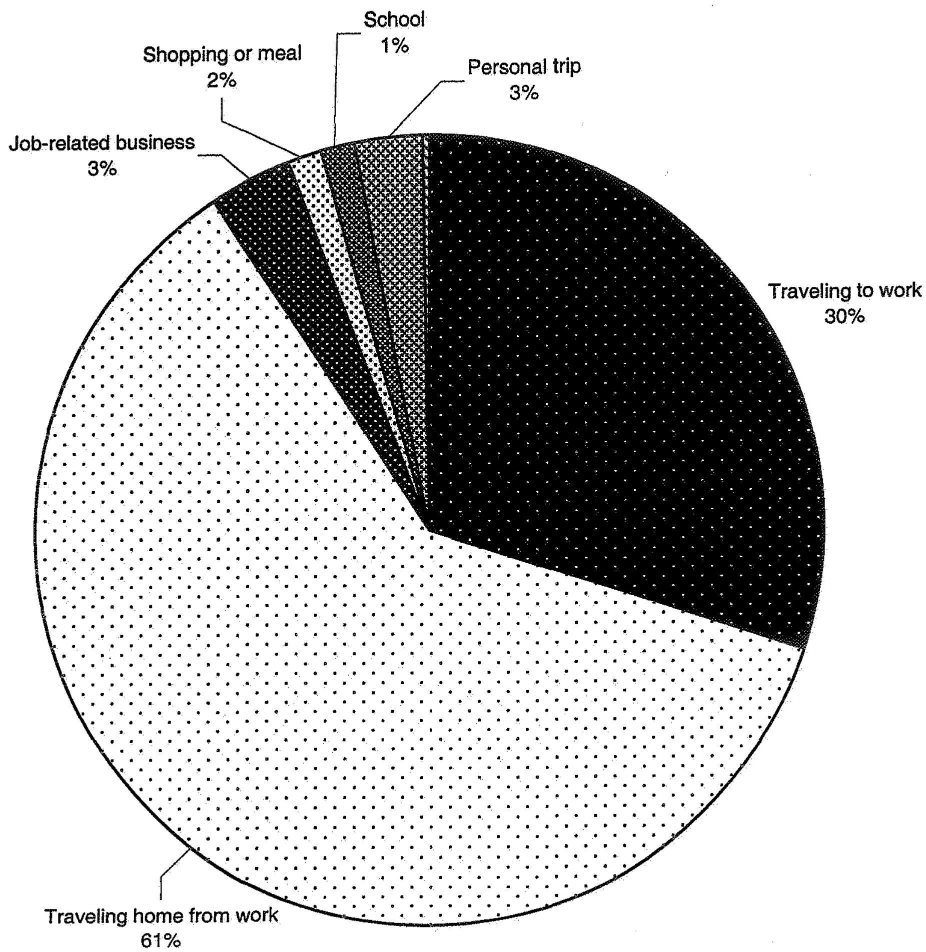
Rosslyn PM Mode Split



Rosslyn AM Trip Purpose



Rosslyn PM Trip Purpose



APPENDIX D

DEVELOPMENT AND RIDERSHIP FORECAST DATA

Rosslyn Metrorail Passenger Forecast

This document provides a more detailed description of the methodology for forecasting Metrorail ridership than was included in the body of the report. The number of new pedestrian Metrorail riders was computed using a two-prong method. Results from the passenger survey were compared with a previous transit mode share study to determine ridership for the Rosslyn Station.

First, results of the passenger survey were examined in detail. Survey respondents who reported that they walked to the station were grouped according to which existing development marked the origin of their trip. The size of these facilities was determined from *Development in the Metro Corridors 2000*. A ratio was then established to determine the number of peak-period pedestrian Metrorail passengers per 1,000 square feet of building size. Ratios for each development type were consolidated into 1/8-mile zones by distance from the Metrorail station.

Ratios were also computed, independent of the passenger survey, using the methodology outlined in *Development-Related Ridership Survey II*. This study was conducted in 1989, but it is the most current WMATA survey devoted to estimating transit mode share. This study was used because it included a larger sample of respondents than the Rosslyn passenger survey. The study's equations were used to predict transit mode share based on distance from the Metrorail station, development type, and location within the metropolitan area. These transit mode shares were converted to ratios of peak-period passengers per 1,000 square feet of building size and averaged for each of the 1/8-mile zones.

Ratios from the passenger survey and the 1989 study were then compared by zone. Generally, the values were similar for the two methods. A final ratio was selected, usually as the mean of the two individual ratios. A best-fitting line was drawn between the final ratios as a predictor of Metro ridership by distance from the station.

Direction from the station was also considered. The passenger survey did not include enough data to make specific mode share predictions by both direction and distance, and the 1989 study did not evaluate mode share as a function of direction from Metrorail stations. Instead, directional factors were assigned for passengers approaching the station from the north, south, east, and west. These factors were determined by general knowledge of the topography and transportation corridors in the vicinity of the station. For a given distance from the station, the factors account for the likelihood that passengers would use Metrorail when approaching from a certain direction.

At the Rosslyn station, the significant grade west of the station is a large impediment to pedestrian use of Metrorail; as such, the directional factor for passengers from the west was set at 0.85. The factor was set at 1.00 for passengers from the south, 1.05 for passengers from the north, and 1.10 for passengers from the east. A unique value for each zone was calculated by multiplying the appropriate directional factor by the appropriate distance factor.

The table entitled "Rosslyn Metro Entries, AM and PM peak periods," included in this appendix, presents the distance, directional, and zonal factors for each zone and development type.

This methodology produces a single value for pedestrian passengers approaching the station from each new development during the four-hour morning peak period and the four-hour evening peak period combined. These values were allocated to the morning versus evening peak periods using ratios from ITE's *Trip Generation*, 6th edition. Specifically, 85 percent of trips generated by office developments were assumed to enter the station during the evening peak period, while only 15 percent of these trips were assumed to enter during the morning peak period. Likewise, 73 percent of residential trips were assumed to enter the station during the morning peak period, and the remaining 27 percent were assumed to enter during the evening peak period. Retail and hotel land uses were assumed to be equally split between morning and evening peak periods.

The table entitled "Future Development Forecast – Rosslyn Station Area," included in this appendix, is an expanded version of Figure 12 in the body of the report. This table documents the trip production calculations presented in the report.

The calculation of the number of new passengers that would be attracted by opening additional entrances to the Metrorail station followed a similar procedure. Passengers who would benefit from the new entrance were assigned a different zonal factor to account for the shorter walking distance to the new entrance. The new factor was computed by interpolating the reduction in walking distance between the fixed 1/8-mile zones. The number of new passengers was then calculated by subtracting the number of passengers computed using the existing zonal factors from the number of passengers computed using the new zonal factors.

	Rosslyn Metro Entries, AM and PM peak periods															
	Metro riders per 1000 sf office				Metro riders per residential unit				Metro riders per hotel unit				Metro riders per 1000 sf retail			
	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis	PTG survey	smoothed PTG survey	WMATA survey/ trip gen.	use for analysis
Zone 1	0.54	0.54	0.85	0.70		0.25	0.76	0.51			0.87	0.87			1.00	1.00
Zone 2	0.42	0.42	0.70	0.56	0.21	0.21	0.70	0.46			0.73	0.73			0.85	0.85
Zone 3		0.30	0.55	0.43	0.17	0.17	0.63	0.40			0.59	0.59			0.69	0.69
Zone 4		0.18	0.40	0.29		0.13	0.57	0.35			0.45	0.45			0.52	0.52
Zone 5		0.06	0.25	0.16		0.09	0.50	0.30	No data		0.31	0.31	No data		0.37	0.37
Zone 6		-0.06	0.10	0.02		0.05	0.44	0.24			0.17	0.17			0.21	0.21
Zone 7		-0.18	-0.05	0.00		0.01	0.37	0.19			0.03	0.03			0.04	0.04
Zone 8		-0.30	-0.20	0.00		-0.03	0.31	0.14			-0.11	0.00			0.00	0.00
Zone 9		-0.42	-0.35	0.00		-0.07	0.24	0.09			-0.25	0.00			0.00	0.00
	Spatial adjustments															
1.00	1.05	1.00	1.10	0.85												
	North	South	East	West	North	South	East	West	North	South	East	West	North	South	East	West
Zone 1	0.73	0.70	0.76	0.59	0.53	0.51	0.56	0.43	0.91	0.87	0.96	0.74	1.05	1.00	1.10	0.85
Zone 2	0.59	0.56	0.62	0.48	0.48	0.46	0.50	0.39	0.77	0.73	0.80	0.62	0.89	0.85	0.94	0.72
Zone 3	0.45	0.43	0.47	0.36	0.42	0.40	0.44	0.34	0.62	0.59	0.65	0.50	0.72	0.69	0.76	0.59
Zone 4	0.30	0.29	0.32	0.25	0.37	0.35	0.38	0.30	0.47	0.45	0.50	0.38	0.55	0.52	0.57	0.44
Zone 5	0.16	0.16	0.17	0.13	0.31	0.30	0.33	0.25	0.33	0.31	0.34	0.26	0.38	0.37	0.40	0.31
Zone 6	0.02	0.02	0.02	0.02	0.26	0.24	0.27	0.21	0.18	0.17	0.19	0.14	0.22	0.21	0.23	0.17
Zone 7	0.00	0.00	0.00	0.00	0.20	0.19	0.21	0.16	0.03	0.03	0.03	0.03	0.05	0.04	0.05	0.04
Zone 8	0.00	0.00	0.00	0.00	0.15	0.14	0.15	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zone 9	0.00	0.00	0.00	0.00	0.09	0.09	0.09	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Future Development Forecast -- Rosslyn Station Area

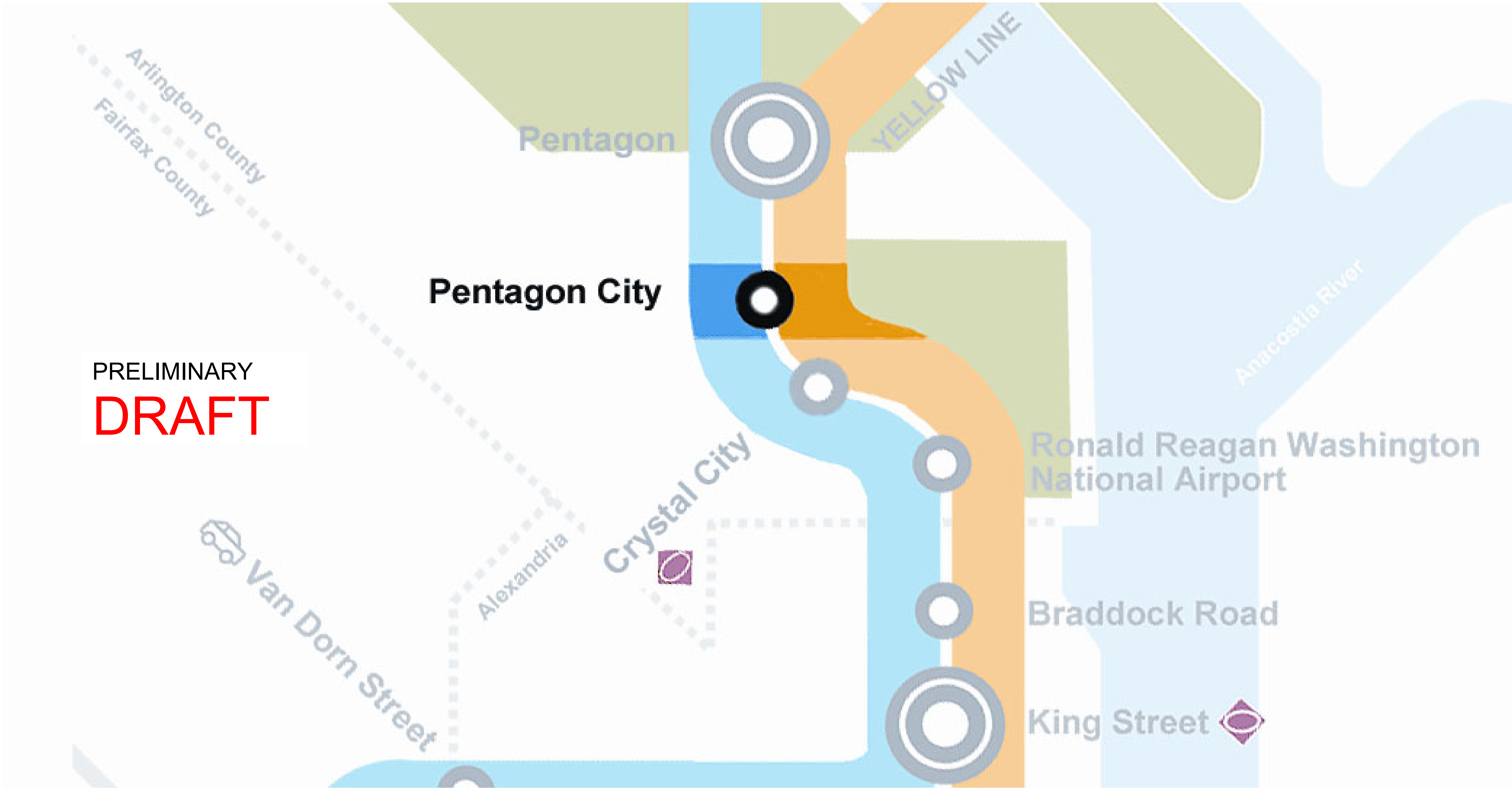
Site No.	Project Number	Project Name	GLUP Designation	Zoning	Development Type	Status on 10/1/01	Notes
B/C	Ros 81	Rosslyn Metro Center	High O-A-H	C-O Rosslyn	Office/-Retail	approved	
H	Ros 83.02	1801 N. Lynn Street	High O-A-H	C-O Rosslyn	Office/-Retail	under const.	
	Ros 19.02	Rosslyn Plaza	High O-A-H	C-O	Office/Retail	Spec.	-95 res units. Site area: 32647 at 10 FAR, 7% retail.
	Ros 19.04	Rosslyn Plaza	High O-A-H	C-O	Residential	Spec.	-147,500 office, 3K retail. Site area: 57753. Assume same density as Twin Oaks.
	Ros 19.05	Rosslyn Plaza	High O-A-H	C-O	Office/Retail	Spec.	-149000 office. 43324 site area.
	Ros 5-21-40	Central Place	Public	C-O	Office/Residential	Spec.	-21072 sf office, -10814 sf retail (#5). -55000 sf office (#21). -12642 sf retail (#40). Site: 14170 sf (#5), 10257 sf (#21) 5000 sf (#40),
	Ros 19.03	Rosslyn Plaza	High O-A-H	C-O	Office/Retail	Spec.	Exst: 142,500 sf office, 10,822 retail. Assume 10 FAR, site area 38034, assume 40K retail.
	Ros 19.01	Rosslyn Plaza	High O-A-H	C-O	Residential	Spec.	Exst: 98 units. Site area: 40700. Assume same density as Twin Oaks
A	Ros 3.04	Waterview	High O-A-H	C-O Rosslyn	Office/-Retail/Hotel/Res	approved	Existing building: 193678 sf. Office. 4200 sf retail
D	Ros 88	Colonial Heights	Low-Medium Res	RA6-15	Residential	approved	
	Ros 16 Ros 26 Ros 28	Rosslyn Bldg South Rosslyn Bldg. North RCA Bldg.	High O-A-H	C-O	Office/Retail	Spec.	Site area * 10 FAR = 1.02 M sf. Exst office 107K sf, 132K sf office, 25K retail, 128K sf office, 28K retail
	Ros 20	1881 Nash	High Residential	C-O Rosslyn	Residential	approved	Approved fall 2001
	Ros 7	CACI Bldg.	High O-A-H	C-O	Office	Spec.	Site: 32000+15000 (power substation). -97350 office, -10661 retail.
	Ros 34	Westpark Hotel	High Residential	C-O	Residential	Spec.	-300 hotel rooms. Site: 60000 sf.
	Ros 13 Ros 31	Key Bldg. Berkeley Bldg.	High O-A-H	C-O Rosslyn	Office/Retail	Spec.	-149461 office (#13), -261K office, -15500 retail (#31). Site area 103888
	Ros 56a	River Place (North)	High-Medium Res	RA-4.8	Office	Spec.	Add 1M sf office/retail. -75% of exst 1633 units.
	Ros 82	Monument Place	Medium Residential	RA-6-15	Residential	under const.	
	Ros 85	Brompton, Potomac	Low-Medium Res	RA-6-15	Residential	under const.	
	Ros 87	Brompton, Monument	Medium Residential	RA-6-15	Residential	under const.	
	Ros 89	North Meade St.	Medium Residential	RA-6-15	Residential	approved	
	Ros 56b	River Place (South)	High-Medium Res	RA-4.8	Residential	Spec.	Add 1M sf residential. -25% of exst 1633 units
	Ros 25	Art Assoc. Bldg.	High O-A-H	C-O Rosslyn	Residential	Spec.	-108000 sf office, -17800 retail. Site area: 30000
	Ros 18	Oak Hills	High O-A-H	C-O Rosslyn	Office/Retail	Spec.	-219000 office, -7000 retail. Site area: 58000
	Ros 22	Nash St Office Bldg.	High O-A-H	C-O Rosslyn	Hotel	Spec.	-146000 office, -12500 retail. Site area: 35000. Assume 1000 sf/room
D	Ros 84	Christiana House	Low-Medium Res	RA6-15	Residential	under const.	
E	Ros 86	Twin Oak Apartments	High Residential	RA-H-3.2	Residential	under const.	
G	Undesignated	Undesignated	Med-High Res	RA-4.8 (3.24)	Residential	Spec.	Assume: 0.5 acre site, 4.2 FAR, 90 units/acre = 189 res units. Then add 25% density bonus for affordable housing
	Ros 79	Colonial Heights	Low-Medium Res	RA-6-15	Residential	approved	
	Ros 38	1600 Bldg.	Service Comm	C-O	Residential	Spec.	-175K office, -7700 retail

Sources: Arlington County Summary of Development (2000), Rosslyn Station Area Plan Addendum (1992)

																		Total daily trips			
			To be demolished between 10/1/01 and 2020				Change from conditions on 10/1/01 to conditions in 2020							Peak period metro entries per				12.11	10.70	5.09	9.05
Site No.	Project Number	Project Name	Office S.F.	Retail S.F.	Res. Units	Hotel Rms.	Office S.F.	Retail S.F.	Res. Units	Hotel Rms.	Parking	Zone	Net new dev per zone	1000 sf office	1000 sf retail	Res. unit	Hotel unit	Office	Retail	Res	Hotel
B/C	Ros 81	Rosslyn Metro Center					254,536	12,368			235	E1	1,481,716	0.76	1.1	0.56	0.96	3082	132	0	0
H	Ros 83.02	1801 N. Lynn Street					347,295	6,565			386	E1		0.76	1.1	0.56	0.96	4206	70	0	0
	Ros 19.02	Rosslyn Plaza			95		303,617	22,853	-95			E1		0.76	1.1	0.56	0.96	3677	245	-484	0
	Ros 19.04	Rosslyn Plaza	147,500	3,000			-147,500	-3,000	271			E1		0.76	1.1	0.56	0.96	-1786	-32	1379	0
	Ros 19.05	Rosslyn Plaza	149,000				253,913	30,327				E1		0.76	1.1	0.56	0.96	3075	324	0	0
	Ros 5-21-40	Central Place	76,072	23,456			73,357	1,385		150		E1		0.76	1.1	0.56	0.96	888	15	0	1358
	Ros 19.03	Rosslyn Plaza	142,500	10,822			197,840	29,178				E2	325,018	0.76	1.1	0.56	0.96	2396	312	0	0
	Ros 19.01	Rosslyn Plaza			98			5,000	93			E2		0.76	1.1	0.56	0.96	0	54	473	0
A	Ros 3.04	Waterview	193,678	4,200			410,592	3,310	65	220	839	N1	1,674,291	0.73	1.05	0.53	0.91	4972	35	331	1991
D	Ros 88	Colonial Heights							14		26	N1		0.73	1.05	0.53	0.91	0	0	71	0
	Ros 16 Ros 26 Ros 28	Rosslyn Bldg South Rosslyn Bldg. North RCA Bldg.	367,000	53,000			553,000	47,000				N1		0.73	1.05	0.53	0.91	6697	503	0	0
	Ros 20	1881 Nash				178		4,400	173	-178		N1		0.73	1.05	0.53	0.91	0	47	881	-1611
	Ros 7	CACI Bldg.	97,350	10,661			339,750	22,239				N1		0.73	1.05	0.53	0.91	4114	238	0	0
	Ros 34	Westpark Hotel				300			282	-300		N2	-18,000	0.59	0.89	0.48	0.77	0	0	1435	-2715
	Ros 13 Ros 31	Key Bldg. Berkeley Bldg.	410,461	15,500			555,697	57,222				S1	612,919	0.7	1	0.51	0.87	6729	612	0	0
	Ros 56a	River Place (North)			1,225		930,000	70,000	-1225			S2	-225,000	0.56	0.85	0.46	0.73	11262	749	-6235	0
	Ros 82	Monument Place							17		37	S3	528,000	0.43	0.69	0.4	0.59	0	0	87	0
	Ros 85	Brompton, Potomac							3		6	S3		0.43	0.69	0.4	0.59	0	0	15	0
	Ros 87	Brompton, Monument							15		33	S3		0.43	0.69	0.4	0.59	0	0	76	0
	Ros 89	North Meade St.							40		93	S3		0.43	0.69	0.4	0.59	0	0	204	0
	Ros 56b	River Place (South)			408			-139,000	592			S3		0.43	0.69	0.4	0.59	0	-1487	3013	0
	Ros 25	Art Assoc. Bldg.	108,000	17,800			-108,000	-17,800	140			W1	884,968	0.59	0.85	0.43	0.74	-1308	-190	713	0
	Ros 18	Oak Hills	219,000	7,000			320,400	33,600				W1		0.59	0.85	0.43	0.74	3880	360	0	0
	Ros 22	Nash St Office Bldg.	146,000	12,500			-146,000	-12,500		350		W1		0.59	0.85	0.43	0.74	-1768	-134	0	3168
D	Ros 84	Christiana House							4			W1		0.59	0.85	0.43	0.74	0	0	20	0
E	Ros 86	Twin Oak Apartments						4,268	317		363	W1		0.59	0.85	0.43	0.74	0	46	1614	0
G	Undesignated	Undesignated							236		225	W2	239,250	0.48	0.72	0.39	0.62	0	0	1203	0
	Ros 79	Colonial Heights							3			W2		0.48	0.72	0.39	0.62	0	0	15	0
	Ros 38	1600 Bldg.	175,000	7,700			-175,000	-7,700	263			W3	80,300	0.36	0.59	0.34	0.5	-2119	-82	1339	0
			2,231,561	165,639	1,826	478															
						Existing (2001)	8,055,236	660,423	4,775	2,125											
						To Be Demolished by 2020	2,231,561	165,639	1,826	478											
						New Development by 2020	6,195,058	335,354	3,034	720											
						Net Change by 2020	3,963,497	169,715	1,208	242											
						Total Anticipated by 2020	12,018,733	830,138	5,983	2,367											

									AM peak period metro entries						PM peak period metro entries					
			Peak period Metro entries						0.15	0.50	0.73	0.50			0.85	0.50	0.27	0.50		
Site No.	**Project Number**	**Project Name**	Office	Retail	Res	Hotel	Total	by zone	Office	Retail	Res	Hotel	**Total AM**	by zone	Office	Retail	Res	Hotel	**Total PM**	by zone
B/C	Ros 81	Rosslyn Metro Center	193	14	0	0	207	1145	29	7	0	0	**36**	306	164	7	0	0	**171**	838
H	Ros 83.02	1801 N. Lynn Street	264	7	0	0	271		40	4	0	0	**43**		224	4	0	0	**228**	
	Ros 19.02	Rosslyn Plaza	231	25	-53	0	203		35	13	-39	0	**8**		196	13	-14	0	**194**	
	Ros 19.04	Rosslyn Plaza	-112	-3	152	0	36		-17	-2	111	0	**92**		-95	-2	41	0	**-56**	
	Ros 19.05	Rosslyn Plaza	193	33	0	0	226		29	17	0	0	**46**		164	17	0	0	**181**	
	Ros 5-21-40	Central Place	56	2	0	144	201		8	1	0	72	**81**		47	1	0	72	**120**	
	Ros 19.03	Rosslyn Plaza	150	32	0	0	182	240	23	16	0	0	**39**	79	128	16	0	0	**144**	161
	Ros 19.01	Rosslyn Plaza	0	6	52	0	58		0	3	38	0	**41**		0	3	14	0	**17**	
A	Ros 3.04	Waterview	300	3	34	200	538	1204	45	2	25	100	**172**	300	255	2	9	100	**366**	904
D	Ros 88	Colonial Heights	0	0	7	0	7		0	0	5	0	**5**		0	0	2	0	**2**	
	Ros 16 Ros 26 Ros 28	Rosslyn Bldg South Rosslyn Bldg. North RCA Bldg.	404	49	0	0	453		61	25	0	0	**85**		343	25	0	0	**368**	
	Ros 20	1881 Nash	0	5	92	-162	-66		0	2	67	-81	**-12**		0	2	25	-81	**-54**	
	Ros 7	CACI Bldg.	248	23	0	0	271		37	12	0	0	**49**		211	12	0	0	**222**	
	Ros 34	Westpark Hotel	0	0	135	-231	-96	-96	0	0	99	-116	**-17**	-17	0	0	37	-116	**-79**	-79
	Ros 13 Ros 31	Key Bldg. Berkeley Bldg.	389	57	0	0	446	446	58	29	0	0	**87**	87	331	29	0	0	**359**	359
	Ros 56a	River Place (North)	521	60	-564	0	17	17	78	30	-411	0	**-303**	-303	443	30	-152	0	**320**	320
	Ros 82	Monument Place	0	0	7	0	7	171	0	0	5	0	**5**	147	0	0	2	0	**2**	24
	Ros 85	Brompton, Potomac	0	0	1	0	1		0	0	1	0	**1**		0	0	0	0	**0**	
	Ros 87	Brompton, Monument	0	0	6	0	6		0	0	4	0	**4**		0	0	2	0	**2**	
	Ros 89	North Meade St.	0	0	16	0	16		0	0	12	0	**12**		0	0	4	0	**4**	
	Ros 56b	River Place (South)	0	-96	237	0	141		0	-48	173	0	**125**		0	-48	64	0	**16**	
	Ros 25	Art Assoc. Bldg.	-64	-15	60	0	-19	503	-10	-8	44	0	**27**	283	-54	-8	16	0	**-45**	220
	Ros 18	Oak Hills	189	29	0	0	218		28	14	0	0	**43**		161	14	0	0	**175**	
	Ros 22	Nash St Office Bldg.	-86	-11	0	259	162		-13	-5	0	130	**111**		-73	-5	0	130	**51**	
D	Ros 84	Christiana House	0	0	2	0	2		0	0	1	0	**1**		0	0	0	0	**0**	
E	Ros 86	Twin Oak Apartments	0	4	136	0	140		0	2	100	0	**101**		0	2	37	0	**39**	
G	Undesignated	Undesignated	0	0	92	0	92	93	0	0	67	0	**67**	68	0	0	25	0	**25**	25
	Ros 79	Colonial Heights	0	0	1	0	1		0	0	1	0	**1**		0	0	0	0	**0**	
	Ros 38	1600 Bldg.	-63	-5	89	0	22	22	-9	-2	65	0	**54**	54	-54	-2	24	0	**-32**	-32

PENTAGON CITY METRO STATION ENHANCEMENTS



PRELIMINARY
DRAFT

metro

Prepared for Arlington County, Virginia
by
Washington Metropolitan Area Transit Authority
Department of Capital Projects Management
May 2003

ARLINGTON COUNTY VIRGINIA

Table of Contents

NOTE: THE DRAWINGS PRESENTED IN THIS DOCUMENT HAVE BEEN PREPARED TO DEMONSTRATE THE BASIC FEASIBILITY OF THE CONCEPT PRESENTED. THESE CONCEPTS ARE SUBJECT TO FURTHER REFINEMENT AND MAY BE REVISED DURING FUTURE PLANNING AND/OR ENGINEERING DESIGN PHASES OF THIS PROJECT. THIS REPORT IS FOR INTERNAL USE ONLY BY WMATA AND ARLINGTON COUNTY AND NOT FOR DISTRIBUTION TO THIRD PARTIES.

Introduction

OVERVIEW

The objective of the Pentagon City Station Enhancements Project is to provide a safe, convenient and attractive pedestrian/transit environment for S. Hayes Street between Army-Navy Drive and S. 15th Street in Arlington County, Virginia, and to give the area a sense of place and identity. To accomplish this objective, this report addresses the following:

- Protective canopies for the two existing Metro entrances and third entrance (northeast corner of S. Hayes and S. 12th Streets) that is presently not open;
- Provide a new elevator to access the Metro station and pedestrian passageway below S. Hayes St.;
- Maintaining the existing number of traffic and bicycle lanes;
- Improve traffic turning movements;
- Provision for increased bus service with bus shelters;
- Reducing street crossing distances and providing well marked pedestrian crossing zones and timed cross walk signals;
- Wider sidewalks;
- Coordinated street furniture and signage;
- Enhanced roadway and pedestrian lighting;
- Redesigned landscape features;
- Provisions for tour bus parking;
- Provisions for Kiss & Ride, shuttles and taxi service;
- Places for public art.

VIEW TOWARDS RITZ CARLTON


VIEW SOUTH TOWARDS PARC VISTA


VIEW EAST TOWARDS METRO ENTRANCE

Introduction

VIEW WEST TOWARDS FASHION CENTRE

VIEW EAST TOWARDS METRO/PENTAGON CENTRE ENTRANCE

AERIAL VIEW OF SOUTH HAYES STREET/12TH STREET INTERSECTION

VIEW OF METRO ENTRANCE AT N.E. CORNER OF SOUTH HAYES STREET AND 12TH STREET

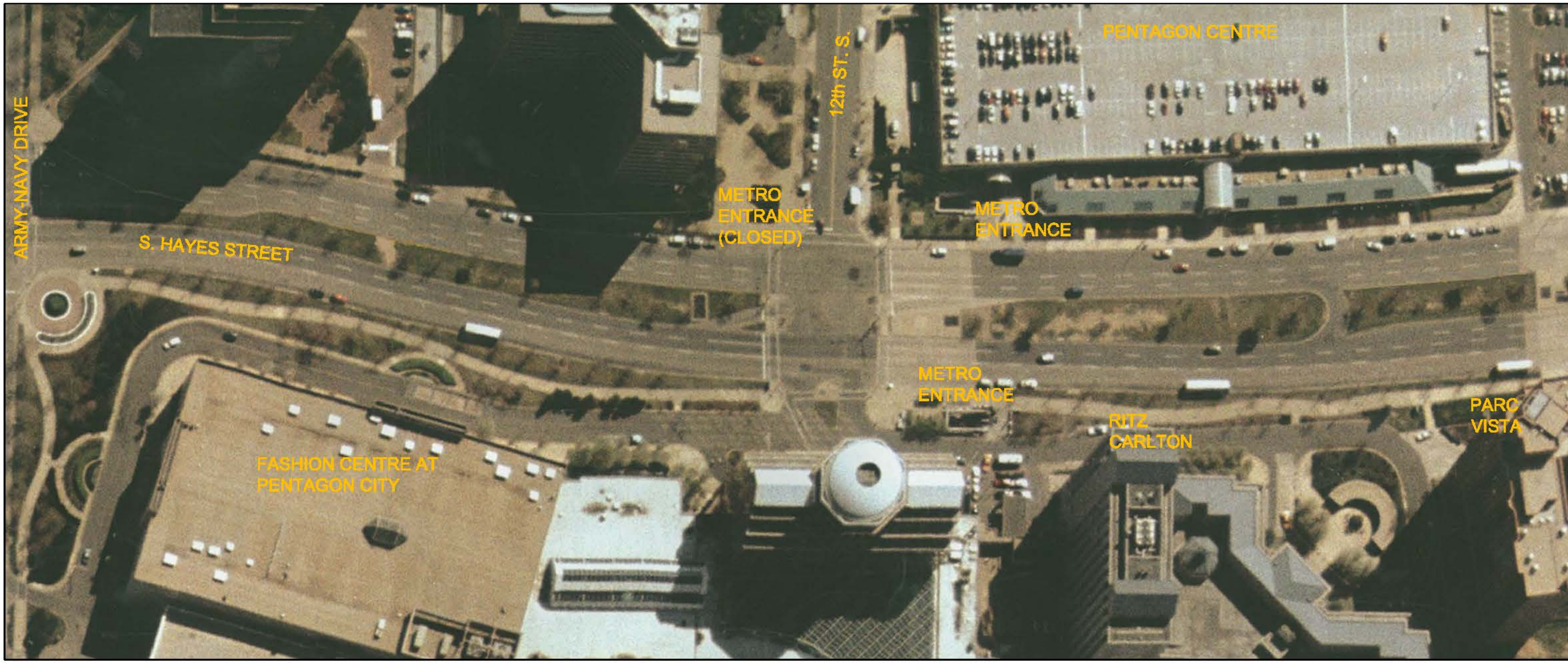
Site Photographs

VIEW NORTH OF PENTAGON CENTRE SIDEWALK

AERIAL VIEW OF SOUTH HAYES STREET/12th STREET INTERSECTION

VIEW NORTH OF SOUTH HAYES STREET

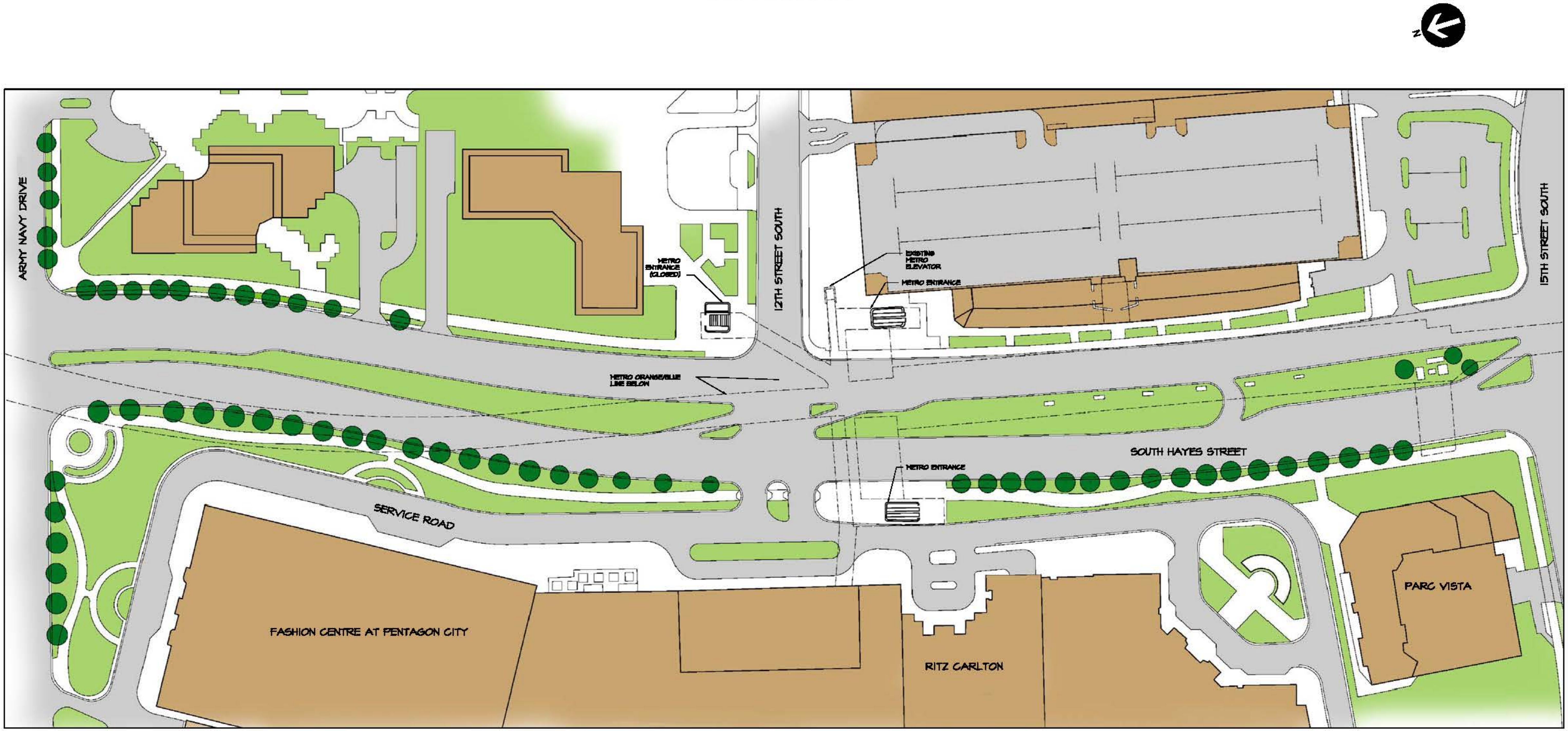
Introduction



60 0 60 120
SCALE: 1"=120'

Aerial Photograph

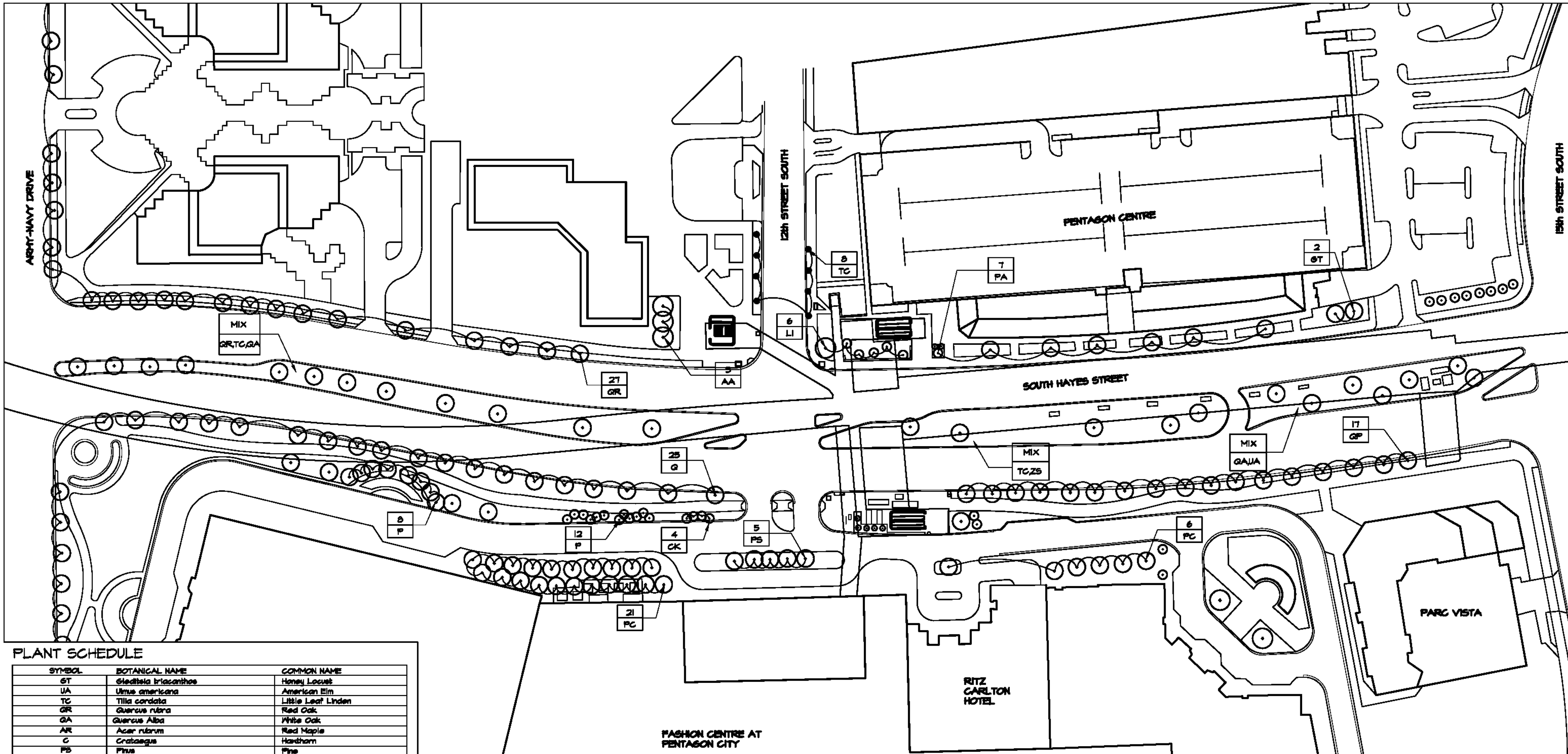
Introduction



Existing Site Plan

PENTAGON CITY METRO STATION ENHANCEMENTS

Introduction



PLANT SCHEDULE

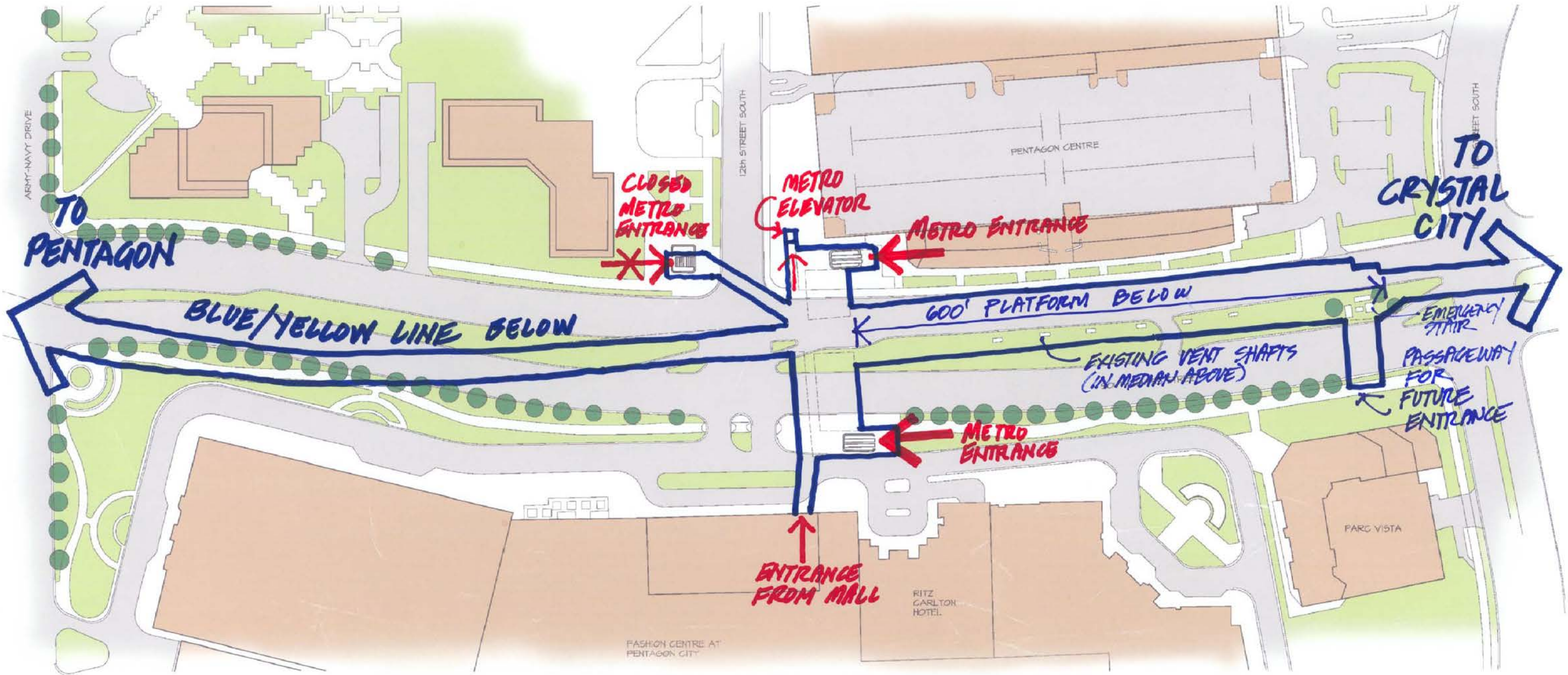
SYMBOL	BOTANICAL NAME	COMMON NAME
GT	Gleditsia triacanthos	Honey Locust
UA	Ulmus americana	American Elm
TC	Tilia cordata	Little Leaf Linden
QR	Quercus rubra	Red Oak
QA	Quercus Alba	White Oak
AR	Acer rubrum	Red Maple
C	Crataegus	Hawthorn
PS	Pinus	Pine
P	Prunus	Cherry
PA	Platanus acerifolia	London Plane Tree
ZS	Zelkova serrata	Zelcova
QP	Quercus palustris	Pin Oak
PC	Pyrus calleryana	Bradford Pear
CK	Cornus kousa	Dogwood
LI	Lagerstroemia indica	Crape Myrtle

Existing Landscape Plan

60 0 60 120
SCALE: 1"=120''

PENTAGON CITY METRO STATION ENHANCEMENTS

Analysis



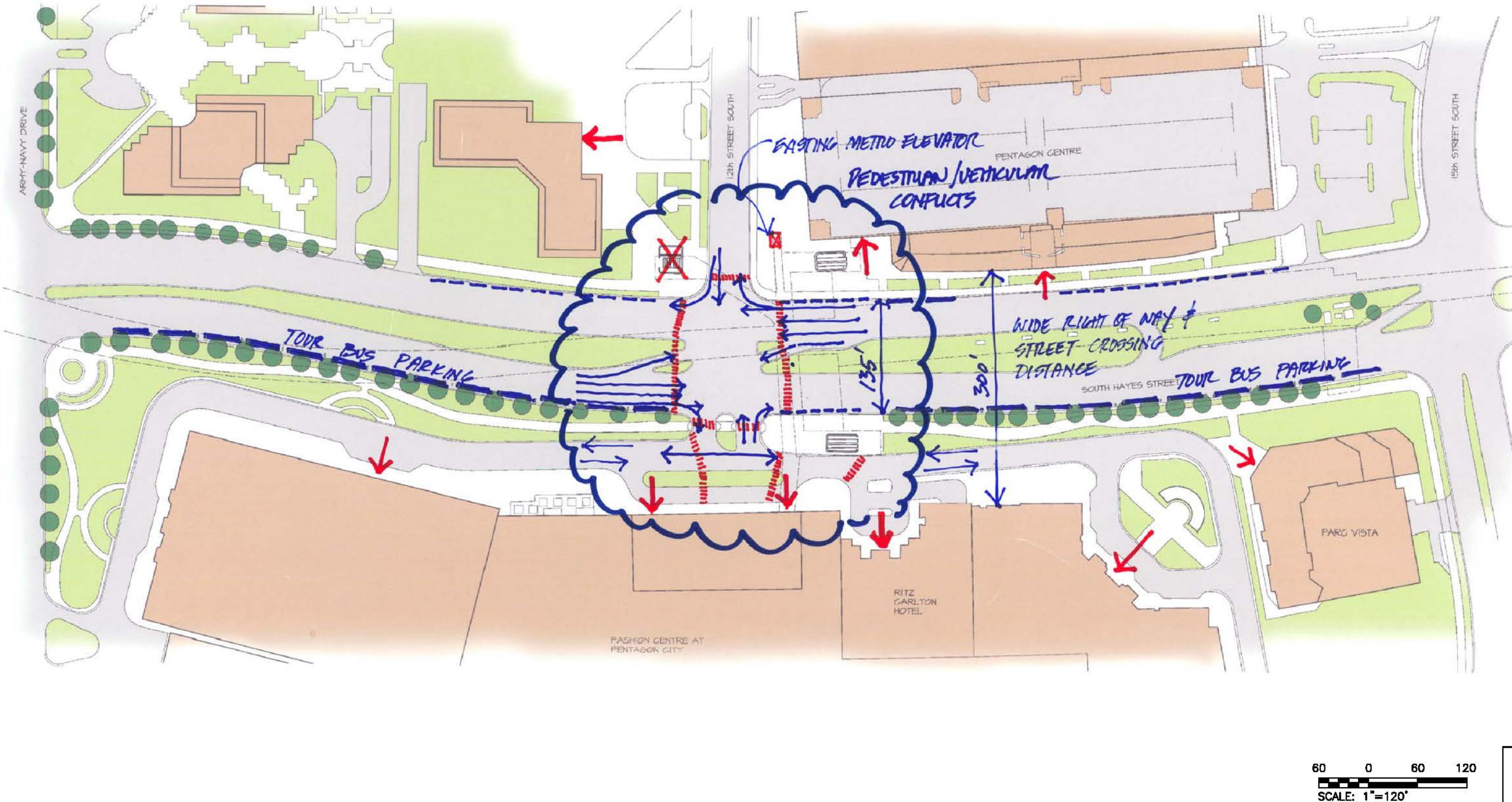
60 0 60 120
SCALE: 1"=120'

PENTAGON CITY METRO STATION ENHANCEMENTS

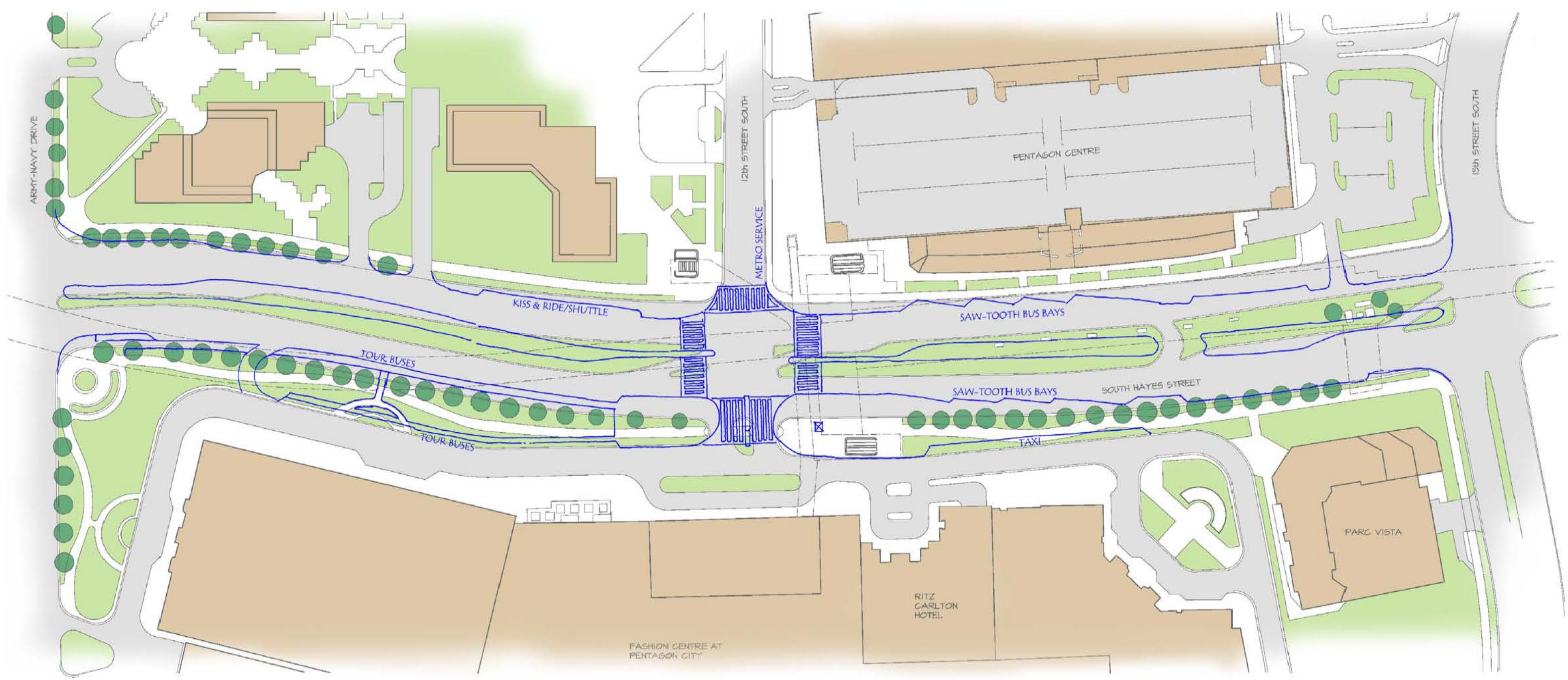
Analysis

PENTAGON CITY METRO STATION ENHANCEMENTS

Analysis

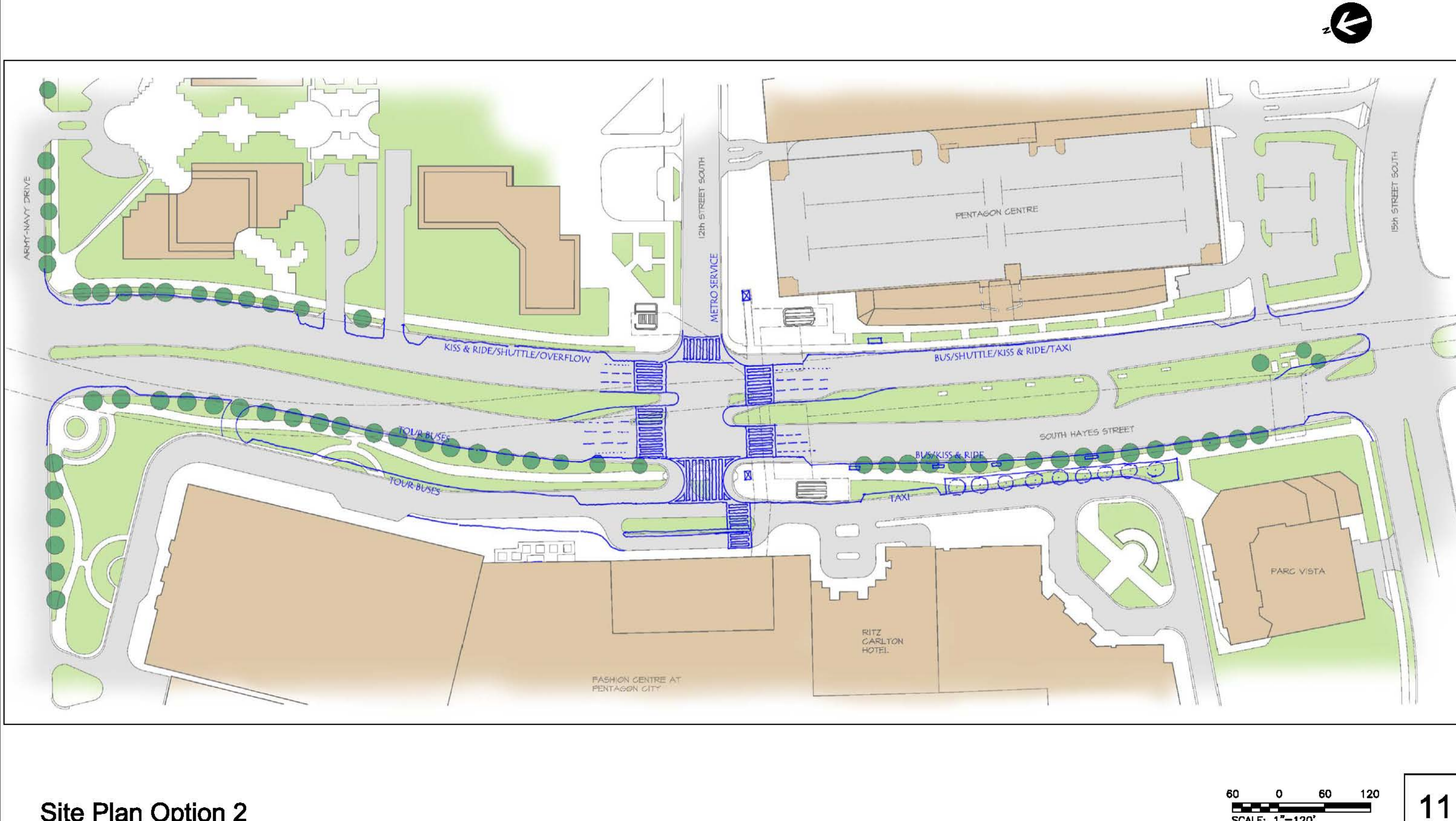


Options



Site Plan Option 1

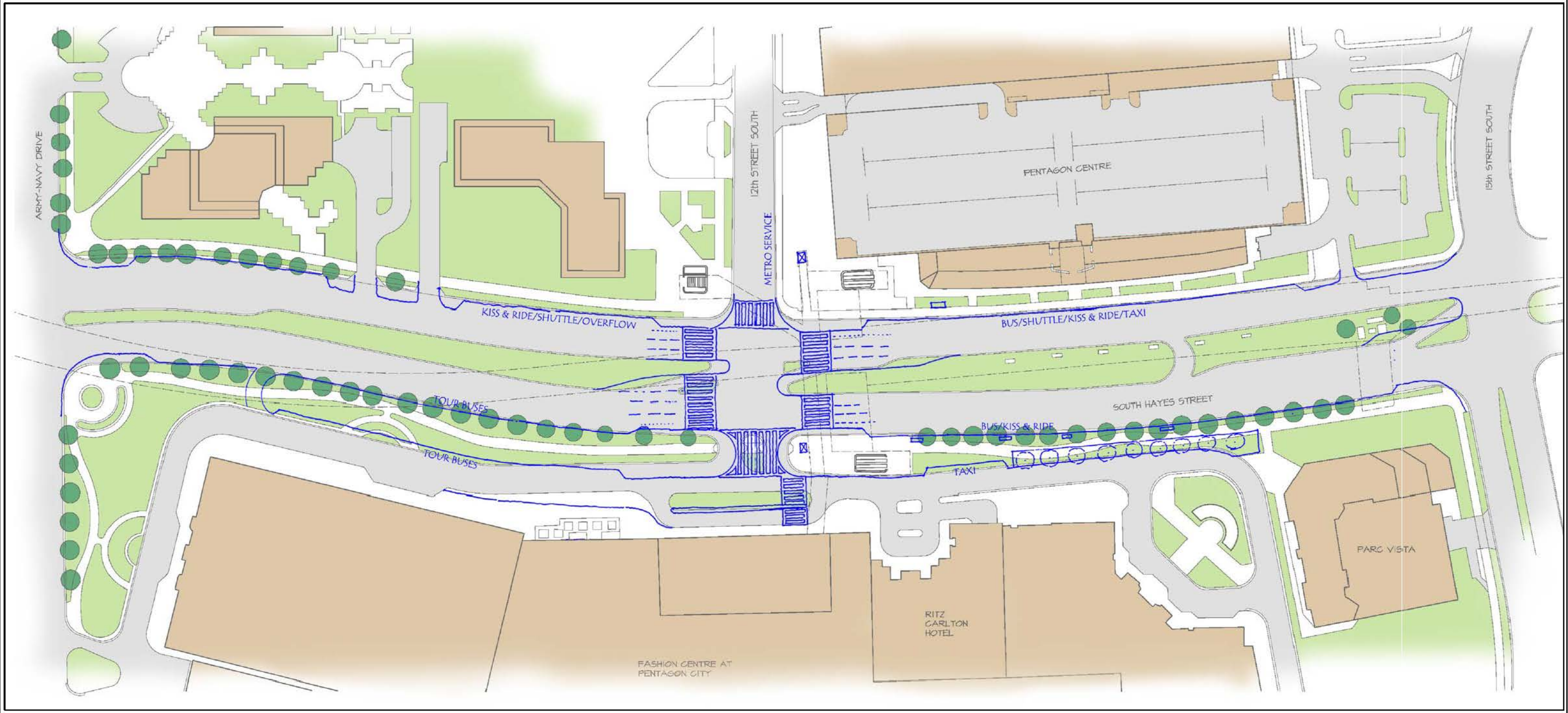
Options



Site Plan Option 2

PENTAGON CITY METRO STATION ENHANCEMENTS

Options

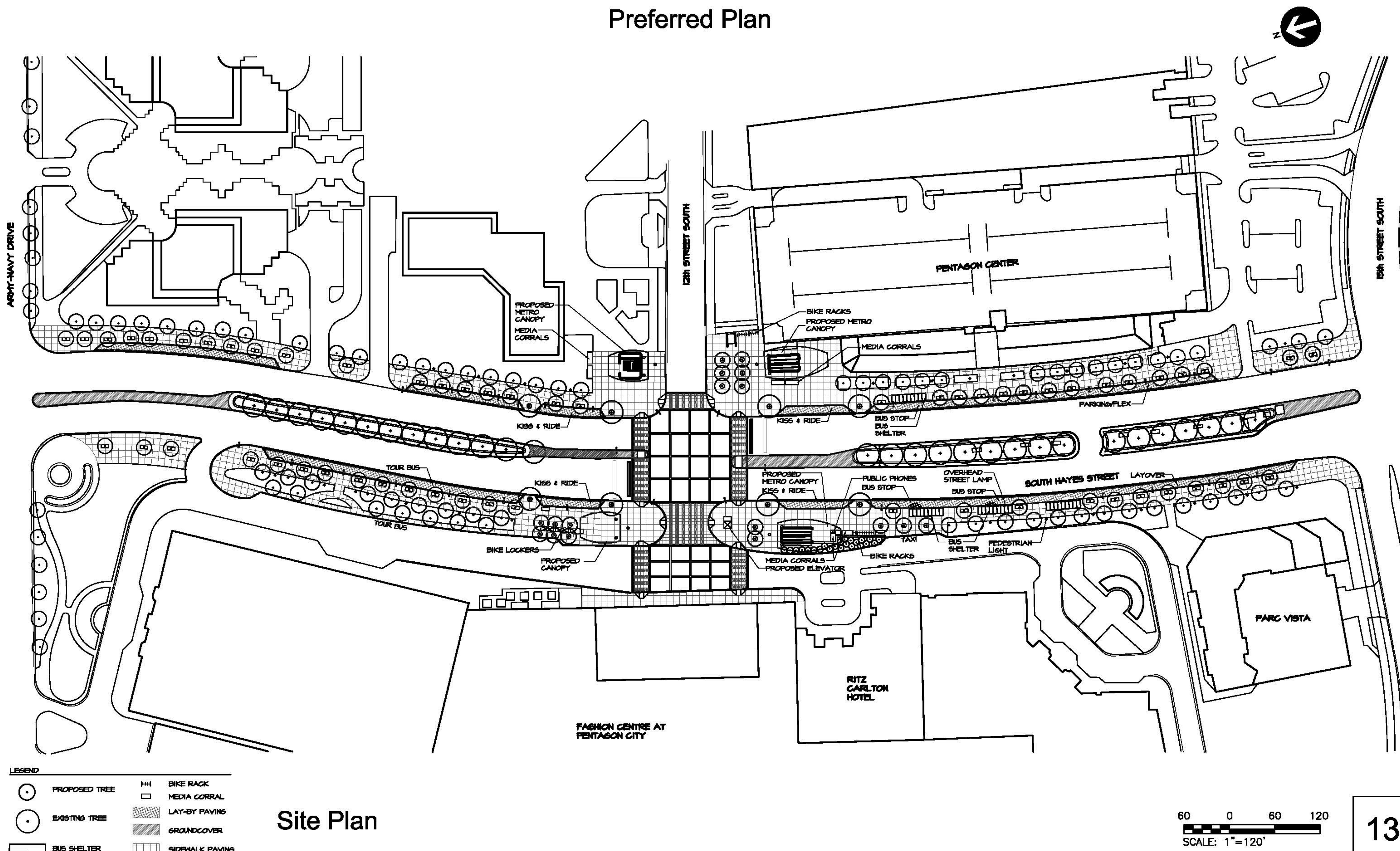


Site Plan Option 3

60 0 60 120
SCALE: 1"=120'

PENTAGON CITY METRO STATION ENHANCEMENTS

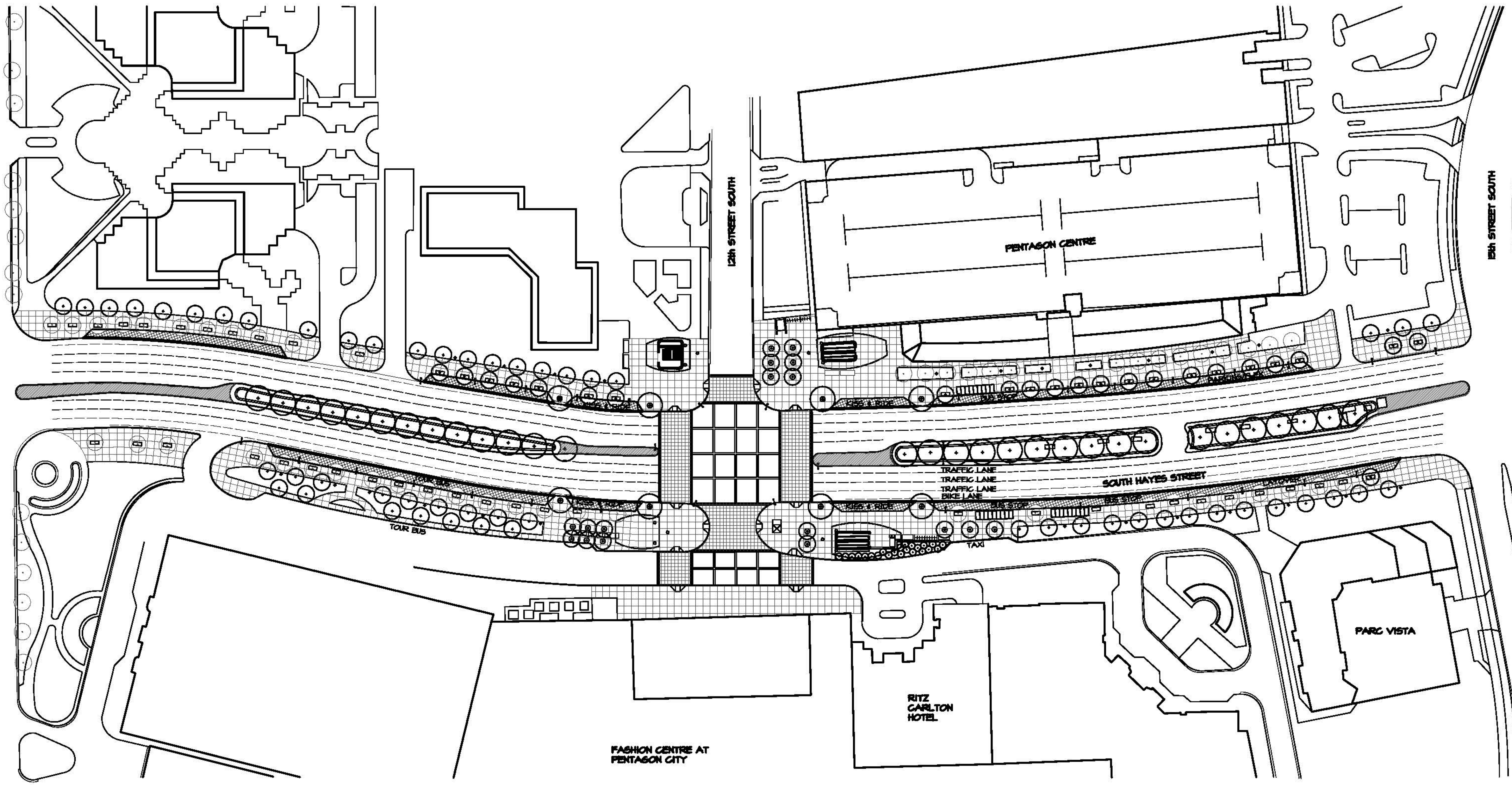
Preferred Plan



Site Plan

PENTAGON CITY METRO STATION ENHANCEMENTS

Preferred Plan

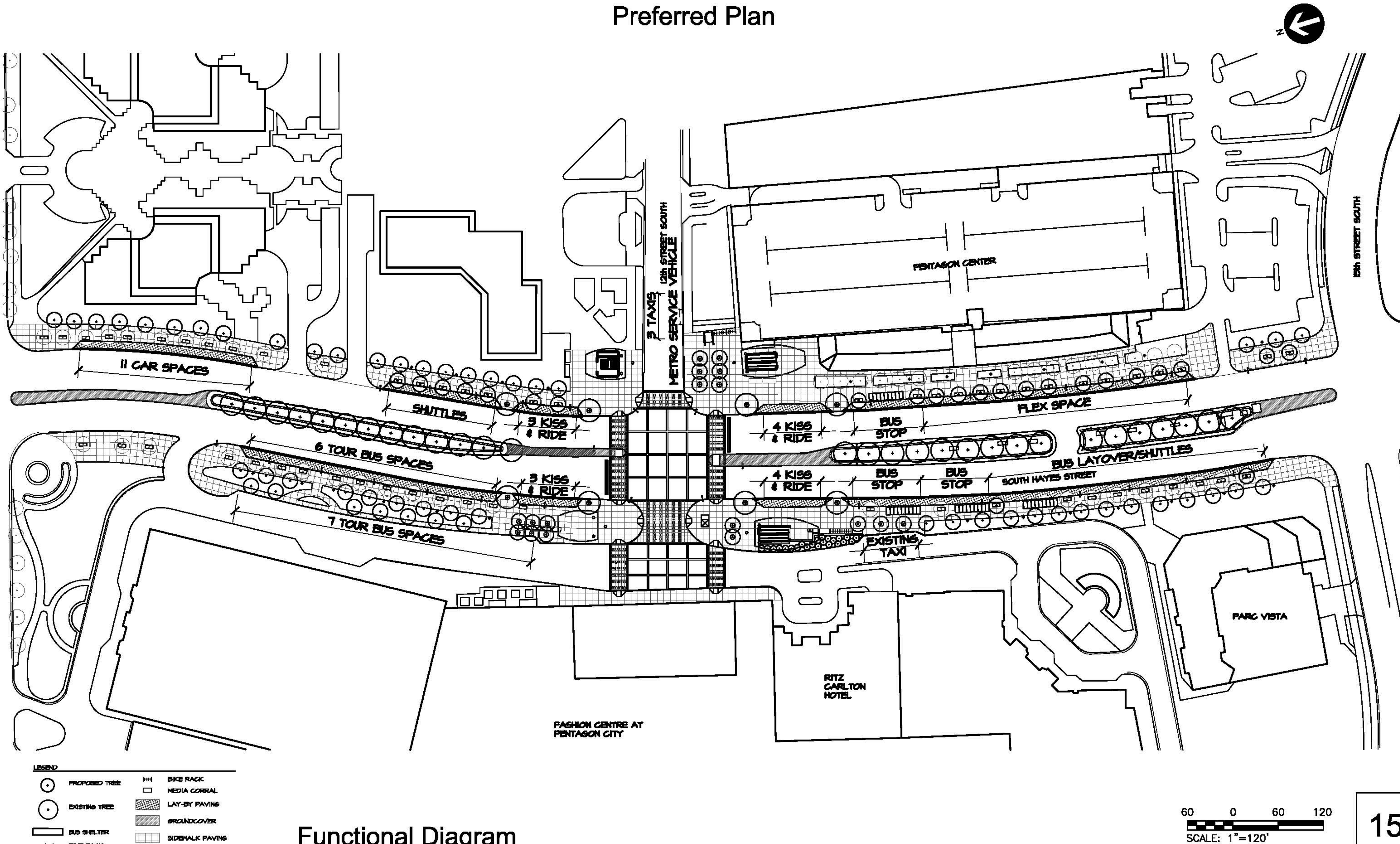


Proposed Traffic Lanes

60 0 60 120
SCALE: 1"=120'

PENTAGON CITY METRO STATION ENHANCEMENTS

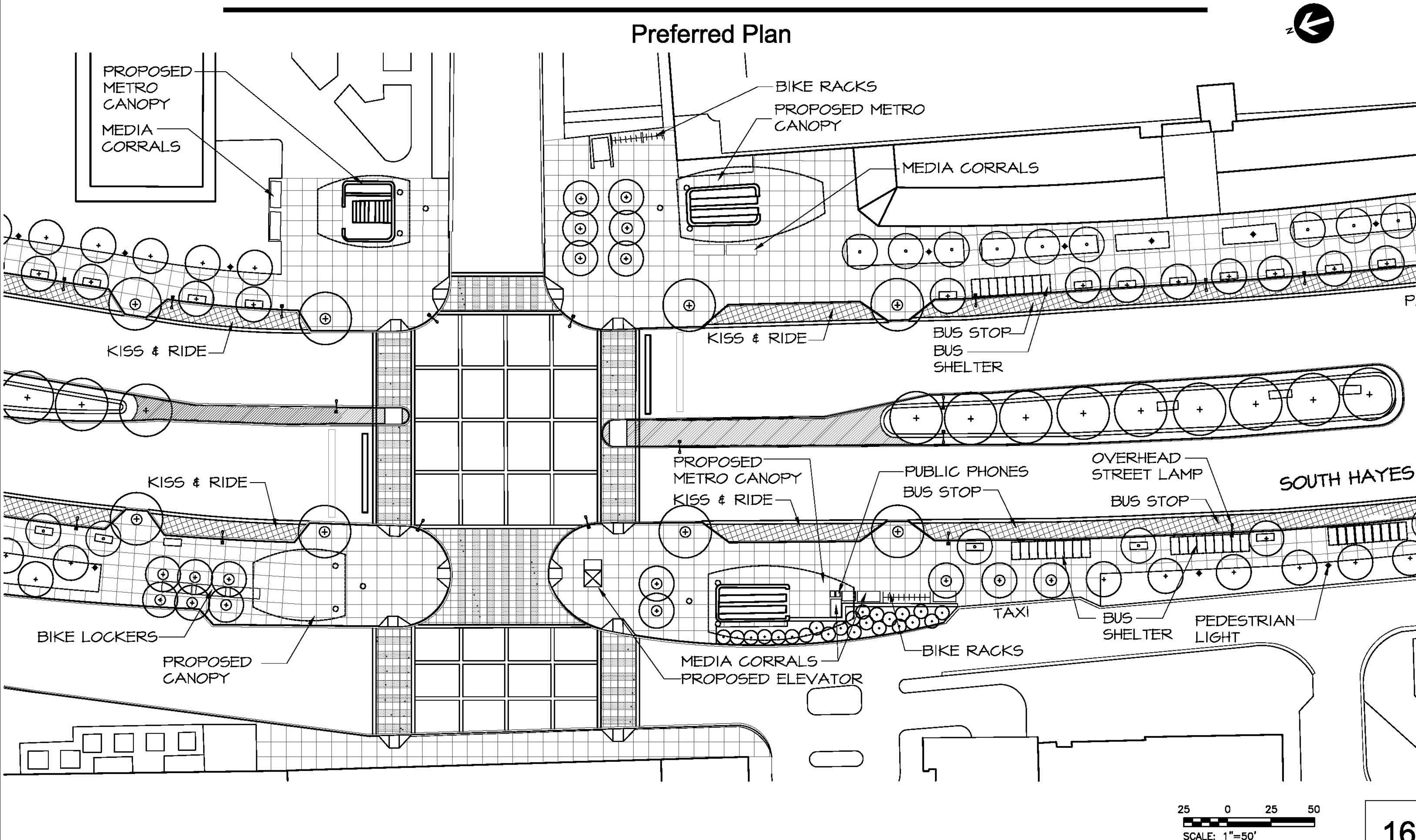
Preferred Plan



Functional Diagram

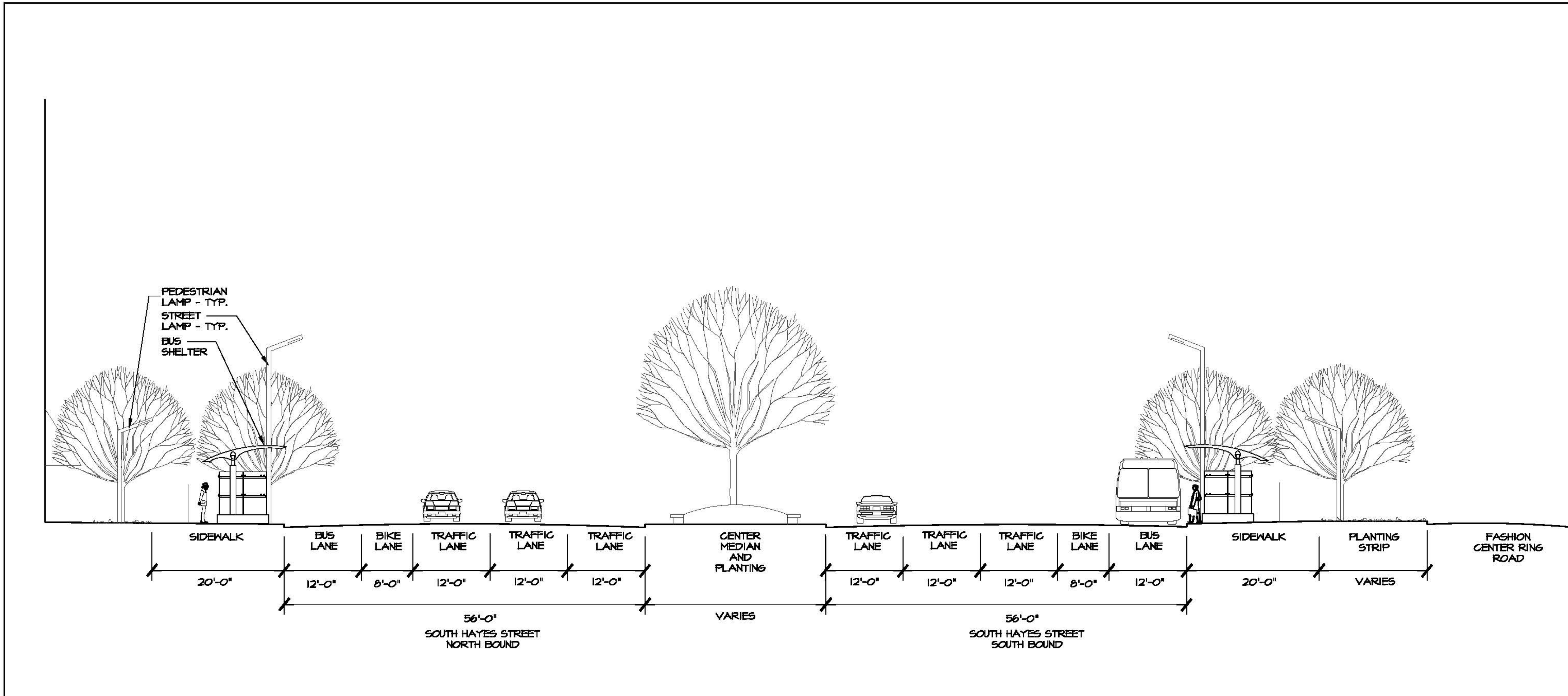
PENTAGON CITY METRO STATION ENHANCEMENTS

Preferred Plan



PENTAGON CITY METRO STATION ENHANCEMENTS

Preferred Plan

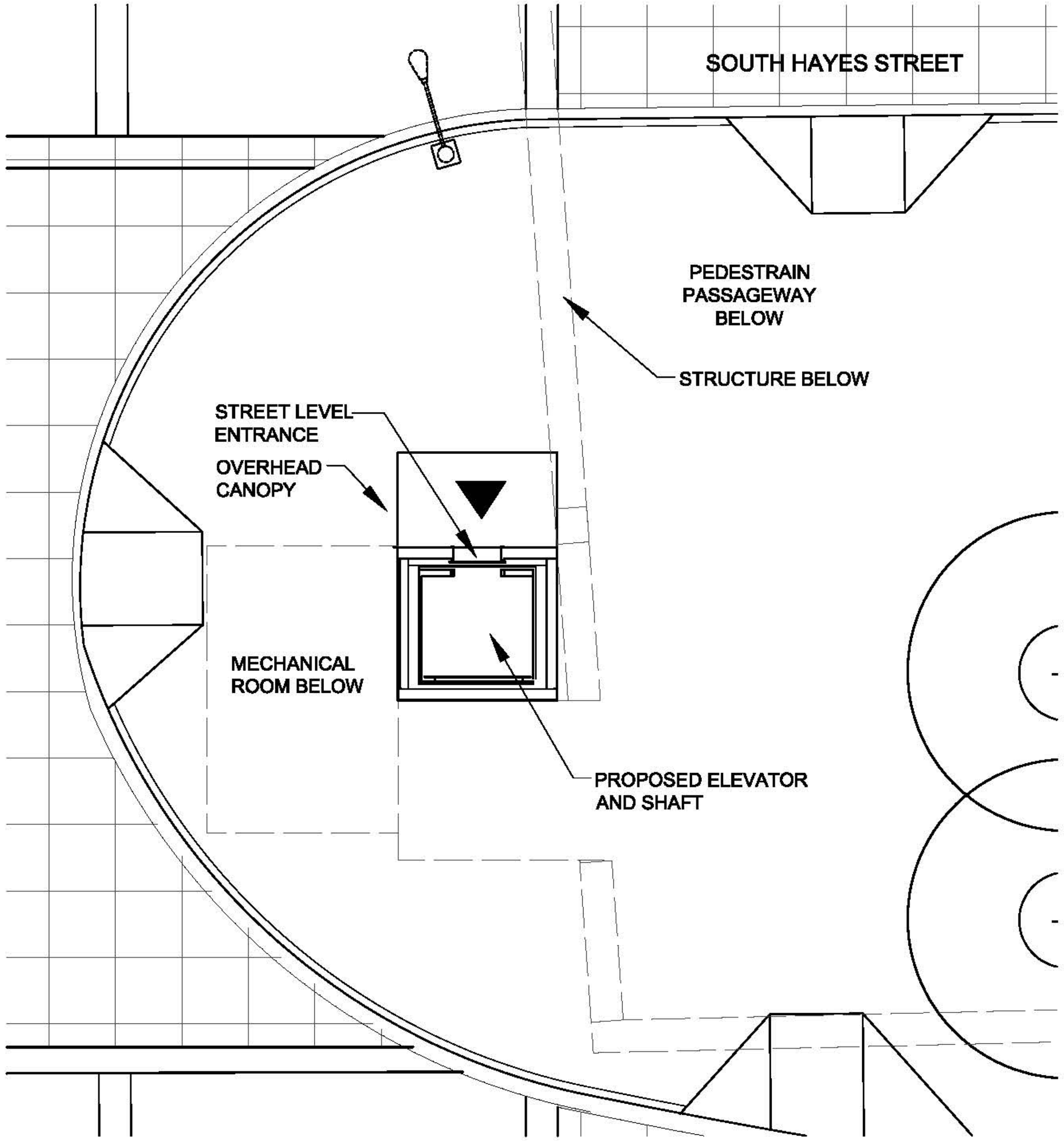


South Hayes Street Section

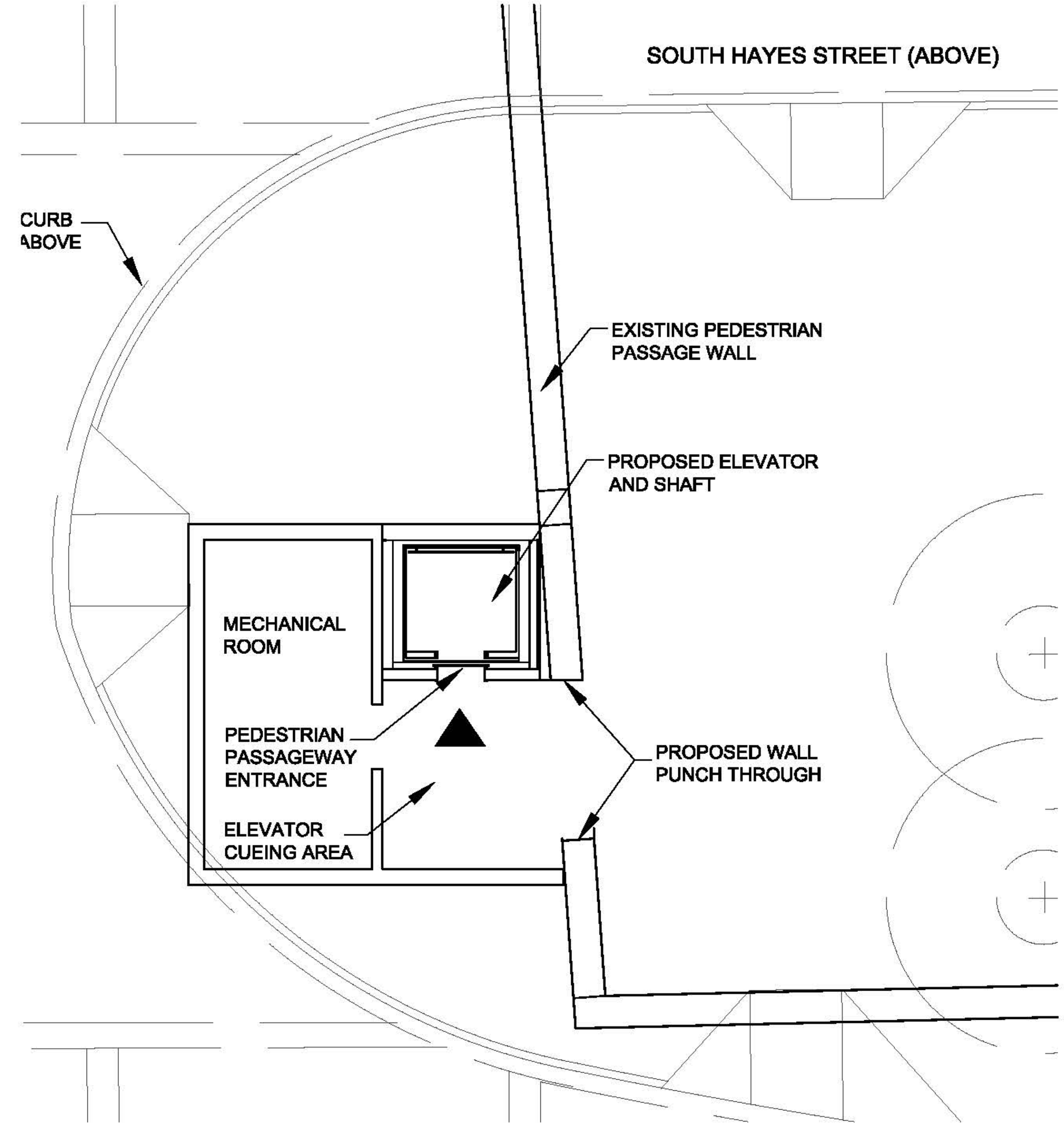
SCALE: 1/16"=1'-0"

PENTAGON CITY METRO STATION ENHANCEMENTS

Preferred Plan



Street Level

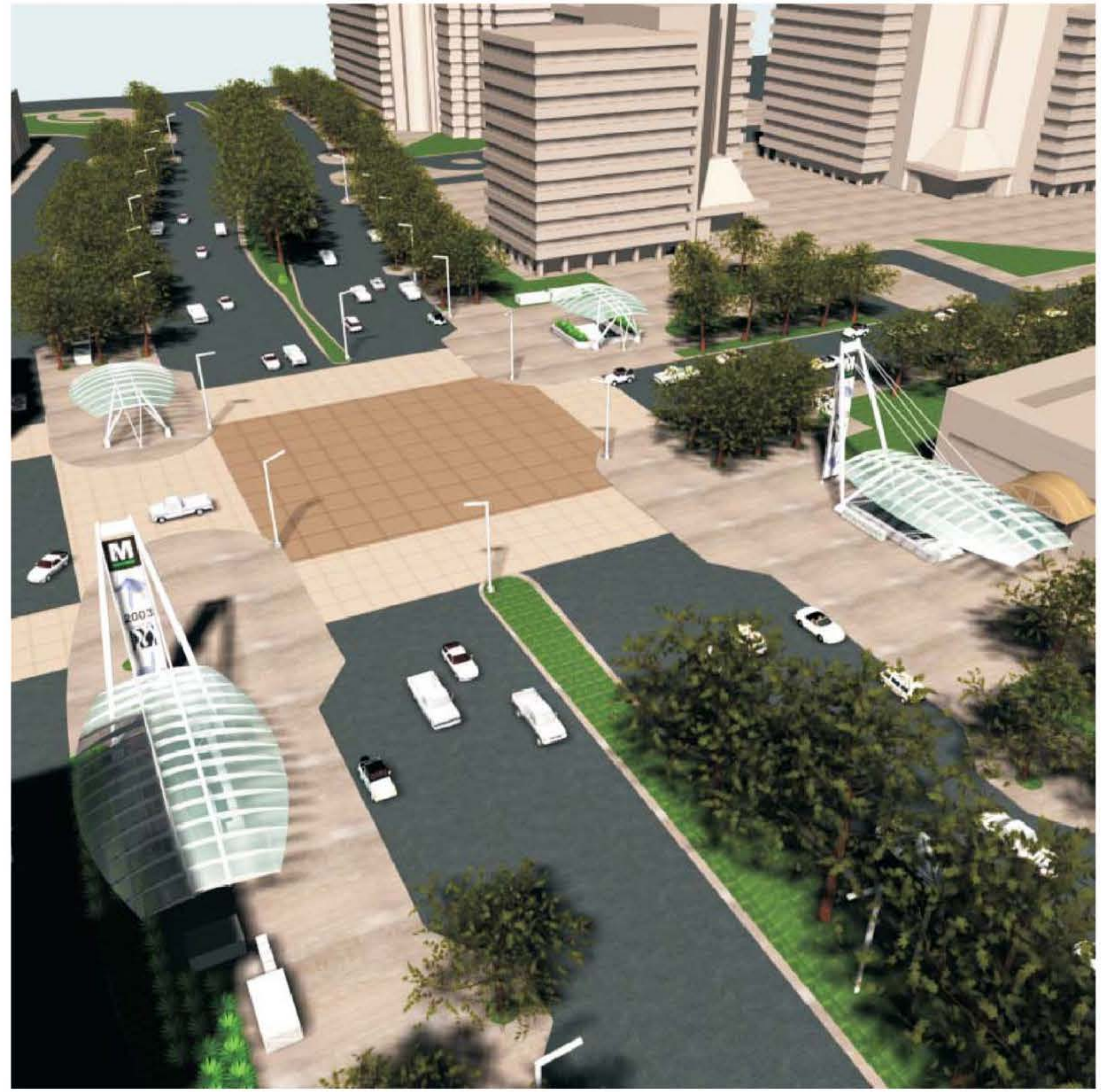


Pedestrian Passageway Level

Elevator Plan

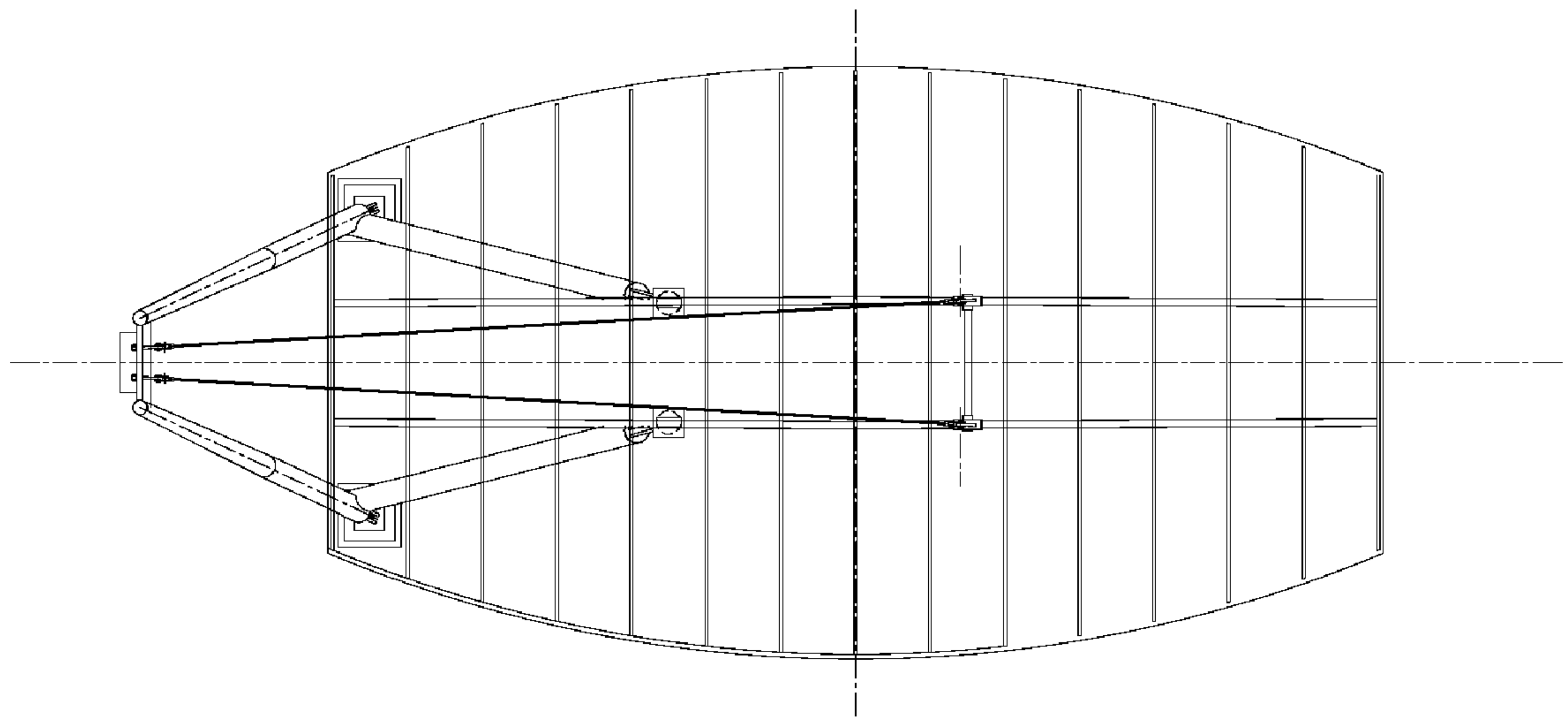
5 0 5 10
SCALE: 1"=10'

Canopy Design



Site Options

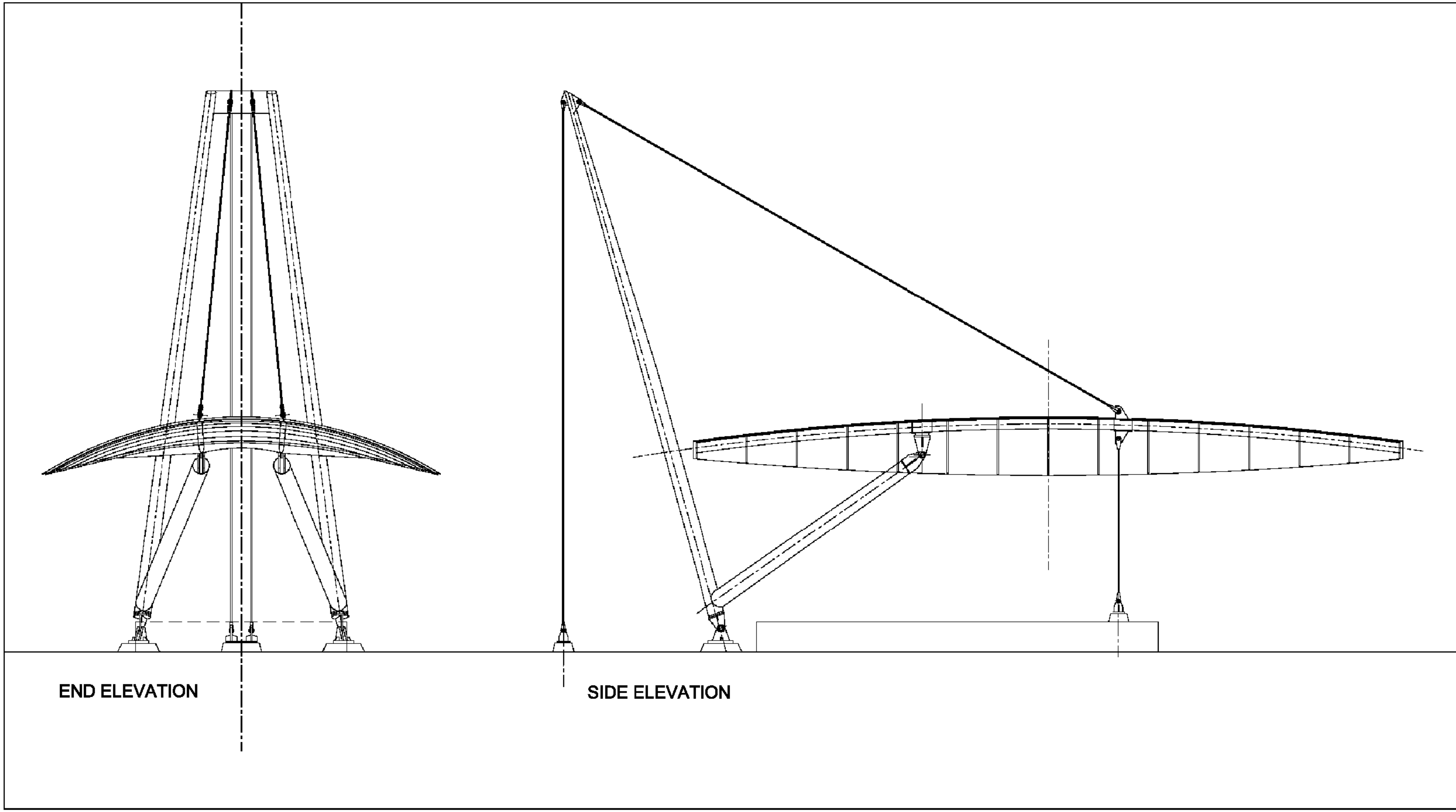
Canopy Design



Plan - Full Canopy

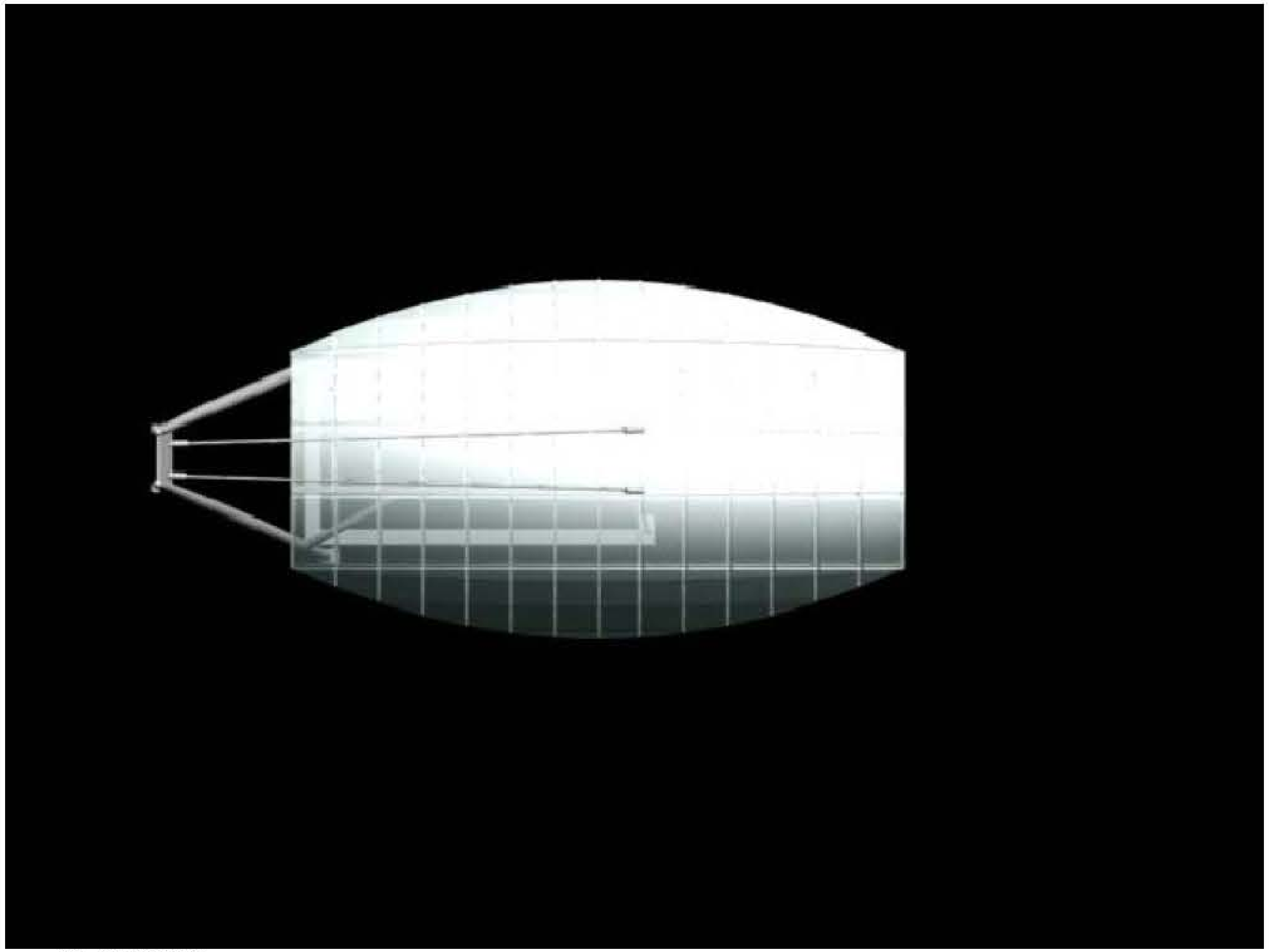
7.5 0 3.75 7.5
SCALE: 1"=7.5'

Canopy Design

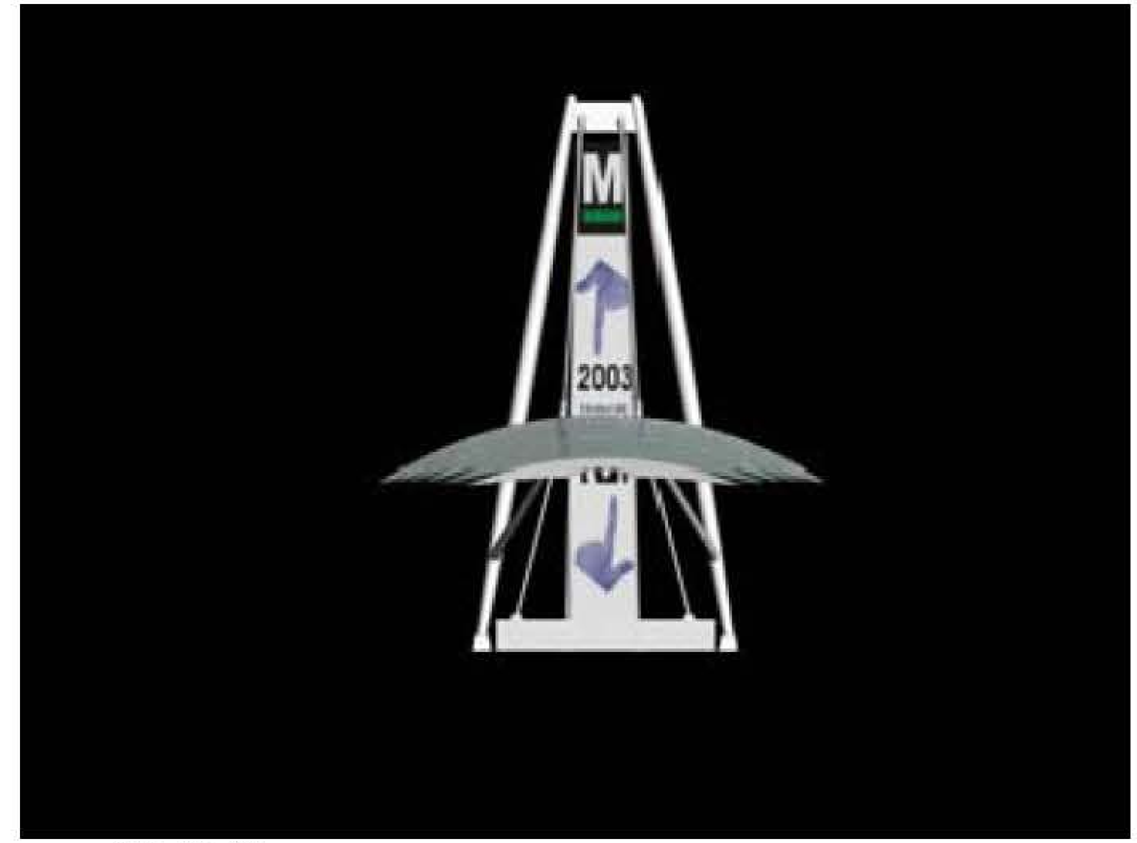


Elevations - Full Canopy

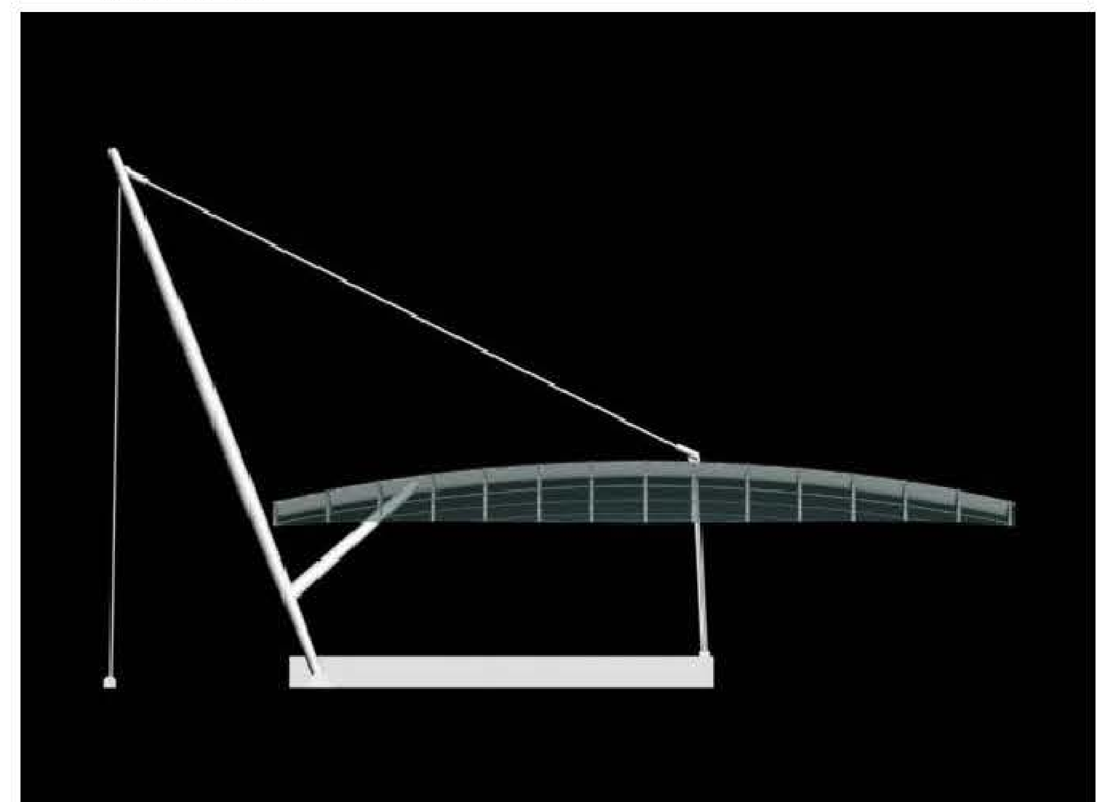
Canopy Design



PLAN VIEW



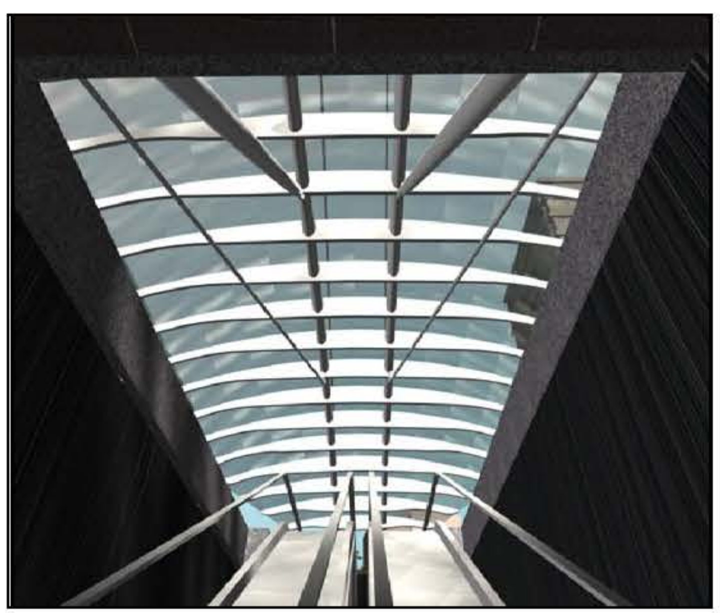
END VIEW



SIDE VIEW

Redered Views - Full Canopy

Canopy Design



Perspectives

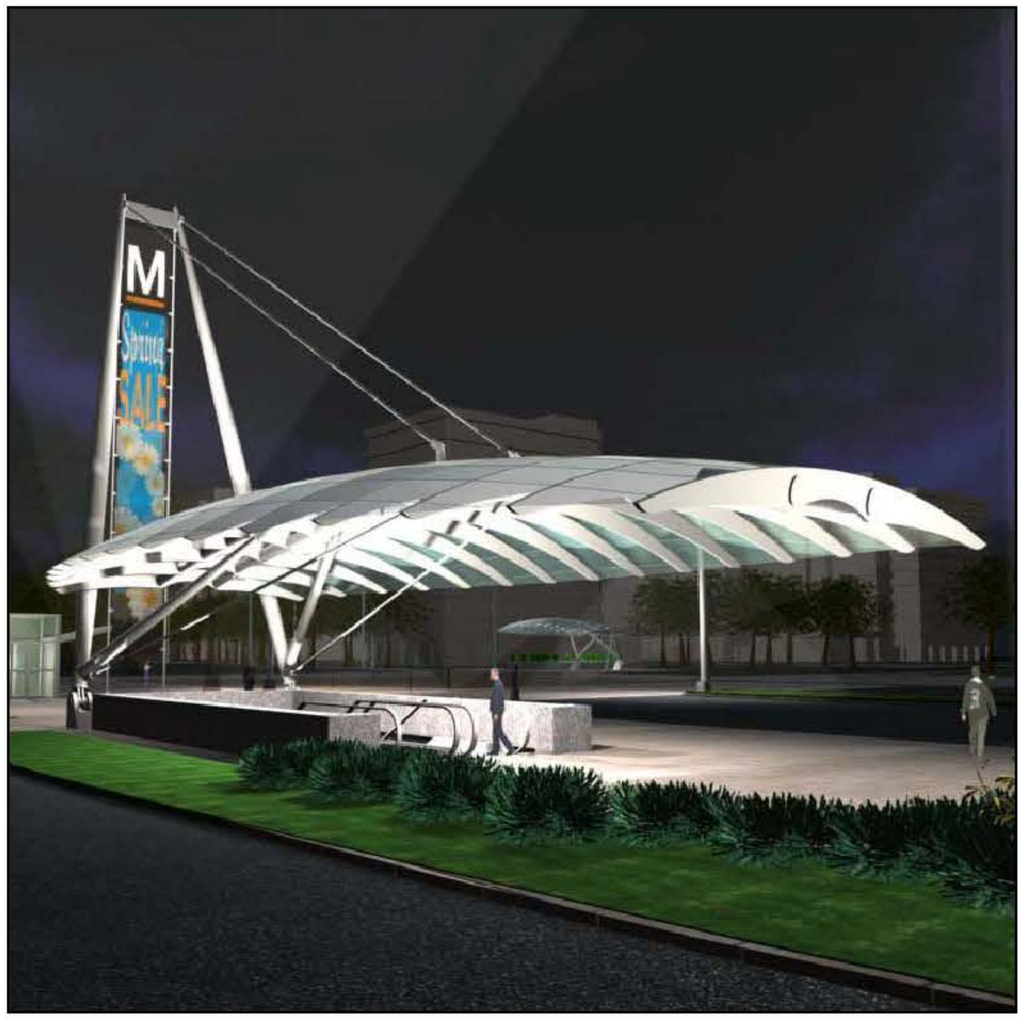
Canopy Design

Perspectives

Canopy Design

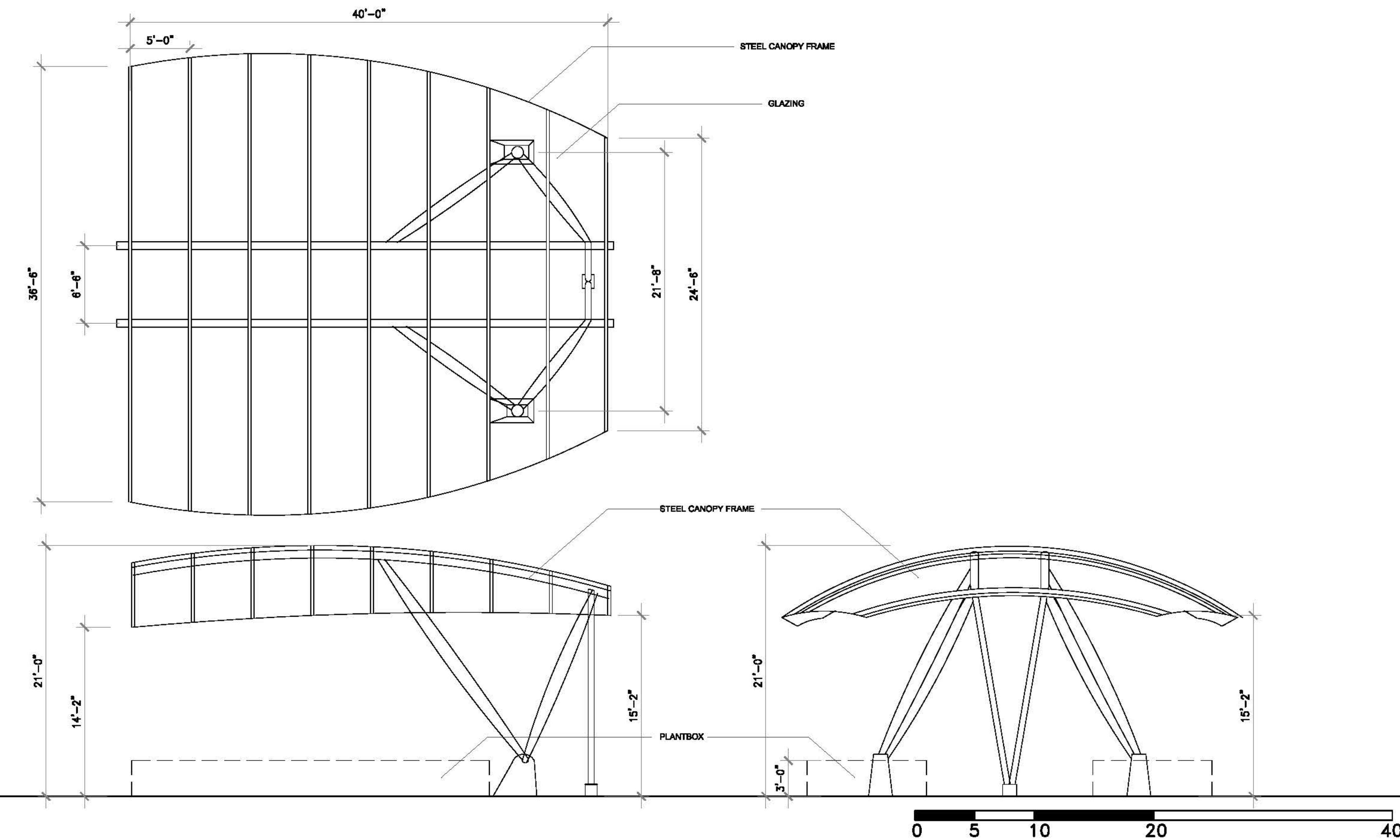
Perspective

Canopy Design



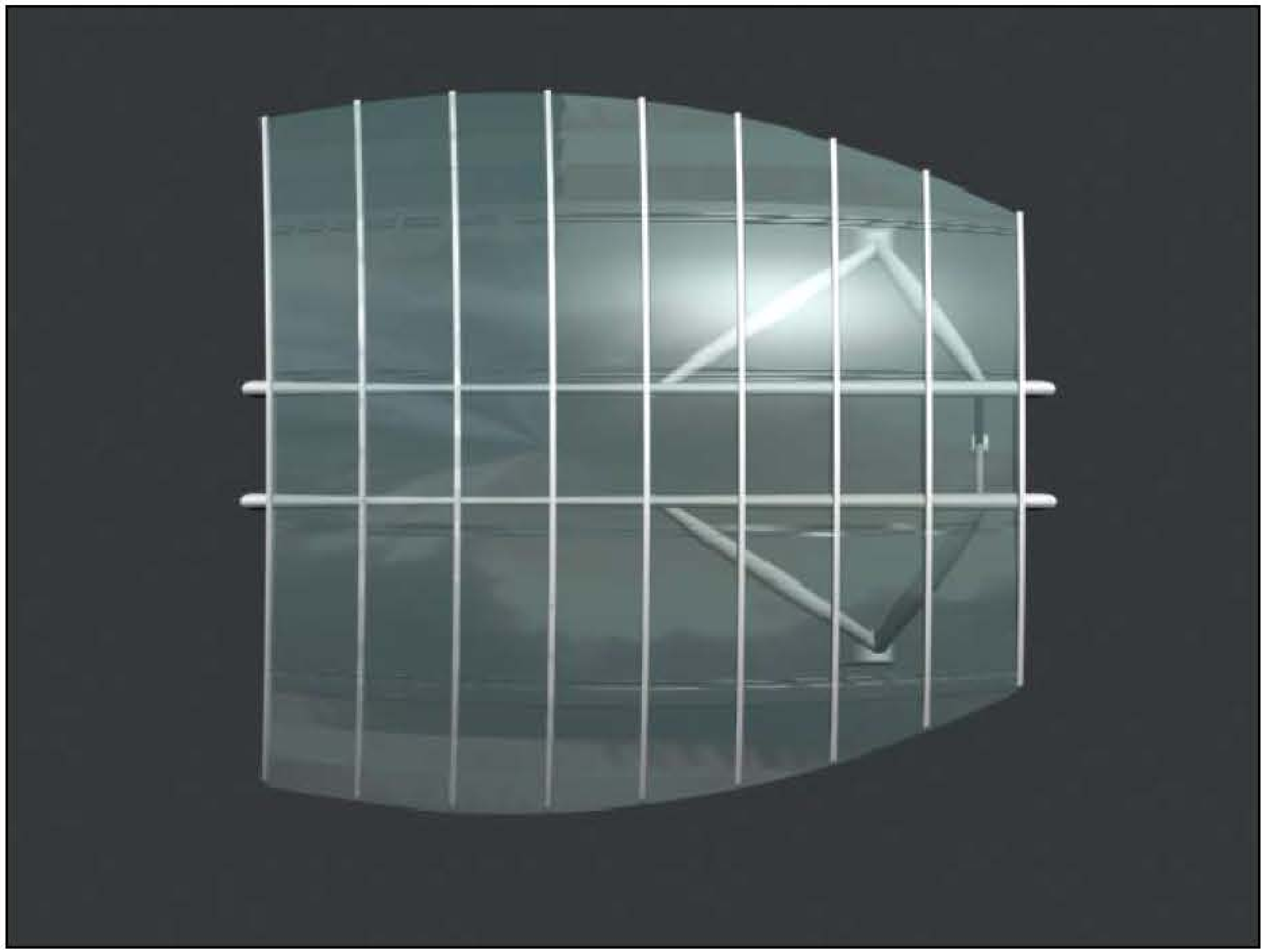
Perspectives at Night - Full Canopy

Canopy Design



Plan - Half Canopy

Half-Canopy

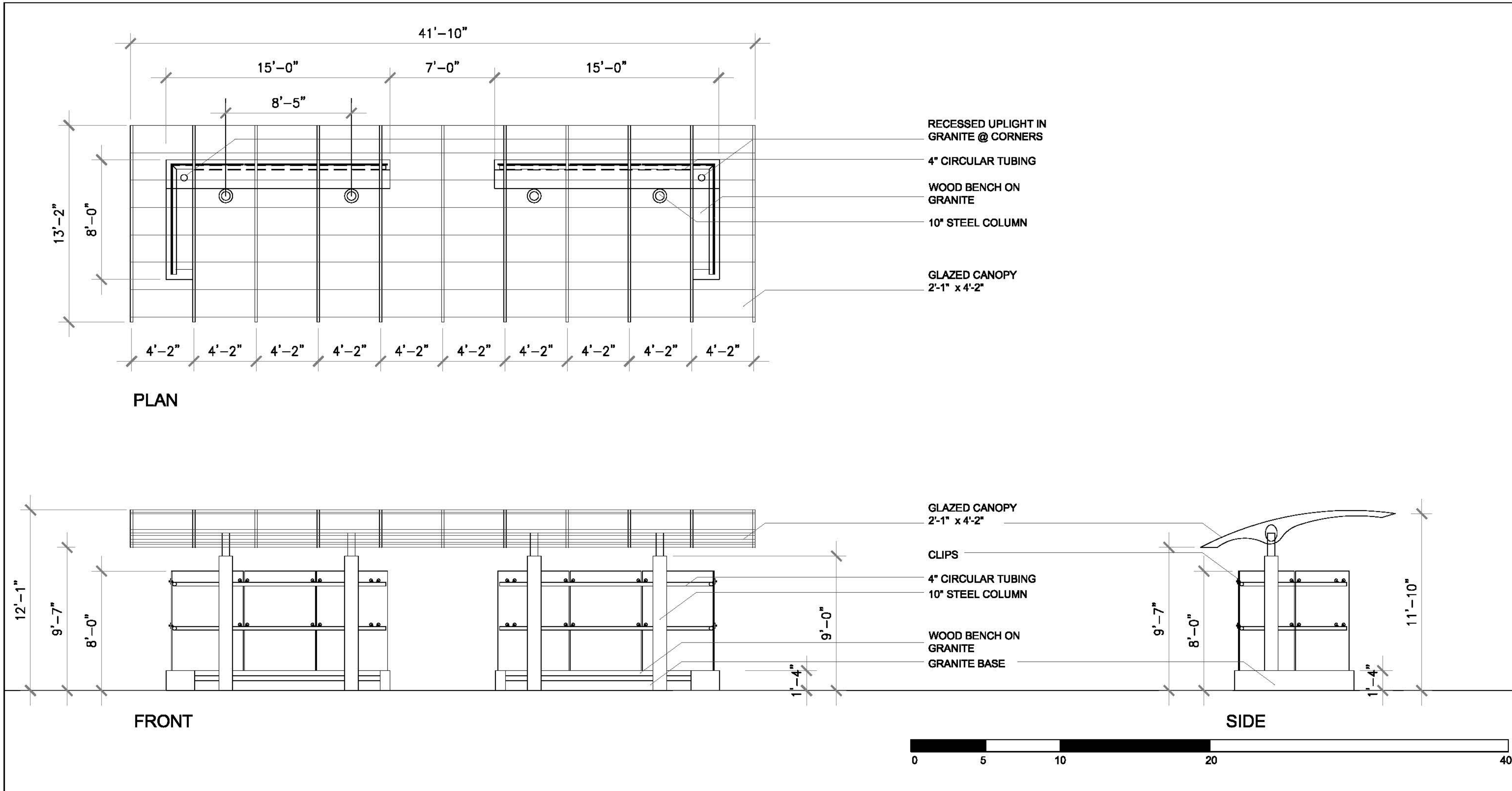


Plan and Perspective

Canopy Design

Perspectives - Half Canopy

Bus Shelter Design



Views

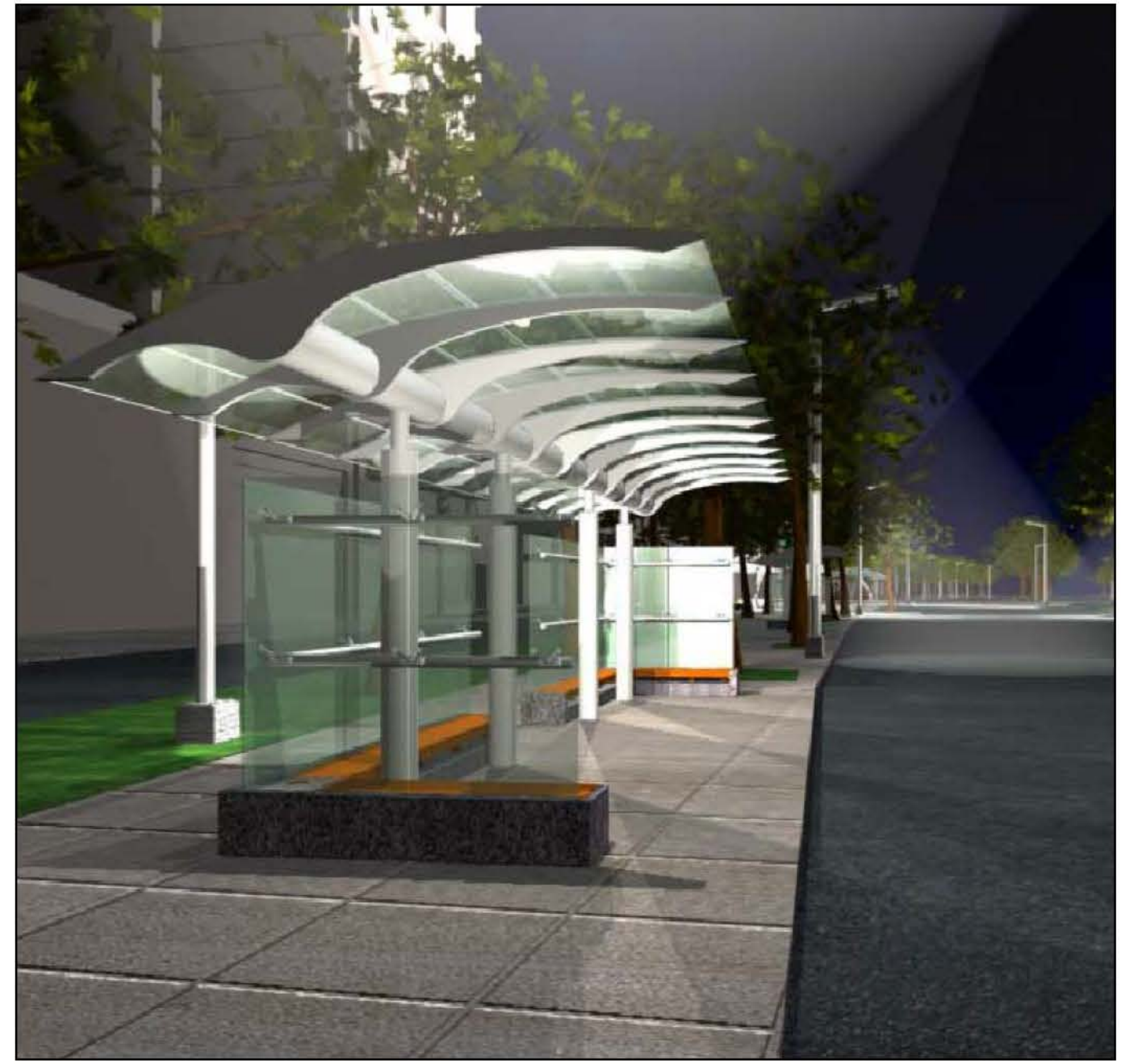
Bus Canopy Design

Perspectives

Bus Canopy Design

Perspectives

Bus Canopy Design

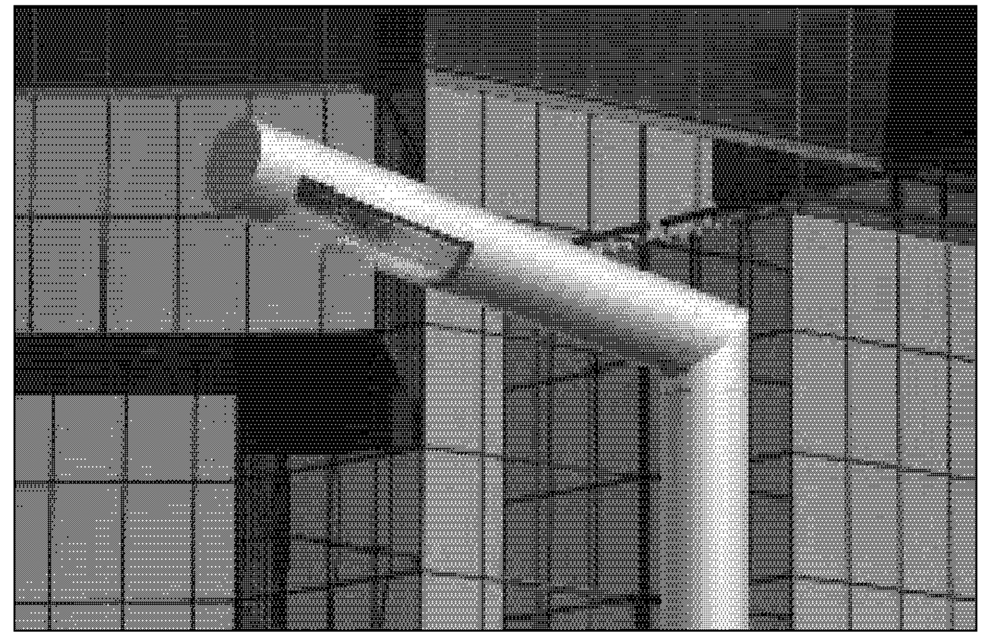


Perspectives

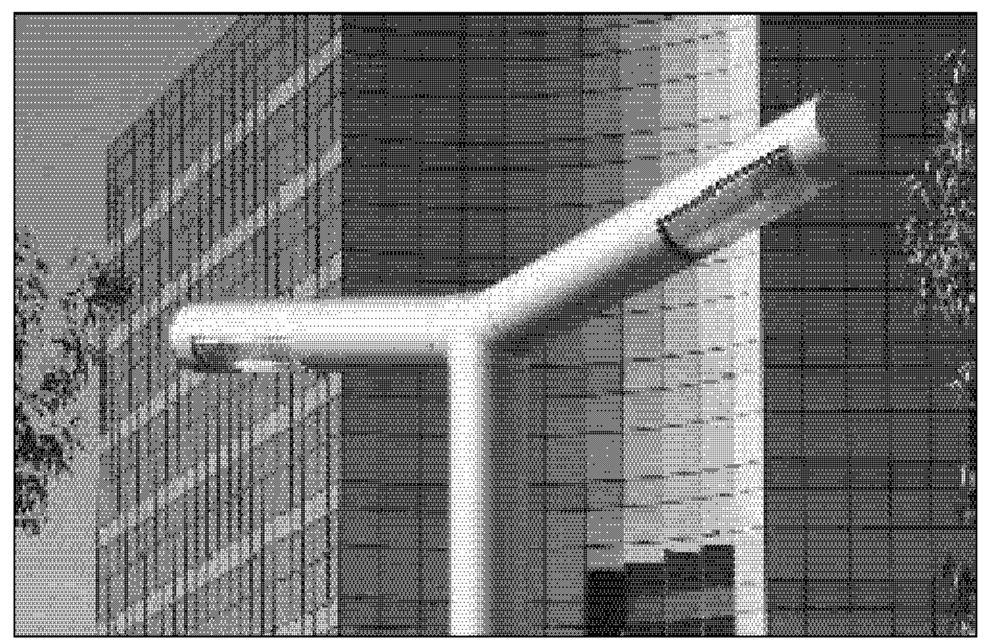
PENTAGON CITY METRO STATION ENHANCEMENTS

Street Lighting

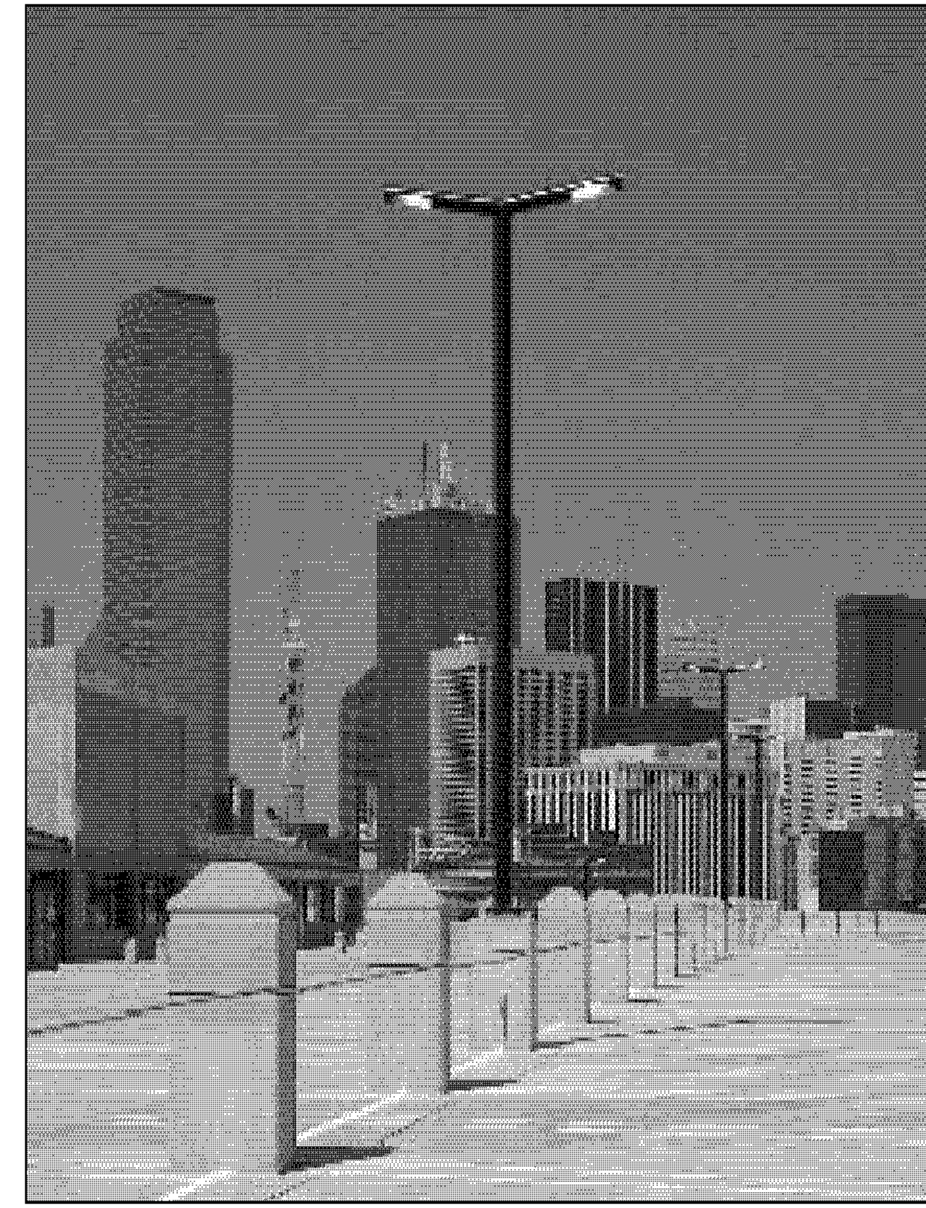
BY KIM LIGHTING



BY KIM LIGHTING



BY KIM LIGHTING



BY KIM LIGHTING

A-1

PENTAGON CITY METRO STATION ENHANCEMENTS

Bicycle Racks

BY BRP ENTERPRISES

BY BRP ENTERPRISES

BY MADRAX

BY PATTERSON WILLIAMS ATHLETIC

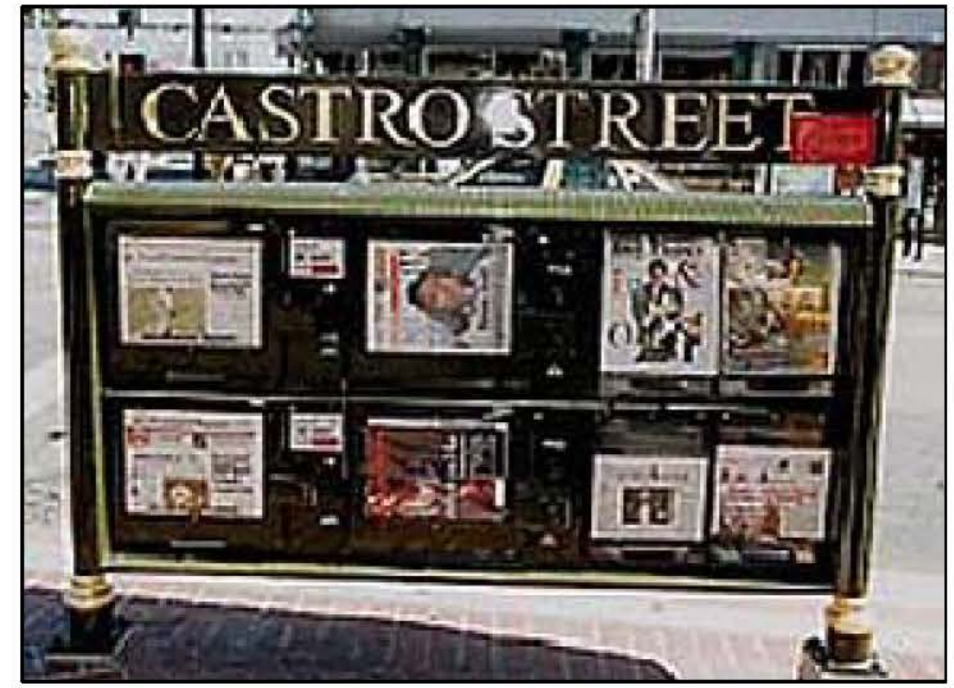
BY PATTERSON WILLIAMS ATHLETIC

A-2

PENTAGON CITY METRO STATION ENHANCEMENTS

Media Kiosks

BY CITY SOLUTIONS



ROSSLYN, VA


BY ADSHEL


CHICAGO O'HARE INTERNATIONAL AIRPORT


ST. PAUL INTERNATIONAL AIRPORT


BY LANDSCAPE FORMS

A-3

PENTAGON CITY METRO STATION ENHANCEMENTS

Stamped Asphalt

WINNSBORO, SC BY STREETPRINT

WINSTON-SALEM, NC BY STREETPRINT

BUCKHEAD, GA BY STREETPRINT

AVONDALE, AZ BY STREETPRINT

A-4

Stamped Concrete

BELGIAN RADIAL
BRICK BY INCRETE

BY BOMANITE

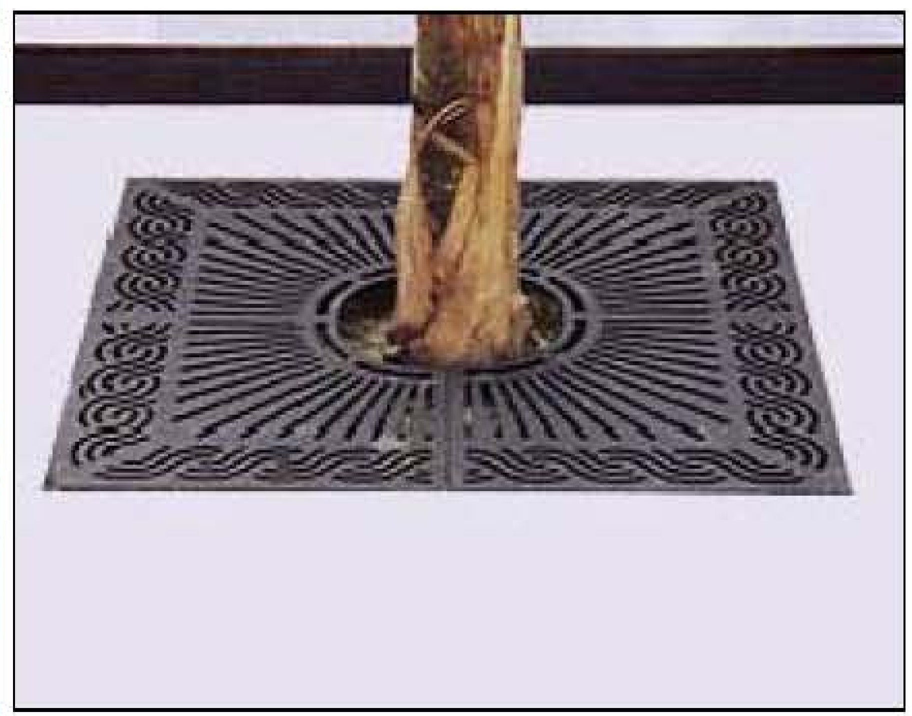
OLD LONDON MERMAID GRANITE BY INCRETE

Tree Grates

BY WAUSAU TILE

BY NEENAH FOUNDRY COMPANY

BY WABASH VALLEY



BY IRONSMITH

BY DURAART

PENTAGON CITY METRO STATION ENHANCEMENTS

Waste Receptacles

BY BOMB CONTAINMENT

BY MAGLIN

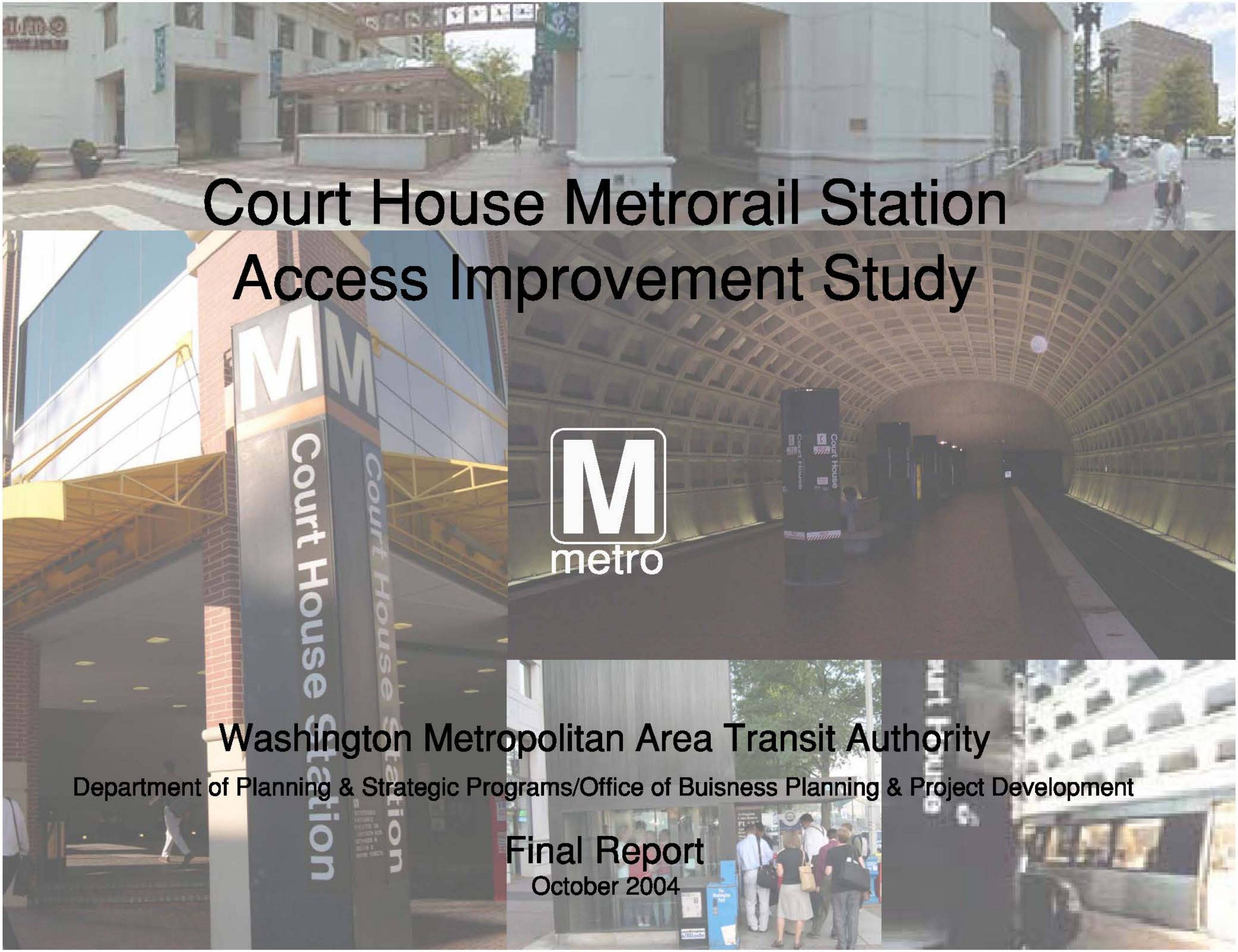
BY MAGLIN

BY VICTOR STANLEY

BY EURO MODUL

A-7

Court House Metrorail Station Access Improvement Study



Washington Metropolitan Area Transit Authority

Department of Planning & Strategic Programs/Office of Buisness Planning & Project Development

Final Report

October 2004

TABLE OF CONTENTS

1.0 INTRODUCTION

The Rosslyn-Ballston Corridor

In the late 1960s, when planning for the original 93-mile Metrorail system, Arlington County made the decision to locate five of its stations underground below an aging, low-density commercial strip along Wilson Boulevard instead of along the I-66 median. The County's long range planning goal was to stimulate office, retail and residential development in an area of Arlington County known as the Rosslyn-Ballston corridor.

In December 1979, Metro opened the Orange Line service along the Rosslyn-Ballston corridor with the Court House, Clarendon, Virginia Square, and Ballston Metrorail Stations. Since that time, the Arlington County vision for transit to serve as the catalyst for intensive redevelopment along the commercial spine of central Arlington has been realized, with the Rosslyn-Ballston corridor becoming a major employment center and a vibrant place for people to live, shop and work.

Since 1980, Arlington County's plans for transit-oriented development generated construction of 22,500 houses and apartments, 21 million square feet of office/commercial/retail space, and 3,000 hotel rooms along the Rosslyn-Ballston corridor. The corridor, containing 7.6 percent of the County's land area, generates 33 percent of its property tax revenue.

In 2002, the U.S. Environmental Protection Agency (EPA) selected Arlington as "Best Overall" in its national recognition program for the County's smart growth policies and results (See Figure 1). The EPA specifically cited the County's policies concentrating high-density development in this corridor as the leading factor in the doubling of Metrorail ridership in the corridor between 1991 and 2002.

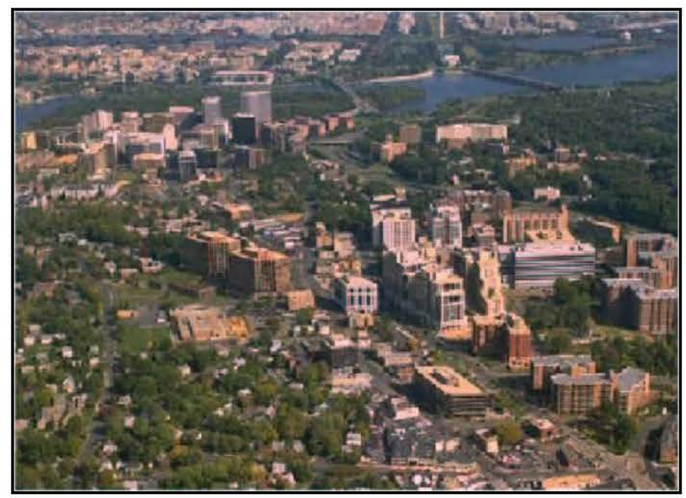


Figure 1: Rosslyn - Courthouse Area

The Courthouse Area

The Courthouse area is one of Arlington County's urban villages along the Rosslyn-Ballston corridor. It is served by the Court House Metrorail station located between the Rosslyn and Clarendon stations. The land use consists of a diverse mix of high to medium density commercial/retail/office, hotel, and residential development that tapers down to townhouses and single family dwellings farther out from the station. Commercial development immediately around the station includes Arlington County government facilities, educational facilities, movie theaters, shops and restaurants. Within the Courthouse area there are approximately 7,000 households and 16,000 jobs [Figure 2].

Study Objective

The main objective of this study is to develop a plan for a new station entrance and mezzanine in order to improve customer convenience and access to the Metrorail station. This includes providing better pedestrian access and generally maximizing the convenience of Metrorail as a service to the Courthouse area. Plans for a new station entrance and pedestrian improvements at the Court House station would be consistent with Arlington County's strategic plans for stimulating transit-oriented development along the Rosslyn-Ballston corridor with continuing investment in Metrorail access.

Figure 1A: Construction Begins on the Court House Metrorail Station

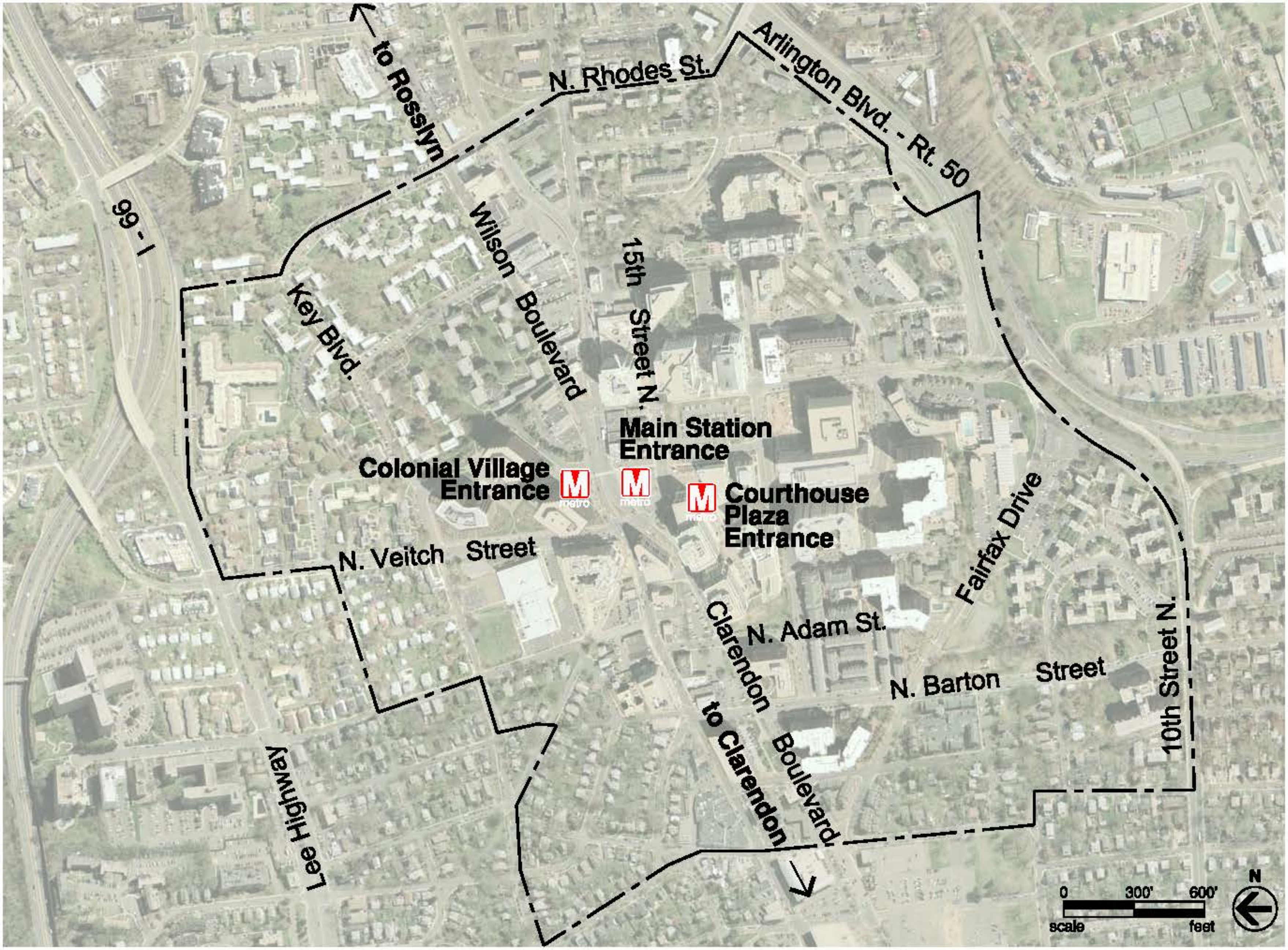


Figure 2: Court House Station Area, Arlington County

2.0 EXISTING CONDITIONS

The Court House Station

The Court House Metrorail Station has three station entrances leading to underground passageways that connect with a single mezzanine on the east end of the station [Figure 6]. The entrance farthest from the station, located on the north side of Wilson Boulevard in the Colonial Village development, is accessed by one stair-case and an elevator [Figure 3]. The main station entrance, located on the south side of Wilson Boulevard, is served by three escalators [Figure 4] . A third station entrance, located within the Courthouse Plaza development, has two escalators and one elevator [Figure 5]. Although the station has three street elevators, only one elevator serves the mezzanine level with an accessible path to the platform elevator. The other two street elevators travel only to the underground passageway that connects to the mezzanine via a bank of three escalators [Figure 6].

Figure 3: Colonial Village Entrance

Transportation Systems

In addition to Metrorail and eleven bus routes serving the corridor, the Courthouse area has excellent transportation facilities located along two, one-way commercial arterial streets: Wilson Boulevard and Clarendon Boulevard. The station area also has convenient access to Route 50/ Arlington Boulevard via Courthouse Road and N. Barton Street and to Lee Highway/I-66 via N. Veitch Street. Sidewalks along both sides of streets provide pedestrians traveling from the neighborhood safe, convenient access to the station with countdown signals at crosswalks at major intersections. Based on visual assessments, both traffic capacity on streets and pedestrian safety at intersections around the station area appeared to be good. Therefore, further traffic analysis was determined to be unwarranted for this study.

Figure 4: Main Station Entrance-Strayer Univ.

Figure 5: Courthouse Plaza Entrance

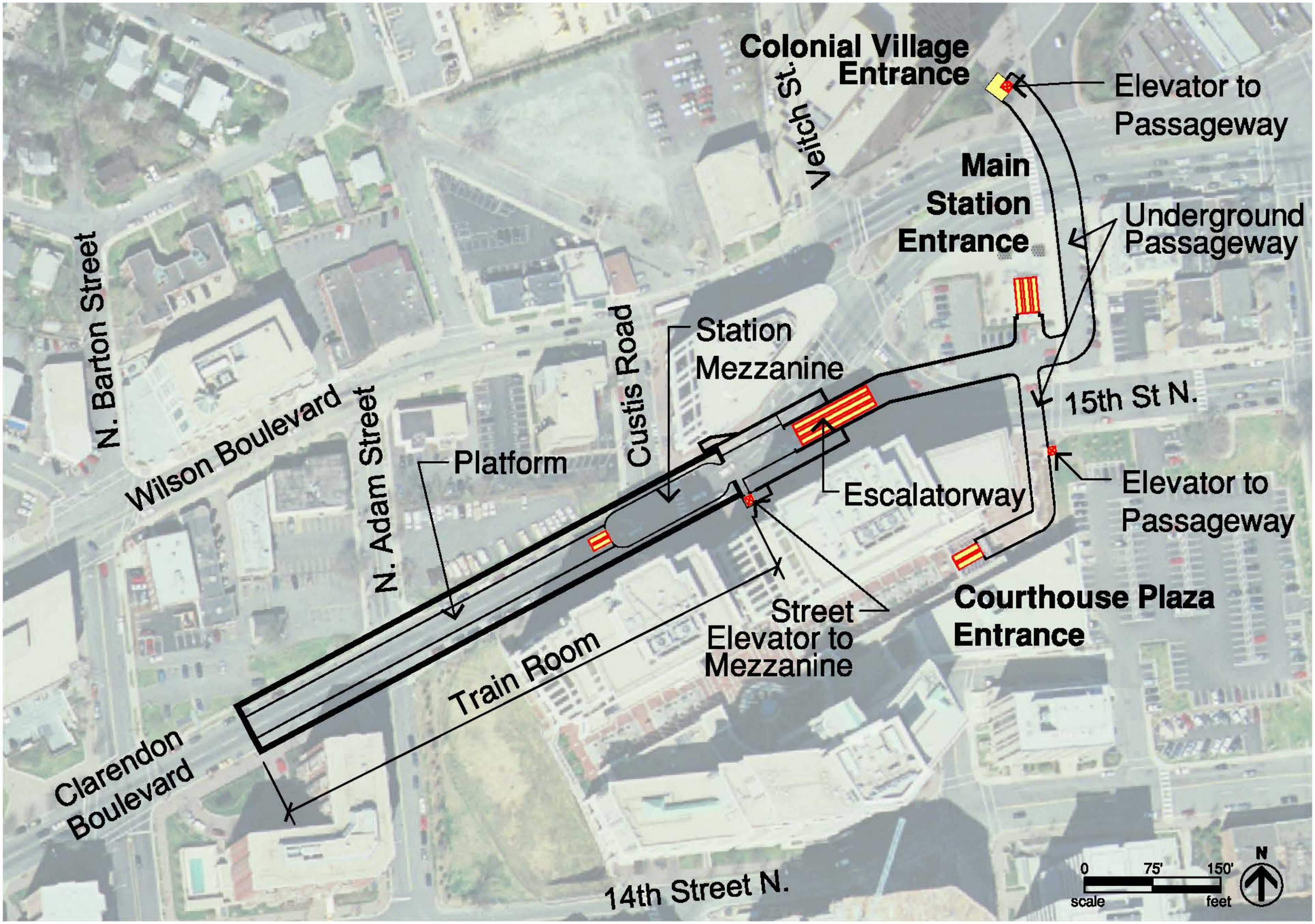


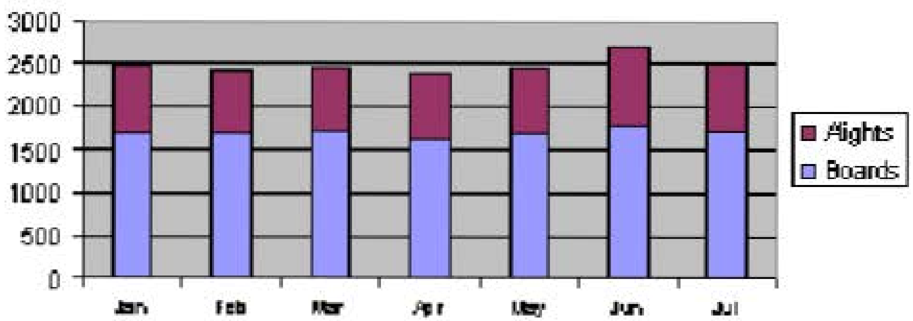
Figure 6: Court House Station Aerial Plan - Existing Conditions

Existing Metrorail Ridership

The Court House station handles approximately 14,000 combined daily entries and exits on a typical weekday. Figure 7 shows passenger counts for boardings (entries) and alightings (exits) at the station in half-hour intervals on an average weekday. In the AM peak hour, there were 1,750 entries and 900 exits. In the PM peak hour, there were 700 entries and 1,100 exits. The ratio of customers entering the station to those exiting suggests that the station is currently used more by residents than by workers. Figure 8 shows AM peak entries and exits in the first half of 2003.

Nearly all of the station customers arrive on foot. WMATA's 2002 Rail Passenger Survey found that 92 % of passengers access the station by walking in the AM peak period while the remaining passengers arrive by vehicle (6%) or by bus (2%). Nearly all of the passengers exiting the station (job end) during the AM peak period walk to their place of employment.

Figure 8: AM Peak Hour Boarding and Alightings



Source: WMATA Faregate Data, 2003

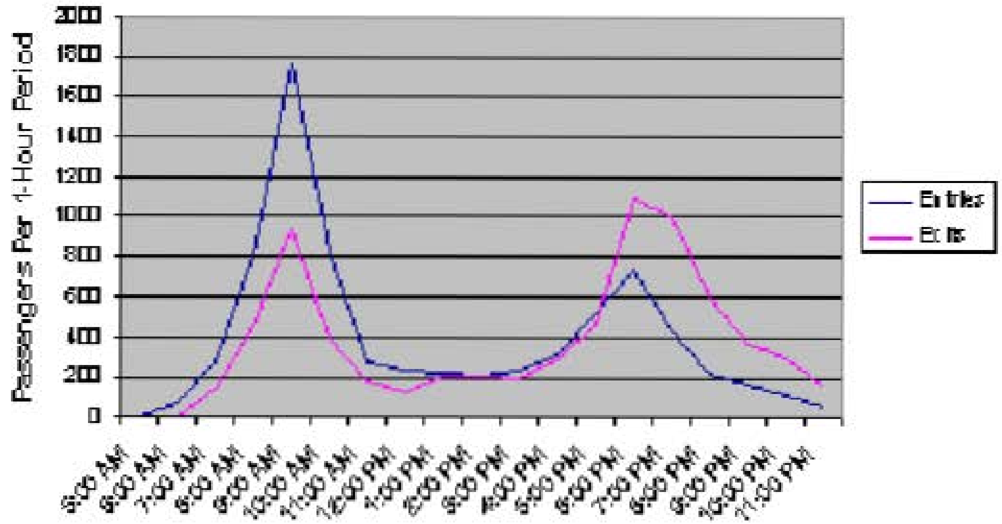


Figure 7: Court House Station entries and exits in one-hour intervals

Station Access Deficiencies

The underground passageways from the station mezzanine escalatorway to the three entrances are convenient for customers who are traveling from the east of the station by providing additional weather protection and giving customers a means to avoid crossing busy streets at 15th Street and Wilson Boulevard. However, these street entrance locations are not convenient for customers accessing the station from the west, since they must continue walking east beyond the mezzanine below before accessing the entrance, then backtrack to the mezzanine through the underground passageway. To avoid this longer walking distance and to save considerable time, customers accessing the station from the west tend to use the street elevator located on the south side of Clarendon Boulevard, which travels directly to the station mezzanine [Figure 6].

Station Access Deficiencies (continued)

Given the volume of customers accessing the station by the street elevator, the PM half-hour peak demand exceeds the elevator design capacity by a factor of 2, or 210% [Appendix I]. The capacity constraint on elevator service is evident from passenger counts conducted during the peak AM and PM half-hour of a typical weekday [Appendix II & III] and from visually observing elevator use by passengers at the street [Figure 9] and mezzanine levels [Figure 10]. The passenger counts indicate that 23% of station customers use the street elevator to access the station in the AM peak half-hour period and 18% in the PM peak period. The elevator vestibule in the mezzanine also is too narrow for adequate queuing space on each side of the elevator door [Figure 10].

Figure 9: Existing Street Elevator - AM Peak Period

Figure 10: Elevator Vestibule - PM Peak Period

Typical wait times for an elevator were observed to be approximately 1 to 1-1/2 minutes. Based upon industry standard planning guidelines for elevator service, the maximum wait time for an elevator should be no more than 30 seconds. In the peak direction, the elevator cab consistently fills beyond capacity leaving passengers who were unable to board waiting for the next elevator and experiencing wait times up to 3 minutes. Customers that regularly use this elevator have indicated that they experience longer than normal door cycle times, where the doors remain open for extended periods and passengers cannot close the door due to the absence of door control buttons. Installing door control buttons would reduce wait times, but only by a few seconds.

Overcrowding on the elevator interferes with its primary function of serving customers using wheelchairs and strollers. In fact, most customers using a wheelchair were observed waiting for the next elevator trip instead of boarding a crowded car.

Station Access Deficiencies (continued)

Station customers using wheelchairs or customers with strollers that rely on elevator service cannot access the station when either the single street elevator or the platform elevator is out of service. For 5 % of the last 6 month period, at least one elevator was out-of-service [Figure 12]. When either elevator is out of service, Court House station customers using wheelchairs must use the street elevator at the Clarendon or the Rosslyn station, then travel to the Court House station area using the Metrobus shuttle service. In light of WMATA's new *Metro Is Accessible* campaign aimed at encouraging people with disabilities to use Metrorail, making stations accessible to all by providing reliable, redundant elevator service becomes an important objective in station access planning.

Figure 12: Street Elevator - Out of Service

To provide optimum, reliable service for customers accessing the Court House station via the street elevator, expanding elevator service in the station with additional elevators becomes neccessary.

Figure 13: Potential Redevelopment Site - 2519 Wilson Blvd. at N. Barton Street

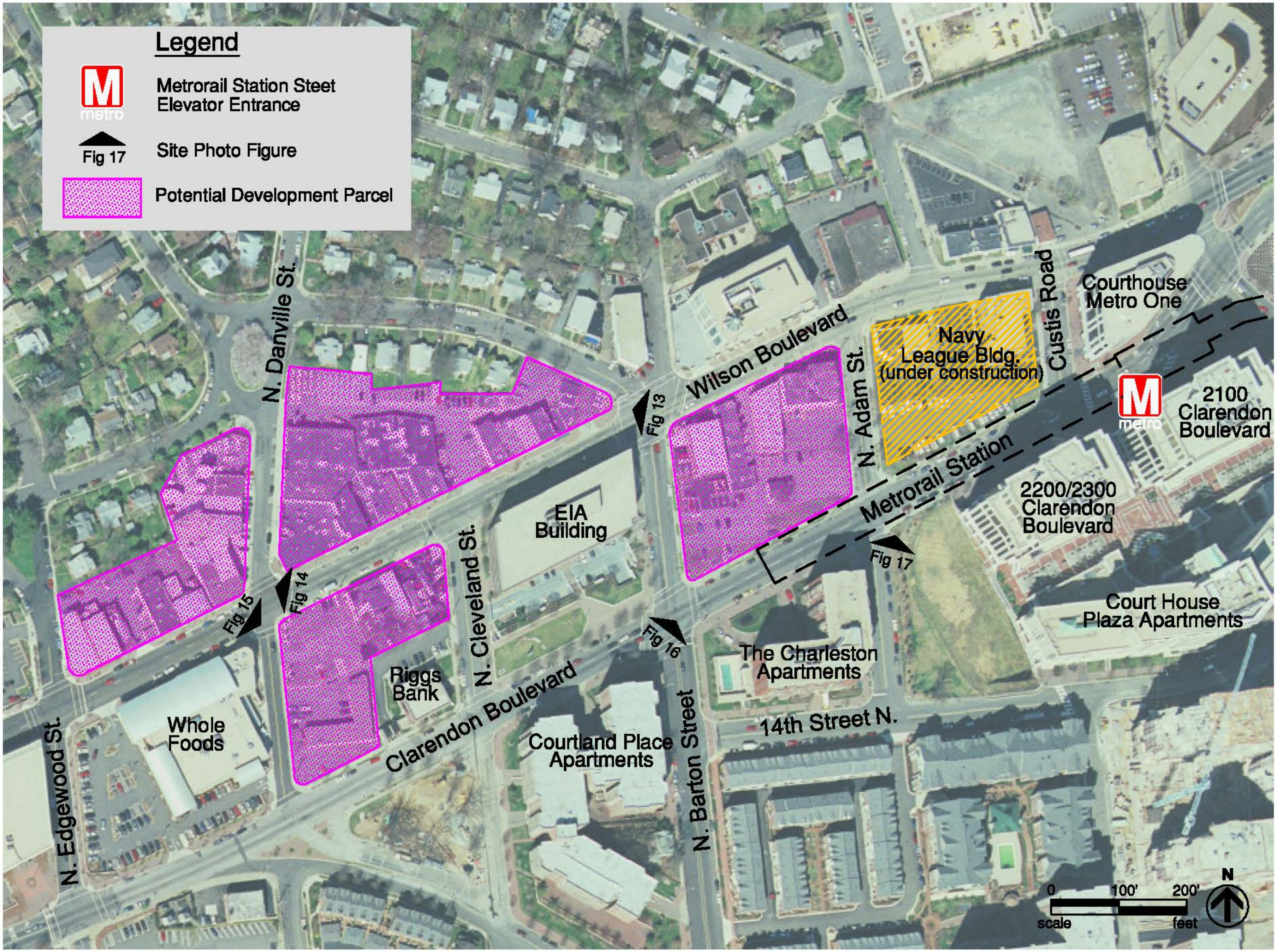
Figure 14: Potential Redevelopment Site - 2705 Wilson Blvd in the Clarendon Sector

3.0 GROWTH FORECASTS

Courthouse Area Development

According to a June 2002 Arlington County planning report entitled "Development Capacity in the Metro Corridors," the Courthouse area has 876,800 square feet of remaining commercial capacity and the potential for 2,633 more residential units. The report identifies five parcels of land located west of the existing Court House station entrances as potential redevelopment sites [Figure 11]. These sites have unbuilt development capacity that is below the allowable or preferred density defined in the County's General Land Use

Figure 11: Clarendon/Courthouse Area - Potential Development Sites



Courthouse Area Development *(continued)*

Plan [Figures 12 through 18]. One of these five parcels, located in the 2300 block of Wilson Boulevard, is the site of the Navy Building, a 200,000 square foot office building with 17,000 square feet of first floor retail space. This site is currently under construction [Figure 18].

Employment from the Navy Building, located across Clarendon Boulevard from the existing Metro street elevator, is expected to generate an additional 500 new Metrorail customers when it opens in the Fall of 2004. Most of these new customers would be expected to access the station via the street elevator.

Figure 15: Potential Redevelopment Site - 2519 Wilson Blvd. at N. Barton Street

Figure 16: Potential Redevelopment Site - New Station Entrance Location

Figure 17: Navy League Building Site

Demand Analysis for New Station Entrance

Planning for a new entrance at Court House Station begins with an assessment of existing and future demand. The future demand is based upon unbuilt capacity around the Courthouse area and Arlington County land use projections. Arlington County provided WMATA with land use data at the Census block level. By isolating the blocks associated with the new station, WMATA estimated the percentage of total station area residential and commercial uses served by a new entrance. These figures are shown below in Table 1.

Table 1: Existing and Future Land Use Analysis

	Residential *(units)*	**Commercial** *(sf)*
Existing	3,373	962,405
Build-Out	4,780	1,565,744
% Change	33%	33%

Source: Arlington County Land Use Data

WMATA Demand Analysis for New Station Entrance *(continued)*

According to the Arlington County planning report, both residential and commercial land use projections show a planned 33% increase in development around the station area. Based on this increased development, future ridership at the station would also increase by 33 %, resulting in combined boardings and alightings of 18,500 on a typical weekday. This would be evenly split between the proposed new entrance and the existing station entrances.

The number of jobs and residential units also is expected to grow by the same proportion, so the ratio of customers entering and exiting the station during the AM and PM peak periods is expected to remain the same as today. The mode of arrival is projected to remain the same with nearly all customers accessing the station on foot.

Figure 18 shows the 1/4-mile catchment area for the proposed station entrance location and the Census blocks contained in the study area. The 1/4-mile area captures a portion of the population outside of the current catchment area of the Clarendon and Court House Stations, thereby attracting new customers to Metrorail.

In planning a new station entrance for capacity considerations, WMATA uses peak half-hour demand figures to ensure that the new station entrance can comfortably, safely and efficiently accommodate Metrorail customers. Table 2 shows ridership projections during both the AM and PM peak periods. During the AM peak half-hour, 600 customers are expected to board the station at the new entrance. In the PM peak half-hour 465 customers are expected to alight at the new entrance.

Table 2: Peak Period Ridership Projections

** People per Minute*

Peak Loads	Peak Hour	Peak 1/2 Hr	PPM*
Existing AM Boardings	1750	900	29.2
Existing PM Alightings	1250	700	23.3
Future AM Boardings w/ 33% Growth	2330	1200	38.8
Future PM Alightings w/ 33% Growth	1660	930	31
Future AM Boardings at New Entrance	1165	600	19.4
Future PM Alightings at New Entrance	830	465	15.5

Source: WMATA Faregate Data, Arlington County Land Use Data

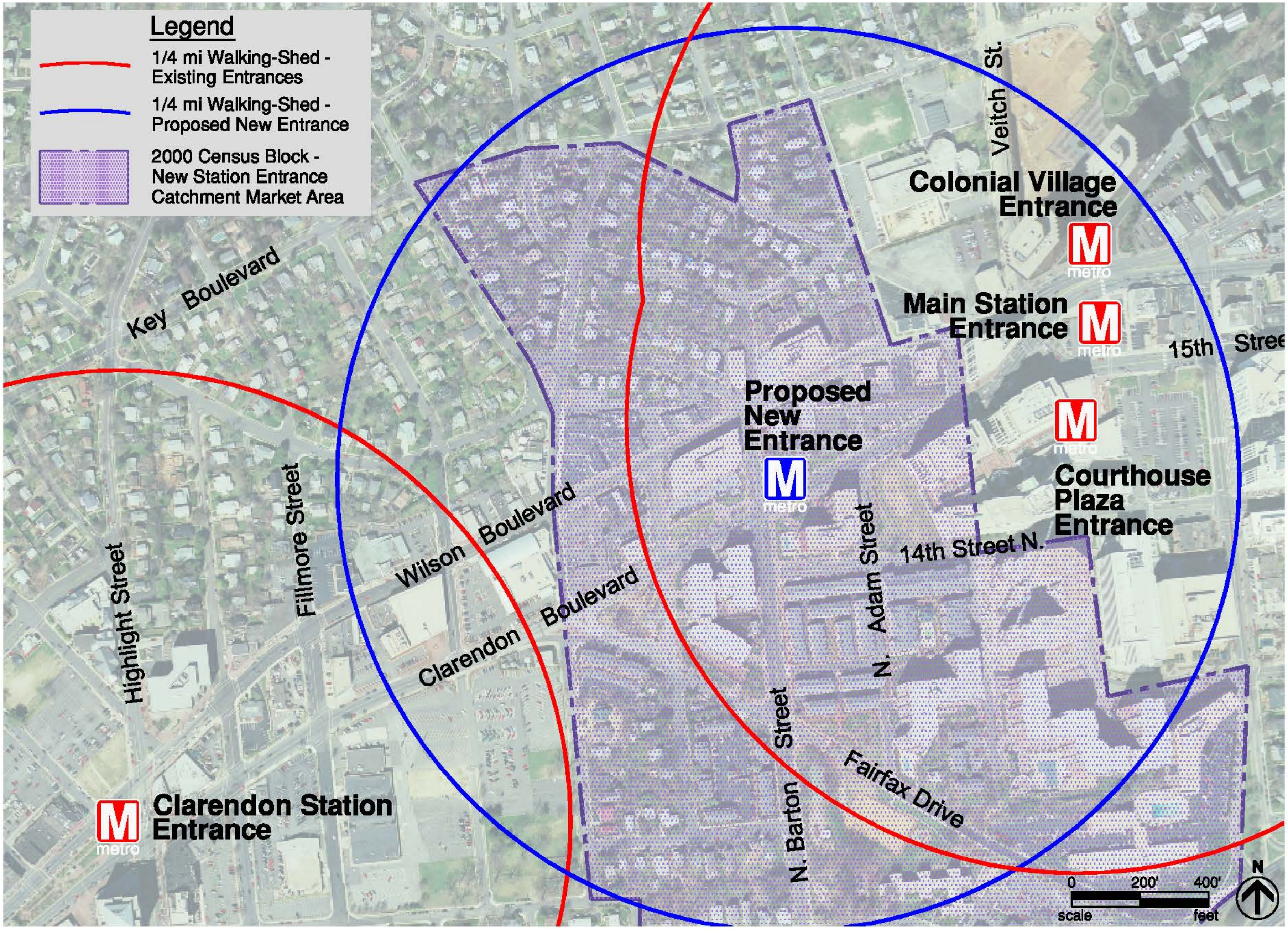


Figure 18: New Entrance Demand Analysis - Catchment Area

WMATA Demand Analysis for New Station Entrance *continued)*

The calculations to determine the elevator system requirements indicate that two high-capacity, high-speed street elevators would provide efficient service for the future demand of 600 passengers at the new station entrance in the peak half-hour period. Because this is an elevator-only entrance to the station, an additional third elevator car should be included to maintain an acceptable level of elevator service during periods of service disruptions for repairs and maintenance.

An enclosed exit stairway from the mezzanine to the street would need to be wide enough to handle the egress capacity requirements of passengers exiting 1/2 of the platform during an emergency. The additional exiting capacity the new entrance would provide at the opposite end of the platform would increase customer safety at the Court House Station.

The calculations for the number of fare aisles in a faregate array in the station mezzanine show a minimum requirement of three units to accommodate the peak demand. However, WMATA's Design Criteria Manual dictates a four faregate minimum in an array inside a Metrorail station mezzanine. The pay area of the mezzanine would also include three fare vending units, two add fare units, and one kiosk for a station manager.

4.0 STATION ACCESS IMPROVEMENTS

Elevator Service

Current WMATA design criteria for new or expanded Metrorail station facilities require redundant elevator service between all levels of a station. When two elevators are provided between each level in a station, access for customers using a wheelchair can be maintained even if one of the elevators is shut down for repairs or maintenance. Maintenance can be performed during revenue hours whenever necessary without restricting wheelchair access.

Although the existing entrances to the station can accommodate the projected growth in ridership, many existing and future customers accessing the station from the west could adversely increase demand on the already constrained street elevator. The Navy League Building is expected to generate an additional 500 new Metrorail customers who would presumably access the Court House Station via the street elevator located directly across Clarendon Boulevard.

Elevator Service *(continued)*

Providing additional elevator service from the street level down to the platform level would be the best method for improving customer access to the Court House station. Not only would additional elevators at the station provide redundancy in service, but they also would relieve overcrowding conditions and long wait times at the one existing street elevator and would help accommodate the projected growth in ridership. Should ridership demand continue to strain the existing street elevator, it could be replaced with a high-speed elevator (see Appendix I for comparison).

New Station Elevator Entrance

Installing additional elevators in the existing elevator location would likely involve shutting down the existing elevator for an extended period of time; therefore, another location needs to be considered. Installing additional elevators at another location in the vicinity of the existing street elevator would involve closing that portion of the sidewalk during construction, restricting access to the adjacent building entrances.

A new elevator entrance located at the west end of the existing train room would improve access to the Court House station for many customers by providing convenient, direct access to the station platform and reducing walking distances. In transit planning, to determine the walking mode share for customers accessing a station, a catchment area of a 1/4 mile radius from a station entrance is used [Figure 18]. A new station entrance located at N. Barton Street and Clarendon Boulevard, 1,000 feet away from the nearest existing Court House station entrance, would increase the walking catchment area for the station and is expected to attract new customers to the Metrorail system. A new entrance with escalators was not considered for this study due to the high capital and maintenance cost of escalators and the problems foreseen in constructing an escalatorway in this location. High-speed elevators can serve the customer demand just as efficiently as escalators.

New Station Elevator Entrance *(continued)*

The preferred site for the proposed new station entrance is located on a mostly vacant city block of approximately 68,000 square feet, and is one of the five designated parcels in the Courthouse area with unbuilt development capacity [Figure 19]. The three, 1-3 story commercial buildings located on the north side of the parcel were built 40-60 years ago and range in size from 4,000 to 9,000 square feet of leaseable space. Given the historical trend of Metrorail investment serving as a catalyst for transit-oriented development in the Rosslyn-Ballston corridor, a new station entrance in the immediate vicinity of these underdeveloped parcels would likely accelerate their redevelopment to the build-out capacity.

Figure 19: New Station Entrance Site

Street Improvements/Image

Part of the Arlington County vision for transit-oriented development includes emphasizing pedestrian access and safety by planning for: paved crosswalks at street intersections, pedestrian countdown signals, paved sidewalks wide enough for future restaurant seating, bike lanes, street trees, and street-level retail. The design for a new elevator entrance to Court House Station would be planned within a mixed-use development that incorporated the County's design precepts for transit-oriented development, having distinctive architecture that raises the overall attractiveness and image of the Courthouse community.

5.0 NEW STATION ENTRANCE DESIGN

Design Alternatives

Part of the planning process for a new station entrance and mezzanine involves the development and analysis of alternative design solutions. When considering the alternatives, the location of the street elevators is first in the planning hierarchy. To gain the largest catchment area for potential new Metrorail customers, the new elevator entrance should be located as far from the existing station entrances as practical. The vacant corner on the northeast side of the Clarendon Boulevard and N. Barton Street intersection is the preferred new station entrance since a mezzanine can be located adjacent to the west end of the train room.

Since the original design for the concrete station structure did not include knock-out panels in the vault for future expansion, any access to a new mezzanine would involve cutting through the existing concrete structure. Two design solutions were evaluated. The initial design alternative considered, but not shown in this study, involved cutting through the end of the existing train room concrete wall to connect a new floating mezzanine above the west end of the platform with a pay area mezzanine above the west service rooms and train tunnel, located directly below Clarendon Boulevard. This alternative involved removing approximately 8,000 cubic yards of earth above the existing structure and decking over the entire width of Clarendon Boulevard in a sixty foot long section so vehicular traffic could be maintained during construction. Also, a wide 42 inch deep section of the 54 inch thick concrete roof above the west service rooms would have to be cut out and removed to provide adequate headroom clearance between the floor of the floating mezzanine and the bottom of the train room vault. Given the difficulty and expense of excavating under Clarendon Boulevard and cutting the existing concrete structure, another alternative was considered.

Preferred Alternative

The preferred design alternative for a new entrance and mezzanine involves accessing a new mezzanine through a cut-opening in the side of the train room vault structure. In this alternative [Figure 22], a floating mezzanine is constructed over the western end of the train room and incorporates an escalator and stairway along with an elevator. This combination is the most efficient vertical transportation system for optimizing passenger flow from the platform to a new mezzanine. A stairway is incorporated in the design to address the emergency egress requirements for passengers exiting the platform while an escalator unit would be used to facilitate continuous and efficient passenger flow in the peak direction. A single platform elevator would easily accommodate customers using wheelchairs and those with luggage or strollers.

Preferred Alternative *(continued)*

Although an escalator unit would provide the highest level of passenger flow from the platform to the mezzanine, the option for a stairway and elevator combination without the escalator unit may also be considered. A wide stairway could handle the capacity requirements while affording the benefit of lower installation, maintenance and operating costs and would eliminate service disruptions associated with escalator service which is a major inconvienence to Metro customers.

Court House is a center-platform station, as opposed to a side-platform station. A center-platform station affords the most efficient vertical transportation system, and more importantly, a floating mezzanine is less difficult and less costly to erect over a 30 foot wide center platform than building over two operating tracks at an existing side-platform station.

The floating mezzanine connects to the street elevator vestibule via a bridge over the westbound train track through the cut-opening in the train room vault. The three elevators to the street are located so that there is adequate area for an entrance in front of a wide sidewalk at the street level. A stairway is located adjacent to the elevators to provide emergency egress from the mezzanine to the street. Service rooms on the lower mezzanine level include a mechanical room and an elevator machine room.

At the street level, the station entrance is located along an attractive street front with adjacent retail space and is identified with an overhead entrance canopy and the signature street pylon. The entrance leads to a mezzanine pay area with a station manager's kiosk, faregates, fare vending equipment, and a glass enclosed elevator hoistway. Three traction power, high-speed elevators would take customers directly to the mezzanine level below. The existing narrow concrete sidewalk along N. Barton Street and the north side of Clarendon Boulevard would be replaced with a 16-foot wide paved sidewalk. Street trees would provide shade to station or retail customers walking along the sidewalk, eating outdoors at nearby cafes, or sitting on new sidewalk benches. In addition to benches, other customer amenities include: a pedestrian shelter for a pick-up/drop-off lane on N. Barton Street, bike racks, waste receptacles, public telephones, and wayfinding signs. Design for customer security would include: adequate sidewalk lighting, appropriate station site lighting inside and outside the station entrance, a glazed elevator hoistway and cars for visibility and CCTV surveillance in the vestibule and each elevator car.

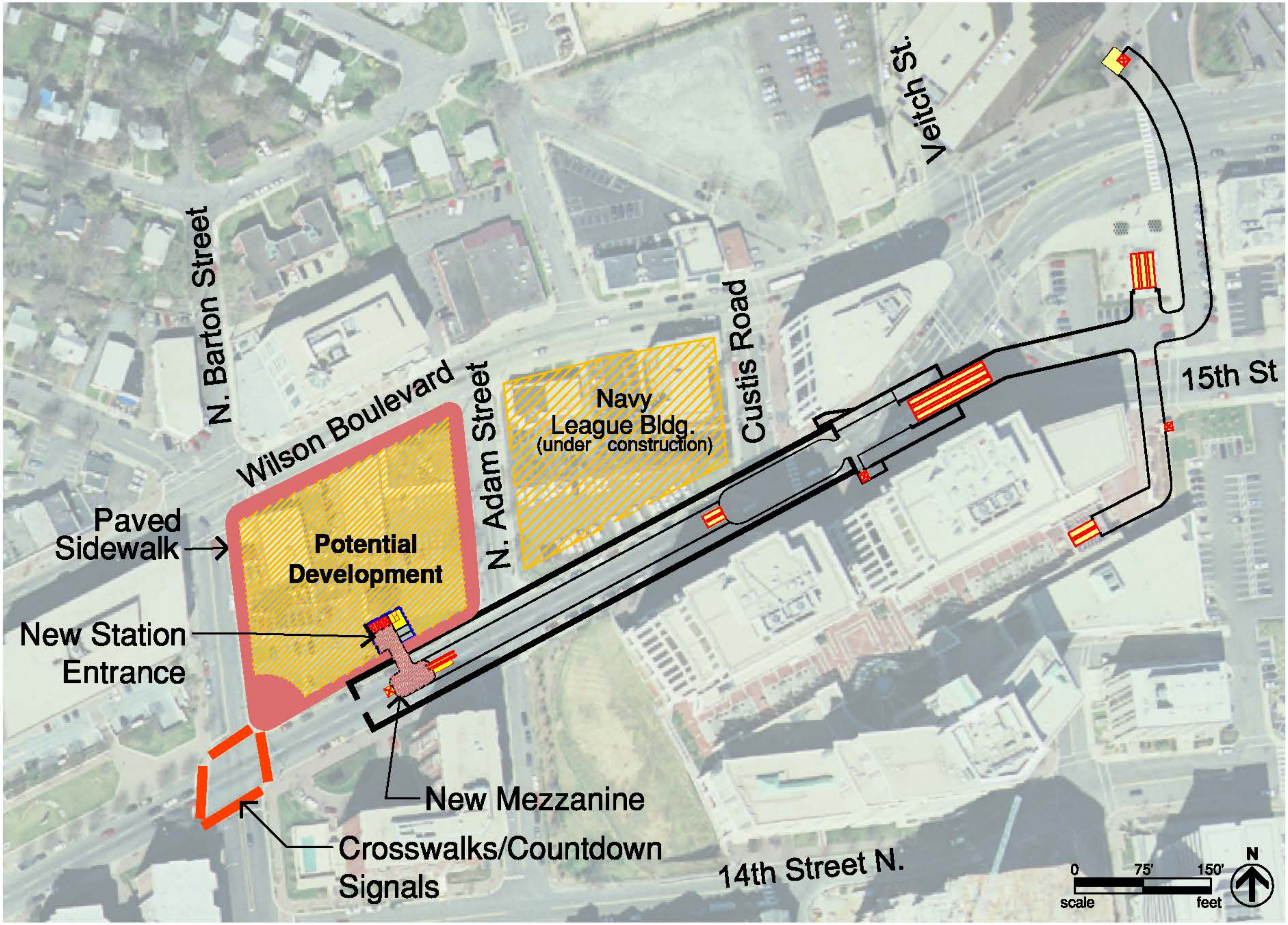


Figure 20: Court House Station Aerial Plan - Proposed New Entrance and Mezzanine

Figure 21: Street Level Plan - Proposed New Entrance

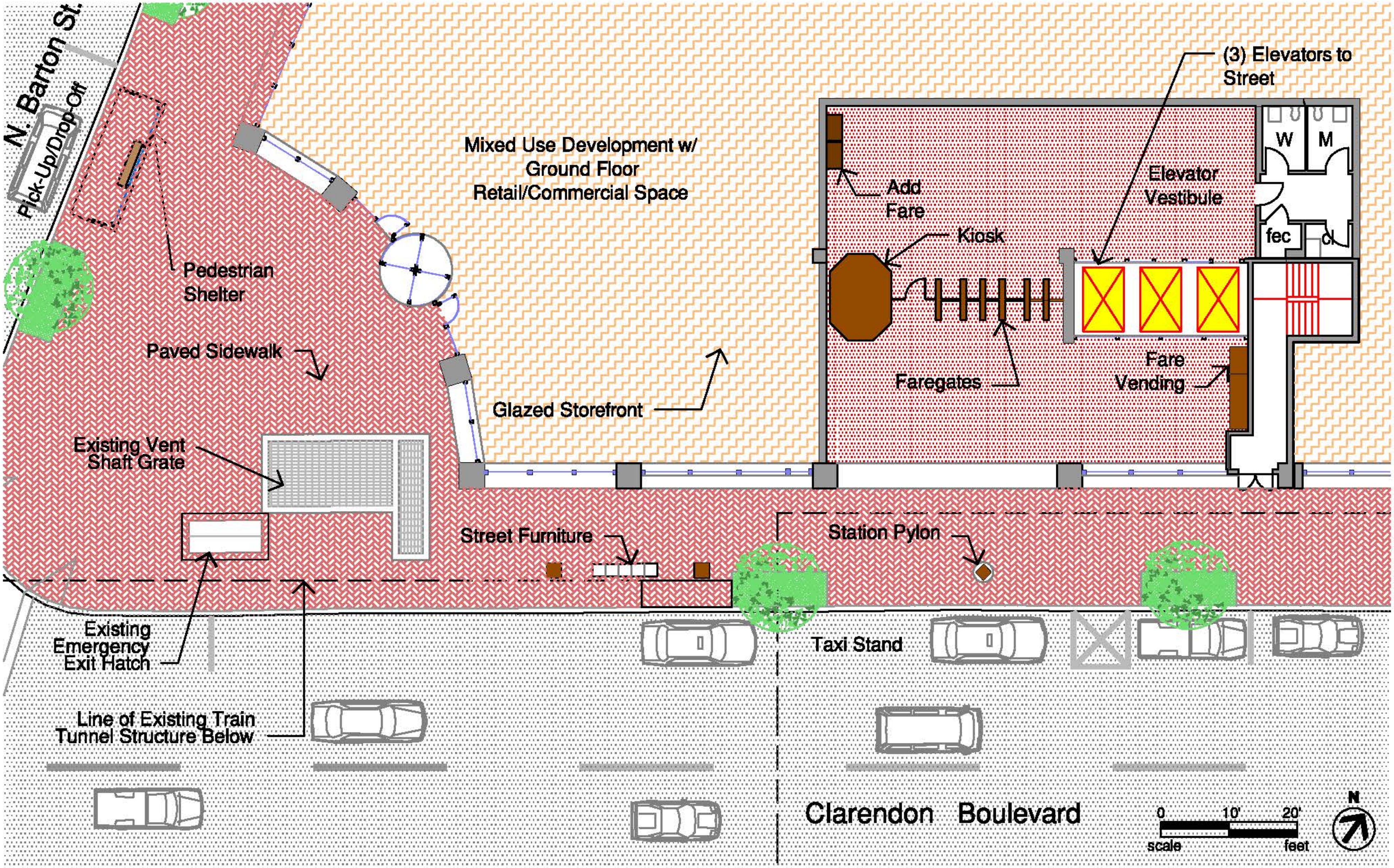
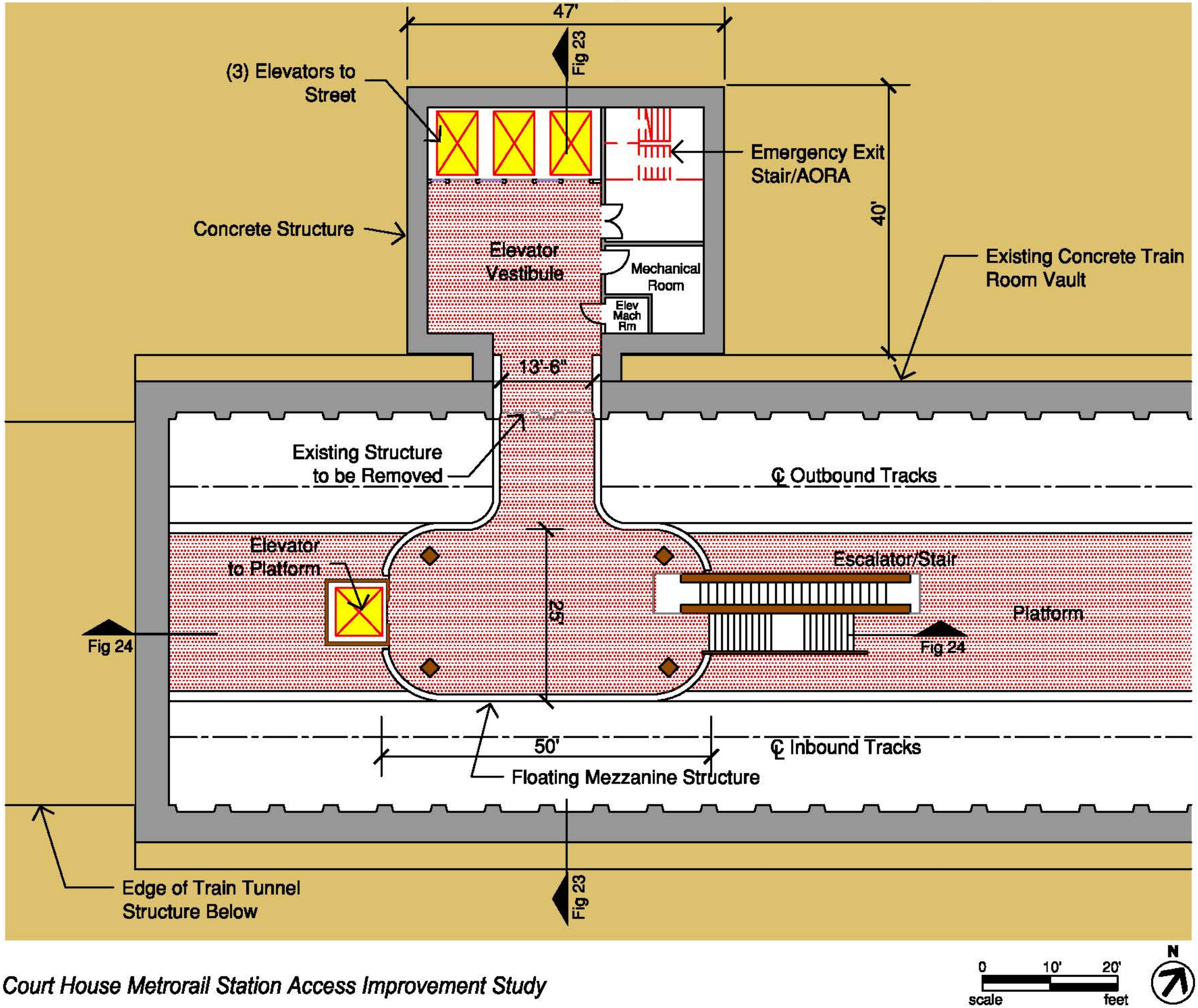


Figure 22: Mezzanine Level Plan - Proposed New Entrance



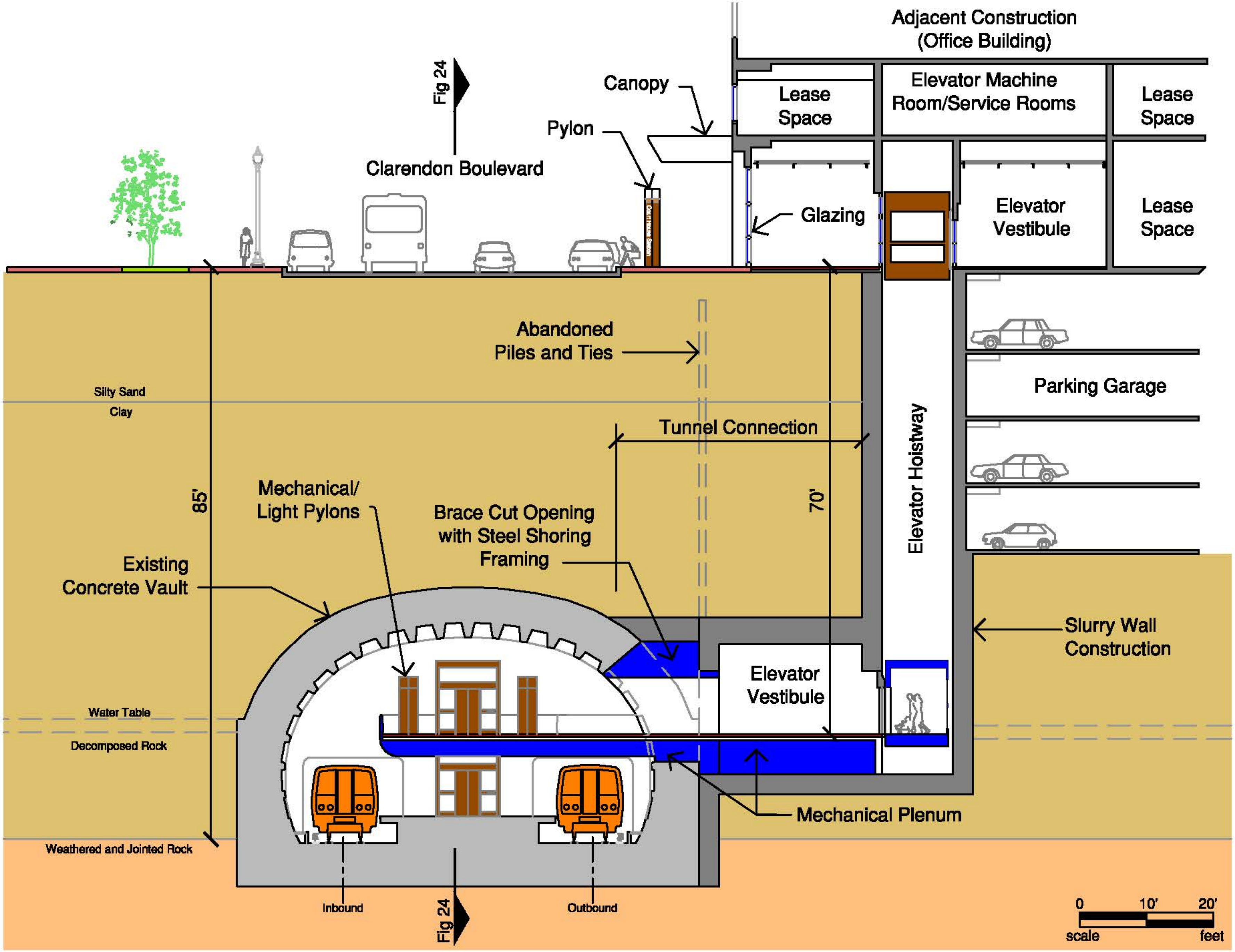


Figure 23: Cross Section Through New Entrance and Mezzanine

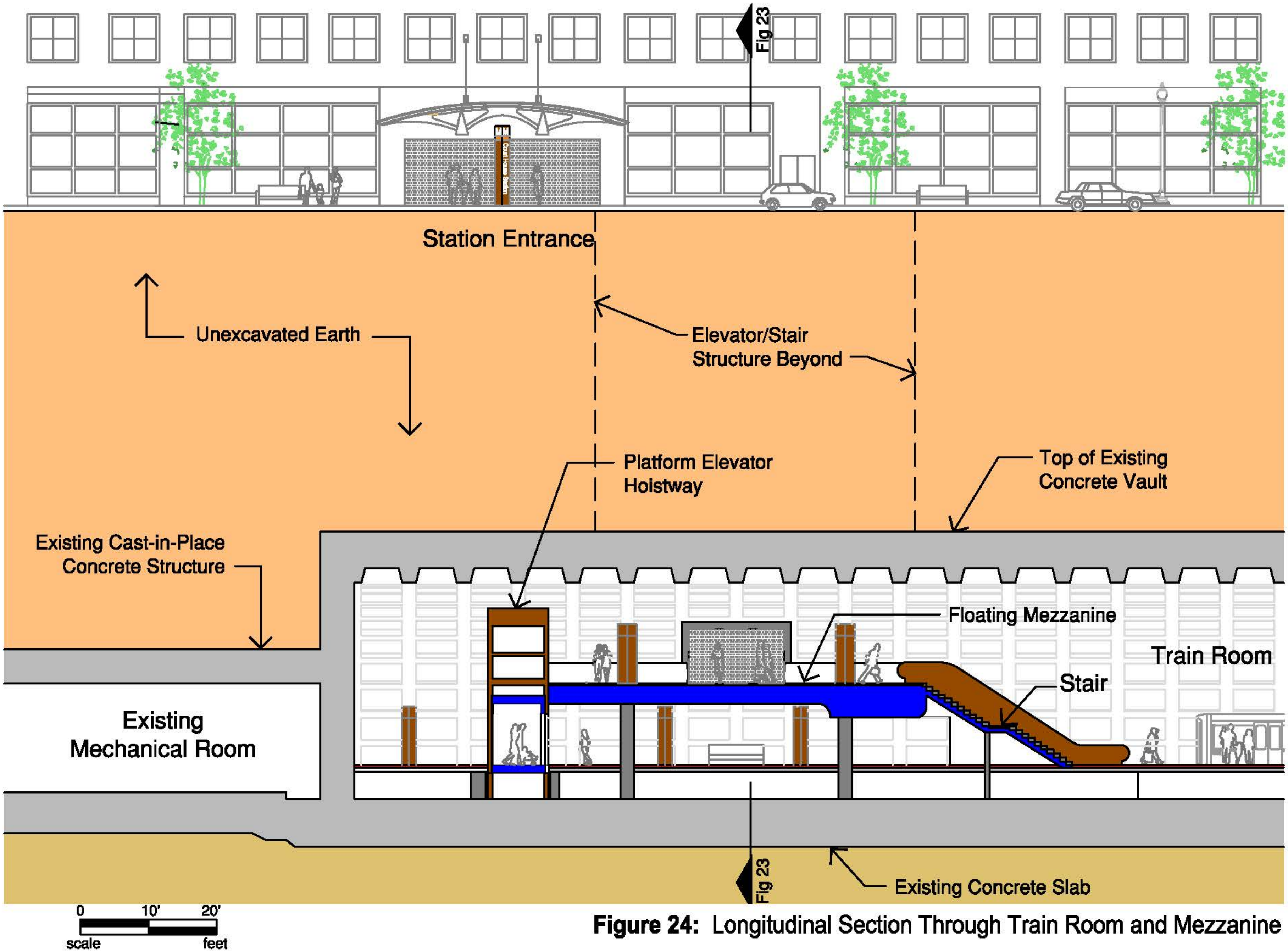


Figure 24: Longitudinal Section Through Train Room and Mezzanine

Construction

The new station entrance, mezzanine, and elevator hoistway would likely be designed and constructed in conjunction with any new development planned for the site. The construction method for shoring, excavation, tunneling, and concrete work would be the Contractor's preference, determined by actual soil conditions and costs.

The opening in the side of the train room structure would involve cutting through two ribs in the concrete vault to create an 18-foot wide opening. The top of the opening would be supported with a reinforced concrete transfer beam supported by concrete columns at each end. A January 2003 engineering study for the Ballston Station Mezzanine & Entrance project analyized vault modifications for the same opening size and similar loadings as proposed at the Court House Station and determined that cutting through the side of the vault was structurally viable.

Construction of the floating mezzanine structure and installation of the precast parapets would be limited to weekend hours when trains could be single tracked through the station unless a temporary construction platform could be erected to allow work during revenue hours; reducing construction time and project cost. Given the impact on the construction schedule and cost, the feasibility of erecting a construction platform should be examined in the early phase of preliminary engineering. Any feasibility study should first consider customer and worker safety, and verify that proper clearance above operating track can be attained. The Order of Magnitude Cost Estimate (Table 3) takes into account the cost impact of labor inefficiencies with limited working hours.

Waterproofing methods should be carefully evaluated and detailed to prevent water infiltration in the below grade structure, especially at the tunnel connection between the elevator vestibule structure and the vault opening (see Figures 22 and 23).

Other work inside the train room could proceed during normal operating hours unless construction began after the planned eight-car train service was initiated along the Orange Line. Six car trains stopping along the platform could avoid the construction zone in the west end of the platform; eight car trains cannot since they will span the entire length of the platform.

Prior to construction of a new mezzanine and entrance, WMATA and the Contractor must thoroughly coordinate traffic plans with the Arlington County Department of Public Works, Courthouse community residents and businesses to limit the impact of construction on Metrorail service and disruption to vehicular and pedestrian traffic in the Courthouse area.

Order of Magnitude Cost

The approximate cost estimate, or the order of magnitude cost, for the design and construction of the new Court House Station entrance and mezzanine is shown in Table 3.

Table 3: Order of Magnitude Cost Estimate

Item No.	Element	Approx. Cost (FY04 $)
1	Mezzanine: Service Rooms, Faregates, Kiosk	$4,700,000
2	Entrance Pavilion: Street Elevators, Hoistway, Emergency Exist Stairwell	$4,100,000
3	Floating Mezzanine: Platform Elevator, Escalator, Stair	$6,600,000
4	Sitework and Structure: Excavation, Concrete Work, Streets, Sidewalks	$650,000
5	Soft Costs: Design+Engineering (10%), Design Management (10%), Construction Support (10%), Insurance/Bond (5%)	$5,617,500
	Sub-Total	**$21,667,500**
6	Contingency (40%)	$8,667,000
	Total Cost	**$30,334,500**

6.0 NEXT STEPS

The Court House Station Access Improvement Study has been prepared to document the need for and feasibility of constructing a new station entrance for Arlington County. If Arlington County decides to advance the planning process, the next steps include preliminary engineering and an environmental assessment (NEPA). The concept design presented in this study would be subject to further development, review and coordination by WMATA, Arlington County and the Courthouse community during an estimated 12-15 month NEPA and public hearing process. After NEPA approval, a Design-Build Contract could be awarded followed by an estimated 20-month construction period [Table 4].

Table 4: Project Schedule

MONTHS

	Tasks	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45
1	NEPA and Public Hearing																							
2	Preliminary Engineering and Contract Documents																							
3	Proposal, Negotiation and Contract Award																							
4	Design by Design Builder																							
5	Construction by Design Builder																							
6	Project Completion																							

Appendix

Appendix I: Elevator Capacity and Traffic Analysis - Existing Street Elevator

Type: Traction Elevator	Existing		**High-Speed Replacement**	
Capacity:	2500	lbs.	2500	lbs.
Speed:	**75**	ft/min	**350**	ft/min
Door opening:	36	in.	36	in.
Stops:	1		1	
Rise: Approximate	61.5	ft.	61.5	ft.
Number of Elevators:	1		1	
Passenger Loading per trip:	6		6	
Door cycle time:	6.22		6.22	
Lobby time:	1	sec/passenger	1	sec/passenger
Lobby Load time:	6	sec.	6	sec.
Acc. and Dec. time:	2	sec.	2	sec.
Rated Speed:	49.20	sec.	10.54	sec.
Round Trip time:	124.84	sec.	47.53	sec.
Interval: Round Trip Time / Number of elevators	124.84	sec.	47.53	sec.
Handling Capacity: Passengers per half-hour/peak direction	**87**		**227**	
		Actual Capacity		Actual Capacity
Usage: Passengers per AM peak half-hour/peak	183	210%	183	-80%
Usage: Passengers per PM peak half-hour/peak direction	106	120%	106	-58%

* Replacing the existing elevator with a high-speed elevator would provide an additional 20% capacity beyond the the existing demand (183 passengers in the AM peak 1/2 hour); however, a high-speed replacement elevator could only meet future demand at the existing location if the new elevator entrance is built.

Appendix II: Existing Street Elevator Use-Peak AM Half-Hour

			A	B	C	D
	TIME		UP/ EXITING	DOWN/ ENTERING	NO BOARD/ WAITING	TOTALS (A+B)
	8:30		12	14		26
	8:32		14	13	8	27
	8:34		3	13	11	16
	8:35		2	12	11	14
	8:37		6	12	7	18
	8:39		4	12	8	16
	8:41		1	13	1	14
	8:43		0	11	2	11
	8:45		11	12	4	23
	8:47		6	10		16
	8:49		9	11	1	20
	8:51		6	11	2	17
	8:54		2	11		13
	8:56		4	11	2	15
	8:58		12	10		22
	9:00		5	7		12
1	**Sub-Total**		97	183		**280**
2	**Totals**		355	867		**1,222**
3	**Percentage**		27%	21%		**23%**

Source: Passenger Counts, September 25, 2003

A. Number of passengers traveling in the up direction.

B. Number of passengers traveling in the down direction.

C. Number of passengers unable to board elevator due to crowding.

D. Total number of passengers in both direction, one cycle.

1. Total number passengers using elevator, peak 1/2 period.

2. Total number passengers accessing station, peak 1/2 period.

3. Percentage of passengers accessing station, peak 1/2 period.

Appendix III: Existing Street Elevator Use-Peak PM Half-Hour

			A	B	C	D
	Time		**UP/ EXITING**	**DOWN/ ENTERING**	**NO BOARD/ WAITING**	**TOTALS (A+B)**
	5:30	w	10	1	5	
	5:32		1		6	
	5:34		8		4	
	5:36		10		5	
	5:38		1		8	
	5:40		0		5	
	5:42		0		1	
	5:44		11	5	3	
	5:46		6		2	
	5:48		10		7	
	5:50	s	11	2	5	
	5:52	s	10	4	5	
	5:54		11	1	5	
	5:56		6		5	
	5:58		0		2	
	6:00		11	3	2	
1	**Sub-Total**		106	16		**122**
2	**Station Totals**		596	375		**971**
3	**Percentage**		18%	4%		**10%**

Source: Passenger Counts, September 25, 2003

A. Number of passengers traveling in the up direction.

B. Number of passengers traveling in the down direction.

C. Number of passengers unable to board elevator due to crowding.

D. Total number of passengers in both direction, one cycle.

1. Total number passengers using elevator, peak 1/2 period.

2. Total number passengers accessing station, peak 1/2 period.

3. Percentage of passengers accessing station, peak 1/2 period.

w Includes passenger using wheelchair.

s   Includes passenger with child stroller.

Appendix IV: Elevator Capacity and Traffic Analysis - New Elevators

Type: Traction Elevator

	Capacity:	4000	lbs.
	Speed:	350	ft/min
	Door opening:	42	in.
	Stops:	1	
	Rise: Approximate	70	ft.
	Number of Elevators:	3	*
	Passenger Loading per trip:	9.6	
	Door cycle time:	6.22	
	Lobby time:	1	sec/pers
	Lobby Load time:	9.6	sec.
	Acc. and Dec. time:	2	sec.
	Rated Speed:	12.00	sec.
	Round Trip time:	54.04	sec.
Interval :	Round Trip Time / Number of elevators	18.01	
Handling Capacity: People per half-hour		**959**	

* While two operational elevators will meet projected demand, a third elevator is necessary to maintain the level of service should one elevator be taken out of service.

Appendix V: Metro is Accessible Program

ADA On Board

Fall 2003

Metro Launches *Metro is Accessible* Project

Metro has launched the *Metro is Accessible* project, designed to encourage people with disabilities to ride Metrobus and Metrorail. Metro's Office of Americans with Disabilities Act Programs (ADAP) and Metro's Elderly & Handicapped Advisory Committee are undertaking several public awareness and educational outreach campaign activities to increase the use of Metrobus and Metrorail by these customers.

The *Metro is Accessible* activities will be directed to a potential population of 385,000 people with disabilities in the Washington metropolitan region. An estimated 80,000 could use fixed-route service (Metrobus and Metrorail service that follows a pre-determined route). Currently, 16,000 people with disabilities are enrolled in Metro's reduced-fare program and 11,000 use MetroAccess (the curb-to-curb service for people who are medically eligible).

ADAP will provide "train the travel trainer" workshops to representatives of disability organizations, such as independent living centers, rehabilitation facilities, special education departments of school systems, agencies on aging, university-based disability services offices and local affiliates of all disability service and advocacy organizations.

These organizations represent potential bus and rail customers and include those with a variety of disabilities among students, seniors and young adults.

The office will administer a Speakers Bureau so that organizations can request guest speakers on Metrobus and Metrorail services for people with disabilities at their meetings and other activities.

ADAP will implement ongoing *Metro is Accessible* project meetings and will participate in a variety of agency presentations on travel options for people with disabilities.

This office will continue its group and individual system orientation program which provides group and individual bus and rail system orientation for people with disabilities.

ADAP will also visit schools to provide on-site photo ID sessions for students with disabilities who plan to ride Metrobus and Metrorail and will institute a referral program for people with disabilities eligible to use private-sector travel training where appropriate.

"The objective of the Metro is Accessible project is to increase the use of Metrobus and Metrorail by people with disabilities," stated Metro General Manager and Chief Executive Officer Richard A. White. "Over the years, Metrobus and Metrorail have increased the number of accessibility features to aid people with disabilities to use our fixed-route systems conveniently and safely. So we strongly encourage these potential customers to give us a try."

The convenient accessibility features Metrobus has added to its individual buses in its 1,446-bus fleet include the following:

- Talking buses that inform people of major intersections and bus stop locations.
- Low floor buses which make it easier for people to board.
- Bus operators who have participated in sensitivity training to more effectively deal with the needs of customers with disabilities as well as senior citizens.
- Lift bus mechanic specialists established to maintain the operational effectiveness of lift buses.

Metrorail also has accessibility features that improve the safety and convenience for customers with disabilities who ride Metrorail, including the following:

- Gap reducers at train entrances to ease entry by customers using wheelchairs.
- Rehabilitated elevators that meet ADA requirements.
- Assistance phone numbers on elevator signs in rail stations.
- Bumpy tile at the platform edge that alert customers with vision impairment that they are nearing the end of the platform.
- Passenger Information Display Signs (PIDS) in Metrorail stations to inform customers of next train arrival and other pertinent service information.
- Barriers between rail cars that help prevent customers with vision impairment from stepping into the gap.
- Braille on rail car intercoms.
- Shuttle service for stations with elevator outages.
- Electronic Elevator Notification (ELLEN) e-mail subscription service.
- Elevator outage notification provided by Internet, phone, PIDS and announcements.

"We can never rest on our laurels and will constantly be examining ways to improve our service for this segment of our customers," noted Rikki S. Epstein, ADA Project Officer within Metro's Office of Americans with Disabilities Act Programs. "The bottom line is that when we improve service for one segment of our customers, all of our customers benefit."

In addition to a public awareness campaign featuring presentations at targeted events, partnerships with agencies serving people with disabilities, a travel training referral program and direct mail and e-mails to this potential customer base, ADAP will also examine implementing talking bus stop signs, talking station signs, increased station lighting and improved pedestrian accessibility to stations and bus stops, among other accessibility features. The date of the official project kick-off event is Wednesday, December 17, 2003.

For more information, please call the *Metro is Accessible* project line at 202-962-1558.

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)

August 23, 2004

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

TABLE OF CONTENTS

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													
ORIGIN 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
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

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY

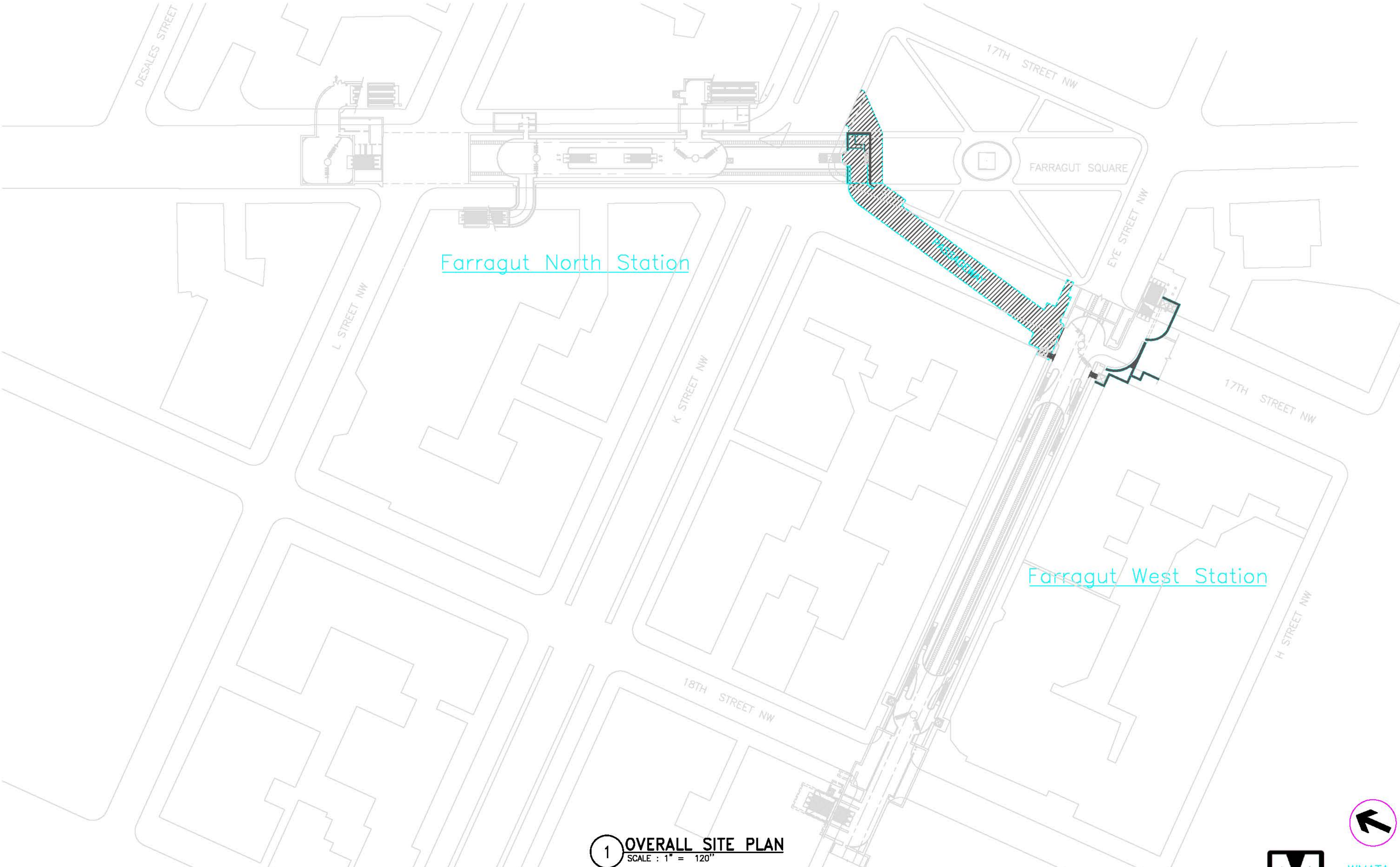
AUGUST 23, 2004

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP

DRAWING INDEX

APPENDIX

KGP DESING STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

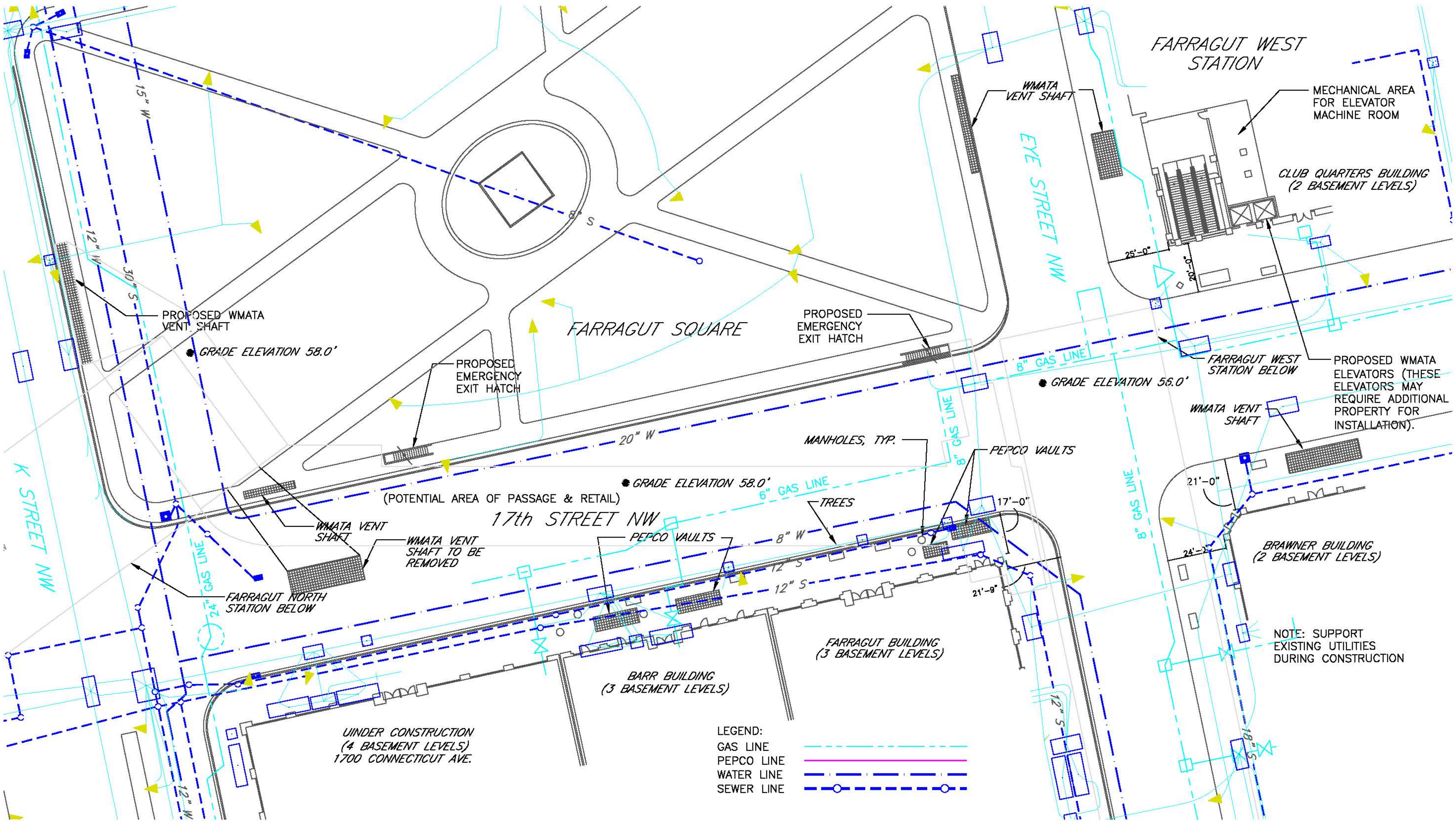


1 OVERALL SITE PLAN
SCALE : 1" = 120"

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN

WMATA
DWG A-1

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04



1 UTILITIES PLAN
SCALE : 1" = 40'

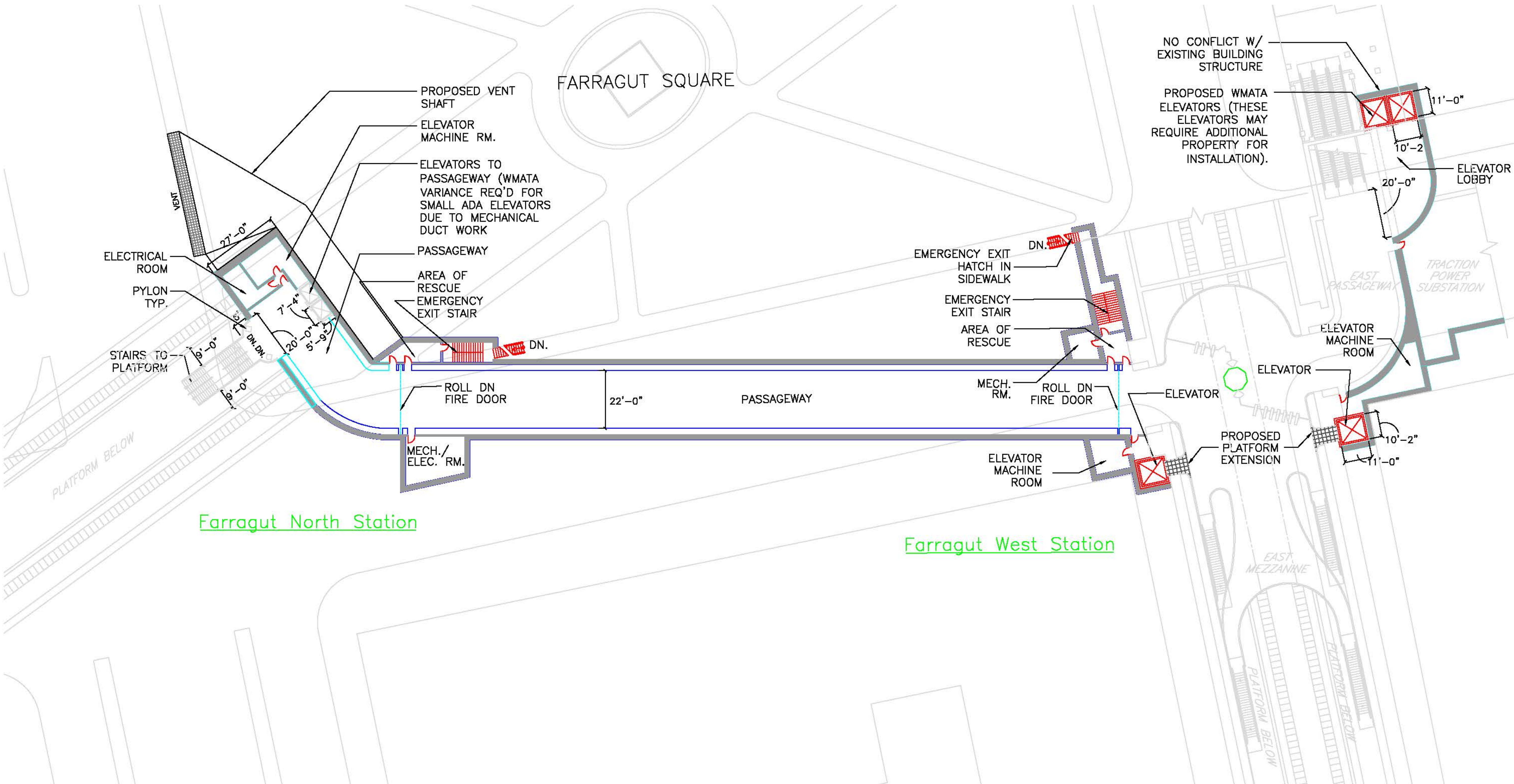
KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
UTILITIES PLAN

metro

WMATA
DWG A-2

10 0 10 20



1 TUNNEL PASSAGEWAY PLAN – OPTION 1
SCALE : 1" = 40'

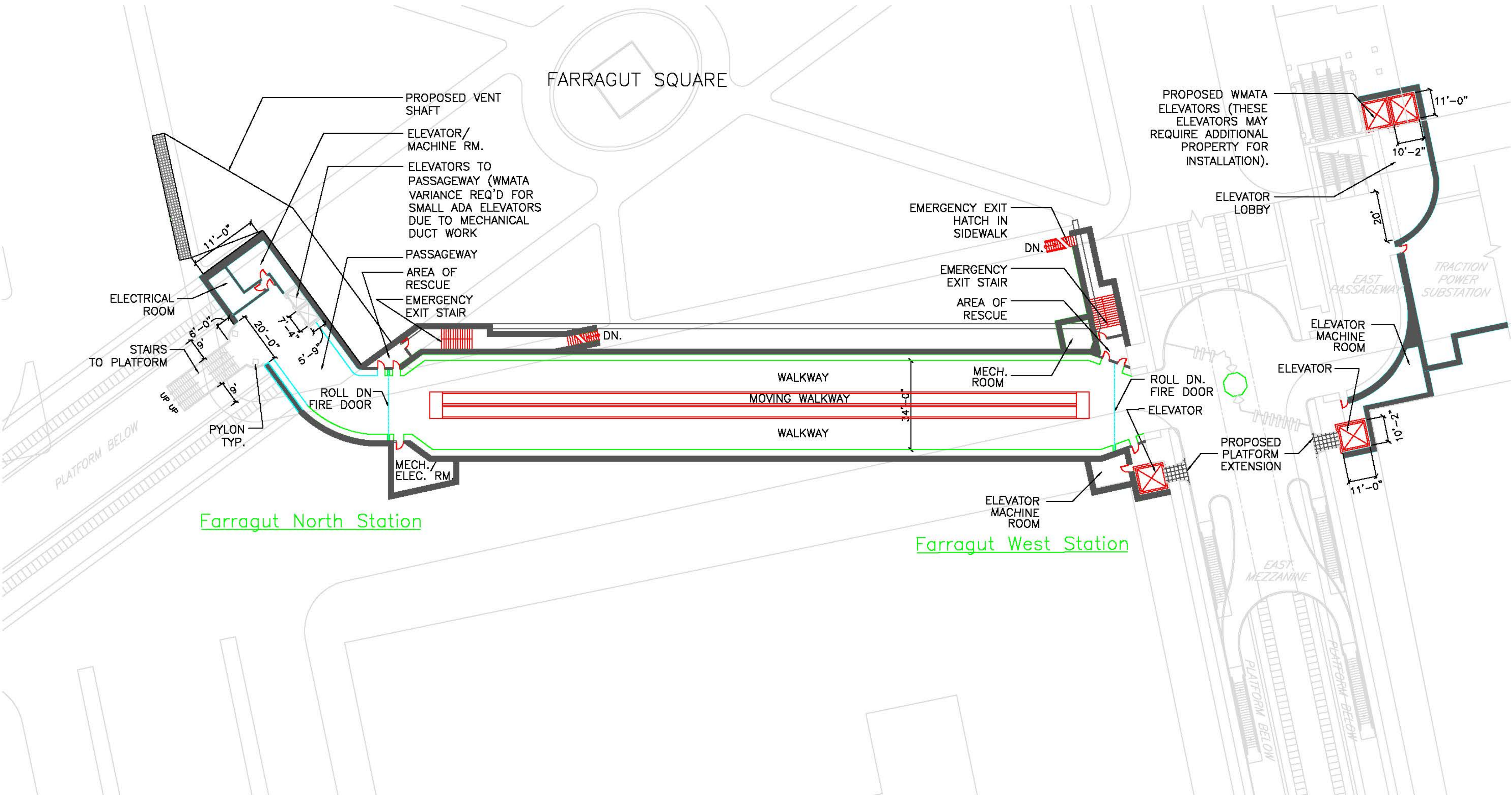
KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ALTERNATIVE 1 – PLAN (PASSAGEWAY OPTION)

metro

WMATA
DWG A-3

10 0 10 20



1 TUNNEL PASSAGE PLAN – OPTION 2 (W/ MOVING WALKWAY)
SCALE : 1" = 20'

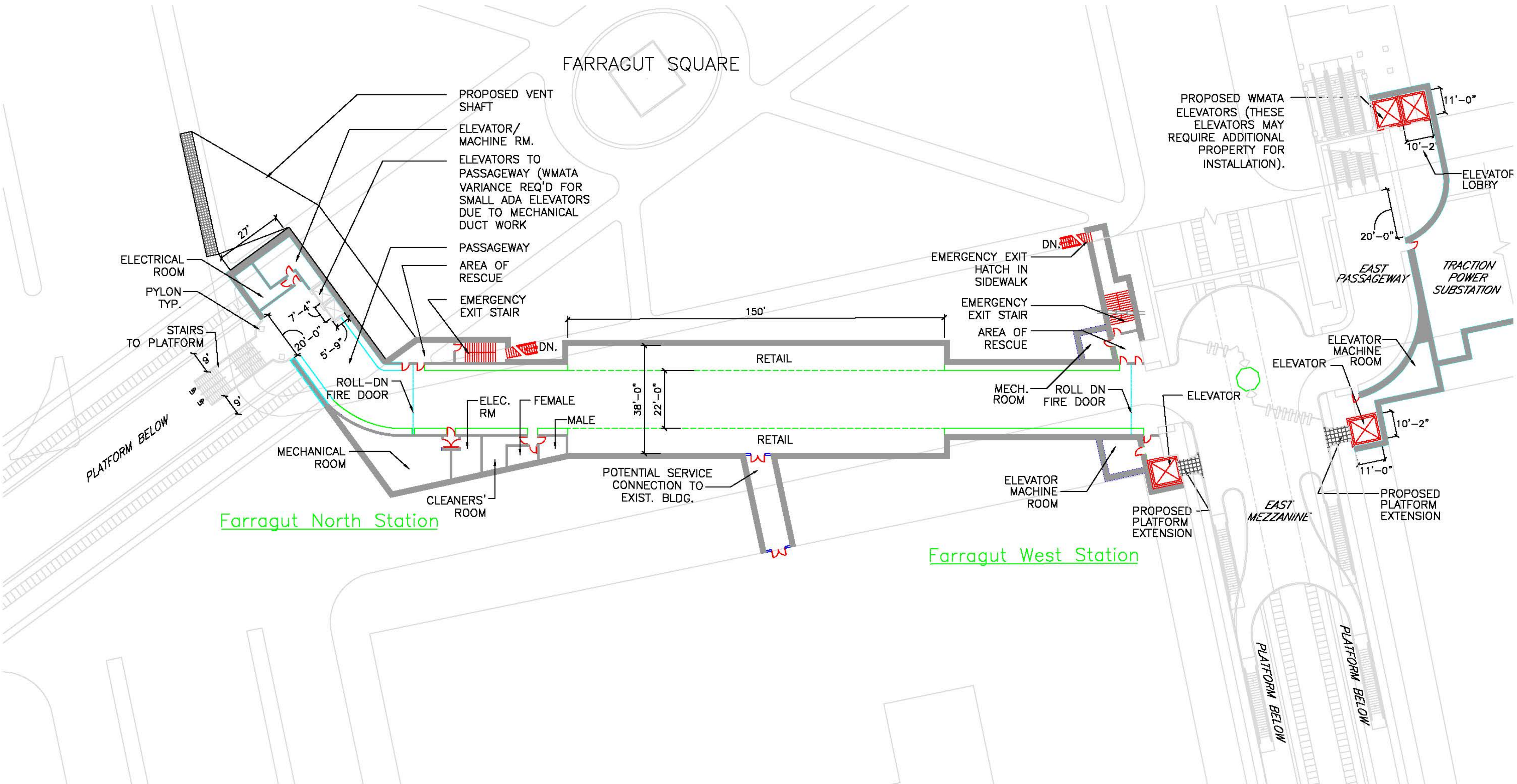
KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ALERNATIVE 2 – PLAN (MOVING WALKWAY OPTION)

metro

WMATA
DWG A-4

10 0 10 20



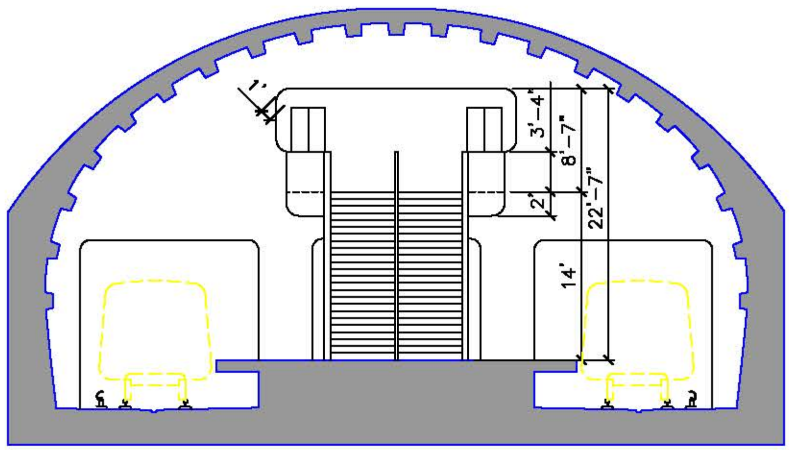
1 TUNNEL PASSAGEWAY PLAN – OPTION 3 (W/ RETAIL)
SCALE : 1" = 40'

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

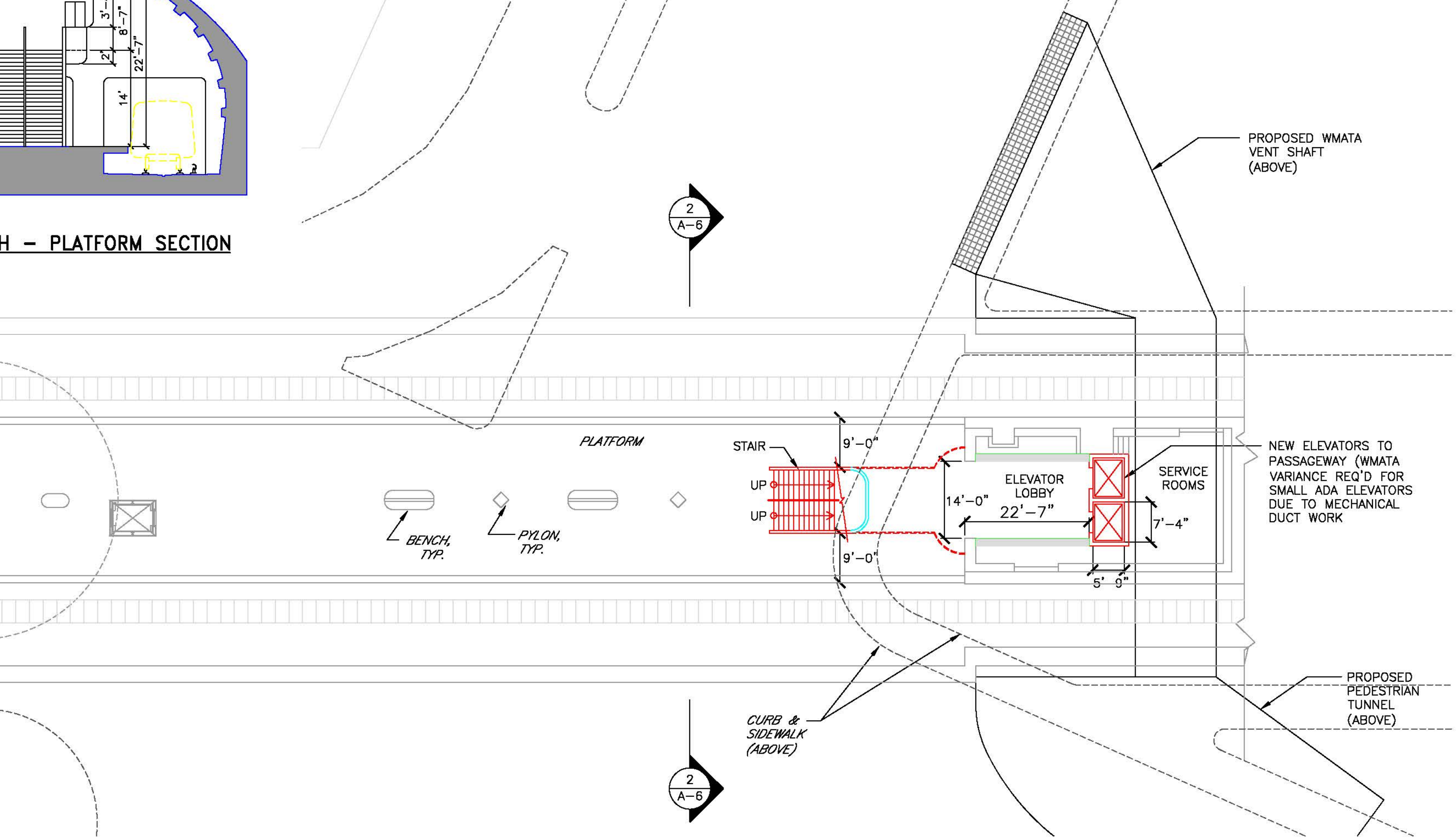
FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ALTERNATIVE 3 – PLAN (RETAIL OPTION)

metro

WMATA
DWG A-5
10 0 10 20



2 FARRAGUT NORTH – PLATFORM SECTION
SCALE : 1/8" = 1'-0"



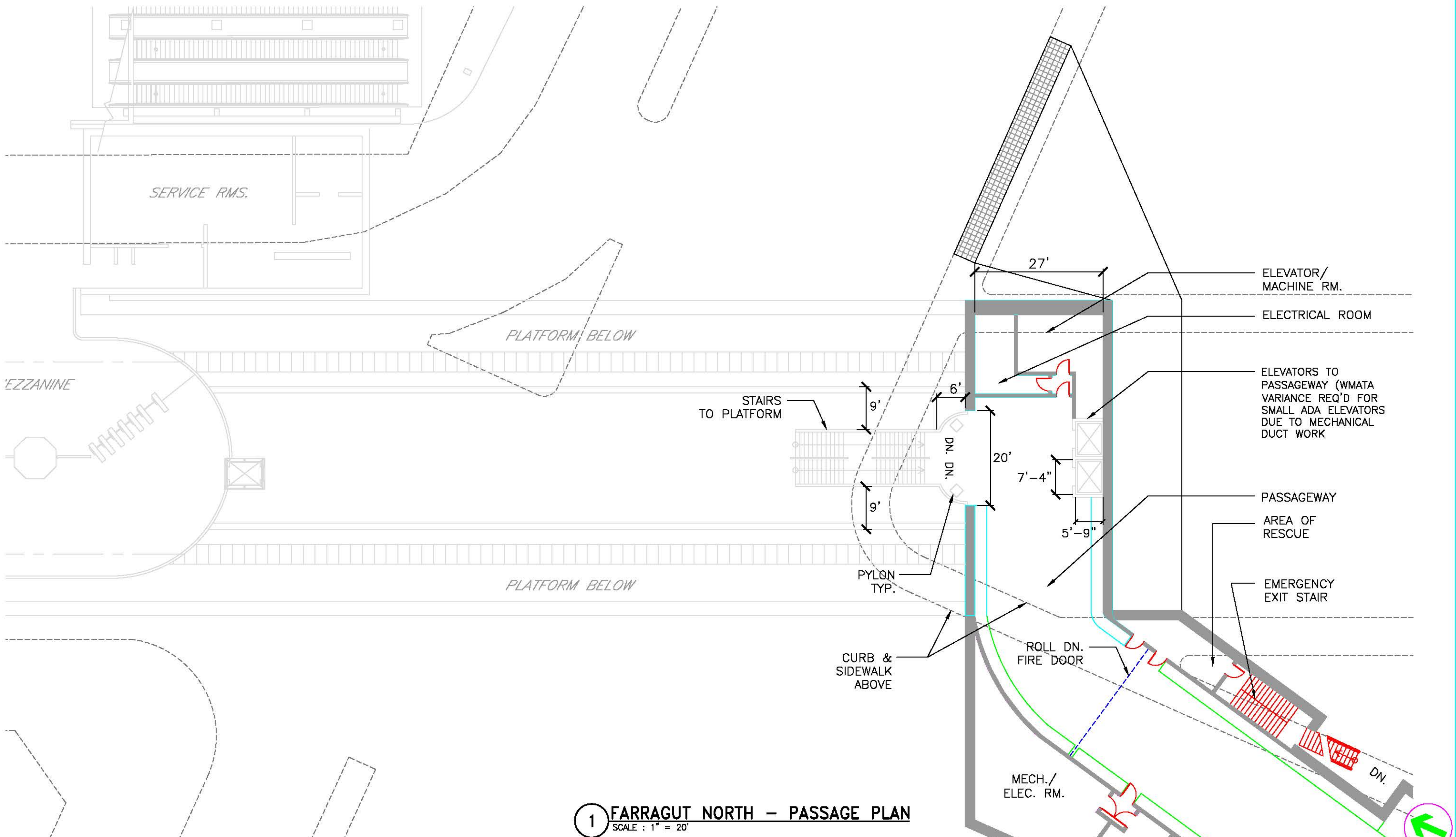
1 FARRAGUT NORTH – PLATFORM PLAN
SCALE : 1" = 20'

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
FARRAGUT NORTH – PLATFORM PLAN

M metro

WMATA
DWG A-6
5 0 5 10



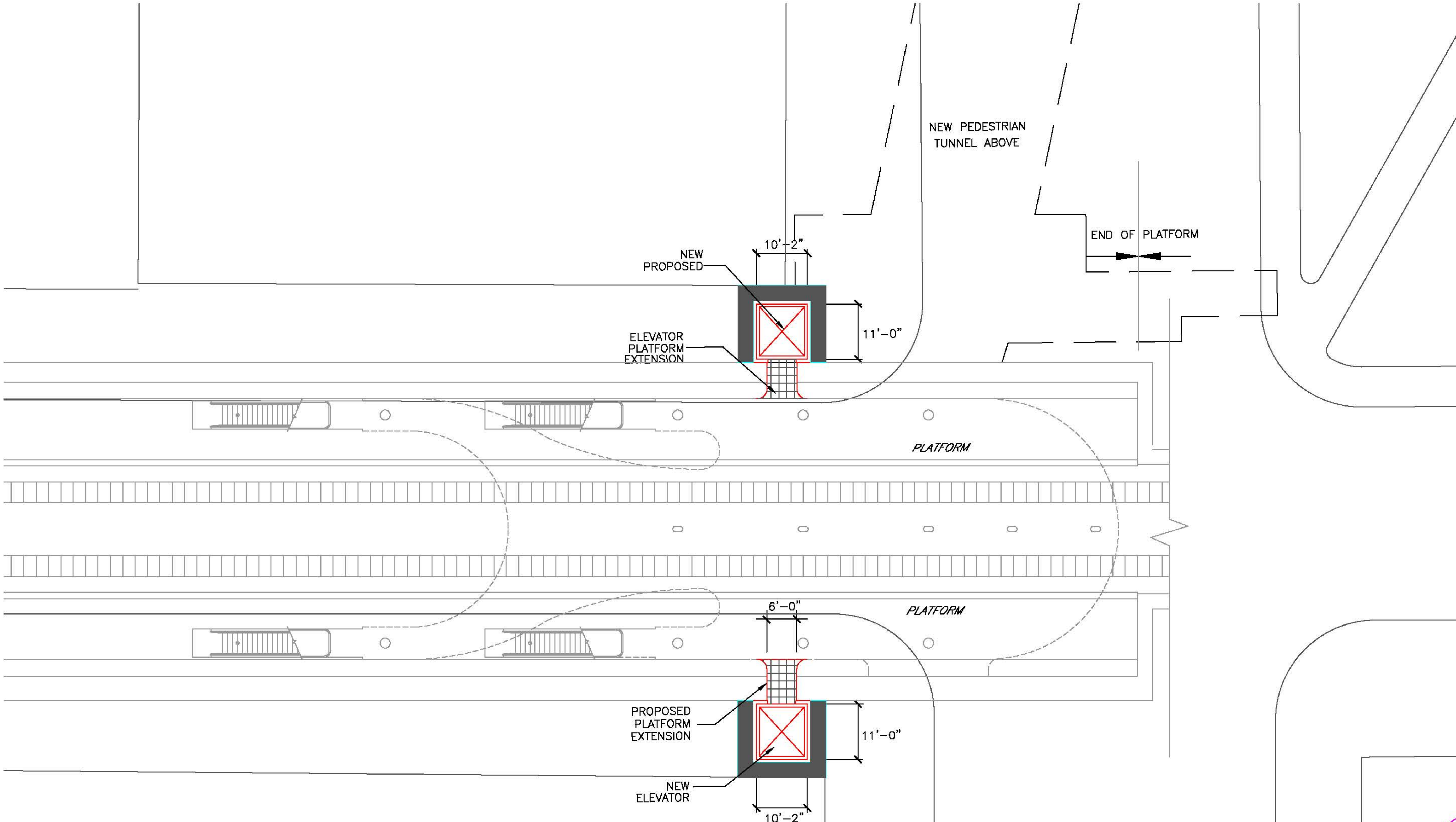
1 FARRAGUT NORTH – PASSAGE PLAN
SCALE : 1" = 20'

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
FARRAGUT NORTH – PASSAGE PLAN

metro

WMATA
DWG A-7
5 0 5 10

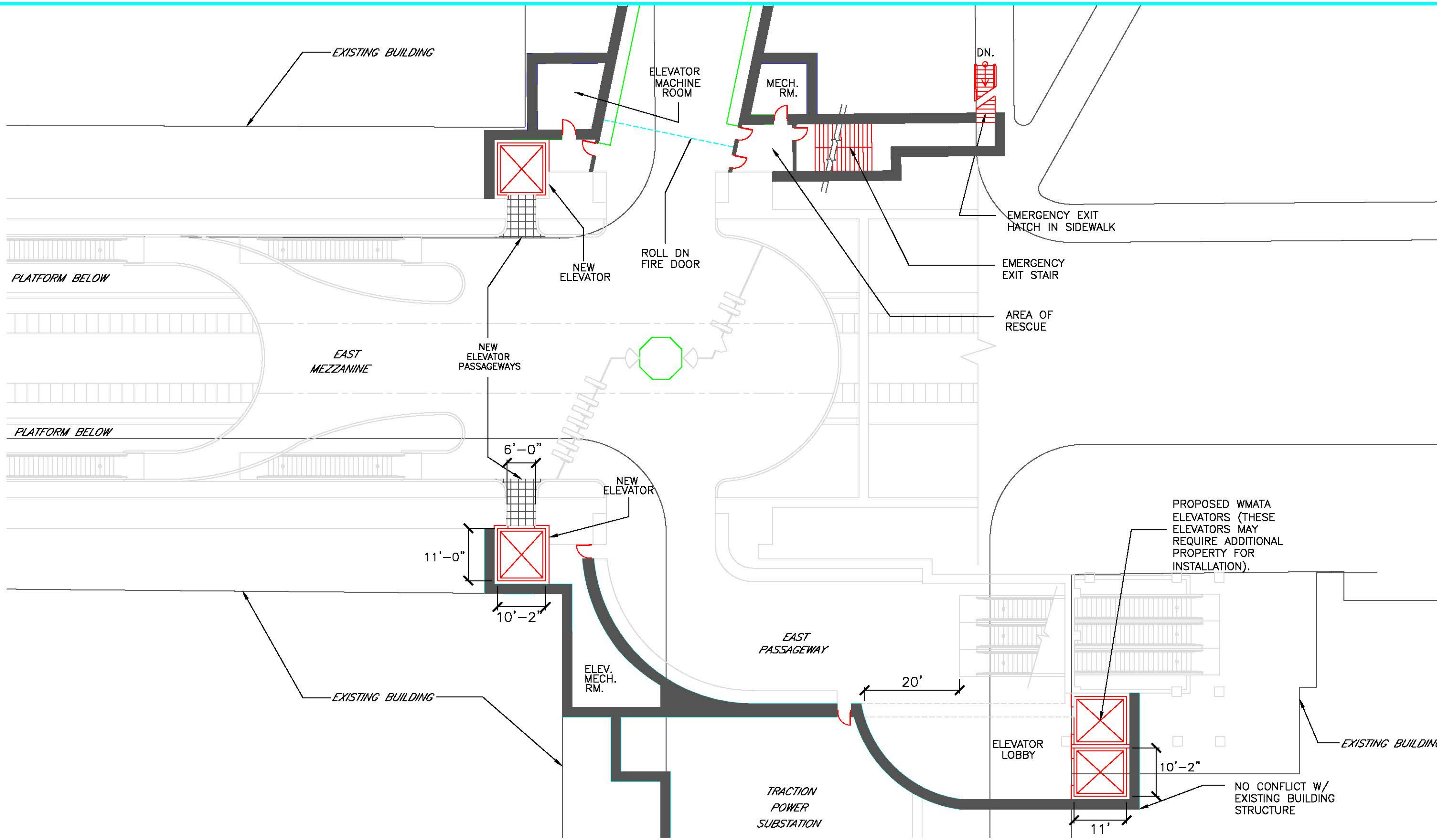


1 FARRAGUT WEST – PLATFORM PLAN
SCALE : 1" = 20'

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
FARRAGUT WEST – PLATFORM PLAN

WMATA
DWG A–8



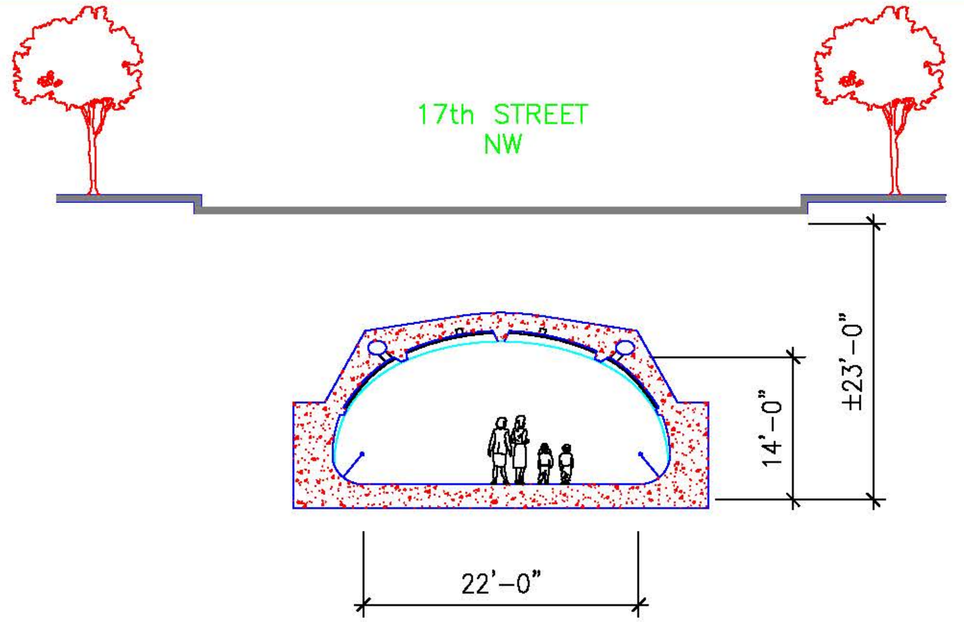
1 FARRAGUT WEST – PASSAGE PLAN
SCALE : 1" = 20'

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

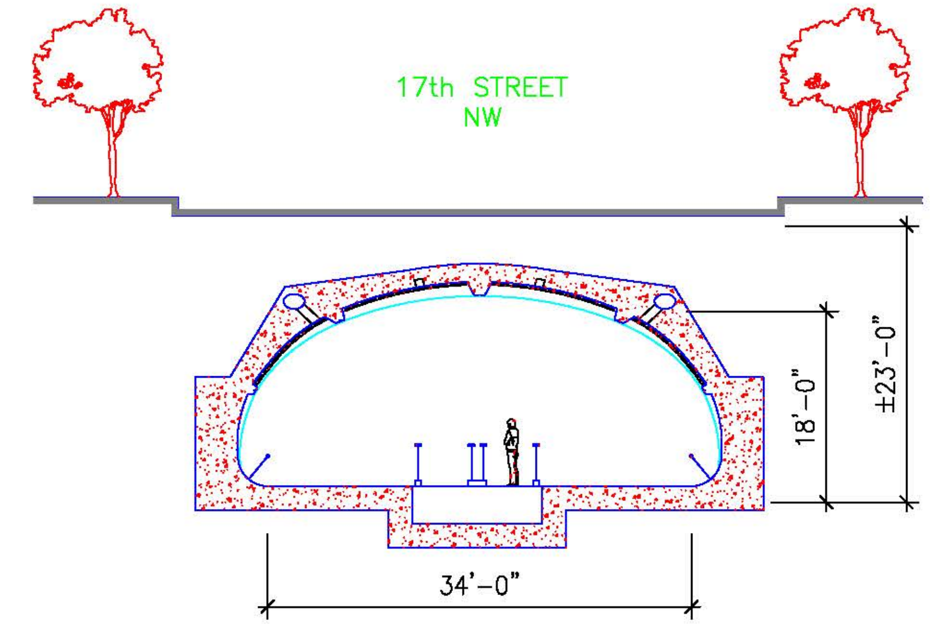
FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
FARRAGUT WEST – PASSAGE PLAN

metro

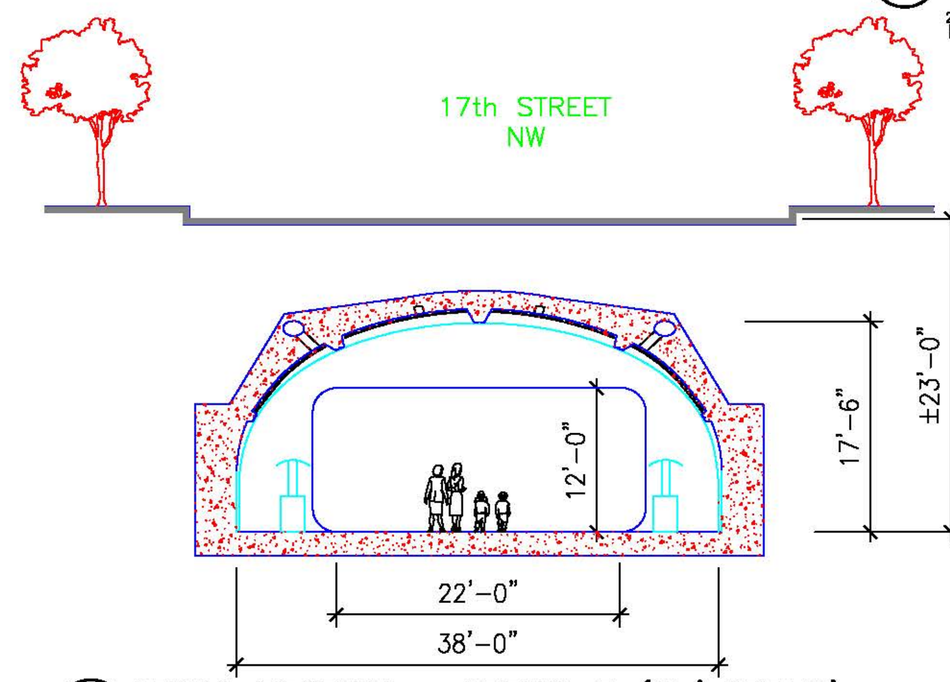
WMATA
DWG A–9



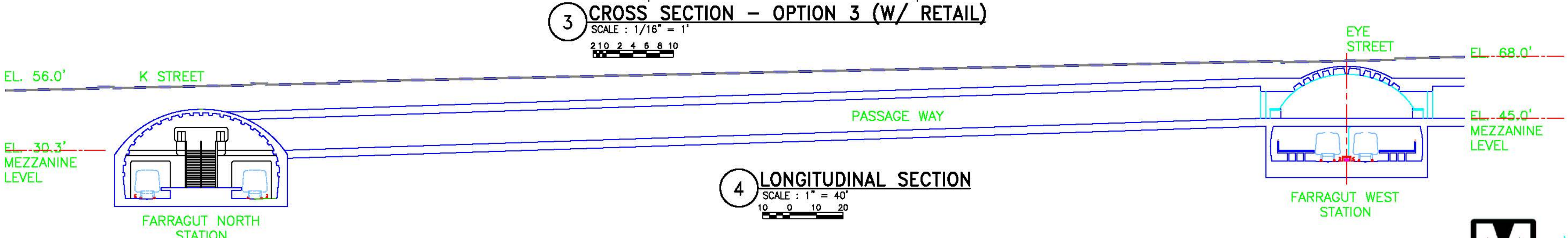
1 CROSS SECTION – OPTION 1 (TYP. PASSAGEWAY)
SCALE : 1/16" = 1'



2 CROSS SECTION – OPTION 2 (W/ MOVING WALKWAY)
SCALE : 1/16" = 1'



3 CROSS SECTION – OPTION 3 (W/ RETAIL)
SCALE : 1/16" = 1'



4 LONGITUDINAL SECTION
SCALE : 1" = 40'

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SECTIONS

WMATA
DWG A–10

PEDESTRIAN CONNECTION PERSPECTIVE - OPTION 3

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY TUNNEL
ALTERNATIVE 3 - ARIAL PERSPECTIVE

WMATA
DWG: A-11

1 PASSAGEWAY PERSPECTIVE – OPTION 3 (RETAIL OPTION)
NTS

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ALTERNATIVE 3 PERSPECTIVE

metro

WMATA
DWG A-12

1 PASSAGEWAY PERSPECTIVE – OPTION 1 (TYPICAL PASSAGEWAY)
NTS

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ALTERNATIVE 1 PERSPECTIVE

WMATA
DWG A–13

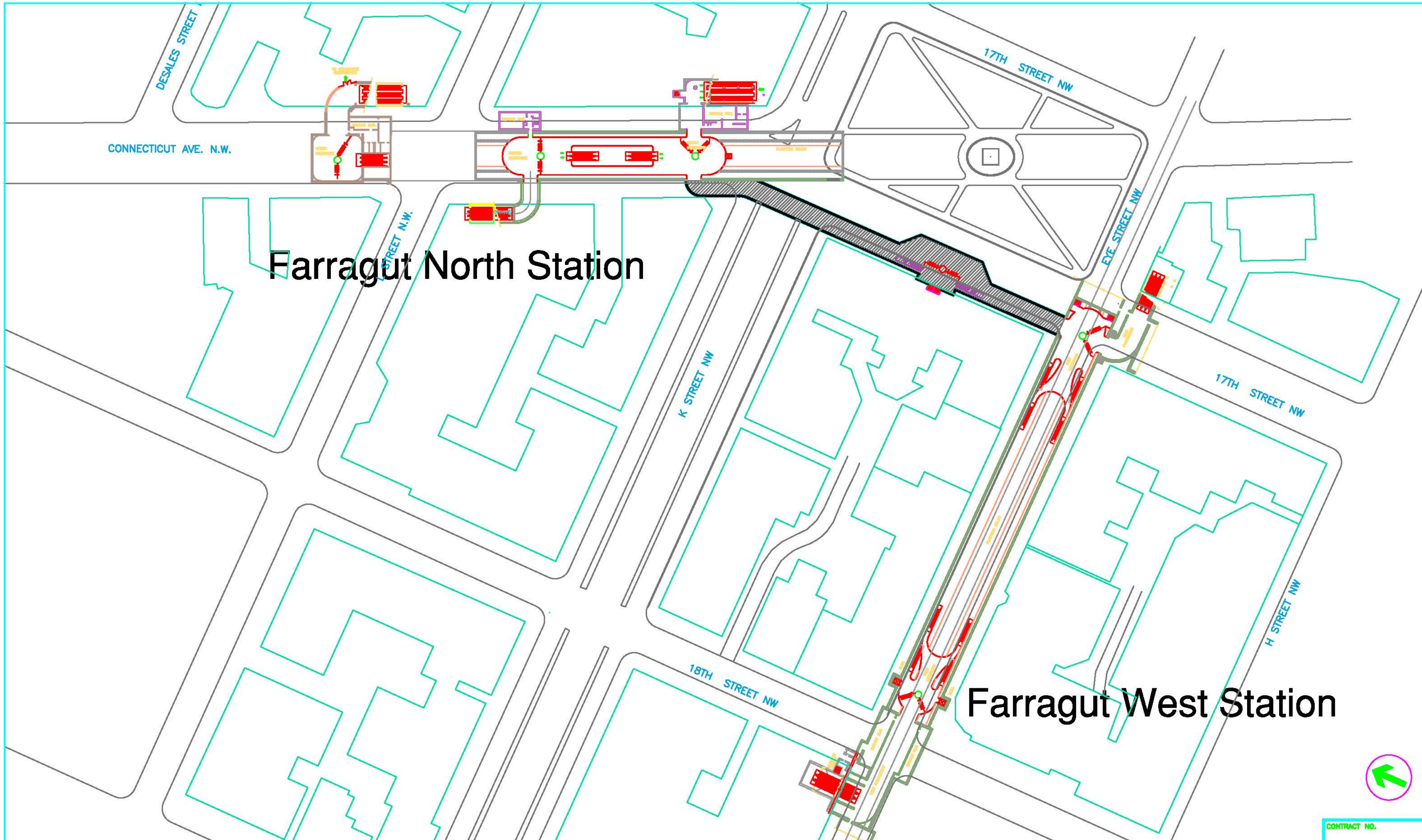
1 PASSAGEWAY ENTRANCE PERSPECTIVE FROM FARRAGUT NORTH
NTS

KGP DESIGN STUDIO
PARSONS TRANPORTATION GROUP
DATE: 8/23/04

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
STAIR ENTRANCE PERSPECTIVE

WMATA
DWG A-14

APPENDIX A



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	08/01 DATE
DRAWN	Lleonag	08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

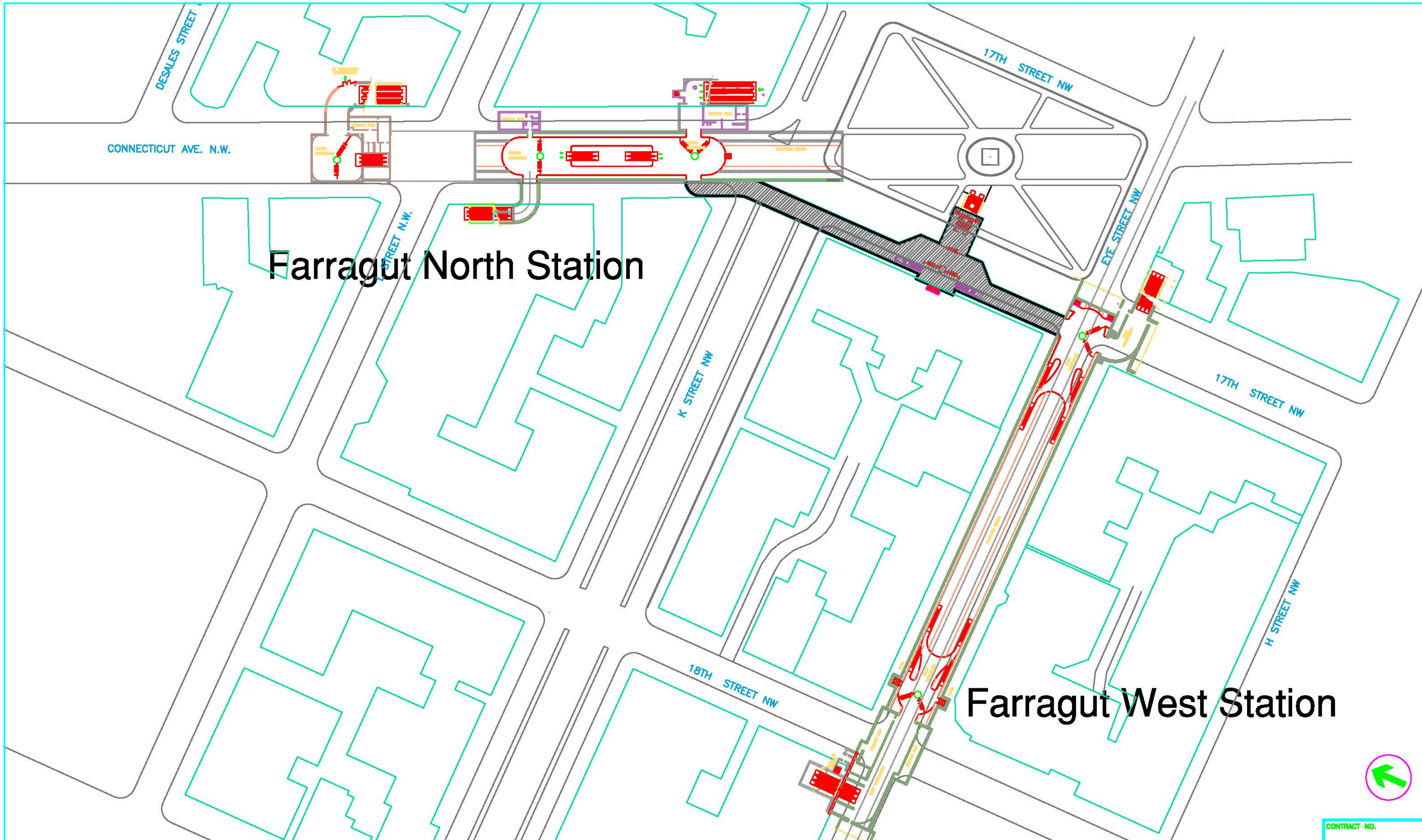
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 1A
PAID PASSAGEWAY

SCALE 1"=60' 30 0 30 60

DRAWING NO. A-1



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	08/01 DATE
DRAWN	Lleonig	08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

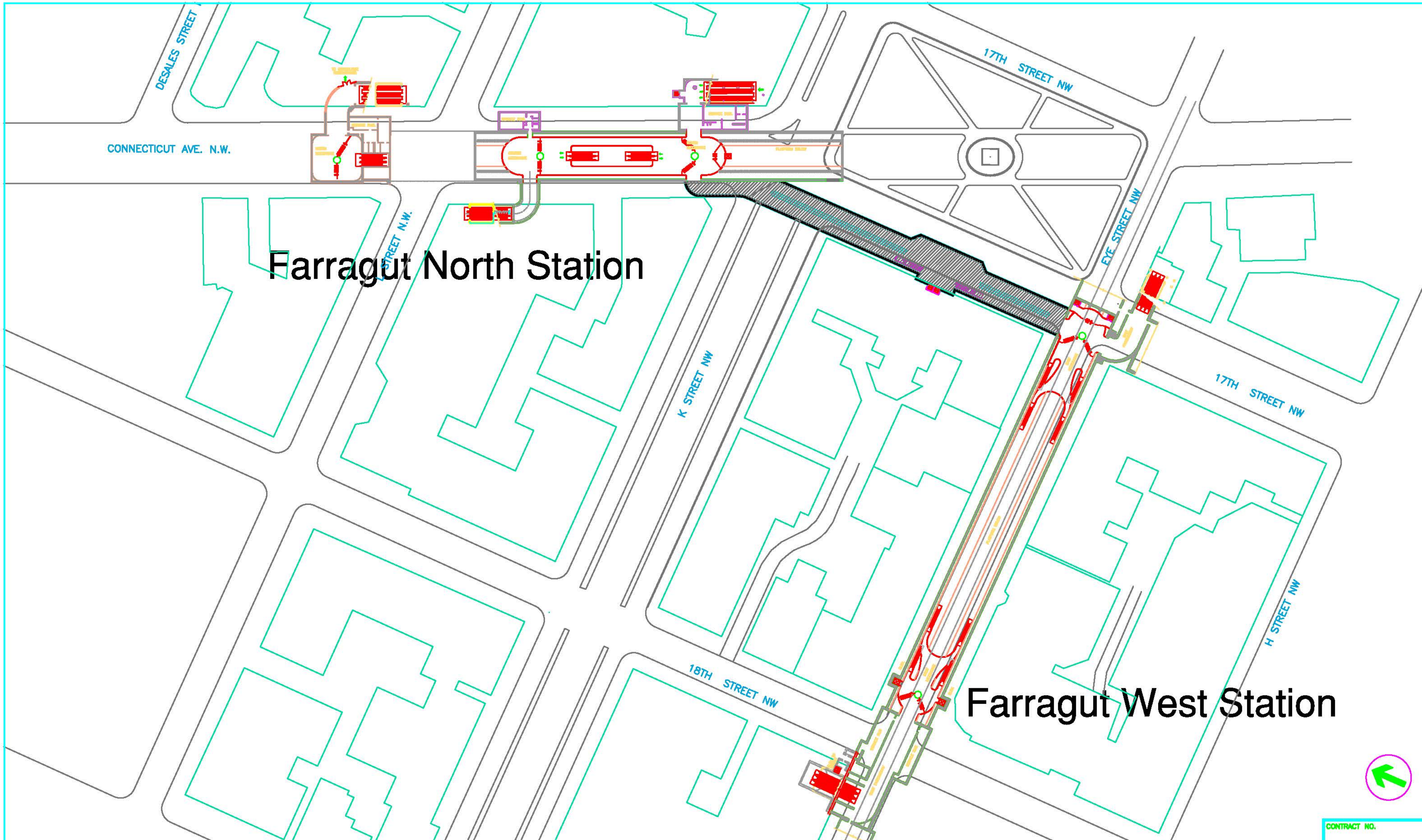
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 1A – ENTRANCE OPTION
PAID PASSAGEWAY

SCALE 1"=60'
30 0 30 60

DRAWING NO. A-2



DESIGNED	KSP DESIGN STUDIO 08/01 DATE
DRAWN	Lieong 08/01 DATE
CHECKED	DATE
APPROVED	DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

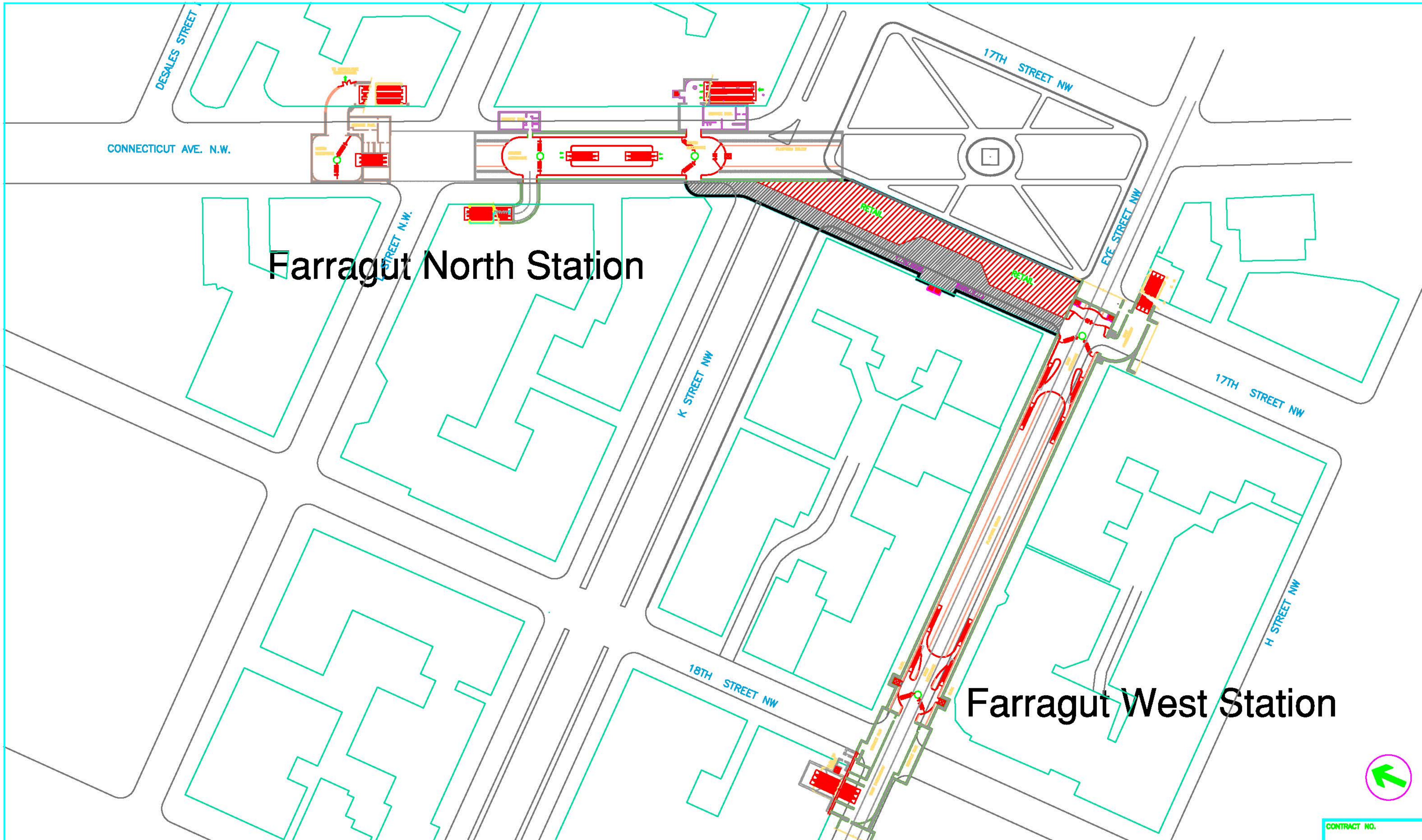
SUBMITTED PROJECT MANAGER

CONTRACT NO.

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 1B
FREE PASSAGEWAY

SCALE 1"=60' 30 0 30 60

DRAWING NO. A-3



CONTRACT NO.

DESIGNED KSP DESIGN STUDIO 08/01 DATE
DRAWN Lleong 08/01 DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

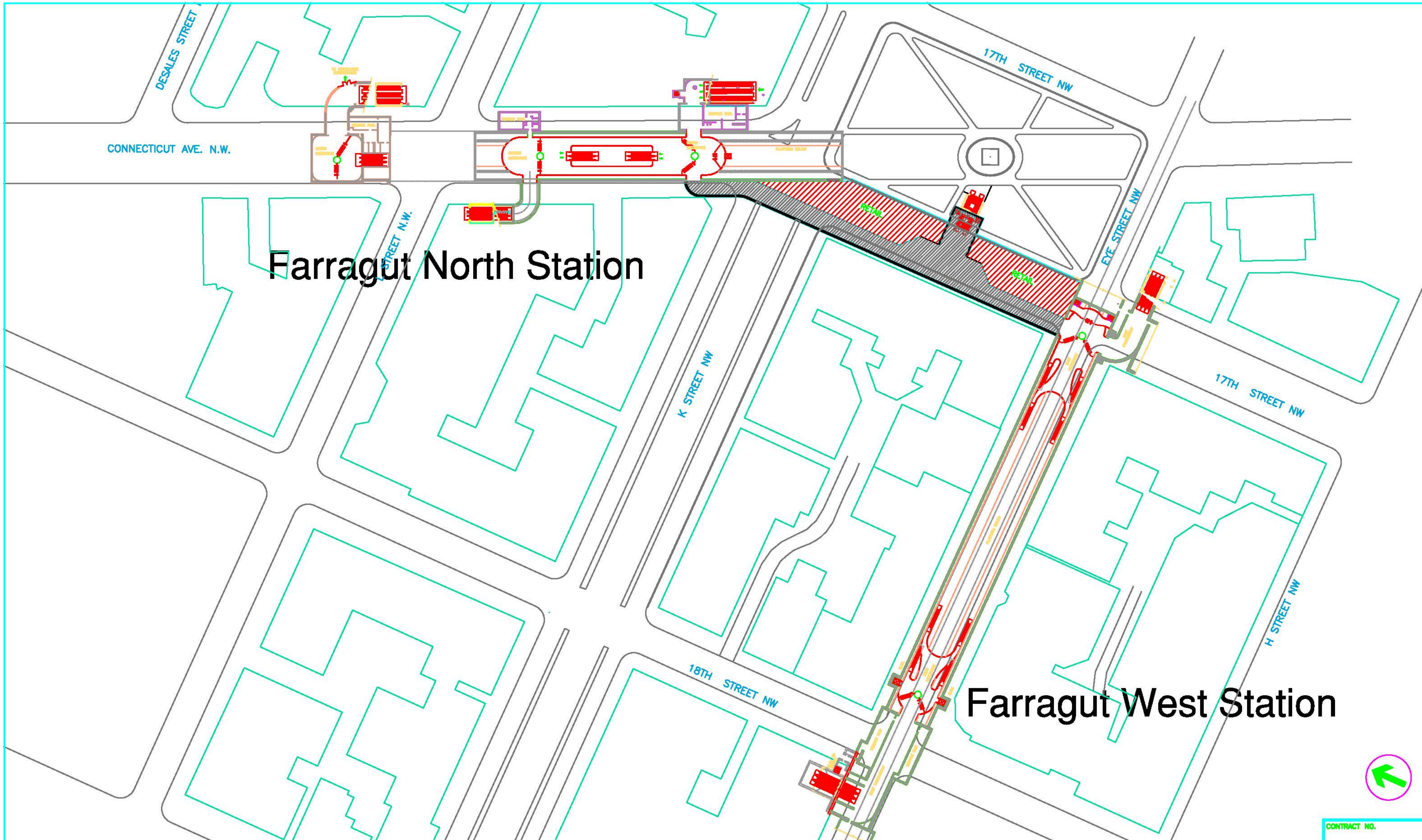
M CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 1C
FREE PASSAGEWAY

SCALE 1"=60' 30 0 30 60

DRAWING NO. A-4



CONTRACT NO.

DESIGNED	KSP DESIGN STUDIO	08/01 DATE
DRAWN	Lisenog	08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

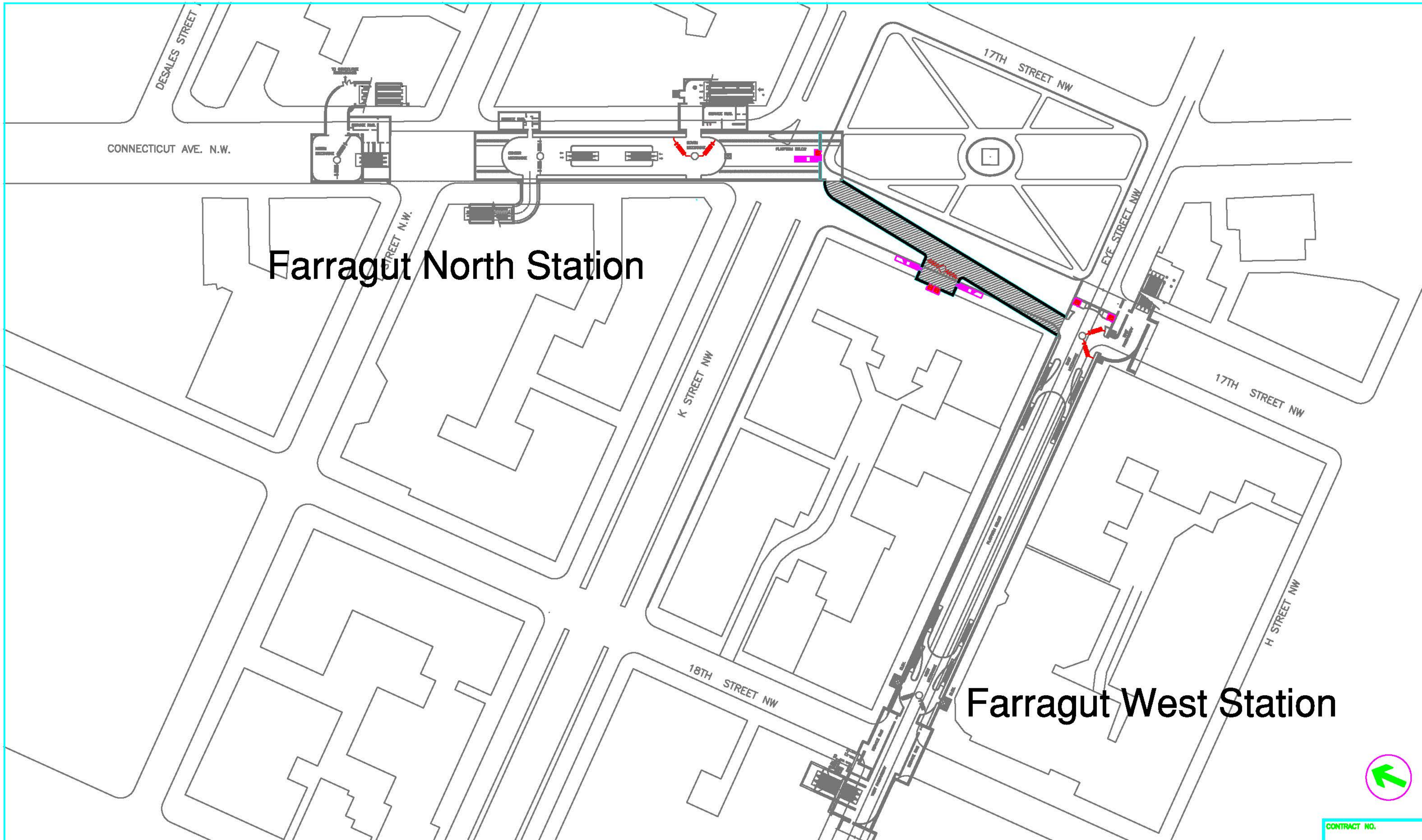
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 1C – ENTRANCE OPTION
FREE PASSAGEWAY

SCALE 1"=60' 30 0 30 60

DRAWING NO. A–5



DESIGNED	KGP DESIGN STUDIO 08/01 DATE
DRAWN	Lisonog 08/01 DATE
CHECKED	DATE
APPROVED	DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

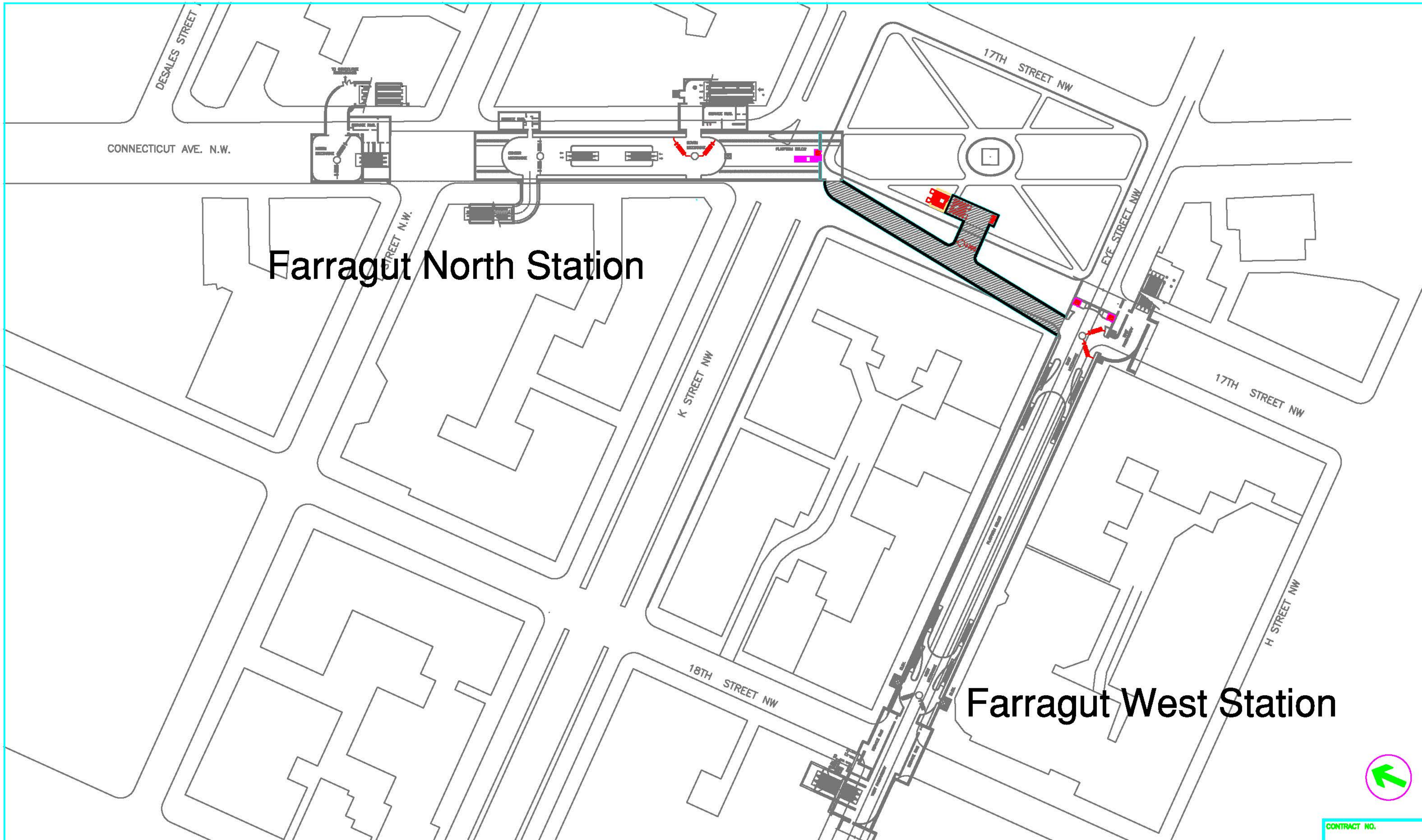
SUBMITTED PROJECT MANAGER

CONTRACT NO.

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 2A
PAID PASSAGEWAY

SCALE 1"=60'

DRAWING NO. A-6



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	DATE
DRAWN	Lisoning	DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

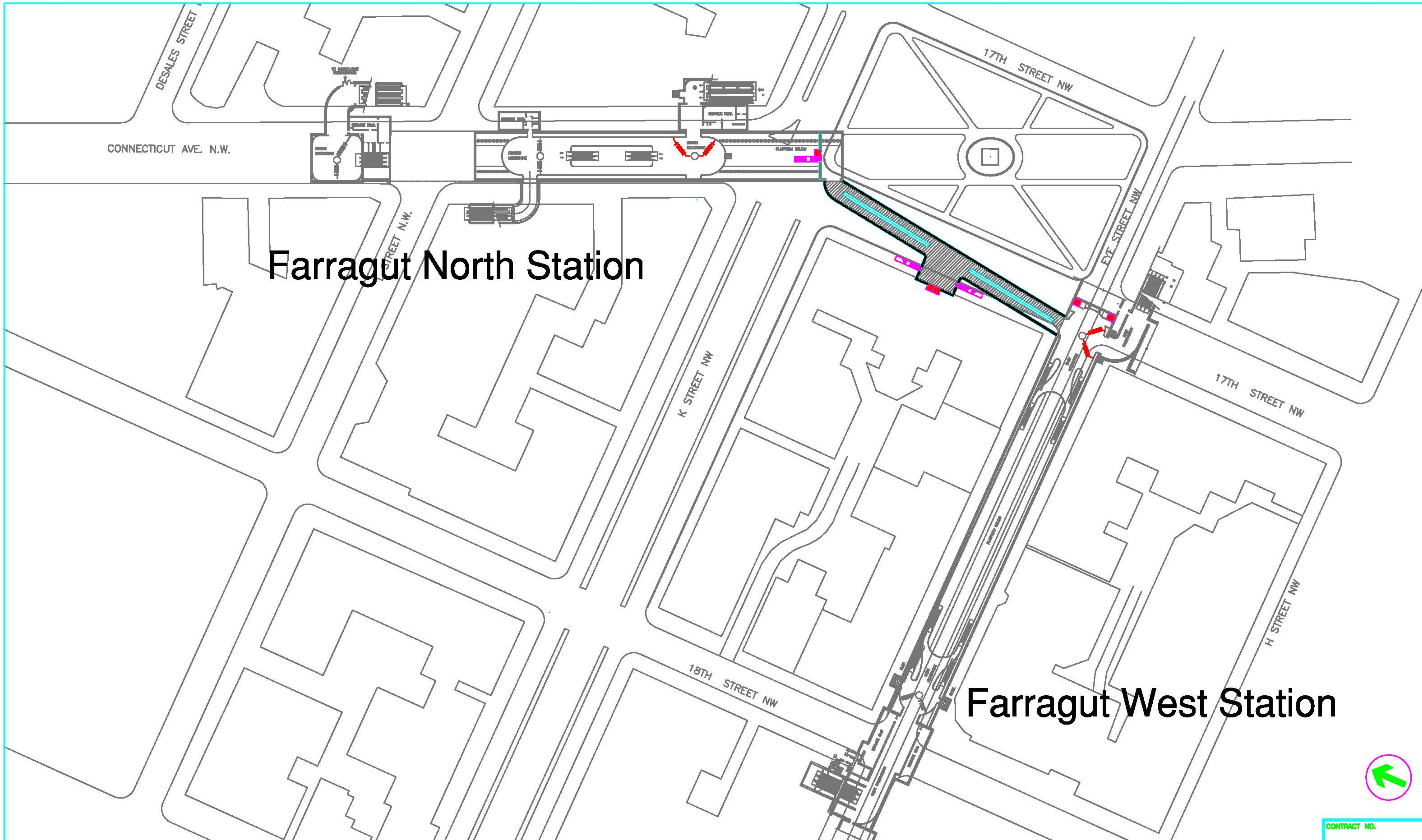
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 2A – ENTRANCE OPTION
PAID PASSAGEWAY

SCALE 1"=60'

DRAWING NO. A-7



DESIGNED	KGP DESIGN STUDIO	08/01 DATE		
DRAWN		08/01 DATE		
CHECKED		DATE		
APPROVED		DATE		

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

CONTRACT NO.

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

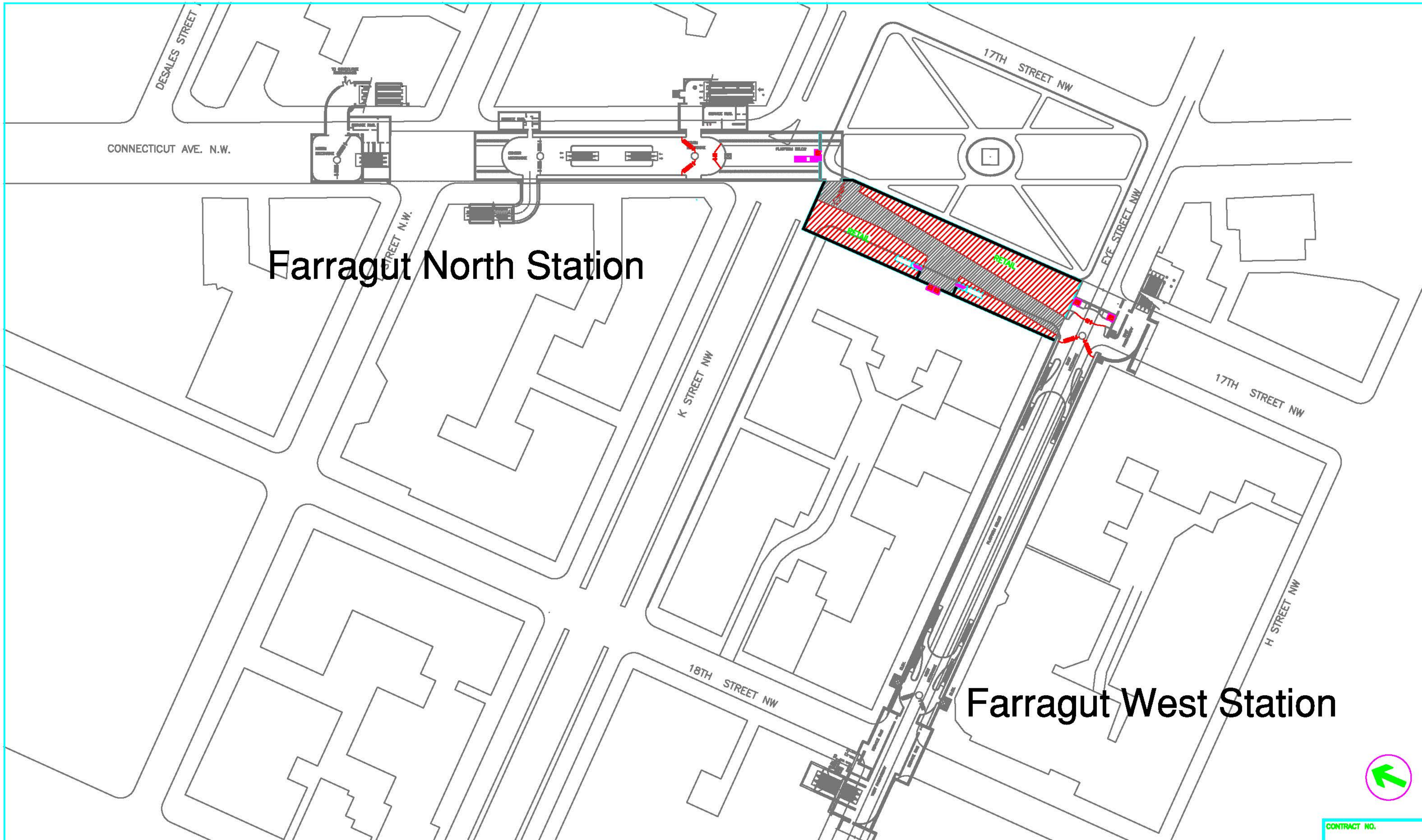
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 2B
FREE PASSAGEWAY

SCALE 1"=60' 30 0 30 60

DRAWING NO. A-8



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	08/01 DATE
DRAWN	Lloong	08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

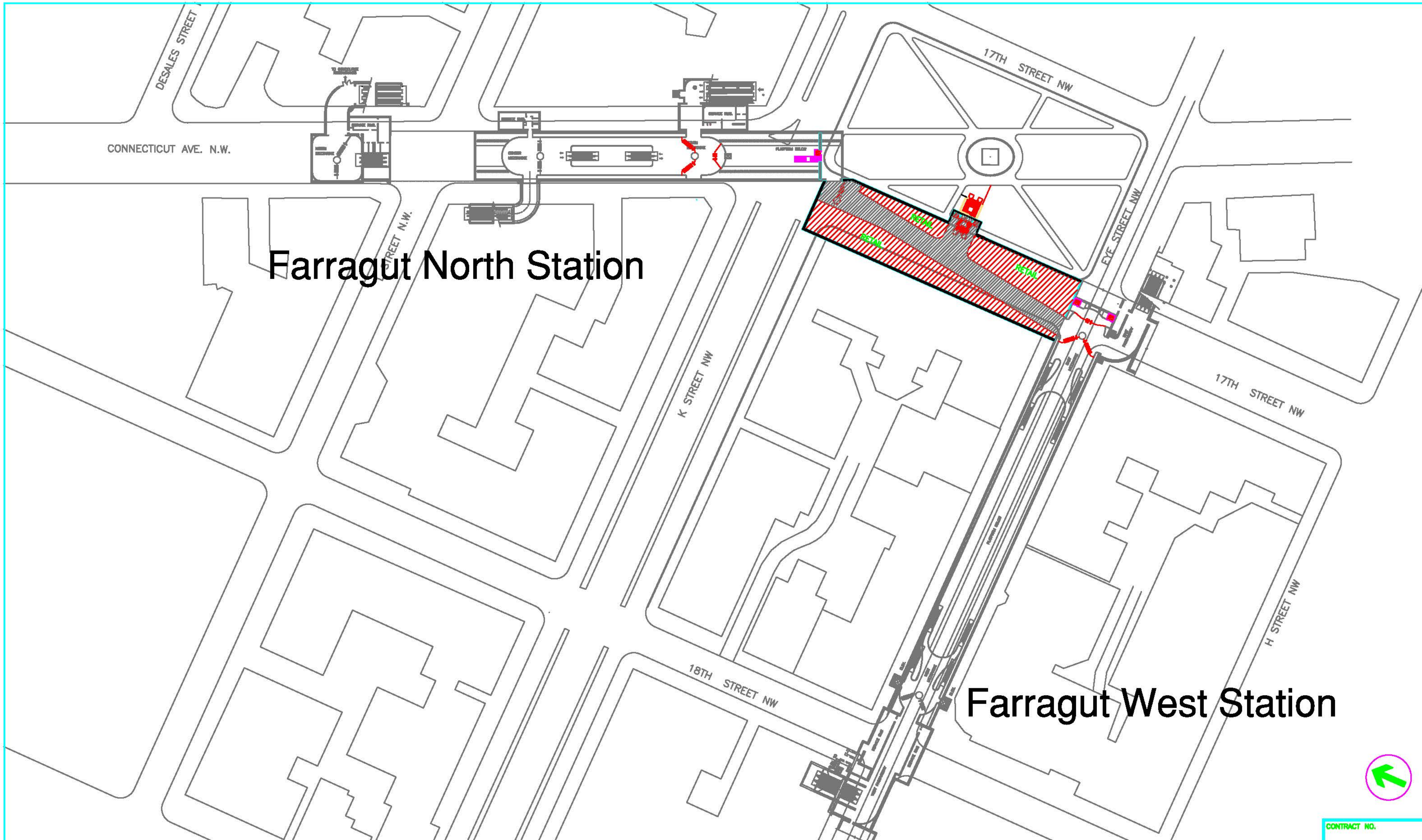
SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 2C
FREE PASSAGEWAY

SCALE 1"=60'

30 0 30 60

DRAWING NO. A-9



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	08/01 DATE
DRAWN	Lleonog	08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

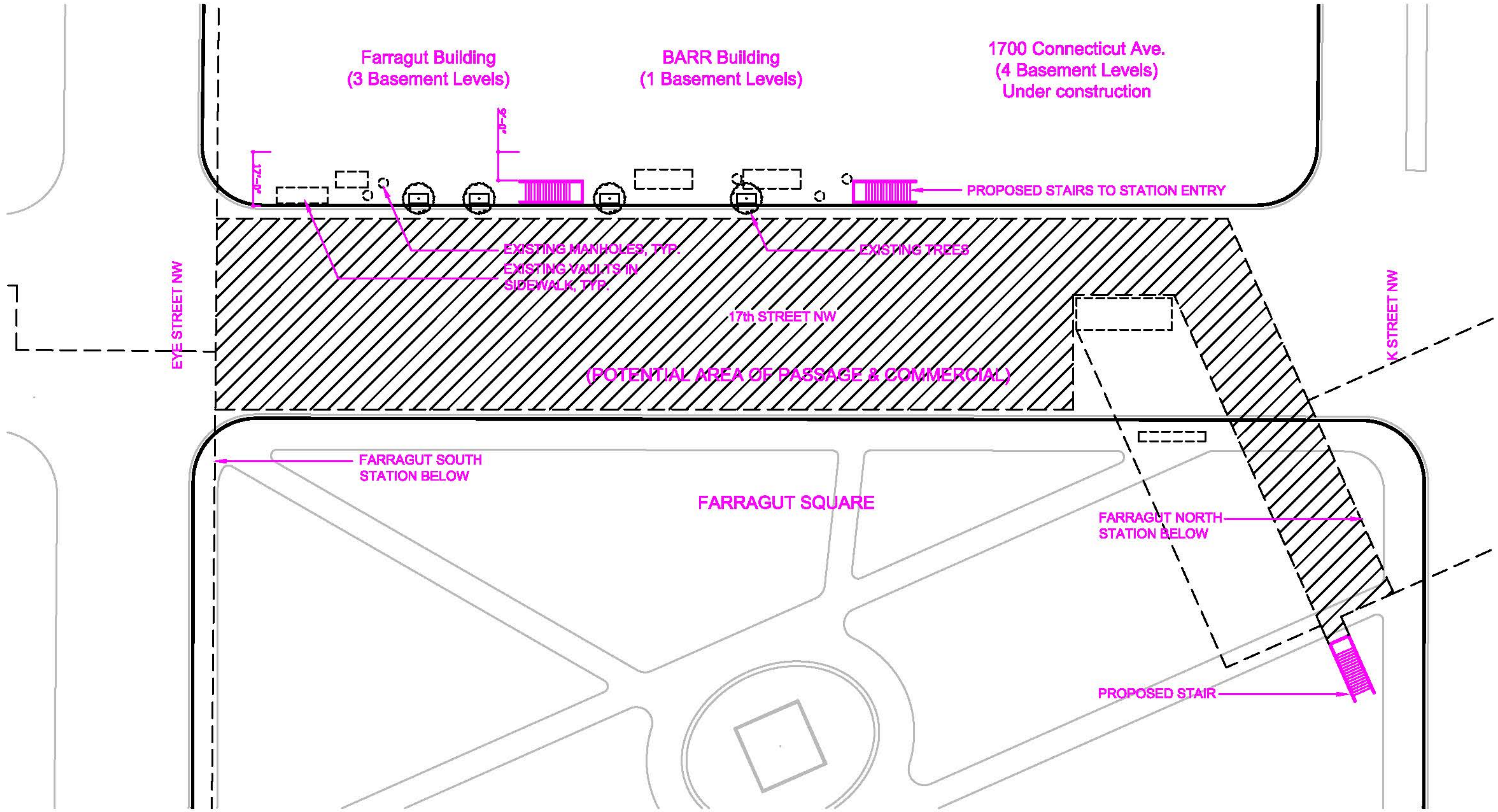
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 2C – ENTRANCE OPTION
FREE PASSAGEWAY

SCALE 1"=60' 30 0 30 60

DRAWING NO. A–10



SITE PLAN

DESIGNED	KGP DESIGN STUDIO	3.28.04	DATE
DRAWN	F.PARACH	3.28.04	DATE
CHECKED			DATE
APPROVED			DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

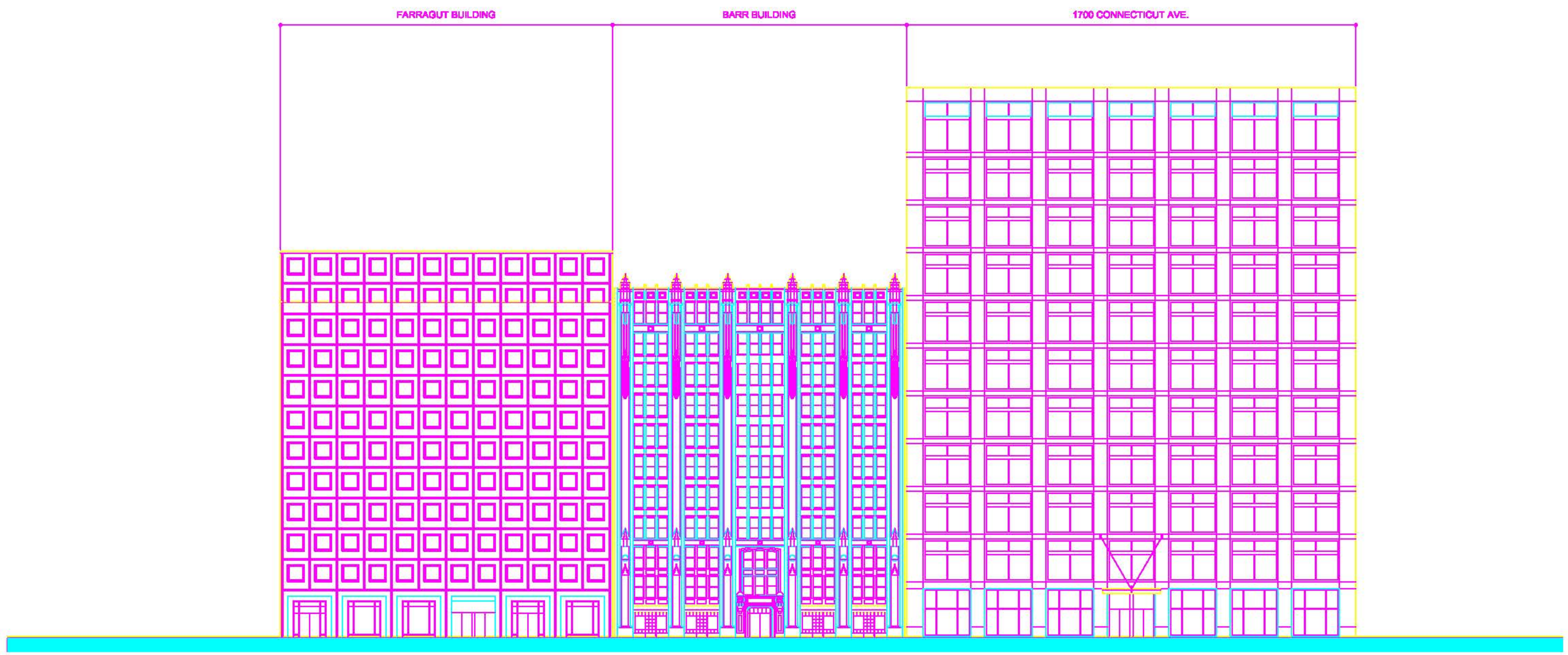
SUBMITTED
PROJECT MANAGER

CONTRACT NO.

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 2
EXISTING VENT SHAFT REMAINS

SCALE 1"=20'

DRAWING NO. A-12



ELEVATION FROM FARRAGUT SQUARE - EXISTING BUILDINGS

DESIGNED KGP DESIGN STUDIO 3.26.04 DATE
DRAWN PARAON 3.26.04 DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

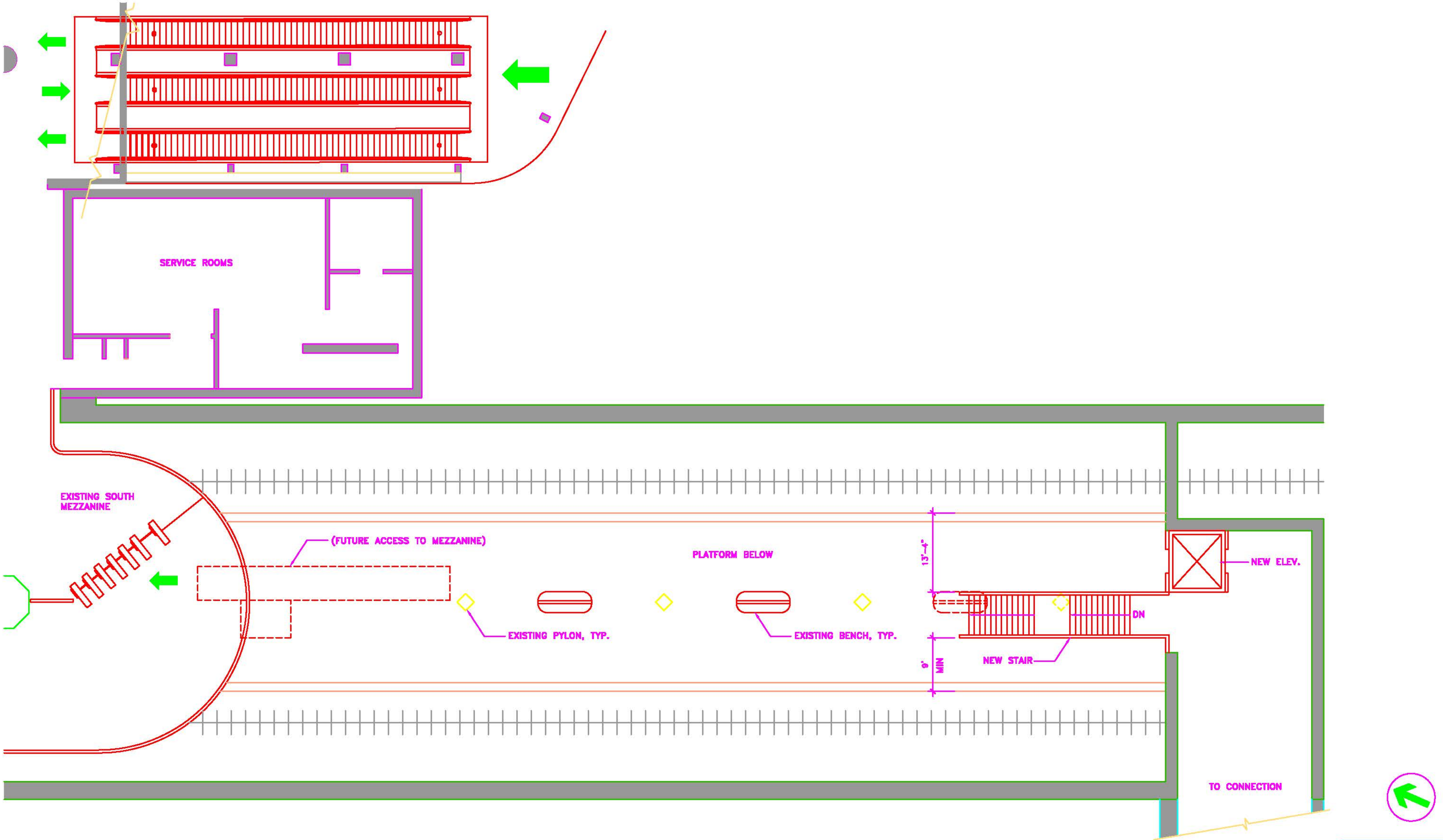
CONTRACT NO.

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SITE PLAN ALTERNATIVE 1
ELEVATION

SCALE 1"=20'

10 0 10 20

DRAWING NO. A-13



CONTRACT NO.

DESIGNED DATE
DRAWN DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

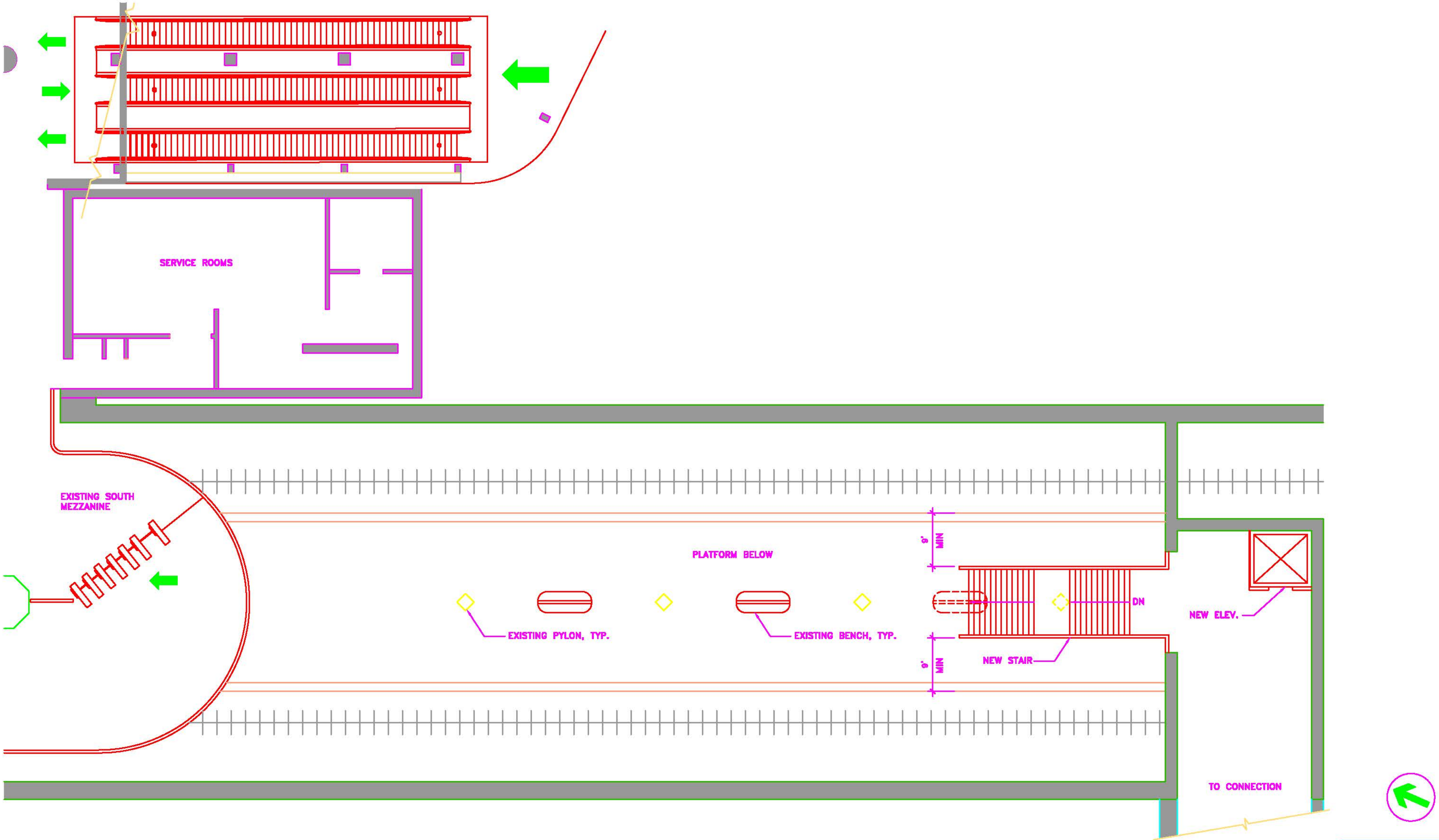
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ENLARGED PLAN ALTERNATIVE 1
STAIR/ELEVATOR COMBINATION

SCALE 1/8"=1'-0"

DRAWING NO. A-14



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	08/01 DATE
DRAWN	Ueoneg	08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

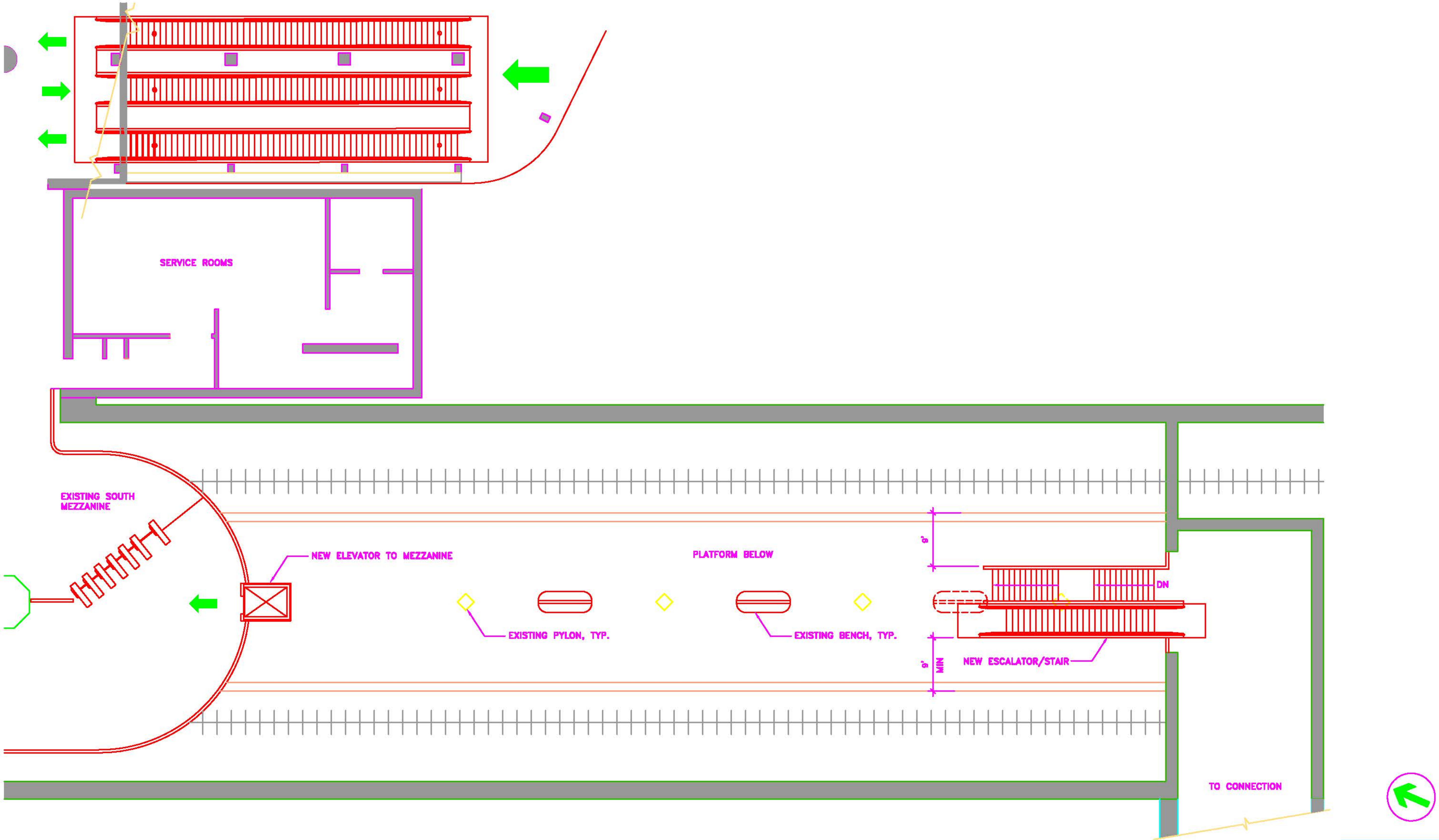
M CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ENLARGED PLAN ALTERNATIVE 2
WIDE STAIR/REMOTE ELEVATOR

SCALE 1/8"=1'-0"

DRAWING NO. A-15



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	08/01 DATE
DRAWN	Lieanog	08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

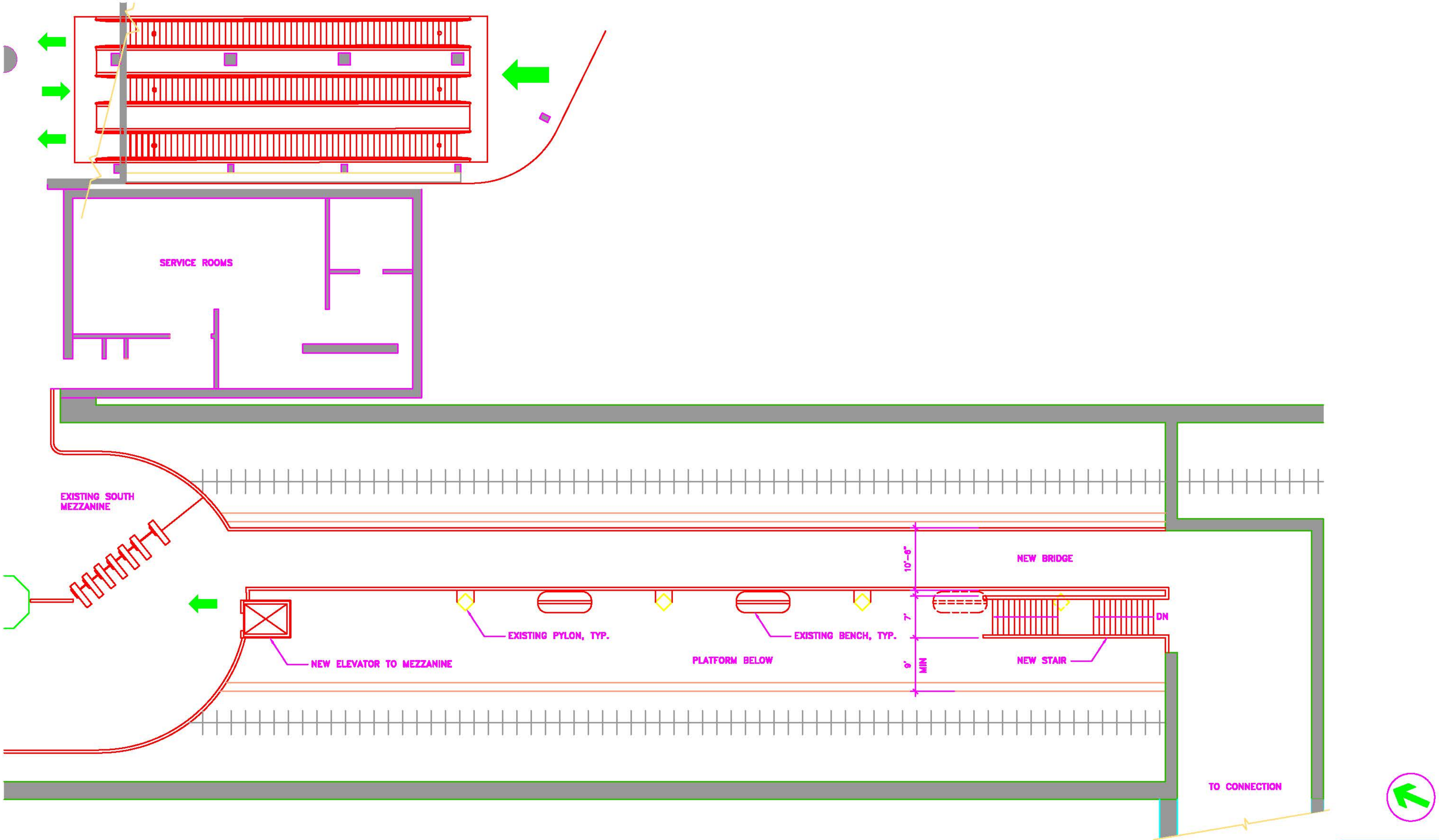
M CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ENLARGED PLAN ALTERNATIVE 3
ESCALATOR/STAIR COMBINATION

SCALE 1/8"=1'-0"

DRAWING NO. A-16



CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	08/01 DATE
DRAWN		08/01 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

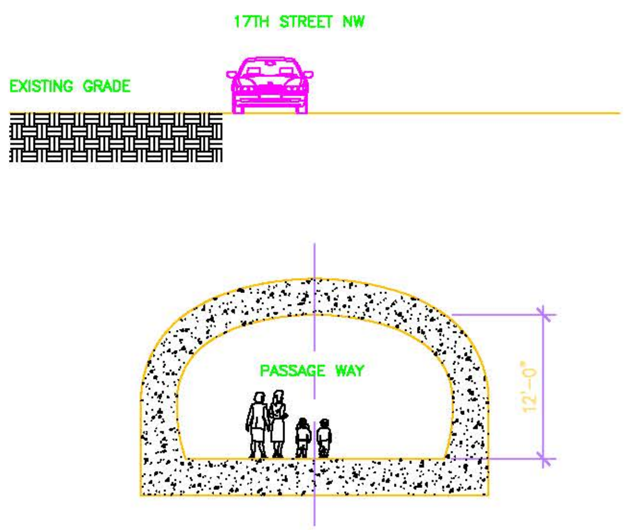
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
ENLARGED PLAN ALTERNATIVE 4
BRIDGE/STAIR COMBINATION

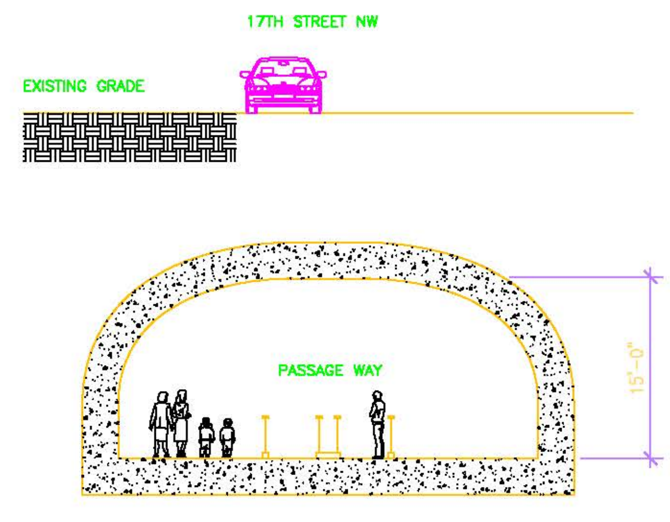
SCALE 1/8"=1'-0"

DRAWING NO. A-17



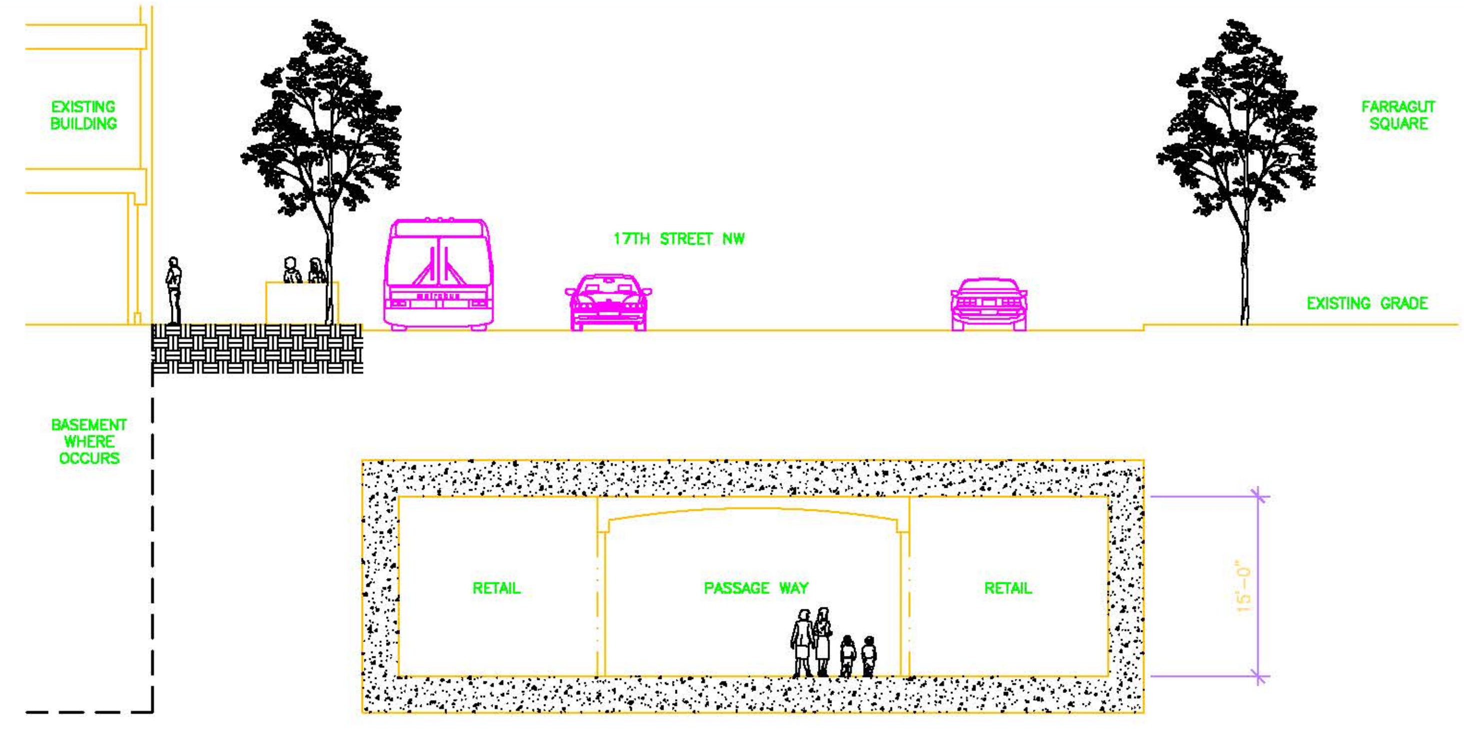
CROSS SECTION - PASSAGE OPTION

SC: 1/8" = 1'-0"



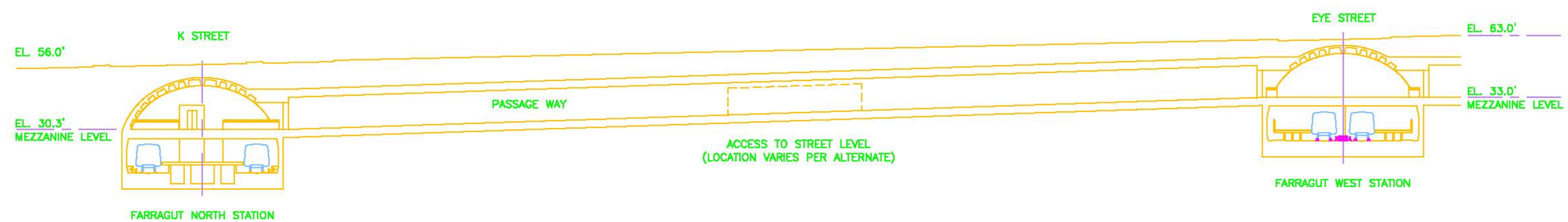
CROSS SECTION - PEOPLE MOVER OPTION

SC: 1/8" = 1'-0"



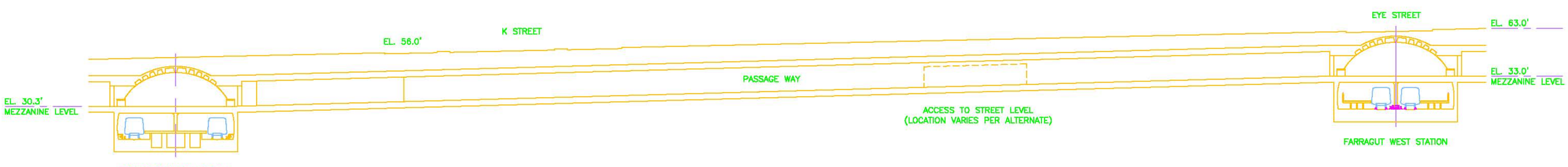
CROSS SECTION - RETAIL OPTION

SC: 1/8" = 1'-0"



LONGITUDINAL SECTION - ALTERNATIVE 2

1" = 25'-0"



LONGITUDINAL SECTION - ALTERNATIVE 1

1" = 25'-0"

CONTRACT NO.

DESIGNED	KGP DESIGN STUDIO	3.26.04 DATE
DRAWN	PARAON	3.26.04 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

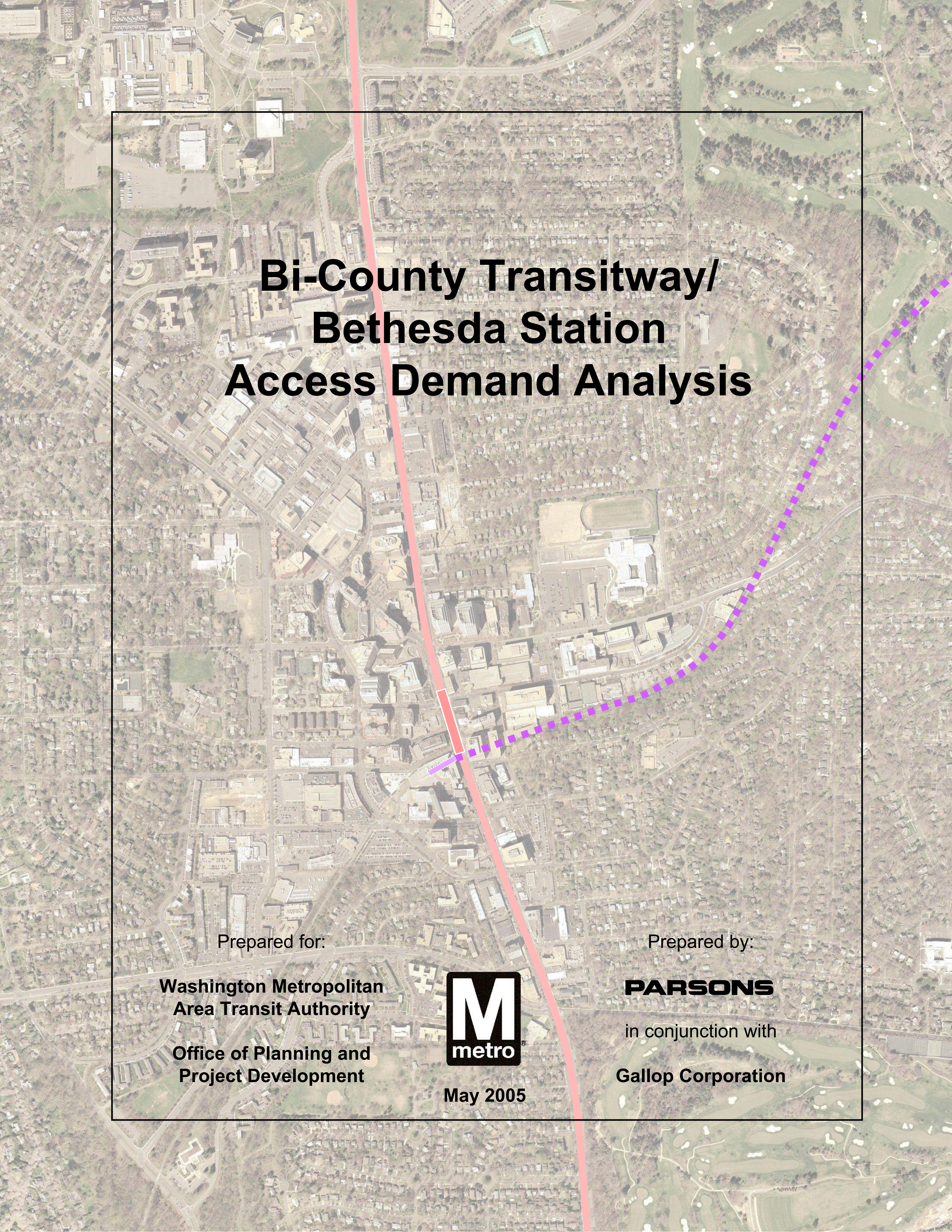
CAPITAL TRANSIT CONSULTANTS
SECTION DESIGNER

SUBMITTED
PROJECT MANAGER

FARRAGUT NORTH & FARRAGUT WEST
PEDESTRIAN PASSAGEWAY
SECTIONS

SCALE: AS NOTED

DRAWING NO.: A-18



Bi-County Transitway/ Bethesda Station Access Demand Analysis

Prepared for:

Washington Metropolitan Area Transit Authority

Office of Planning and Project Development

metro

May 2005

Prepared by:

PARSONS

in conjunction with

Gallop Corporation

Contents

Figures

Tables

Appendices

EXECUTIVE SUMMARY

The addition of a new south entrance to the Bethesda Metrorail Station offers an opportunity to expand the accessibility of the station to the surrounding area. Likewise, the proposed Bi-County Transitway offers the prospect of improved transit connections between Bethesda and Silver Spring, College Park, and New Carrollton. This study determines the effects of a south entrance and the Bi-County Transitway on Bethesda-based transit ridership and on the infrastructure of the Bethesda Station.

Three options were considered in this study for the year 2030, as follows:
- Option 1: No-build scenario, where existing conditions remain unchanged
- Option 2: South Entrance scenario, where no new transitway is assumed, but the south entrance is assumed to provide access to the Metrorail platform
- Option 3: Bi-County Transitway scenario, where the transitway is assumed to be in place along with the new south entrance

Land Use

A comprehensive review of land use in the Bethesda Station area was conducted based on data from the Metropolitan Washington Council of Governments (MWCOG) and the Maryland-National Capital Park and Planning Commission (M-NCPPC). The forecast calls for a 37 percent increase in Bethesda-area jobs and a 55 percent increase in Bethesda-area households by 2030.

A new south entrance to the Bethesda Station would help serve the increased population and employment by reducing walking distances to and from the station. By 2030, the south entrance would increase the number of jobs within ¼ mile of a Metrorail Station entrance by 11 percent, and would increase the number of households within the same radius by 27 percent.

Existing Ridership

The Bethesda station currently handles about 9,500 Metrorail boardings per day, with a similar number of alightings; the station is in the top fourth of all Metrorail stations when ranked by ridership. Boardings and alighting volumes are nearly equal during much of the day, demonstrating that the Bethesda area attracts Metrorail passengers nearly equally from both residential and office land uses.

Walking is by far the most common access mode for passengers arriving at the Bethesda station. Over 70 percent of daily passengers walk to the station, increasing to nearly 90 percent during the afternoon peak period. About 10 percent of daily passengers arrive by bus, while 9 percent drive and park.

Future Ridership

Version 2.1 D of the MWCOG travel forecasting model was used to evaluate future ridership on Metrorail and the Bi-County Transitway in the year 2030, and the Metrorail Development-Related Ridership Survey was used to evaluate the ability of the south entrance to induce new ridership. Ridership results are presented in Table 1.

Table 1: Adjusted Ridership Summary, 2030

AM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	5,100	3,100	0	0	0	0	**5,100**	**3,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**5,100**	**3,100**	**0**	**0**	**0**	**0**	**5,100**	**3,100**
Option 2: South Entrance without Bi-County	North	3,600	2,200	0	0	0	0	**3,600**	**2,200**
	South	1,600	1,000	0	0	0	0	**1,600**	**1,000**
	Total	**5,200**	**3,200**	**0**	**0**	**0**	**0**	**5,200**	**3,200**
Option 3: South Entrance with Bi-County	North	3,500	1,900	0	0	0	0	**3,500**	**1,900**
	South	1,500	900	300	1,400	400	800	**1,900**	**2,200**
	Total	**5,000**	**2,800**	**300**	**1,400**	**400**	**800**	**5,300**	**4,200**

PM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	3,100	5,000	0	0	0	0	**3,100**	**5,000**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**3,100**	**5,000**	**0**	**0**	**0**	**0**	**3,100**	**5,000**
Option 2: South Entrance without Bi-County	North	2,200	3,500	0	0	0	0	**2,200**	**3,500**
	South	1,000	1,600	0	0	0	0	**1,000**	**1,600**
	Total	**3,200**	**5,100**	**0**	**0**	**0**	**0**	**3,200**	**5,100**
Option 3: South Entrance with Bi-County	North	2,000	3,300	0	0	0	0	**2,000**	**3,300**
	South	900	1,500	1,400	300	800	300	**2,300**	**1,800**
	Total	**2,900**	**4,800**	**1,400**	**300**	**800**	**300**	**4,300**	**5,100**

Daily		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	13,000	13,100	0	0	0	0	**13,000**	**13,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**13,000**	**13,100**	**0**	**0**	**0**	**0**	**13,000**	**13,100**
Option 2: South Entrance without Bi-County	North	8,500	8,400	0	0	0	0	**8,500**	**8,400**
	South	4,700	5,100	0	0	0	0	**4,700**	**5,100**
	Total	**13,300**	**13,500**	**0**	**0**	**0**	**0**	**13,300**	**13,500**
Option 3: South Entrance with Bi-County	North	7,900	7,800	0	0	0	0	**7,900**	**7,800**
	South	4,400	4,800	2,400	3,200	2,000	2,000	**6,700**	**8,000**
	Total	**12,200**	**12,600**	**2,400**	**3,200**	**2,000**	**2,000**	**14,600**	**15,800**

Note: Figures are rounded to the nearest 100 riders, which may affect sums.

The ridership forecast shows the following notable trends:

- In Option 1, boardings and alightings would increase to about 13,000 per day by 2030, an increase of about 35 percent over existing conditions.
- The south entrance would induce a 3.2 percent increase in pedestrian-based Metrorail ridership from residential areas and a 7.5 percent increase in pedestrian-based ridership from commercial areas.
- The south entrance would capture about 37 percent of the station's rail access trips in Option 2 and about 48 percent of rail access trips in Option 3.
- The addition of the Bi-County Transitway would increase total Bethesda-based rail ridership by about 13 percent, although Metrorail ridership would decrease slightly.

Capacity Constraints

An evaluation of the Bethesda Station's infrastructure showed the following:

- In the No-build scenario, the Bethesda station's only capacity shortfall would be the vertical passenger circulation between platform and mezzanine. If a south entrance were constructed, the existing north entrance would operate below capacity.
- The elevator-based south entrance would require three elevator cabs in Option 2 and five cabs in Option 3.

A summary of the station's infrastructure requirements is presented in Table 2.

Table 2: Summary of Bethesda Station Infrastructure Requirements

Infrastructure Element			***North Entrance***				***South Entrance***	
			Existing	***Option 1***	***Option 2***	***Option 3***	***Option 2***	***Option 3***
Vertical Circulation	Street to mezzanine	Escalators	3	3	2	2	0	0
		Elevators*	1	2	2	2	3**	5**
		Stairs	0	0	0	0	1	1
	Mezzanine to platform	Escalators	2	2	2	2	1	1
		Elevators*	1	2	2	2	2	2
		Stairs	0	1	0	0	1	1
Farecard Vendors			7	7	5	5	2	3
Fare Gate Aisles		Standard	7	5	3	3	2	3
		ADA	1	2	2	2	2	2
		Spare	0	1	1	1	1	1
		Total	8	8	6	6	5	6

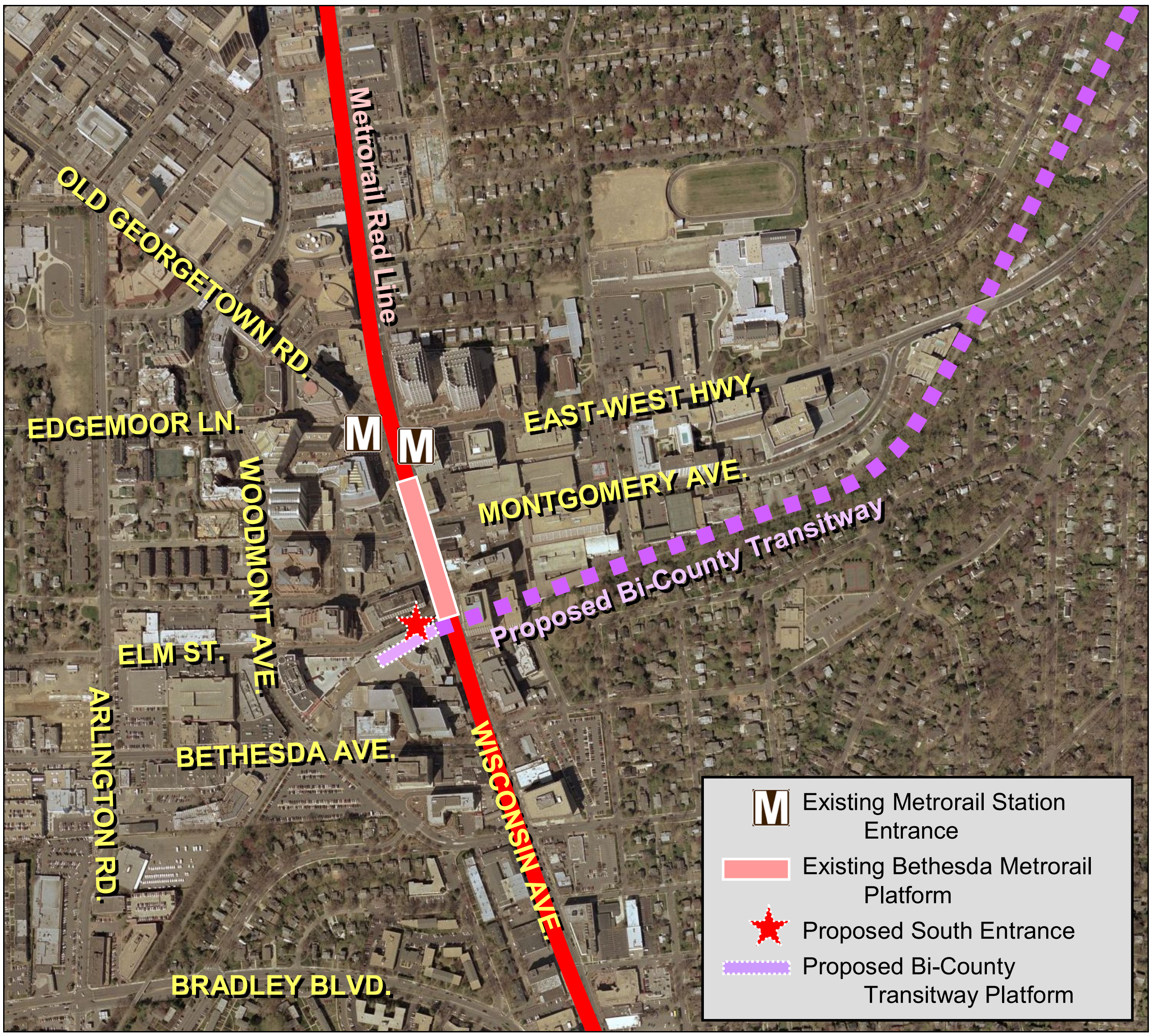
* A minimum of two elevators is recommended for redundancy.

** One additional elevator should be considered for redundancy.

INTRODUCTION

The Bethesda Metrorail Station is located in southern Montgomery County, Maryland, and serves the surrounding mix of office, retail, entertainment and residential development. The station is on Metrorail's Red Line, which operates between Shady Grove and Glenmont via downtown Washington, D.C. The Bethesda Station opened in 1984. An aerial photograph of the area is presented in Figure 1.

Figure 1: Bethesda Vicinity



In the Bethesda vicinity, the Red Line runs in a tunnel under Wisconsin Avenue, at a depth of roughly 130 feet below street level. The platform's depth poses a challenge to Metrorail passenger access.

Existing access is provided from the north of the platform, via an escalatorway connecting the station's underground mezzanine level with the bus level, about 20 feet below street level. A second, much shorter, set of escalators connects the bus level with street level, at the southwest corner of Wisconsin Avenue and Old Georgetown Road. An existing pedestrian tunnel also crosses under Wisconsin Avenue from the bus level to a second entrance point on the southeast corner of Wisconsin Avenue and East-West Highway.

A single elevator also provides access between the street and mezzanine levels. At street level, the elevator is located on the northwest corner of Wisconsin and Montgomery Avenues.

The station's bus level is mostly enclosed below a plaza and other development. It includes a bus terminal with seven bus bays serving 15 Metrobus and Ride-On bus routes, as well as the Bethesda 8 Trolley, which provides free shuttle service in the Bethesda central business district. The bus level also includes a kiss-and-ride lot with 26 parking spaces. Vehicular access to the bus bays and the kiss-and-ride lot is from the west, on Woodmont Avenue and Edgemoor Lane.

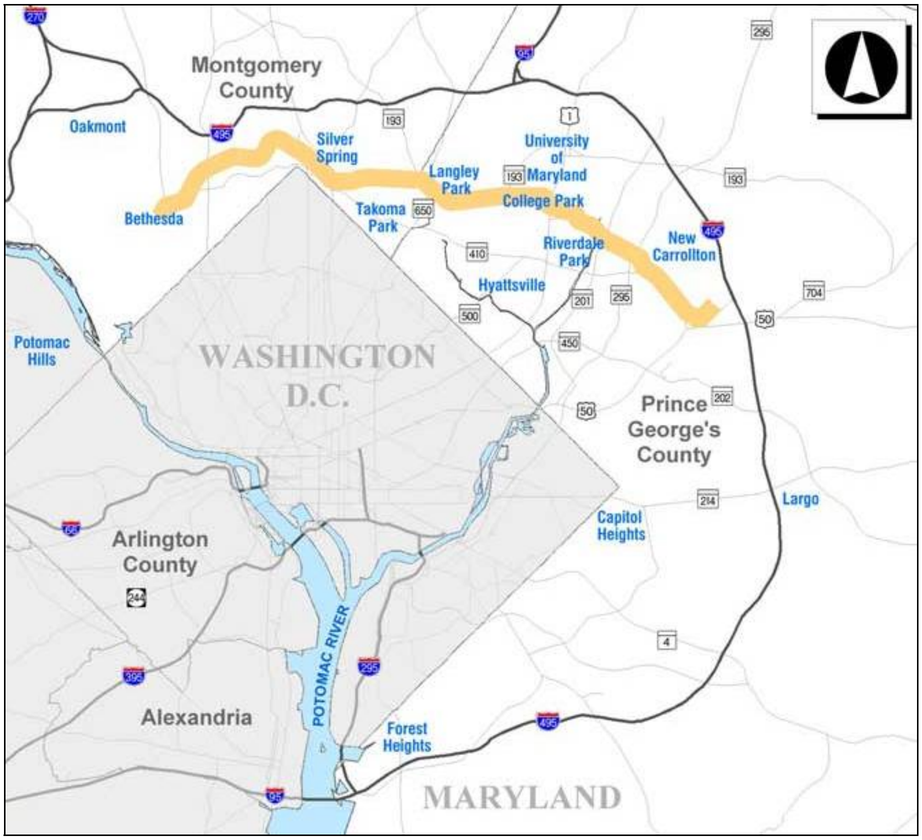
Vertical circulation between the mezzanine and center platform includes a single elevator and two escalators.

Bi-County Transitway

The proposed Bi-County Transitway would provide a high-capacity transit link between the Bethesda and New Carrollton Metrorail Stations, with stops at Silver Spring, College Park and intermediate points, as shown in Figure 2. The 14-mile route would provide direct connections between the Metrorail Red, Orange and Green Lines. Sometimes referred to as the Purple Line, the Bi-County Transitway evolved from the Capital Beltway Purple Line Study and the Georgetown Branch Transitway Study, which proposed to link Bethesda and Silver Spring on a shorter alignment.

Originally, the Georgetown Branch was established around 1900 to provide rail service between Silver Spring and Georgetown. After rail service ended, the corridor was identified as a potential transit corridor in the 1980s. Following feasibility studies, Montgomery County purchased the Georgetown Branch right-of-way in 1988. Portions of the alignment currently serve as the interim Capital Crescent Trail, a popular shared-use facility for pedestrians and bicyclists.

Figure 2: Bi-County Transitway Alignment



Source: Maryland Transit Administration

Several recent studies of the corridor have been undertaken:

- The Georgetown Branch Transitway/Trail Major Investment Study (MIS)/Draft Environmental Impact Statement (EIS) was completed in 1996. This study considered light-rail and a busway on the 4.4-mile section of the Georgetown Branch between Bethesda and Silver Spring.

- The Georgetown Branch Transitway Terminal Stations Study was conducted by the Washington Metropolitan Area Transit Authority (WMATA) in 2001, to provide technical support to the Final EIS. The study proposed configurations for the Bethesda and Silver Spring Stations, which were considered the termini of the line at that time.

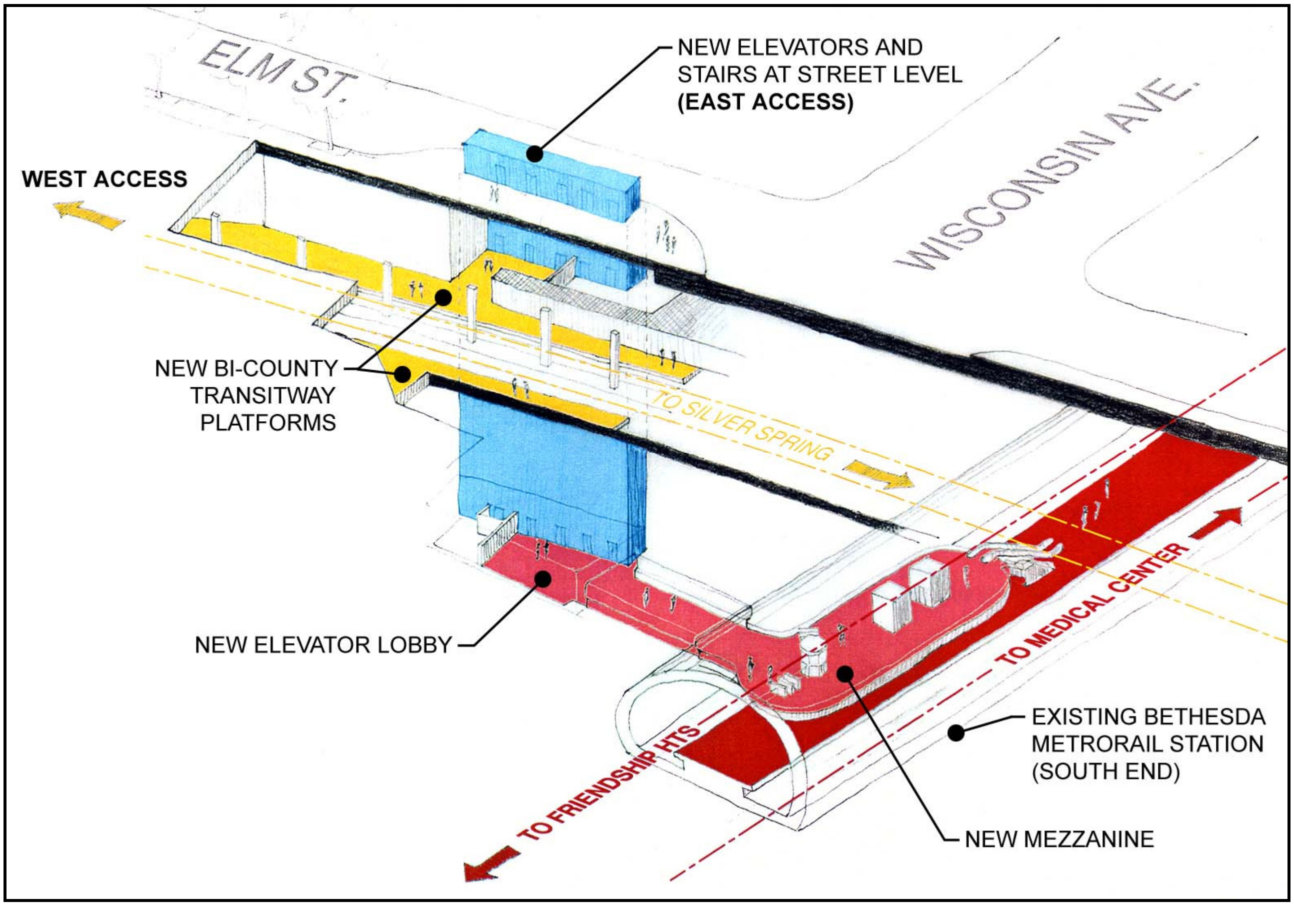
- The Maryland Transit Administration (MTA) is currently conducting the large-scale Bi-County Transitway Alternatives Analysis (AA)/EIS. MTA is looking at a variety of alternatives, including bus rapid transit (BRT) and light-rail transit (LRT); an alignment other than the Georgetown Branch right-of-way; and use of portions of existing roads for LRT.

The Bi-County Transitway's terminal station in Bethesda is proposed just west of Wisconsin Avenue and south of Elm Street. The platform would be one level below street level, as shown in

Figure 3. The Bi-County Transitway would be well above the existing Metrorail Red Line, and the platform would be near the south end of the existing Bethesda Metrorail platform.

For BRT alternatives, the transitway's Bethesda Station could also be located near the existing Metrorail Station's north entrance, in the same general vicinity as the existing bus bays.

Figure 3: Proposed Bethesda South Entrance Configuration



Source: Adapted from Georgetown Branch Transitway Terminal Stations Study Executive Summary

Figure 3 shows the Georgetown Branch Study's vertical circulation assumptions. Access to the Bi-County Transitway's Bethesda platform was proposed as a set of four elevators on the southwest corner of Wisconsin Avenue and Elm Street. The elevators would stop at the Bi-County Transitway level, 24.5 feet below street level, and would continue to the Metrorail Station, on a new mezzanine 122.5 feet below street level. This configuration would facilitate direct access to either transit route, as well as transfers between the two routes.

Because of the depth of the Metrorail platform, it was determined that escalator access to Metrorail at the south entrance would be prohibitive.

Access to the Bi-County Transitway Bethesda platform could also be provided via the existing Capital Crescent Trail to the west, which continues under the Apex Building to the intersection of Bethesda and Woodmont Avenues.

Study Purpose

The purpose of this study is to evaluate the Bethesda station facilities to determine their ability to accommodate the passenger traffic generated by the proposed south entrance and the proposed Bi-County Transitway. The following three future scenarios are considered:

- Option 1: No-build scenario, where existing transit service and infrastructure remain unchanged
- Option 2: South Entrance scenario, where no new transitway is assumed, but the south elevator access point is assumed to provide access to the Metrorail station
- Option 3: Bi-County Transitway scenario, where the transitway is assumed to be in place between Bethesda and New Carrollton, along with the new south elevator access point to serve both local and transfer access to Metrorail and the transitway

The study involved evaluation of existing and future land use, estimates of existing and future ridership levels on Metrorail and the Bi-County transitway, forecasts of new ridership generated by the south entrance, full evaluation of station features, such as elevators and fare gate aisles, and a review of the proposed station configurations for compliance with NFPA-130, the applicable transit station evacuation guideline published by the National Fire Protection Association.

Assumptions

General assumptions used throughout the study are as follows:

- Design year: 2030
- Future Red Line Metrorail service: 2.5-minute headways (24 trains per hour)
- Future Metrorail train consist: 8-car trains

EXISTING AND FUTURE LAND USE

The initial phase of the study allocated pedestrian trips to and from the existing and proposed entrances to the Bethesda Metrorail station and proposed Bi-County Transitway station based on the surrounding land use. The future land use in the Bethesda station area was determined based on MWCOG Round 6.4 forecasts for jobs and dwelling units. The data was examined at the Traffic Analysis Zone (TAZ) level for the year 2030.

The MWCOG TAZ data was further refined based on information provided by M-NCPPC. The additional data included smaller geographic increments, approaching the block level, for three TAZs in the Bethesda central business district (CBD) area. The M-NCPPC block data provided a more accurate forecast of the distribution of jobs and dwelling units within the TAZs located closest to the existing and proposed entrances. Figure 4 illustrates the location of TAZs and M-NCPPC blocks in the Bethesda area. Complete details about the existing and future land use forecast are included in Appendix A.

The primary access point to the proposed south entrance of the Bethesda station would be the elevators on Elm Street just west of Wisconsin Avenue. However, if the Bi-County Transitway is constructed, these elevators would also stop at the Bi-County Transitway level 24.5 feet below street level. This is also the same level as the current interim Capital Crescent Trail, which would serve as a secondary access point to the elevators and the Bi-County Transitway. The trail access point would shorten the walking distance from some blocks and eliminate the need for patrons to use the elevator to access the Bi-County Transitway. For this report, the primary street-level access is referred to as the east access point, and the secondary transitway-level access is referred to as the west access point.

Although there is a mix of uses in the station area, the higher density uses are concentrated around the station and consist of predominantly office space and supporting retail. As the distance from the station increases, so does the percentage of residential uses, which occur at lower intensities. Adding a south entrance to the Metrorail station would expand the catchment area for pedestrian trips in the Bethesda area as illustrated Figure 5 and Table 3.

Dwelling units within the station's catchment area increase by a relatively high 27 percent—larger than the 9 to 11 percent increase in employment. The percent increase in dwelling units is larger than for employment because of the concentration of employment near the existing station, whereas the expanded catchment area captures large residential areas. However, the number of new trips is much larger from employment land uses because the density of the residential uses is much lower, attracting far fewer trips per unit area.

Figure 4: Bethesda Area TAZs and M-NCPPC Blocks

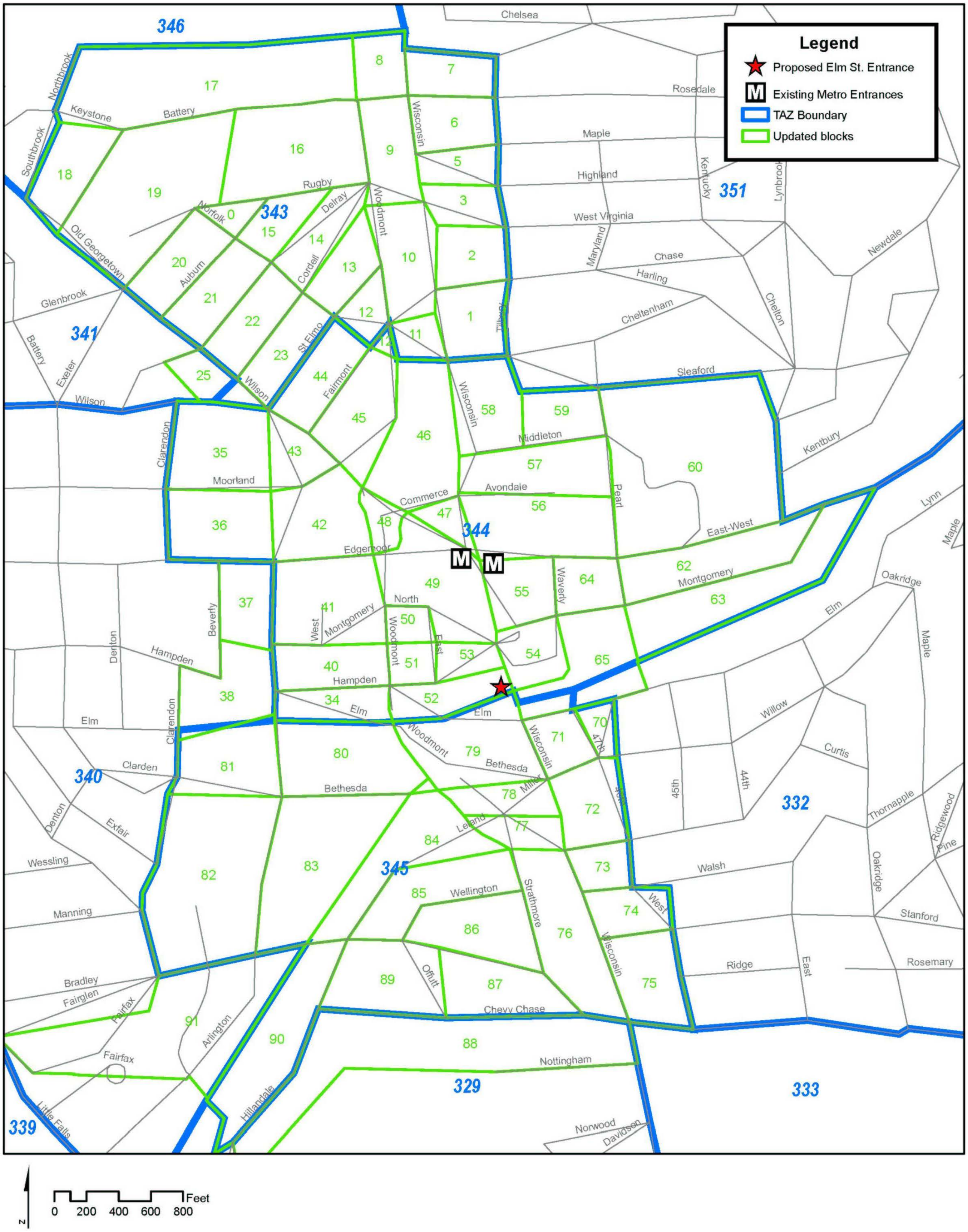


Figure 5: Expansion of Service Areas Caused by South Entrance

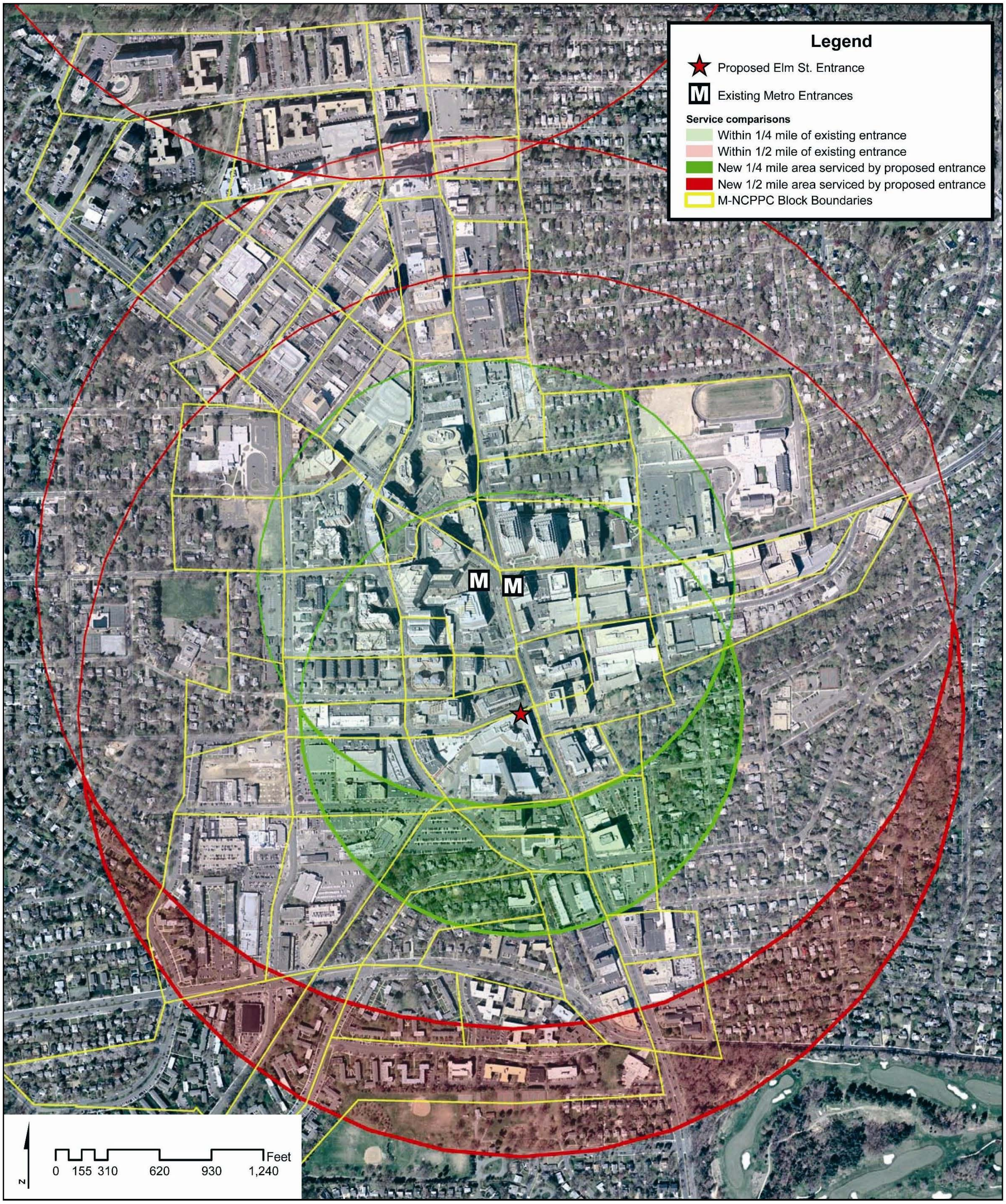


Table 3: Change in Area, Dwelling Units and Employment near Station Entrances

		Land Area (acres)	Dwelling Units		Employment	
			Existing	2030	Existing	2030
¼ mile radius	Within ¼ mile of existing entrance	12.77	1,349	2,891	21,096	29,104
	Within ¼ mile of existing or proposed entrance	16.75	2,261	3,680	23,509	32,296
	Increase Due to South Entrance	**3.98**	**912**	**789**	**2,413**	**3,192**
		31%	**68%**	**27%**	**11%**	**11%**
½ mile radius	Within ½ mile of existing entrance	48.78	3,869	6,237	33,282	45,267
	Within ½ mile of existing or proposed entrance	56.68	5,253	7,931	36,211	49,167
	Increase Due to South Entrance	**7.9**	**1,384**	**1,694**	**2,929**	**3,900**
		16%	**36%**	**27%**	**9%**	**9%**

Source: MWCOG Round 6.4

The allocation of Metrorail boardings in the morning peak period was determined based on the distribution of dwelling units in the station area and assumes that most morning trips are from home to work. The morning alightings were allocated based on the distribution of jobs in the station area, based on a similar assumption that most people exiting the station in the morning are on their way to their place of employment. The allocation of Metrorail trips in the afternoon peak period was the reverse of the morning, such that alightings in the afternoon follow the same pattern as boardings in the morning, and boardings in the afternoon follow the same pattern as alightings in the morning. The morning and afternoon allocation of Metrorail boardings and alightings between the north and south entrances are presented in Table 4.

Table 4: Allocation of Trips to Bethesda Metrorail Station Entrances by TAZ

TAZ	AM Boardings and PM Alightings		PM Boardings and AM Alightings	
	North Entrance	South Entrance	North Entrance	South Entrance
329	0%	100%	0%	100%
332	30%	70%	30%	70%
340	50%	50%	50%	50%
343	100%	0%	100%	0%
344	87%	13%	77%	23%
345	0%	100%	0%	100%
351	100%	0%	100%	0%

Source: Based on MWCOG Round 6.4 population and employment for 2030.

If a south entrance were constructed, all or most of the boardings and alightings from TAZs 329, 332, and 345 would use that entrance. All or most of the boardings and alightings from TAZs 343, 344, and 351 would use the existing north entrance. TAZ 340 would be split fairly evenly between the two entrances.

If the Bi-County Transitway is constructed, all Bi-County Transitway passengers are assumed to use the south entrance. Use of the north entrance would require a long trip through the Metrorail Station, including vertical circulation down the long north escalators and back up the south elevators, passing through the faregates and along the platform. This route would be unattractive to Bi-County passengers; the street-level route would require much less time.

However, if the Bi-County Transitway is constructed, both Metrorail passengers and Bi-County Transitway passengers may choose to use either the east or west access points to the south entrance. (The locations of the east and west access points are included on Figure 3.) The allocation of boardings and alightings by south entrance access point was determined based on the same method previously described for the Metrorail station entrances. The morning and afternoon allocations between the west and east access points are presented in Table 5.

It was assumed that the elevators would not stop at the Capital Crescent Trail if the south entrance were constructed without the Bi-County Transitway (under Option 2), to improve elevator operations.

Table 5: Allocation of Trips to South Entrance Access Points by TAZ

TAZ	AM Boardings/PM Alightings		PM Boardings/AM Alightings	
	West Access	East Access	West Access	East Access
329	100%	0%	100%	0%
332	0%	100%	0%	100%
340	50%	50%	50%	50%
343	0%	100%	0%	100%
344	0%	100%	0%	100%
345	89%	11%	44%	56%
351	0%	100%	0%	100%

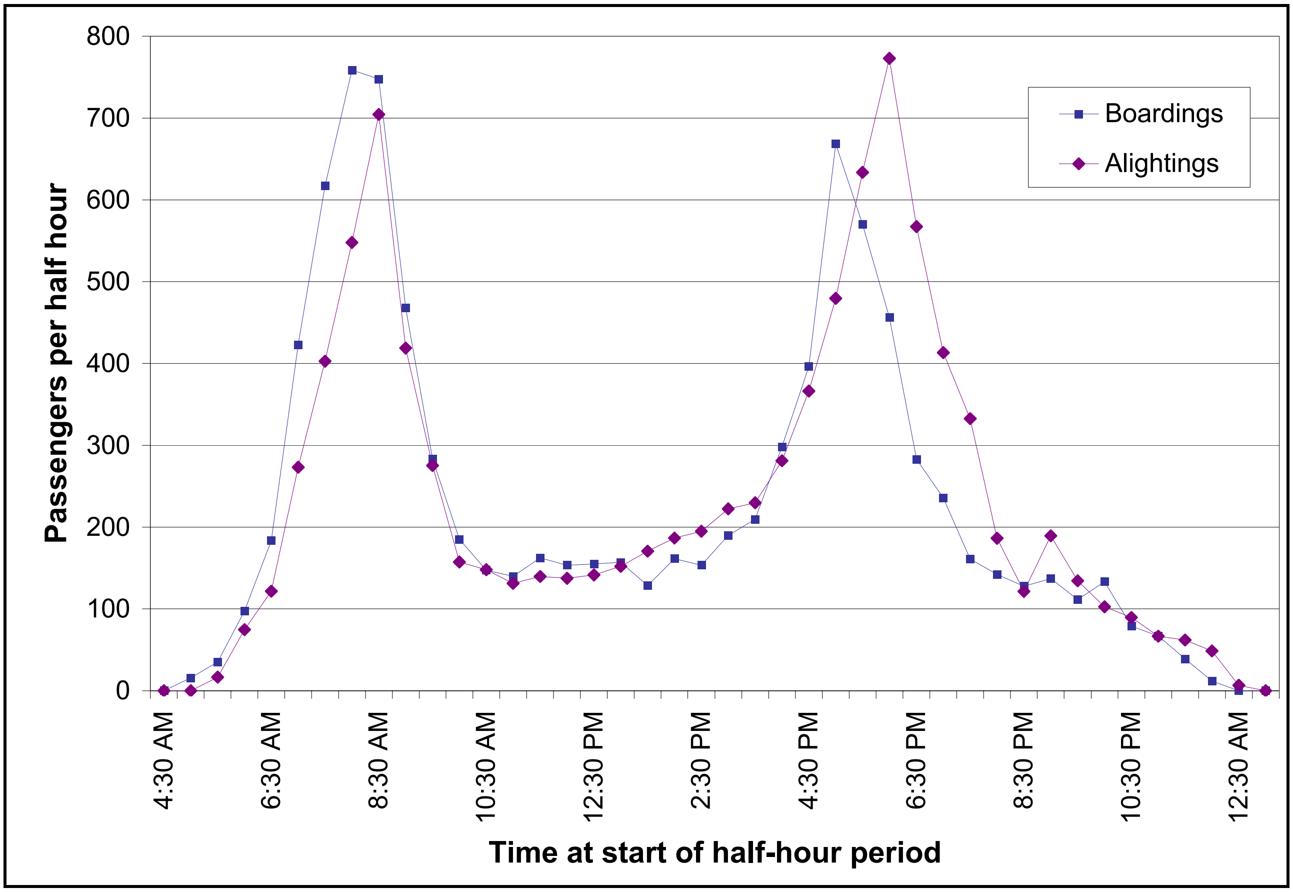
Note: Applies only to trips that are determined to use the South Entrance.
Source: Based on MWCOG Round 6.4 population and employment for 2030.

All or most of the boardings and alightings from TAZs 329 and 345 would use the west access point. All or most of the boardings and alightings from TAZs 332, 343, 344, and 351 would use the east access point. TAZ 340 would be split fairly evenly between the two access points.

EXISTING METRORAIL RIDERSHIP

Existing Metrorail ridership was determined from three mid-week days in May 2004, generally taken to be an average, representative period. May ridership levels were used as the baseline for computations of future ridership in this report; however, it is noted that ridership often surges above May levels, particularly during the summer. Figure 6 graphically presents the existing boarding and alighting patterns at the Bethesda station in 30-minute increments. Table 6 documents existing boardings and alightings during peak periods of various lengths and on a daily basis.

Figure 6: Existing Bethesda Metrorail Station Boardings and Alightings



Source: WMATA Faregate data, May 2004

The WMATA 2002 Metrorail Passenger Survey was used to determine the modes of access for Metrorail trips with origins at the Bethesda Station. The relevant results of the survey are presented in Table 7 and graphically in Figure 7.

Table 6: Existing Boardings and Alightings, Peak Periods and Daily

		Boardings	Alightings
AM Peak Period	30-min peak	759	704
	1-hr peak	1506	1252
	3-hr peak	3298	2622
PM Peak Period	30-min peak	668	773
	1-hr peak	1239	1407
	3-hr peak	2672	3233
Daily		9490	9701

Table 7: Access Modes for Metrorail Trips with origins at Bethesda

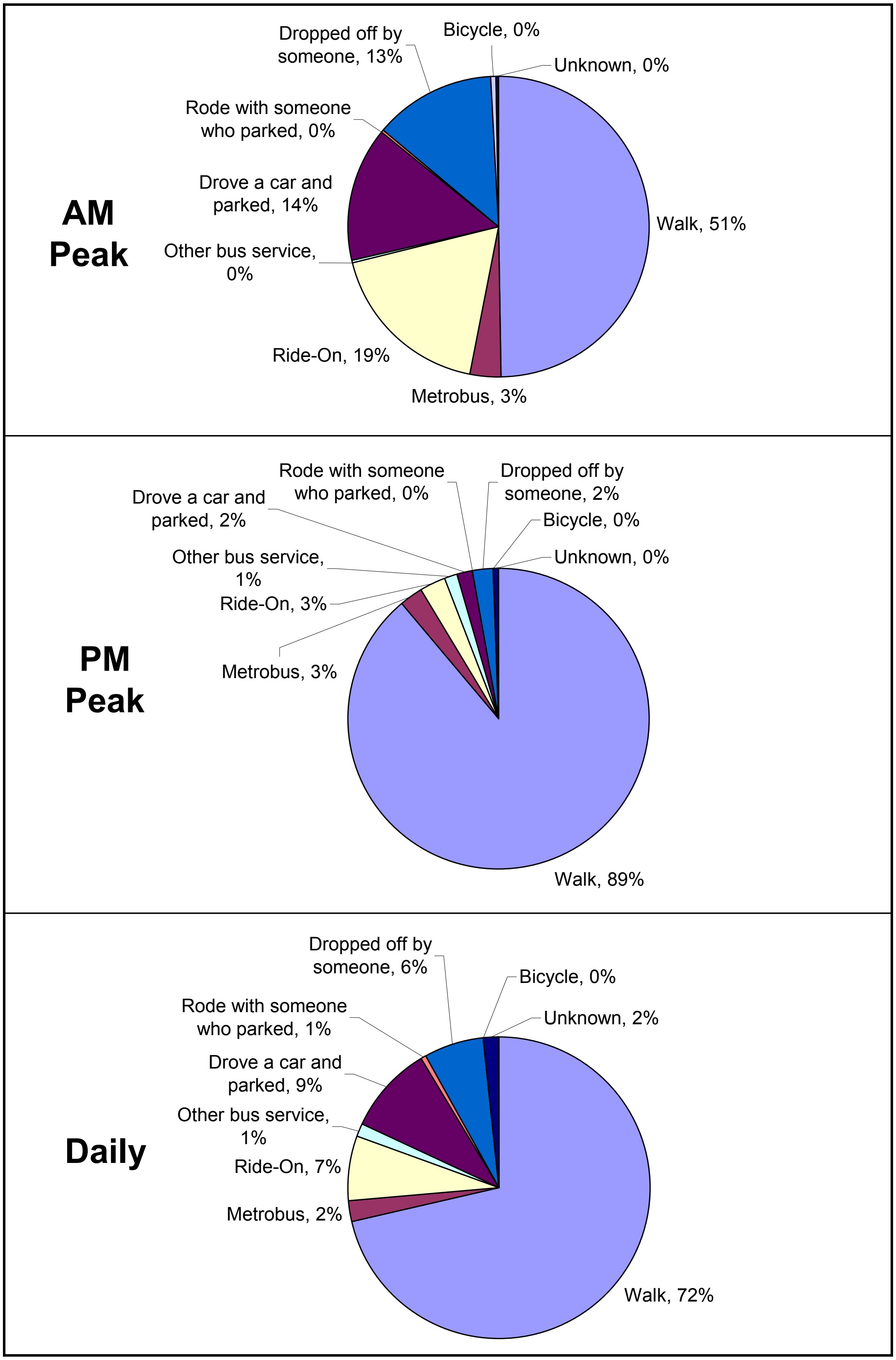
Access Mode	AM Peak		AM Off Peak		PM Peak		PM Off Peak		Daily	
	no.	pct.	no.	pct.	no.	pct.	no.	pct.	no.	pct.
Walk	1,464	49.8%	1,955	72.9%	1,561	88.8%	1,900	84.3%	6,880	71.4%
Metrobus	96	3.3%	0	0.0%	47	2.7%	63	2.8%	206	2.1%
Ride-On	528	18.0%	45	1.7%	47	2.7%	63	2.8%	683	7.1%
Other bus service	12	0.4%	45	1.7%	24	1.3%	42	1.9%	123	1.3%
Drove a car and parked	420	14.3%	409	15.3%	31	1.8%	42	1.9%	902	9.4%
Rode with someone who parked	12	0.4%	45	1.7%	0	0.0%	0	0.0%	57	0.6%
Dropped off by someone	384	13.1%	45	1.7%	39	2.2%	146	6.5%	615	6.4%
Bicycle	12	0.4%	0	0.0%	0	0.0%	0	0.0%	12	0.1%
Unknown	12	0.4%	136	5.1%	8	0.5%	0	0.0%	156	1.6%
Total	**2,941**	**100.0%**	**2,682**	**100.0%**	**1,757**	**100.0%**	**2,255**	**100.0%**	**9,635**	**100.0%**

Source: WMATA 2002 Metrorail Passenger Survey
Note: Rounding may affect sums.

Walking is the dominant access mode for Bethesda passengers. About half of passengers in the morning peak period walk to the station, increasing to nearly 90 percent in the afternoon peak period. Ride On Bus service is about six times more popular than Metrobus service as an access mode; Ride On is the second most frequent mode of access in the morning peak. About 14 percent of morning-peak passengers drove and parked, accounting for over 400 parked vehicles in the vicinity of the station.

A review of egress mode data from the Metrorail Passenger Survey shows patterns that are largely symmetric with the access mode data presented in Table 7 and Figure 7.

Figure 7: Access Modes for Metrorail Trips with origins at Bethesda



Source: WMATA 2002 Metrorail Passenger Survey

RIDERSHIP DEMAND ANALYSIS

Two methodologies were used to forecast future ridership. First, the MWCOG travel forecasting model was used to compare ridership under existing, No-build, and Bi-County Transitway scenarios. However, the model is not the best way to predict new Metrorail demand that would be induced by providing better access through a south entrance. As such, the south entrance was evaluated using the methodology outlined in WMATA's *Development-Related Ridership Survey* (1987, 1989), coupled with the land use forecast discussed earlier. Each of these methods is outlined in further detail below.

MWCOG Travel Forecasting Model

WMATA provided a copy of the MWCOG Version 2.1 D/TP+#50 travel forecasting model with Round 6.4A of the MWCOG Cooperative Forecasts on demographic data, and it was initially expected that this Version D model would be used exclusively in the study. However, the Version D model does not include the Bi-County Transitway, which is the most critical component of this study. In the earlier Georgetown Branch Transitway study, the Bi-County Transitway and its supplementary network of feeder buses were coded and tested as one of the alternatives under the MWCOG Version 2.1 C model with Round 6.2 Cooperative Forecasts. Modeling assumptions used in the earlier study and carried forward to this study are presented in Appendix B.

It was initially expected that this earlier coding of the Bi-County Transitway could be easily adapted into the new MWCOG Version D model. However, a review of the Version D model indicated that the Bi-County Transitway coding could not be readily converted from Version C model because of significant changes in the structure and algorithms of the Version D model.

Because of these constraints, the Version C model that includes the Bi-County Transitway was selected for use in this study, with the following refinements to reflect the needed updates:

- Metrorail service in the Version 2.1 C model was replaced with the service from the "Dulles Corridor Final EIS Full Build after 2015" plan. Appendix C compares Metrorail service assumptions between the original 2025 Constrained Long Range Plan (CLRP) transit network and the updated 2030 plan used in this study.
- Round 6.4A land use input data for the year 2030 replaced the Round 6.2 data from 2025 used in the Version C model. As such, the impacts of the most recent land use assumptions on Bi-County Transitway ridership were assessed. Appendix D further illustrates the differences among land use forecasts for TAZs in the Bethesda CBD.
- A separate node was added to represent the Bethesda Bi-County Transitway station to document transfers between the transitway and Metrorail.

Because the Version D model was not used in the study, a sensitivity analysis was undertaken to document the differences in model results attributable to the use of the Version C model. The results of this analysis are discussed later in this section.

In the model, the transit vehicle mode was coded as light rail. Because BRT and LRT are expected to have only minor operational differences, this study does not directly consider changes to transit vehicle mode.

To develop ridership forecasts for the Bethesda Station based on the demand analysis from the MWCOG travel forecasting model, prior to adding a new south station entrance, the following three scenarios were studied:

- Existing 2005 conditions
- Future 2030 No-build (does not include Bi-County Transitway)
- Future 2030 Build (includes Bi-County Transitway)

The results of the existing conditions scenario were compared to actual ridership, forming a basis for adjusting future ridership forecasts from the model.

The MWCOG model is only able to simulate the morning peak and off-peak periods. Afternoon peak-period data was synthesized by assuming that trip distribution is symmetric to the morning peak, and by assigning afternoon trips to times of the day that are consistent with existing patterns.

The raw model outputs and adjusted results for these three scenarios were summarized into three categories: regional transit demand, Bethesda Station demand, and Bethesda local access demand. Each of these categories is discussed further as follows.

Regional Transit Demand

Part I of Appendix E presents the differences in regional transit demand among the scenarios. Regional transit demand accounts for changes in transit trip patterns on a regional basis, including the following elements:

- Modeled transit person trips by trip purpose, time period and access mode
- Modeled rail trips by time period and access mode
- Observed rail trips by time period from May 2004
- Future adjusted rail trips by time period based on observed rail trips and the relationship between modeled rail trips of different scenarios

Bethesda Station Demand

Bethesda Station demand, as shown in Appendix E, Part II, accounts for transit trip patterns at the Bethesda station, including the following elements:

- Metrorail and Bi-County Transitway boardings and alightings by time period, access mode, and direction of travel
- Observed rail boarding and alighting by time period from May 2004
- Modeled rail transfers between Metrorail and the Bi-County Transitway by time period and access mode
- Future adjusted boarding and alighting, adjusted transfers between Metrorail and the transitway, and local (non-transfer) access demand by time period based on observed boarding and alighting data and the relationship between modeled rail boarding and alighting data of different scenarios

Bethesda Station Local Access Demand

Bethesda local access demand, as shown in Appendix E, Part III, represents direct access and egress from the Bethesda area to Metrorail and the Bi-County Transitway. It differs from station demand in that it excludes passengers transferring between Metrorail and the transitway, focusing only on those passengers who access the Bethesda Station by other modes. The following elements are included:

- Modeled local boarding and alighting rail demand by time period, access mode, and direction to and from station
- For passengers who walk to the station, the boarding and alighting demand was further segregated by origin and destination TAZ.
- Future adjusted local rail demand by time period, access mode, and direction

The rail ridership estimates derived from the above modeling procedure represented the basic demand without the new south entrance, with and without Bi-County Transitway.

South Entrance

A new south entrance would provide significant benefits for current Metrorail users and would attract new riders because of the shorter walking access time for areas south of the station. The increase in Bethesda Metrorail demand due to the addition of a south entrance was computed by calculating the reduction in walking distance for individual M-NCPPC blocks south of the station. The differences in walking distances were converted to differences in mode share using the *Development-Related Ridership Survey*.

The use of the M-NCPPC block land use forecasts allows more accurate forecasting than would be possible in the MWCOG model, because the model's land use forecast does not have nearly as much detail about the Bethesda area.

Appendix F presents the calculations and results of the south entrance analysis for each M-NCPPC block. For blocks where a reduction in walking distance can be achieved, the resulting difference in transit mode share was applied to the block's 2030 population and employment forecast to determine the likely percent increase that the south entrance would cause in 2030 Metrorail ridership levels among patrons who access the station on foot. (The south entrance is not expected to increase ridership among patrons who access the station by other modes, such as by bus or car, because it would not significantly change riders' access times.)

The results show that the south entrance would induce a 3.2 percent increase in pedestrian-based Metrorail ridership generated by residential areas, and a 7.5 percent increase in pedestrian-based ridership generated by employment areas. Overall, the weighted average of both land uses shows that the south entrance could be expected to increase pedestrian-based Metrorail ridership by 6.2 percent.

The magnitude of the mode share increase, 6.2 percent, is much smaller than would be suggested by Figure 5 and Table 3. Although the population of the ¼-mile and ½-mile transit catchment areas increases by 27 percent with a south entrance, individual households observe relatively small reductions in walking distance—never exceeding the distance between the entrances of about 800 feet.

Model Version Sensitivity

As discussed earlier, the most recent version of the MWCOG model (Version D) was not able to be used in the current study because of difficulties with coding the Bi-County Transitway. Instead, this study used the Version C model, in which the Bi-County Transitway had been coded as part of an earlier project.

Version D includes several changes to transportation facilities in the region that are not included in Version C. Among these changes are the additions of the Inter-County Connector and the Corridor Cities Transitway. A sensitivity analysis was conducted to determine whether these facility changes would significantly affect ridership levels in the Bethesda area. The sensitivity analysis compared transit person trip-table patterns from this study's 2030 No-build scenario with the 2030 CLRP Version 2.1 D model. By using the total boardings and alightings for the Bethesda area and total regional transit person trips as measures for computing quantitative effects on local access and transfer rail trips respectively, the results are summarized in Part IV of Appendix E.

The sensitivity analysis showed only minor changes in forecast ridership levels, both in the Bethesda area and region-wide.

Ridership Summary

The final ridership forecasts, presented in Table 8 and Figure 8, were computed by combining the results of the MWCOG methodology with the results of the South Entrance methodology. Results for the No-build Option (Option 1) are identical to those in the MWCOG forecast. The South Entrance Option (Option 2) was computed by applying the mode share increase caused by the south entrance to the appropriate time period, land use, and travel access modes of Option 1.

The Bi-County Transitway Option (Option 3) was computed by applying the south entrance mode share increase to the MWCOG scenario with the Bi-County Transitway in place.

The ridership in Table 8 was assigned to the closer station entrance, according to the allocations developed for Table 4. However, it was assumed that all passengers using the Bi-County Transitway would use the south entrance, because using the north entrance would require traveling through the Bethesda Metrorail Station, an awkward trip because of the large amount of vertical travel.

Table 8: Adjusted Ridership Summary, 2030

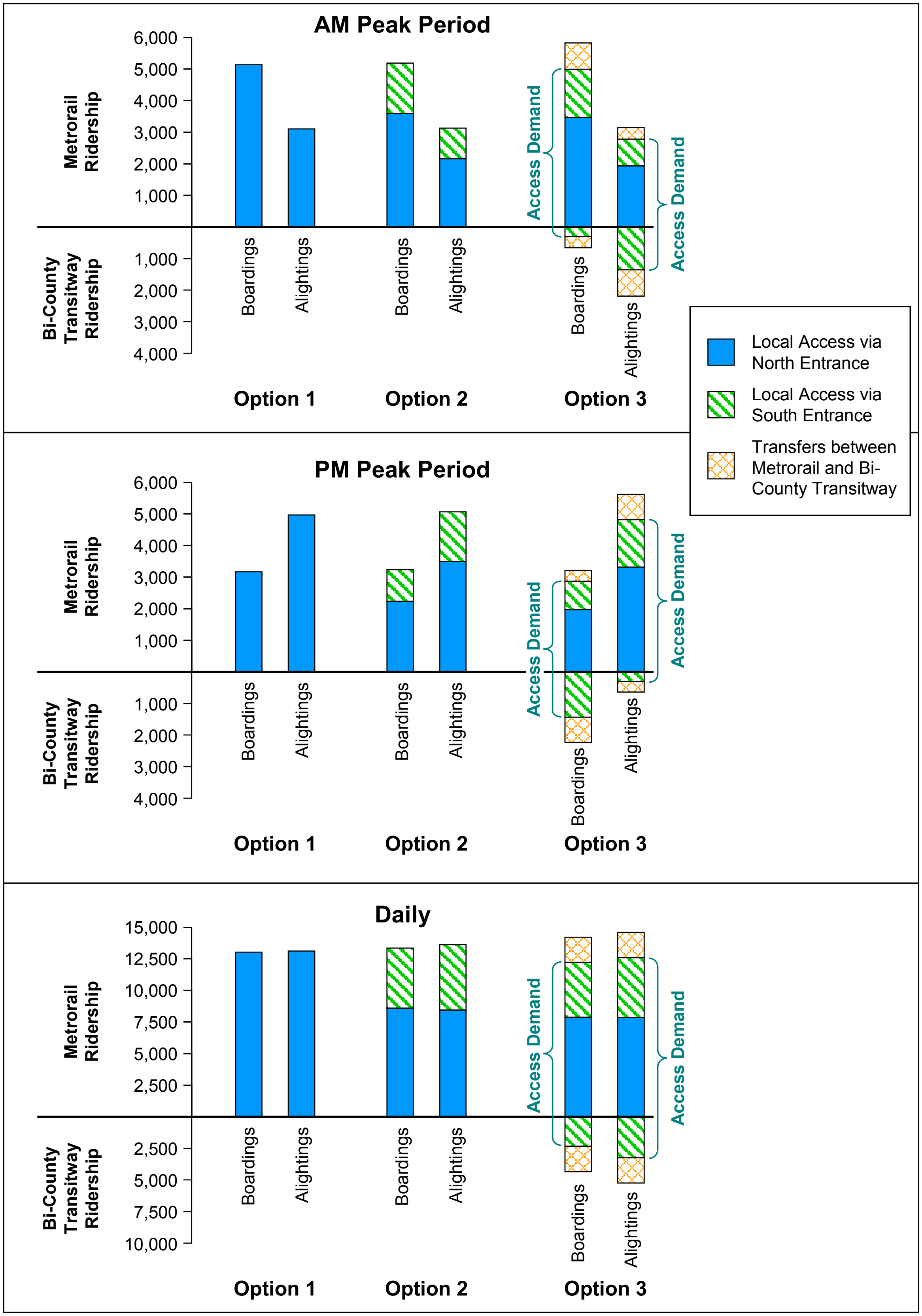
AM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	5,100	3,100	0	0	0	0	**5,100**	**3,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**5,100**	**3,100**	**0**	**0**	**0**	**0**	**5,100**	**3,100**
Option 2: South Entrance without Bi-County	North	3,600	2,200	0	0	0	0	**3,600**	**2,200**
	South	1,600	1,000	0	0	0	0	**1,600**	**1,000**
	Total	**5,200**	**3,200**	**0**	**0**	**0**	**0**	**5,200**	**3,200**
Option 3: South Entrance with Bi-County	North	3,500	1,900	0	0	0	0	**3,500**	**1,900**
	South	1,500	900	300	1,400	400	800	**1,900**	**2,200**
	Total	**5,000**	**2,800**	**300**	**1,400**	**400**	**800**	**5,300**	**4,200**

PM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	3,100	5,000	0	0	0	0	**3,100**	**5,000**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**3,100**	**5,000**	**0**	**0**	**0**	**0**	**3,100**	**5,000**
Option 2: South Entrance without Bi-County	North	2,200	3,500	0	0	0	0	**2,200**	**3,500**
	South	1,000	1,600	0	0	0	0	**1,000**	**1,600**
	Total	**3,200**	**5,100**	**0**	**0**	**0**	**0**	**3,200**	**5,100**
Option 3: South Entrance with Bi-County	North	2,000	3,300	0	0	0	0	**2,000**	**3,300**
	South	900	1,500	1,400	300	800	300	**2,300**	**1,800**
	Total	**2,900**	**4,800**	**1,400**	**300**	**800**	**300**	**4,300**	**5,100**

Daily		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	13,000	13,100	0	0	0	0	**13,000**	**13,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**13,000**	**13,100**	**0**	**0**	**0**	**0**	**13,000**	**13,100**
Option 2: South Entrance without Bi-County	North	8,500	8,400	0	0	0	0	**8,500**	**8,400**
	South	4,700	5,100	0	0	0	0	**4,700**	**5,100**
	Total	**13,300**	**13,500**	**0**	**0**	**0**	**0**	**13,300**	**13,500**
Option 3: South Entrance with Bi-County	North	7,900	7,800	0	0	0	0	**7,900**	**7,800**
	South	4,400	4,800	2,400	3,200	2,000	2,000	**6,700**	**8,000**
	Total	**12,200**	**12,600**	**2,400**	**3,200**	**2,000**	**2,000**	**14,600**	**15,800**

Note: Figures are rounded to the nearest 100 riders, which may affect sums.

Figure 8: Adjusted Ridership Summary, 2030



ANALYSIS OF CAPACITY CONSTRAINTS

The infrastructure requirements at each entrance to the Bethesda Station were evaluated based on the forecasted ridership levels. At each point of access, each of the following station elements were analyzed:

- Vertical circulation: elevators, escalators and stairways
- Fare gate aisles
- Farecard vendors

The design criteria used for the capacity analysis are presented in Table 9, sourced to their use in other recent WMATA studies.

Table 9: Assumed Metrorail Station Capacity Criteria

Item		***Source***
Peaking factor for alighting passengers	1.28	Convention Center Metrorail Expansion Program, page 2
Escalator flow rate	83 ppm*	Technical Report and Program for the Mount Vernon Square-UDC Station to Complement the New Washington Convention Center, 1997.
Up stair flow rate	55 ppm	Core Capacity Study, table on page 21, modified per Convention Center Program
Down stair flow rate	55 ppm	Core Capacity Study, table on page 21
Percent of passengers using farecard vendor	30%	Convention Center Metrorail Expansion Program, page 2
Farecard vendor peaking factor	1.1	Convention Center Metrorail Expansion Program, page 2
Farecard vendor transactions per minute	2.5	Concurrence among Core Capacity Study and Convention Center Program
Fare gate aisle flow rate	32 ppm	Average for the range (25 to 40 ppm) as cited in the Transit Capacity and Quality of Service Manual
Ascent/descent rate of high-speed elevator	350 ft/min	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator acceleration and deceleration time	2 sec	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator load and unload time per passenger	1 sec	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator door cycle time	6.22 sec	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator cab passenger capacity	9.6 passengers	Courthouse Metrorail Station Access Study, Appendices I, IV

*ppm = passengers per minute

South Entrance

At the south entrance, passenger demand predicted according to the ridership forecast was allocated to the east and west access points in accordance with Table 5.

Elevators

Of particular concern at the south entrance is the new bank of elevators that would connect street level with the Metrorail Station and, in the case of Option 3, the transitway station. Because the elevators would stop at three levels under this latter option, they were evaluated using an iterative approach to determine the cycle length and number of passengers per elevator cab. The analysis considered the peak 30-minute ridership during both morning and afternoon peaks.

The results of the analysis show that three elevator cabs are required to serve passenger demand under Option 2 and five cabs are required under Option 3. The elevator requirement is higher when the Bi-County Transitway is in place not only because the passenger load increases, but also because the elevators are required to serve an additional level, increasing travel times.

One additional cab should be considered under both options so that service can continue when one cab is taken out of service for maintenance or repair.

Elevator capacity could be increased using several methods, such as increasing speed or enlarging the cabs to accommodate more passengers. These or other similar capacity improvements may reduce the number of elevator cabs required.

Under Option 3, other studies have suggested that escalators or stairways be provided between street level and Bi-County Transitway level, in addition to elevators. Escalators or stairs would improve vertical circulation, but they would not reduce the number of elevator cabs required. Elevator cabs would carry their maximum loads between Bi-County Transitway level and Metrorail level, so providing additional circulation between the transitway and street levels does not significantly reduce the need for elevator capacity. (Additional vertical circulation is also not expected to be needed for emergency egress of the Bi-County Transitway platform because of its high-capacity at-grade egress to the west.)

Detailed results of the elevator analysis are presented in Appendix H.

Infrastructure

Aside from the elevator access, the infrastructure required to serve the south entrance is not extensive. Again, peak 30-minute flows were evaluated during morning and afternoon periods to determine the infrastructure needs.

In both Option 2 and Option 3, vertical circulation between the platform and mezzanine could be served easily by one pair of escalators. This system would operate at well below half of its capacity, even during peak times. It would remain below capacity even if one or both of the escalators were replaced with a static stairway of similar width. (Including a stairway offers emergency egress advantages as well.) To comply with the Americans with Disabilities Act (ADA), it is also recommended that elevator access be provided between mezzanine and platform.

A minimum of two elevators is recommended so that service can continue during maintenance or repair.

Two fare card vendors would be sufficient to serve demand in Option 2, increasing to three in Option 3.

Passenger volume suggests that two standard fare gate aisles would be required to serve demand in Option 2 and three would be required in Option 3. In both options, two additional ADA-accessible aisles are recommended, as is one additional standard aisle as a spare. This results in a total of five aisles in Option 2 and six aisles in Option 3.

Further details about the infrastructure analysis are included in Appendix I.

North Entrance

Passenger volume at the north entrance is highest in Option 1. It drops significantly in Option 2, as many existing passengers switch to the south entrance, and it drops further in Option 3 when Bi-County Transitway passengers shift to the south entrance.

Infrastructure

The existing bank of three escalators from street level to mezzanine level is expected to remain below capacity, even in the highest-volume Option 1. The single elevator between street and mezzanine provides ADA access, but a second elevator would be desirable, particularly in Option 1, when elevator access is not provided in a new south entrance.

Vertical circulation between mezzanine and platform, provided by two escalators and a single elevator, is expected to be about 7 percent over capacity in Option 1. An additional unit of exit is recommended in Option 1 to offset this capacity shortfall; a static stairway is the most effective way to increase capacity because of its emergency egress advantages.

In Options 2 and 3, the existing platform-to-mezzanine circulation remains below capacity, but the bank of two escalators does not provide for redundant service. When one escalator is removed from service, congestion is expected to result. In all options, a second platform elevator would be desirable to provide redundant ADA accessibility.

The existing seven fare card vendors at the north entrance are predicted to be sufficient in Option 1. The farecard vendor requirement drops to five in Options 2 and 3.

The north entrance features seven standard fare gate aisles and one ADA-accessible aisle. Under Option 1, only five standard aisles are needed to serve peak demand, with a sixth aisle as a spare. A second ADA aisle would be desirable; sufficient space exists to add an ADA aisle to the existing fare gate array without reconfiguring the kiosk or existing fare gate aisles. Under Options 2 and 3, three standard fare gate aisles are needed to serve peak demand, two fewer than under Option 1. In both Options 2 and 3, an additional ADA aisle would be desirable.

Further details about infrastructure elements at the north entrance are presented in Appendix I.

Infrastructure Summary

Table 10 provides a summary of the existing and required infrastructure elements for both north and south entrances for the three options under consideration.

If a south entrance is constructed, it would reduce the passenger load at the north entrance, which has ample reserve capacity. As such, it is recommended that bus-to-Metrorail transfers remain focused near the north entrance, rather than shifting some to the south entrance, where the elevator access point will have less reserve capacity to handle additional traffic.

Table 10: Summary of Bethesda Station Infrastructure Requirements

Infrastructure Element			***North Entrance***				***South Entrance***	
			Existing	***Option 1***	***Option 2***	***Option 3***	***Option 2***	***Option 3***
Vertical Circulation	Street to mezzanine	Escalators	3	3	2	2	0	0
		Elevators*	1	2	2	2	3**	5**
		Stairs	0	0	0	0	1	1
	Mezzanine to platform	Escalators	2	2	2	2	1	1
		Elevators*	1	2	2	2	2	2
		Stairs	0	1	0	0	1	1
Farecard Vendors			7	7	5	5	2	3
Fare Gate Aisles		Standard	7	5	3	3	2	3
		ADA	1	2	2	2	2	2
		Spare	0	1	1	1	1	1
		Total	8	8	6	6	5	6

* A minimum of two elevators is recommended for redundancy.
** One additional elevator should be considered for redundancy.

Emergency Egress

Emergency egress requirements for transit stations are set forth in *NFPA-130: Standard for Fixed Guideway Transit and Passenger Rail Systems,* published by the National Fire Protection Association most recently in 2003. As per section 1.3.1 of NFPA-130, the standard only applies "to new fixed guideway transit and passenger rail systems and to extensions of existing systems." Therefore, it is WMATA's position that the standard does not apply to stations within the original Metrorail system, but only to new stations on extensions of that system. As such, adding a new entrance to the Bethesda Station would not require the station to comply with NFPA-130.

In order to assess the potential benefits of a new entrance, an emergency egress analysis of the Bethesda Station was conducted, using the parameters specified by NFPA-130. The analysis showed the following:

- The time required to evacuate the station platform at the existing Bethesda Station is 15.3 minutes in the morning peak period and 14.9 minutes in the afternoon peak. Under Option 1 (future No-build scenario), platform evacuation times would increase to 20.9 minutes in the morning peak and 19.6 minutes in the afternoon peak.

- At the Bethesda Station, the time required to evacuate from the most remote point on the platform to a point of safety is 18.6 minutes during the morning peak and 18.2 minutes in the afternoon peak. Under Option 1, the station evacuation times would increase to 24.2 minutes in the morning peak and 23.0 minutes in the afternoon peak.

Adding a south entrance improves egress times dramatically. If the station elements in Table 10 are provided, the platform evacuation times under Option 2 decrease to 7.0 minutes in the morning peak hour and 6.6 minutes in the afternoon peak hour. Station evacuation times decrease to 10.4 minutes in the morning peak hour and 10.0 minutes in the afternoon peak hour. Both of these times are significant improvements over conditions in Option 1.

Conditions in Option 3 are very similar to Option 2, with identical platform evacuation times and only slightly longer station evacuation times during the morning peak period.

Detailed calculations of emergency egress features are presented in Appendix J for the Metrorail Station with the infrastructure as shown in Table 10.

In Option 3, the Bethesda Bi-County Transitway Station is expected to satisfy NFPA requirements easily, because patrons can exit that station to a point of safety via the west access, along the Capital Crescent Trail, without using any vertical circulation features and without passing through fare gates.

Appendix A: Summary of Jobs and Dwelling Units by Block, Bethesda CBD

Block*	Employees			Dwelling Units		
	Existing	Net Change	Future	Existing	Net Change	Future
1	44.7	234.7	279.4	34	93	127
2	97.9	40.4	138.3	4	0	4
3	75.5	86.6	162.1	7	0	7
4	12.2	161.5	173.7	2	104	106
5	21.8	51.5	73.3	11	164	175
6	39.1	16.7	55.8	16	0	16
7	18	9.9	27.9	7	0	7
8	365.7	48	413.7	0	127	127
9	1,116.5	112.7	1,229.2	245	0	245
10	357	123.4	480.4	112	122	234
11	143.3	59.2	202.5	0	0	0
12	1,009.3	150.1	1,159.4	0	0	0
13	197.7	288.6	486.3	0	103	103
14	92	78.1	170.1	260	314	574
15	234.3	83.9	318.2	0	56	56
16	1,061.3	275.9	1,337.2	273	418	691
17	0	0	0	749	88	837
18	0	0	0	89	0	89
19	0	0	0	264	0	264
20	520.1	134.4	654.5	8	7	15
21	230	56.2	286.2	0	0	0
22	356.8	140.5	497.3	0	0	0
23	763.9	162.7	926.6	0	0	0
24	34.5	45.2	79.7	0	0	0
25	180.4	26.9	207.3	0	0	0
26	0	41.2	41.2	0	-1	-1
27	0	0	0	0	0	0
28	0	0	0	0	0	0
29	0	0	0	0	0	0
30	0	0	0	0	0	0
31	0	0	0	0	0	0
32	0	0	0	0	0	0

Table continues, next page

Block*	Employees			Dwelling Units		
	Existing	Net Change	Future	Existing	Net Change	Future
33	0	0	0	0	0	0
34	0	0	0	0	0	0
35	0	0	0	0	0	0
36	0	0	0	2	0	2
37	0	0	0	0	0	0
38	0	0	0	0	0	0
39	195.9	235.7	431.6	0	0	0
40	558.8	107.7	666.5	60	95	155
41	38.1	150.1	188.2	284	253	537
42	71	95.9	166.9	586	5	591
43	707.2	105.2	812.4	0	0	0
44	873.7	238.5	1,112.2	0	21	21
45	371.1	76.9	448	0	264	264
46	2,390.8	1477	3,867.8	0	0	0
47	669.8	196	865.8	0	0	0
48	0	252.4	252.4	312	0	312
49	3,831.6	646.5	4,478.1	0	0	0
50	0	0	0	0	0	0
51	0	0	0	37	0	37
52	1,021.4	141.8	1,163.2	1	0	1
53	384.1	655.8	1,039.9	0	0	0
54	754.1	181	935.1	0	0	0
55	1,219.3	181.4	1,400.7	0	0	0
56	2,830.9	483.8	3,314.7	204	0	204
57	107.6	75.2	182.8	59	0	59
58	186.7	1,048.7	1,235.4	0	263	263
59	0	0	0	27	0	27
60	424	142	566	18	49	67
61	0	0	0	12	0	12
62	2,261.6	812.5	3,074.1	371	-1	370
63	1,545.4	454.1	1,999.5	0	0	0
64	660.5	698.3	1,358.8	0	0	0
65	985.1	271.4	1,256.5	0	198	198

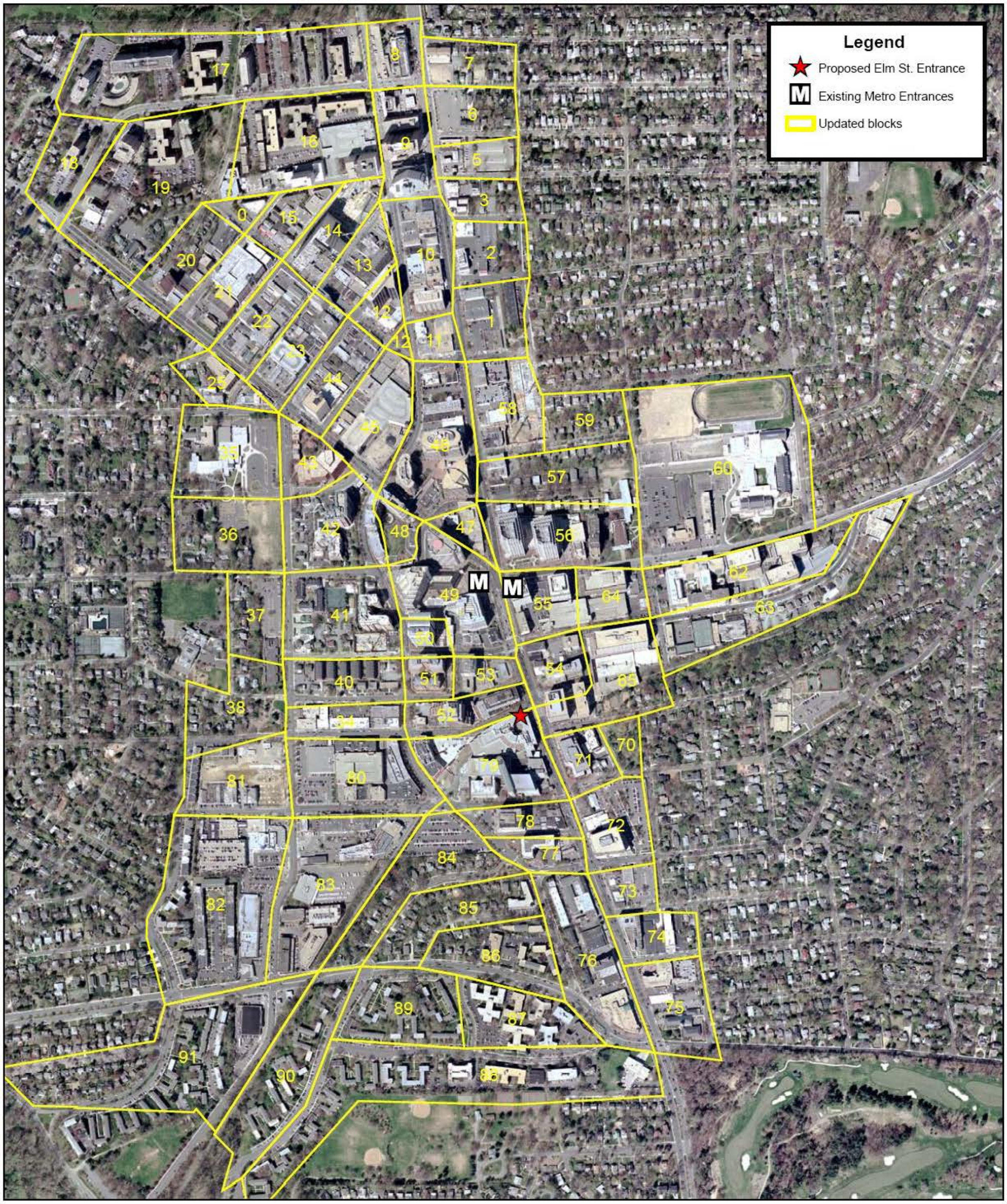
Table continues, next page

Block*	Employees			Dwelling Units		
	Existing	Net Change	Future	Existing	Net Change	Future
66	392	58.3	450.3	0	0	0
67	0	0	0	0	0	0
68	0	0	0	0	0	0
69	0	0	0	0	0	0
70	0	0	0	0	0	0
71	739.4	145.7	885.1	3	0	3
72	888.1	132.2	1,020.3	0	0	0
73	31	69.1	100.1	0	2	2
74	226.2	46	272.2	1	21	22
75	221.4	71.9	293.3	0	16	16
76	402.1	360.4	762.5	54	103	157
77	0	25.9	25.9	149	60	209
78	38.7	36.9	75.6	247	10	257
79	2,070.2	386.2	2,456.4	0	0	0
80	1,075.7	434.4	1,510.1	0	180	180
81	168.5	205.8	374.3	63	0	63
82	383.7	123.5	507.2	306	0	306
83	1342	418	1760	0	105	105
84	0	32.6	32.6	21	100	121
85	0	0	0	70	0	70
86	0	0	0	179	0	179
87	0	0	0	369	0	369
88	28.9	4.3	33.2	274	17	291
89	0	0	0	88	0	88
90	0	0	0	110	0	110
91	43	62.6	105.6	103	-1	102
TOTAL	**37,111.6**	**13,770**	**50,881.6**	**6,091**	**3,355**	**9,446**

Source: Maryland National Capital Park and Planning Commission, 2004

* Block number designations per M-NCPPC, as shown on attached map.

Bethesda CBD Block Map



Source: Maryland National Capital Park and Planning Commission

Appendix B: Modeling and Operating Assumptions

Bi-County Transitway Assumptions

Travel Demand Model

- *Model Version:* MWCOG Version 2.1/TP+, Release C
- *Demographic Forecast:* Round 6.2 of the MWCOG Cooperative Forecasts
- *Background Networks:* FY 2003-2008 TIP/2002 CLRP Air Quality Conformity Networks adopted in July, 2002.
- *Horizon Year:* 2025

Transit Operations

- *Mode:* Light Rail
- *Vehicle:* Low-floor, 60 seats, 60 standees
- *Consist:* Peak: 2-car trains; Off-Peak: 2-car trains
- *Fleet:* Bethesda to New Carrollton: 47 cars (including 8 spares)
- *Travel Time:* Bethesda to New Carrollton: 32 min (27 mph)
- *Fares:* LRT uses Metrorail fare structure

Rail Operations

Rail operations are as coded in the CLRP, adding the Purple Line between Bethesda and New Carrollton Metrorail stations. The following additional transitway stations are coded:

- Chevy Chase Lake
- West Silver Spring
- Silver Spring Metrorail station
- New Hampshire Avenue
- University of Maryland West
- University of Maryland East
- College Park Metrorail station
- Riverdale Road

Headways are assumed as 6 minutes during peak periods, 10 minutes midday and early evening, and 15 minutes in late evening.

Bus Operations

Bus operations are as coded in the CLRP with the following changes:

METROBUS

- 84, 85 - code to serve the Riverdale LRT station
- C2 – code to serve the New Hampshire, UM West, and UM East LRT stations
- C4 – code to serve the New Hampshire LRT station
- C8 – code to serve the UM West and UM East LRT stations
- F4 – code to serve the Riverdale LRT station
- F6 – eliminate, duplicates the Purple Line
- F8 – code to serve the New Hampshire LRT station
- J1 – terminate at proposed Chevy Chase Lake LRT station
- J2, J3 – reduce frequency to 20 minutes each
- J4 – eliminate
- J5 – reroute along Rockville Pike to the Bethesda Metrorail Station
- K6 - code to serve the New Hampshire LRT station
- L7, L8 – code to serve the Chevy Chase Lake LRT station
- R3 – code to serve the UM West LRT station

RIDE-ON

- 1 – reroute to serve the proposed West Silver Spring LRT station
- 3 & 5 - code to serve the Woodside station

THE BUS

- G – code to serve the UM East LRT station
- 14 – code to serve the Riverdale LRT station

STATION SERVICE (new stations)

- Chevy Chase Lake – Metrobus J1, L7, L8
- West Silver Spring – Ride-On 1
- New Hampshire Av. –Metrobus C2, C4, F8, K6, Z19
- UM West – C2, C8, F8, R3
- UM East – C2, C8; The Bus G
- Riverdale Rd. – 84, 85, F4; The Bus 14

Assumed Ride-On Bus Service to Silver Spring and Bethesda, 2025 Build Scenario

Route	*Route Description*	*Span of Service*	*Headway* (minutes)*	
			Peaks	*Off-Peaks*
1	Friendship Heights Station - Silver Spring Station	5:00 AM - 10:45 PM	30	30
2	Silver Spring Ride-On Operations Center - Silver Spring Station	4:45 AM - 10:45 PM	20	30
3	Takoma Station - Silver Spring Station	7:00 AM - 8:45 AM 5:15 PM - 6:45 PM	30	NA
4	Kensington Station - Silver Spring Station	6:00 AM - 7:00 PM	30	30
5	Twinbrook Station - Silver Spring Station	5:00 AM - 1:00 AM	8	30
8	Wheaton Station - Forest Glen Station - Silver Spring Station	6:00 AM - 8:00 PM	30	30
9	Wheaton Station - Silver Spring Station	5:15 AM - 10:45 PM	15	30
11	Friendship Heights Station - Silver Spring Station	6:00 AM - 10:00 AM 2:00 PM - 7:30 PM	8	NA
12	Takoma Station - Silver Spring Station	4:30 AM - 1:00 PM	10	30
13	Takoma Station - Silver Spring Station	6:30 AM - 9:45 AM 4:15 PM - 7:00 PM	20	NA
14	Takoma Station - Silver Spring Station	5:30 AM - 9:00 PM	25	30
15	Langley Park - Silver Spring Station	4:15 AM - 1:15 AM	4	12
16	Langley Park - Silver Spring Station	4:30 AM - 1:15 AM	12	15
17	Langley Park - Silver Spring Station	4:45 AM - 12:00 AM	15	20
18	Langley Park - Silver Spring Station	5:15 AM - 10:30 PM	7	15
19	Dallas Avenue - Silver Spring Station	6:15 AM - 9:00 AM 4:15 PM - 8:15 PM	30	NA
20	Hillandale - Silver Spring Station	4:15 AM -1:00 AM	7	15
22	Hillandale - Silver Spring Station	6:30 AM - 8:45 AM 3:45 PM - 7:00 PM	30	NA
27	Medical Center Station - Bethesda Station - Friendship Heights Station	7:15 AM - 9:15 AM 4:45 PM - 6:30 PM	30	NA
28	Silver Spring - MARC Shuttle	6:15 AM - 7:15 PM	7.5	7.5
29	Glen Echo - Bethesda Station	6:15 AM - 7:15 PM	30	30
30	Medical Center Station - Bethesda Station	6:00 AM - 9:00 PM	20	30

Table continues, next page

Route	Route Description	Span of Service	Headway* (minutes)	
			Peaks	Off-Peaks
32	Naval Ship Research and Development Center - Bethesda Station	6:30 AM - 9:30 AM 3:15 PM - 7:45 PM	30	30
33	Wheaton Station - Medical Center Station	6:00 AM - 9:00 AM 3:15 PM - 7:15 PM	30	NA
34	Aspen Hill - Wheaton Station - Bethesda Station	5:45 AM - 10:15 AM 2:15 PM - 7:45 PM	25	NA
35	Wheaton Station - Medical Center Station - Montgomery mall	5:00 AM - 10:15 PM	25	30
36	Potomac - Bethesda Station	6:30 AM - 8:00 PM	20	30
42	Medical Center - Bethesda Station - Friendship Heights Station	5:15 AM - 12:45 AM	20	30
92	Bethesda 8 Shuttle	7:00 AM - 2:00 AM	8	NA

*Headway is the time between buses on a given route.

Assumed MTA Bus Service to Silver Spring, 2025 Build Scenario

Route	Route Description	Span of Services	Headway* (minutes)	
			Peaks	Off Peaks
929	Baltimore - Columbia - Silver Spring Station - Washington	5:00 AM - 8:45 PM	12	limited service
915	Columbia - Silver Spring Station – Washington	5:15 AM - 8:00 PM	8	limited service

*Headway is the time between buses on a given route.

Assumed WMATA Metrobus Service to Silver Spring & Bethesda, 2025 Build Scenario

Route	Route Description	Span of Services	Headway* (minutes)	
			Peaks	Off-Peaks
B11	Bethesda Reverse Commute	6:00 AM – 9:45 AM 4:00 PM – 7:45 PM	20	NA
F4,6	New Carrollton Station - Silver Spring Station	5:15 AM - 10:45 PM	15	40
J1,2,3	Silver Spring Station - Montgomery Mall	4:45 AM – 3:00 AM	6	20
J4	College Park – Bethesda	5:45 AM – 9:15 AM 3:30 PM – 7:15 PM	20	20
J5	Twinbrook Station - Silver Spring Station	6:15 AM - 9:30 AM 3:45 PM - 6:45 PM	30	NA
J8-9	1-270 Express	5:45 AM – 9:00 AM 3:00 PM – 7:00 PM	15	20
L7,8	Aspen Hill - Wheaton Station - Friendship Heights Station	5:15 AM - 11:30 PM	8	30
Q2	Shady Grove Station - Silver Spring Station	4:15 AM – 2:45 AM	15	30
S2,4	Silver Spring – Federal Triangle	4:15 AM – 3:00 AM	5	15
Y7,8,9	Rockville Station - Wheaton Station - Silver Spring Station	4:30 AM - 3:15 AM	7	15
Z1,4	Glenmont – Silver Spring	5:00 AM – 9:45 AM 3:00 PM – 9:15 PM	30	NA
Z3,5	Colesville - Fairland - Silver Spring Station	5:30 AM - 8:45 AM 4:00 PM - 8:45 PM	15	NA
Z2	Colesville Road - Silver Spring Station	6:00 AM – 7:45 PM	30	30
Z7,17, 19	Old Columbia Pike - Silver Spring Station	6:15 AM - 9:00 AM 12:15 PM -7:00 PM	30	NA
Z8	Fairland - Silver Spring Station	5:00 AM - 3:00 AM	15 (8)	30
Z11, Z-13	Briggs Chaney Park-and-Ride Lot - Silver Spring Station	5:15 AM – 9:30 AM 3:30 PM – 8:15 PM	10	NA
Z9,29	Burtonsville Park-and-Ride Lot - Silver Spring Station - Laurel	5:15 AM - 10:00 AM 3:15 PM - 7:45 PM	20	NA
14A,B	Old Georgetown Rd/ Bethesda Corridor – Tysons Beltway Express Service	6:30 AM – 10:00 AM 3:15 PM – 7:45 PM	20	30

*Headway is the time between buses on a given route.

Appendix C: Metrorail Service and Headway Comparison (minutes)

Line	*Branch*	*MWCOG Version 2.1C Model Type*			
		2025 CLRP Network		*2030 Bi-County Network*	
		Peaks	*Off-Peaks*	*Peaks*	*Off-Peaks*
Orange	A, Vienna to New Carrollton	4	12	7	12
	B, Dulles/R772 to Stadium/Armory	4	12	7	12
	C, Vienna to Largo	N/A	N/A	14	N/A
Blue	A, Franconia-Springfield to Largo	4	12	14	12
	B, Franconia-Springfield to Greenbelt	N/A	N/A	14	N/A
Red	A, Shady Grove to Glenmont	4	12	2.5	6
	B, Grosvenor to Silver Spring	4	12	N/A	N/A
Yellow	Huntington to Mt. Vernon Square	4	12	7	12
Green	Greenbelt to Branch Ave.	4	12	7	12
	Tripper, Branch Ave. to Greenbelt	N/A	N/A	*	N/A
*4 trains for tripper service					

Appendix D: Comparison between Land Use Forecasts in the Bethesda CBD

	TAZ	House-holds	Popu-lation	Employment				
				Total	Industrial	Retail	Office	Other
A. 2025/6.2	343	2,890	7,318	8,376	10	1,607	6,247	512
	344	2,665	6,713	28,984	9	2,059	25,636	1,280
	345	2,100	5,288	10,408	30	2,705	7,255	418
	Total	**7,655**	**19,319**	**47,768**	**49**	**6,371**	**39,138**	**2,210**
B. 2030/6.4A	343	4,786	7,954	7,549	9	1,476	5,422	642
	344	4,648	7,387	26,109	8	1,799	23,167	1,135
	345	3,752	5,753	9,454	24	2,793	6,293	344
	Total	**13,186**	**21,094**	**43,112**	**41**	**6,068**	**34,882**	**2,121**
C. 2005/6.4A	343	2,431	4,027	6,530	9	1,307	4,617	597
	344	2,263	3,706	22,843	8	1,616	20,171	1,048
	345	2,282	3,593	8,369	24	2,454	5,574	317
	Total	**6,976**	**11,326**	**37,742**	**41**	**5,377**	**30,362**	**1,962**
Percent Change (B vs. A)	343	66%	9%	-10%	-10%	-8%	-13%	25%
	344	74%	10%	-10%	-11%	-13%	-10%	-11%
	345	79%	9%	-9%	-20%	3%	-13%	-18%
	Total	**72%**	**9%**	**-10%**	**-16%**	**-5%**	**-11%**	**-4%**
Percent Change (C vs. B)	343	97%	98%	16%	0%	13%	17%	8%
	344	105%	99%	14%	0%	11%	15%	8%
	345	64%	60%	13%	0%	14%	13%	9%
	Total	**89%**	**86%**	**14%**	**0%**	**13%**	**15%**	**8%**

Appendix E: Summary of Transit Forecasting Results and Initial Ridership Adjustments

Part I - General Demand

1. 2005 Existing Year

	Regional Transit Person Trips (2005)						Rail Trips	
Per Acc.	HBW	HBS	HBO	NHB	Sum	PrdSum		PrdSum
AM Wk	137,077	4,144	30,939	20,321	192,481	292,254	160,952	239,004
AM Dr	87,073	1,375	9,547	87,073	99,773		78,052	
PM Wk	148,681	8,009	37,124	45,019	238,833	351,488	201,023	288,154
PM Dr	94,439	2,695	11,448	94,439	112,655		87,131	
OP Wk	100,424	19,936	86,684	79,885	286,929	391,792	235,132	310,662
OP Dr	63,826	6,876	26,729	63,826	104,863		75,530	
Total	631,520	43,035	202,471	158,508	1,035,534		837,820	

May-04	
Rail Trips	
AM	**196,899**
PM	**201,580**
OP	**283,930**
Total	**682,409**

2. 2030 No-Build

	Regional Transit Person Trips (2030NB)						Rail Trips	
Per Acc.	HBW	HBS	HBO	NHB	Sum	PrdSum		PrdSum
AM Wk	194,144	5,683	42,983	25,761	268,571	399,198	226,192	329,008
AM Dr	114,898	1,490	11,734	114,898	130,627		102,816	
PM Wk	210,568	10,985	51,563	57,084	330,200	477,638	279,515	394,522
PM Dr	124,625	2,965	14,104	124,625	147,438		115,007	
OP Wk	142,229	27,322	120,343	101,311	391,205	526,141	325,262	422,558
OP Dr	84,182	7,499	32,907	84,182	134,936		97,296	
Total	870,646	55,944	273,634	202,753	1,402,977		1,146,088	

2030NB	
Adjusted Rail Trips*	
AM	**271,047**
PM	**275,990**
OP	**386,198**
Total	**933,235**

3. 2030 Bi-County Transitway

	Regional Transit Person Trips (2030BI)						Rail Trips	
Per Acc.	HBW	HBS	HBO	NHB	Sum	PrdSum		PrdSum
AM Wk	190,593	5,784	43,554	27,063	266,994	403,429	229,360	338,922
AM Dr	120,581	1,674	11,807	120,581	136,435		109,562	
PM Wk	206,685	11,186	52,257	59,955	330,083	483,805	283,907	404,331
PM Dr	130,785	3,296	14,182	130,785	153,722		120,424	
OP Wk	139,594	27,878	121,984	106,392	395,848	535,526	332,189	434,235
OP Dr	88,392	8,312	33,113	88,392	139,678		102,046	
Total	876,630	58,130	276,897	211,103	1,422,760		1,177,488	

2030BI	
Adjusted Rail Trips**	
AM	**279,215**
PM	**282,852**
OP	**396,870**
Total	**958,937**

* Adjusted = May-04 Observed * (Modeled 2030 NB / 2005)

** Adjusted = 2030 NB Adjusted * (Modeled 2030 BI / 2030 NB)

Part II - Bethesda Station Demand

1. 2005 Existing Year

			Boarding	Alighting
AM Wk	Metro	To CBD	2,186	482
		From CBD	112	2,426
AM Dr	Metro	To CBD	2,013	292
		From CBD	443	644
Total AM	Metro	To CBD	4,199	774
		From CBD	555	3,070
		Total	**4,754**	**3,844**
OP Wk	Metro	To CBD	2,935	511
		From CBD	238	3,280
OP Dr	Metro	To CBD	2,984	361
		From CBD	960	626
Total OP	Metro	To CBD	5,919	872
		From CBD	1,198	3,906
		Total	**7,117**	**4,778**

2. 2030 No-Build

			Boarding	Alighting
AM Wk	Metro	To CBD	4,368	821
		From CBD	250	2,261
AM Dr	Metro	To CBD	2,124	1,045
		From CBD	639	403
Total AM	Metro	To CBD	6,492	1,866
		From CBD	889	2,664
		Total	**7,381**	**4,530**
OP Wk	Metro	To CBD	4,725	426
		From CBD	386	5,096
OP Dr	Metro	To CBD	2,971	88
		From CBD	1,421	578
Total OP	Metro	To CBD	7,696	514
		From CBD	1,807	5,674
		Total	**9,503**	**6,188**

	May-04	
	Boarding	**Alighting**
AM	**3,298**	**2,622**
PM	**2,672**	**3,200**
OP	**3,520**	**3,879**
Total	**9,490**	**9,701**

2030 No-Build (Adjusted)		
	Boarding	**Alighting**
AM*	**5,120**	**3,090**
PM**	**3,149**	**4,968**
OP*	**4,700**	**5,024**
Total	**12,969**	**13,082**

* Adjusted = May-04 Observed * (Modeled 2030 NB / 2005)
** Adjusted Boarding = 2030 NB AM Adjusted Alighting * (May-04 PM Boarding / AM Alighting)
** Adjusted Alighting = 2030 NB AM Adjusted Boarding * (May-04 PM Alighting / AM Boarding)

Part II - Bethesda Station Demand (continued)

3. 2030 Bi-County Transitway

			Boarding	Alighting
AM Wk	LRT	B to N	898	0
		N to B	0	2,156
	Metro	To CBD	4,439	960
		From CBD	572	2,172
AM Dr	LRT	B to N	67	0
		N to B	0	1,066
	Metro	To CBD	2,547	1,048
		From CBD	685	232
Total AM	LRT	B to N	965	0
		N to B	0	3,222
	Metro	To CBD	6,986	2,008
		From CBD	1,257	2,404
		Total	**9,208**	**7,634**
OP Wk	LRT	B to N	2,414	0
		N to B	0	2,444
	Metro	To CBD	4,867	1,023
		From CBD	1,006	4,951
OP Dr	LRT	B to N	178	0
		N to B	0	606
	Metro	To CBD	3,252	210
		From CBD	1,292	450
Total OP	LRT	B to N	2,592	0
		N to B	0	3,050
	Metro	To CBD	8,119	1,233
		From CBD	2,298	5,401
		Total	**13,009**	**9,684**

Transfers between LRT & Metro		
	L to M	M to L
AM Wk	902	453
AM Dr	287	58
Total AM	1,189	511
OP Wk	1,122	1,090
OP Dr	143	172
Total OP	1,265	1,262

Transfers (Adjusted)		
	L to M	M to L
AM^	**819**	**352**
PM^^	**349**	**812**
OP^	**797**	**795**
Total	**1,965**	**1,959**

^ Adjusted = Modeled 2030 BI * (2030 BI Adjusted Sum of B&A / Modeled 2030 BI Sum of B&A)

^^ Adjusted L to M = Modeled 2030 BI Adjusted AM M to L * (2030 BI Adjusted Sum of B&A PM / AM)

^^ Adjusted M to L = Modeled 2030 BI Adjusted AM L to M * (2030 BI Adjusted Sum of B&A PM / AM)

2030 Bi-County (Adjusted) Access Demand		
	Boarding	**Alighting**
AM^^^	**5,217**	**4,037**
PM^^^	**4,145**	**5,037**
OP^^^	**4,842**	**6,270**
Total	**14,205**	**15,344**

^^^ Adjusted Access Demand = 2030 BI Adjusted - Sum of L to M & M to L Transfers Adusted

2030 Bi-County (Adjusted)		
	Boarding	**Alighting**
AM* **	**6,388**	**5,207**
PM****	**5,306**	**6,198**
OP***	**6,434**	**7,862**
Total	**18,128**	**19,267**

*** Adjusted = 2030 NB Adjusted * (Modeled 2030 BI / 2030 NB)

**** Adjusted Boarding = 2030 BI AM Adjusted Alighting * (2030 NB PM Boarding / AM Alighting)

**** Adjusted Alighting = 2030 BI AM Adjusted Boarding * (2030 NB PM Alighting / AM Boarding)

Part III - Bethesda Station Local Access Demand

1. 2005 Existing Year

		TAZ/ node	Boarding	Alighting
AM	Wk Access	329	16	6
		332	59	40
		340	97	26
		343	341	298
		344	480	1273
		345	410	581
		351	214	70
	Wk Access	Total	**1617**	**2294**
	Bus Access	3048	**781**	**1648**
	Dr Access	7507	**2454**	**0**
	Total Demand		**4852**	**3942**
OP	Wk Access	329	12	23
		332	76	167
		340	119	173
		343	465	523
		344	1226	1393
		345	795	886
		351	192	235
	Wk Access	Total	**2885**	**3400**
	Bus Access	3048	**357**	**1447**
	Dr Access	7507	**3944**	**0**
	Total Demand		**7186**	**4847**

2. 2030 No-Build

		TAZ/ node	Boarding	Alighting
AM	Wk Access	329	20	11
		332	72	26
		340	119	11
		343	1141	365
		344	1139	1371
		345	1019	834
		351	254	83
	Wk Access	Total	**3764**	**2701**
	Bus Access	3048	**1047**	**2013**
	Dr Access	7507	**2754**	**0**
	Total Demand		**7565**	**4714**
OP	Wk Access	329	14	22
		332	86	178
		340	121	159
		343	970	1106
		344	1892	2132
		345	1419	1551
		351	227	319
	Wk Access	Total	**4729**	**5467**
	Bus Access	3048	**429**	**768**
	Dr Access	7507	**4392**	**0**
	Total Demand		**9550**	**6235**

2030 No-Build (Adjusted)

		TAZ/ node	Boarding	Alighting
AM*	Wk Access	329	14	7
		332	49	17
		340	81	7
		343	772	239
		344	771	899
		345	690	547
		351	172	54
	Wk Access	Total	**2,548**	**1,770**
	Bus Access	3048	**709**	**1,319**
	Dr Access	7507	**1,864**	**0**
	Total Demand		**5,120**	**3,090**
PM**	Wk Access	329	7	13
		332	17	47
		340	7	78
		343	244	749
		344	916	748
		345	557	669
		351	55	167
	Wk Access	Total	**1,804**	**2,472**
	Bus Access	3048	**1,345**	**688**
	Dr Access	7507	**0**	**1,809**
	Total Demand		**3,149**	**4,968**
OP*	Wk Access	329	7	18
		332	42	143
		340	60	128
		343	477	891
		344	931	1,718
		345	698	1,250
		351	112	257
	Wk Access	Total	**2,327**	**4,405**
	Bus Access	3048	**211**	**619**
	Dr Access	7507	**2,162**	**0**
	Total Demand		**4,700**	**5,024**

* Adjusted = 2030 Access Demand * Modeled Access Mode Shares
** Adjusted = 2030 Access Demand * Inversed AM Modeled Access Mode Shares

Part III - Bethesda Station Local Access Demand (continued)

3. 2030 Bi-County Transitway

		TAZ/ node	Boarding	Alighting
AM	Wk Access	329	23	15
		332	70	31
		340	132	33
		343	1182	426
		344	1270	2080
		345	1060	939
		351	418	65
	Wk Access	Total	**4155**	**3589**
	Bus Access	3048	**568**	**2505**
	Dr Access	7507	**2945**	**0**
	Total Demand		**7668**	**6094**
OP	Wk Access	329	33	47
		332	83	196
		340	119	183
		343	1046	1164
		344	2383	2754
		345	1599	1828
		351	281	297
	Wk Access	Total	**5544**	**6469**
	Bus Access	3048	**563**	**714**
	Dr Access	7507	**4401**	**0**
	Total Demand		**10508**	**7183**

2030 Bi-County Transitway (Adjusted)

		TAZ/ node	Boarding	Alighting
AM*	Wk Access	329	16	10
		332	48	21
		340	90	22
		343	804	282
		344	864	1,378
		345	721	622
		351	284	43
	Wk Access	Total	**2,827**	**2,377**
	Bus Access	3048	**386**	**1,659**
	Dr Access	7507	**2,004**	**0**
	Total Demand		**5,217**	**4,037**
PM**	Wk Access	329	10	15
		332	21	46
		340	22	87
		343	290	776
		344	1,415	834
		345	639	696
		351	44	275
	Wk Access	Total	**2,441**	**2,729**
	Bus Access	3048	**1,704**	**373**
	Dr Access	7507	**0**	**1,934**
	Total Demand		**4,145**	**5,037**
OP*	Wk Access	329	15	41
		332	38	171
		340	55	160
		343	482	1,016
		344	1,098	2,404
		345	737	1,596
		351	129	259
	Wk Access	Total	**2,555**	**5,647**
	Bus Access	3048	**259**	**623**
	Dr Access	7507	**2,028**	**0**
	Total Demand		**4,842**	**6,270**

* Adjusted = 2030 Access Demand * Modeled Access Mode Shares

** Adjusted = 2030 Access Demand * Inversed AM Modeled Access Mode Shares

Part IV - Model Version Sensitivity

	Transit Person Trips
1. Version C	
From Bethesda	14,209
To Bethesda	19,597
Total Bethesda Access Trips	33,806
Regional Trips***	1,369,685
2. Version D	
From Bethesda	13,095
To Bethesda	23,077
Total Bethesda Access Trips	36,172
Regional Trips***	1,213,464
3. Adjusted Factors****	
Bethesda Access Trips	**1.07**
Regional Trips	**0.89**

*** Excluding "From & To Bethesda" Trips

**** Adjusted Factors = Version D Transit Trips / Version C Transit Trips

Appendix F: Calculation of Increased Ridership Caused by South Entrance

Block	2030		Avg. dist. to entrance (ft)		Future mode share (pct.)*				Surrogate Ridership								
					N. Entr. only		N. & S. Entr.		N. Entr. only			N. & S. Entr.			Percent Increase		
	Empl.	DU	North	South	Office	Res	Office	Res	Office	Res	Total	Office	Res	Total	Office	Res	Total
1	279	127	1543	2304	14	41	14	41	39	52	91	39	52	91	0%	0%	0%
2	138	4	1924	2684	11	39	11	39	15	2	17	15	2	17	0%	0%	0%
3	162	7	2254	3018	9	37	9	37	14	3	17	14	3	17	0%	0%	0%
5	73	175	2510	3275	7	35	7	35	5	61	66	5	61	66	0%	0%	0%
6	56	16	2748	3514	5	33	5	33	3	5	8	3	5	8	0%	0%	0%
7	28	7	3072	3839	3	31	3	31	1	2	3	1	2	3	0%	0%	0%
8	414	127	3167	3951	2	31	2	31	8	39	47	8	39	47	0%	0%	0%
9	1229	245	2633	3418	6	34	6	34	72	84	155	72	84	155	0%	0%	0%
10	480	234	1943	2731	11	39	11	39	53	91	143	53	91	143	0%	0%	0%
11	203	0	1470	2257	14	42	14	42	29	0	29	29	0	29	0%		0%
12	1159	0	1708	2497	13	40	13	40	147	0	147	147	0	147	0%		0%
12	1159	0	1478	2268	14	42	14	42	167	0	167	167	0	167	0%		0%
13	486	103	2026	2814	10	38	10	38	50	39	90	50	39	90	0%	0%	0%
14	170	574	2248	3035	9	37	9	37	15	210	225	15	210	225	0%	0%	0%
15	318	56	2417	3198	7	36	7	36	24	20	44	24	20	44	0%	0%	0%
16	1337	691	2788	3576	5	33	5	33	63	229	292	63	229	292	0%	0%	0%
17	0	837	3370	4155	0	29	0	29	0	245	245	0	245	245		0%	0%
18	0	89	3431	4148	0	29	0	29	0	26	26	0	26	26		0%	0%
19	0	264	3073	3818	3	31	3	31	0	82	82	0	82	82		0%	0%
20	655	15	2597	3328	6	34	6	34	40	5	45	40	5	45	0%	0%	0%
21	286	0	2308	3045	8	36	8	36	24	0	24	24	0	24	0%		0%
22	497	0	2033	2777	10	38	10	38	51	0	51	51	0	51	0%		0%
23	927	0	1755	2506	12	40	12	40	114	0	114	114	0	114	0%		0%
25	207	0	1948	2635	11	39	11	39	23	0	23	23	0	23	0%		0%
34	0	0	1178	1065	17	44	17	44	0	0	0	0	0	0			
35	0	0	1709	2324	13	40	13	40	0	0	0	0	0	0			
36	0	2	1554	2044	14	41	14	41	0	1	1	0	1	1		0%	0%
37	0	0	1388	1694	15	42	15	42	0	0	0	0	0	0			
38	0	0	1640	1677	13	41	13	41	0	0	0	0	0	0			
40	667	155	1040	1090	18	45	18	45	118	69	187	118	69	187	0%	0%	0%
41	188	537	883	1218	19	46	19	46	35	245	281	35	245	281	0%	0%	0%
42	167	591	958	1559	18	45	18	45	30	267	297	30	267	297	0%	0%	0%
43	812	0	1243	1936	16	43	16	43	131	0	131	131	0	131	0%		0%
44	1112	21	1507	2267	14	42	14	42	158	9	166	158	9	166	0%	0%	0%
45	448	264	1135	1907	17	44	17	44	76	116	192	76	116	192	0%	0%	0%
46	3868	0	820	1610	19	46	19	46	745	0	745	745	0	745	0%		0%
47	866	0	289	1076	23	50	23	50	201	0	201	201	0	201	0%		0%
48	252	312	593	1289	21	48	21	48	53	148	201	53	148	201	0%	0%	0%
49	4478	0	198	818	24	50	24	50	1069	0	1069	1069	0	1069	0%		0%

			Avg. dist. to entrance (ft)		Future mode share (pct.)*				Surrogate Ridership								
	2030				N. Entr. only		N. & S. Entr.		N. Entr. only			N. & S. Entr.			Percent Increase		
Block	**Empl.**	**DU**	**North**	**South**	**Office**	**Res**	**Office**	**Res**	**Office**	**Res**	**Total**	**Office**	**Res**	**Total**	**Office**	**Res**	**Total**
50	0	0	491	708	22	48	22	48	0	0	0	0	0	0			
51	0	37	682	603	20	47	21	48	0	17	17	0	18	18		1%	1%
52	1163	1	820	336	19	46	23	49	224	0	224	266	0	266	19%	7%	19%
53	1040	0	590	269	21	48	23	50	218	0	218	243	0	243	11%		11%
54	935	0	668	285	20	47	23	50	191	0	191	217	0	217	14%		14%
55	1401	0	358	600	23	49	23	49	318	0	318	318	0	318	0%		0%
56	3315	204	509	1020	22	48	22	48	715	98	813	715	98	813	0%	0%	0%
57	183	59	743	1358	20	47	20	47	36	27	64	36	27	64	0%	0%	0%
58	1235	263	1013	1763	18	45	18	45	220	118	338	220	118	338	0%	0%	0%
59	0	27	1103	1719	17	44	17	44	0	12	12	0	12	12		0%	0%
60	566	67	1530	1803	14	41	14	41	79	28	107	79	28	107	0%	0%	0%
62	3074	370	1530	1508	14	41	14	42	431	153	584	436	154	589	1%	0%	1%
63	2000	0	1830	1695	12	39	13	40	236	0	236	256	0	256	8%		8%
64	1359	0	772	824	20	46	20	46	267	0	267	267	0	267	0%		0%
65	1257	198	1036	608	18	45	21	47	222	88	310	262	94	356	18%	6%	15%
70	0	0	1325	660	16	43	20	47	0	0	0	0	0	0			
71	885	3	1237	481	16	43	22	48	143	1	144	193	1	194	35%	12%	34%
72	1020	0	1649	880	13	41	19	46	134	0	134	192	0	192	43%		43%
73	100	2	2035	1255	10	38	16	43	10	1	11	16	1	17	56%	14%	53%
74	272	22	2364	1583	8	36	14	41	21	8	29	37	9	46	74%	14%	58%
75	293	16	2778	1994	5	33	11	38	14	5	19	31	6	37	122%	16%	92%
76	763	157	2328	1539	8	36	14	41	62	57	119	106	65	171	72%	14%	45%
77	26	209	1664	886	13	41	19	46	3	85	88	5	95	100	44%	13%	14%
78	76	257	1436	669	15	42	20	47	11	108	119	15	121	136	39%	12%	15%
79	2456	0	1108	398	17	44	22	49	421	0	421	550	0	550	31%		31%
80	1510	180	1385	1049	15	42	18	45	228	76	304	265	80	346	16%	5%	14%
81	374	63	1883	1748	11	39	12	40	43	25	67	46	25	72	9%	2%	6%
82	507	306	2494	2175	7	35	9	37	35	107	142	47	114	160	34%	6%	13%
83	1760	105	2019	1563	10	38	14	41	183	40	223	242	43	285	32%	8%	28%
84	33	121	1840	1248	12	39	16	43	4	48	51	5	52	58	37%	10%	12%
85	0	70	1973	1294	11	38	16	43	0	27	27	0	30	30		12%	12%
86	0	179	2247	1497	9	37	14	42	0	66	66	0	74	74		13%	13%
87	0	369	2636	1876	6	34	11	39	0	126	126	0	144	144		15%	15%
88	33	291	2971	2253	3	32	9	37	1	93	94	3	107	109	159%	15%	17%
89	0	88	2612	1955	6	34	11	39	0	30	30	0	34	34		13%	13%
90	0	110	3131	2570	2	31	6	35	0	34	34	0	38	38		12%	12%
91	106	102	3331	2872	1	30	4	33	1	30	31	4	33	38	500%	10%	22%
Weighted Average															**7.5%**	**3.2%**	**6.2%**

* Source: WMATA Development-Related Ridership Survey, 1987, 1989

Appendix G: Ridership Adjustments to Account for South Entrance

Walk Access Trip Adjustment Factors	
AM Boarding	1.032
PM Alighting	1.032
AM Alighting	1.075
PM Boarding	1.075
Daily	1.062

Option 2: South Entrance Only

			Boarding	Alighting
AM Wk	Metro	To CBD	4,508	847
		From CBD	258	2,333
AM Dr	Metro	To CBD	2,124	1,045
		From CBD	639	403
Total AM	Metro	To CBD	6,632	1,892
		From CBD	897	2,736
		Total	**7,529**	**4,629**
OP Wk	Metro	To CBD	5,018	452
		From CBD	410	5,412
OP Dr	Metro	To CBD	2,971	88
		From CBD	1,421	578
Total OP	Metro	To CBD	7,989	540
		From CBD	1,831	5,990
		Total	**9,820**	**6,530**

2030 South Only (Adjusted)		
	Boardin	**Alighting**
AM	**5,223**	**3,157**
PM	**3,217**	**5,068**
OP	**4,857**	**5,302**
Total	**13,297**	**13,527**

Option 3 adjusted to account for south entrance

Part A: Trips subject to increasing

			Boarding	Alighting
AM Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,537	960
		From CBD	572	1,719
AM Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total AM	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,537	960
		From CBD	572	1,719
		Total	**4,109**	**2,679**
OP Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,745	1,023
		From CBD	1,006	3,861
OP Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total OP	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,745	1,023
		From CBD	1,006	3,861
		Total	**4,751**	**4,884**

Option 3 adjusted to account for south entrance (continued)

Part B: Increase in trips due to south entrance

			Boarding	Alighting
AM Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	113	72
		From CBD	18	129
AM Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total AM	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	113	72
		From CBD	18	129
		Total	**131**	**201**
OP Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	232	63
		From CBD	62	239
OP Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total OP	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	232	63
		From CBD	62	239
		Total	**295**	**303**

Part C: New total trips, adjusted for south entrance

			Boarding	Alighting
AM Wk	LRT	B to N	898	0
		N to B	0	2,156
	Metro	To CBD	4,552	1,032
		From CBD	590	2,301
AM Dr	LRT	B to N	67	0
		N to B	0	1,066
	Metro	To CBD	2,547	1,048
		From CBD	685	232
Total AM	LRT	B to N	965	0
		N to B	0	3,222
	Metro	To CBD	7,099	2,080
		From CBD	1,275	2,533
		Total	**9,339**	**7,835**
OP Wk	LRT	B to N	2414	0
		N to B	0	2,444
	Metro	To CBD	5,099	1,086
		From CBD	1,068	5,190
OP Dr	LRT	B to N	178	0
		N to B	0	606
	Metro	To CBD	3,252	210
		From CBD	1,292	450
Total OP	LRT	B to N	2,592	0
		N to B	0	3,050
	Metro	To CBD	8,351	1,296
		From CBD	2,360	5,640
		Total	**13,304**	**9,987**

Part D: New total trips, excluding transfers

			Boarding	Alighting
AM Wk	LRT	B to N	445	0
		N to B	0	1,254
	Metro	To CBD	3,650	1,032
		From CBD	590	1,848
AM Dr	LRT	B to N	9	0
		N to B	0	779
	Metro	To CBD	2,260	1,048
		From CBD	685	174
Total AM	LRT	B to N	454	0
		N to B	0	2,033
	Metro	To CBD	5,910	2,080
		From CBD	1,275	2,022
		Total	**7,639**	**6,135**
OP Wk	LRT	B to N	1,324	0
		N to B	0	1,322
	Metro	To CBD	3,977	1,086
		From CBD	1,068	4,100
OP Dr	LRT	B to N	6	0
		N to B	0	463
	Metro	To CBD	3,109	210
		From CBD	1,292	278
Total OP	LRT	B to N	1,330	0
		N to B	0	1,785
	Metro	To CBD	7,086	1,296
		From CBD	2,360	4,378
		Total	**10,777**	**7,460**

Option 3 adjusted to account for south entrance (continued)

2030 Bi-County (Adjusted)		
	Boarding	Alighting
AM	6,479	5,344
PM	5,446	6,287
OP	6,580	8,108
Total	18,505	19,739

Transfers (Adjusted)		
	L to M	M to L
AM	819	352
PM	349	812
OP	798	796
Total	1,965	1,960

2030 Bi-County (Adjusted) Access Demand		
	Boarding	Alighting
AM	5,309	4,174
PM	4,285	5,125
OP	4,986	6,514
Total	14,580	15,813

Access Demand by Mode (excludes transfers)					
Boarding			Alighting		
M	L	Both	M	L	Both
4,993	315	5,309	2,791	1,383	4,174
2,865	1,420	4,285	4,821	305	5,125
4,371	615	4,986	4,955	1,559	6,514
12,229	2,351	14,580	12,567	3,246	15,813

2030 No-Build (Adjusted)

			Entrance Use Ratios				Trips by Entrance					
		TAZ/	Boardings		Alightings		Boardings			Alightings		
		Node	North	South	North	South	North	South	Total	North	South	Total
AM	Wk Access	329	0%	100%	0%	100%	0	14	14	0	7	7
		332	30%	70%	30%	70%	15	34	49	5	12	17
		340	50%	50%	50%	50%	40	40	81	4	4	7
		343	100%	0%	100%	0%	772	0	772	239	0	239
		344	87%	13%	77%	23%	671	100	771	692	207	899
		345	0%	100%	0%	100%	0	690	690	0	547	547
		351	100%	0%	100%	0%	172	0	172	54	0	54
	Wk Access	Total					**1,670**	**878**	**2,548**	**994**	**776**	**1,770**
	Bus Access	3048	90%	10%	90%	10%	638	71	**709**	1,188	132	**1,319**
	Dr Access	7507	70%	30%	70%	30%	1,305	559	**1,864**	0	0	**0**
	Total Demand						**3,612**	**1,508**	**5,120**	**2,182**	**908**	**3,090**
PM	Wk Access	329	0%	100%	0%	100%	0	7	7	0	13	13
		332	30%	70%	30%	70%	5	12	17	14	33	47
		340	50%	50%	50%	50%	4	4	7	39	39	78
		343	100%	0%	100%	0%	244	0	244	749	0	749
		344	77%	23%	87%	13%	705	211	916	651	97	748
		345	0%	100%	0%	100%	0	557	557	0	669	669
		351	100%	0%	100%	0%	55	0	55	167	0	167
	Wk Access	Total					**1,013**	**791**	**1,804**	**1,620**	**852**	**2,472**
	Bus Access	3048	90%	10%	90%	10%	1,210	134	**1,345**	619	69	**688**
	Dr Access	7507	70%	30%	70%	30%	0	0	**0**	1,266	543	**1,809**
	Total Demand						**2,223**	**925**	**3,149**	**3,505**	**1,463**	**4,968**
OP	Wk Access	329	0%	100%	0%	100%	0	7	7	0	18	18
		332	30%	70%	30%	70%	13	30	42	43	100	143
		340	50%	50%	50%	50%	30	30	60	64	64	128
		343	100%	0%	100%	0%	477	0	477	891	0	891
		344	82%	18%	82%	18%	764	168	931	1,409	309	1,718
		345	0%	100%	0%	100%	0	698	698	0	1,250	1,250
		351	100%	0%	100%	0%	112	0	112	257	0	257
	Wk Access	Total					**1,395**	**932**	**2,327**	**2,664**	**1,741**	**4,405**
	Bus Access	3048	90%	10%	90%	10%	190	21	**211**	557	62	**619**
	Dr Access	7507	70%	30%	70%	30%	1,513	648	**2,162**	0	0	**0**
	Total Demand						**3,098**	**1,602**	**4,700**	**3,221**	**1,803**	**5,024**

2030 Bi-County Transitway (Adjusted)

			Entrance Use Ratios				Trips by Entrance					
		TAZ/	Boardings		Alightings		Boardings			Alightings		
		Node	North	South	North	South	North	South	Total	North	South	Total
AM	Wk Access	329	0%	100%	0%	100%	0	16	16	0	10	10
		332	30%	70%	30%	70%	14	33	48	6	14	21
		340	50%	50%	50%	50%	45	45	90	11	11	22
		343	100%	0%	100%	0%	804	0	804	282	0	282
		344	87%	13%	77%	23%	752	112	864	1,061	317	1,378
		345	0%	100%	0%	100%	0	721	721	0	622	622
		351	100%	0%	100%	0%	284	0	284	43	0	43
	Wk Access	Total					**1,900**	**927**	**2,827**	**1,403**	**974**	**2,377**
	Bus Access	3048	90%	10%	90%	10%	348	39	**386**	1,493	166	**1,659**
	Dr Access	7507	70%	30%	70%	30%	1,403	601	**2,004**	0	0	**0**
	Total Demand						**3,650**	**1,567**	**5,217**	**2,897**	**1,140**	**4,037**
PM	Wk Access	329	0%	100%	0%	100%	0	10	10	0	15	15
		332	30%	70%	30%	70%	6	15	21	14	32	46
		340	50%	50%	50%	50%	11	11	22	43	43	87
		343	100%	0%	100%	0%	290	0	290	776	0	776
		344	77%	23%	87%	13%	1,089	325	1,415	726	108	834
		345	0%	100%	0%	100%	0	639	639	0	696	696
		351	100%	0%	100%	0%	44	0	44	275	0	275
	Wk Access	Total					**1,441**	**1,000**	**2,441**	**1,834**	**895**	**2,729**
	Bus Access	3048	90%	10%	90%	10%	1,534	170	**1,704**	336	37	**373**
	Dr Access	7507	70%	30%	70%	30%	0	0	**0**	1,354	580	**1,934**
	Total Demand						**2,975**	**1,171**	**4,145**	**3,524**	**1,513**	**5,037**
OP	Wk Access	329	0%	100%	0%	100%	0	15	15	0	41	41
		332	30%	70%	30%	70%	11	27	38	51	120	171
		340	50%	50%	50%	50%	27	27	55	80	80	160
		343	100%	0%	100%	0%	482	0	482	1,016	0	1,016
		344	82%	18%	82%	18%	900	198	1,098	1,971	433	2,404
		345	0%	100%	0%	100%	0	737	737	0	1,596	1,596
		351	100%	0%	100%	0%	129	0	129	259	0	259
	Wk Access	Total					**1,551**	**1,004**	**2,555**	**3,378**	**2,269**	**5,647**
	Bus Access	3048	90%	10%	90%	10%	233	26	**259**	561	62	**623**
	Dr Access	7507	70%	30%	70%	30%	1,420	608	**2,028**	0	0	**0**
	Total Demand						**3,204**	**1,638**	**4,842**	**3,939**	**2,331**	**6,270**

2030 Bi-County Transitway (Adjusted) (continued)

			Access Point Use Ratios (for South Trips)				Boardings			Alightings		
		TAZ/	Boardings		Alightings		West	East	Total	West	East	Total
		Node	West	East (elev)	West	East (elev)						
AM	Wk Access	329	100%	0%	100%	0%	16	0	16	10	0	10
		332	0%	100%	0%	100%	0	33	33	0	14	14
		340	50%	50%	50%	50%	22	22	45	5	5	11
		343	0%	100%	0%	100%	0	0	0	0	0	0
		344	0%	100%	0%	100%	0	112	112	0	317	317
		345	89%	11%	44%	56%	642	79	721	274	348	622
		351	0%	100%	0%	100%	0	0	0	0	0	0
	Wk Access	Total					**680**	**247**	**927**	**289**	**685**	**974**
	Bus Access	3048	0%	100%	0%	100%	0	39	**39**	0	166	**166**
	Dr Access	7507	2%	98%	2%	98%	12	589	**601**	0	0	**0**
	Total Demand						**692**	**875**	**1,567**	**289**	**851**	**1,140**
PM	Wk Access	329	100%	0%	100%	0%	10	0	10	15	0	15
		332	0%	100%	0%	100%	0	15	15	0	32	32
		340	50%	50%	50%	50%	6	6	11	22	22	43
		343	0%	100%	0%	100%	0	0	0	0	0	0
		344	0%	100%	0%	100%	0	325	325	0	108	108
		345	44%	56%	89%	11%	281	358	639	620	77	696
		351	0%	100%	0%	100%	0	0	0	0	0	0
	Wk Access	Total					**297**	**703**	**1,000**	**656**	**239**	**895**
	Bus Access	3048	0%	100%	0%	100%	0	170	**170**	0	37	**37**
	Dr Access	7507	2%	98%	2%	98%	0	0	**0**	12	569	**580**
	Total Demand						**297**	**874**	**1,171**	**668**	**845**	**1,513**
OP	Wk Access	329	100%	0%	100%	0%	15	0	15	41	0	41
		332	0%	100%	0%	100%	0	27	27	0	120	120
		340	50%	50%	50%	50%	14	14	27	40	40	80
		343	0%	100%	0%	100%	0	0	0	0	0	0
		344	0%	100%	0%	100%	0	198	198	0	433	433
		345	67%	34%	67%	34%	490	247	737	1,061	535	1,596
		351	0%	100%	0%	100%	0	0	0	0	0	0
	Wk Access	Total					**519**	**485**	**1,004**	**1,142**	**1,127**	**2,269**
	Bus Access	3048	0%	100%	0%	100%	0	26	**26**	0	62	**62**
	Dr Access	7507	2%	98%	2%	98%	12	596	**608**	0	0	**0**
	Total Demand						**531**	**1,107**	**1,638**	**1,142**	**1,189**	**2,331**

Appendix H: South Entrance Elevator Analysis

Bethesda South Entrance Elevator Analysis

Time Period	AM Peak
Option	2: South Entrance
No. of cabs required	**3**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2453			
From Street to Metro	1611.0	395.2		0.0	395.2
From Street to Bi-County	0.0	0.0	0.0		0.0
From Bi-County to Metro	0.0	0.0			0.0
From Bi-County to Street	0.0	0.0	0.0		0.0
From Metro to Bi-County	0.0	0.0			0.0
From Metro to Street	975.0	239.2		0.0	306.1

Trail Access Proportion	
Boardings	0
Alightings	0

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis							
Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
395.2	131.7	6.2	Passengers enter at street level		6.2	6.2	6.2
			Doors close		3.1	9.3	6.2
			Travel to Bi-County level	24.5	8.2	17.5	6.2
			Doors open		0.0	17.5	6.2
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	17.5	6.2
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	17.5	6.2
			Doors close		0.0	17.5	6.2
			Travel to Metro level	98	16.8	34.3	6.2
			Doors open		3.1	37.4	6.2
395.2	131.7	6.2	Passengers exit at Metro level		6.2	43.6	0.0
306.1	102.0	4.8	Passengers enter at Metro level		4.8	48.3	4.8
			Doors close		3.1	51.5	4.8
			Travel to Bi-County level	98	16.8	68.3	4.8
			Doors open		0.0	68.3	4.8
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	68.3	4.8
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	68.3	4.8
			Doors close		0.0	68.3	4.8
			Travel to street level	24.5	8.2	76.5	4.8
			Doors open		3.1	79.6	4.8
306.1	102.0	4.8	Passengers exit at street level		4.8	84.3	0.0
			TOTAL CYCLE TIME			84.3	
			PEAK PASSENGER LOAD				6.2

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	28.1
From Street to Metro	43.6
From Street to Bi-County	17.5
From Bi-County to Metro	26.1
From Bi-County to Street	16.1
From Metro to Bi-County	24.7
From Metro to Street	40.8

Bethesda South Entrance Elevator Analysis

Time Period	PM Peak
Option	2: South Entrance
No. of cabs required	**3**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2103			
From Street to Metro	993.0	208.8		0.0	208.8
From Street to Bi-County	0.0	0.0	0.0		0.0
From Bi-County to Metro	0.0	0.0			0.0
From Bi-County to Street	0.0	0.0	0.0		0.0
From Metro to Bi-County	0.0	0.0			0.0
From Metro to Street	1563.0	328.7		0.0	420.7

Trail Access Proportion	
Boardings	0
Alightings	0

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis

Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
208.8	69.6	3.1	Passengers enter at street level		3.1	3.1	3.1
			Doors close		3.1	6.3	3.1
			Travel to Bi-County level	24.5	8.2	14.5	3.1
			Doors open		0.0	14.5	3.1
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	14.5	3.1
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	14.5	3.1
			Doors close		0.0	14.5	3.1
			Travel to Metro level	98	16.8	31.3	3.1
			Doors open		3.1	34.4	3.1
208.8	69.6	3.1	Passengers exit at Metro level		3.1	37.5	0.0
420.7	140.2	6.3	Passengers enter at Metro level		6.3	43.9	6.3
			Doors close		3.1	47.0	6.3
			Travel to Bi-County level	98	16.8	63.8	6.3
			Doors open		0.0	63.8	6.3
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	63.8	6.3
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	63.8	6.3
			Doors close		0.0	63.8	6.3
			Travel to street level	24.5	8.2	72.0	6.3
			Doors open		3.1	75.1	6.3
420.7	140.2	6.3	Passengers exit at street level		6.3	81.4	0.0
			TOTAL CYCLE TIME			81.4	
			PEAK PASSENGER LOAD				6.3

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	27.1
From Street to Metro	37.5
From Street to Bi-County	14.5
From Bi-County to Metro	23.1
From Bi-County to Street	17.7
From Metro to Bi-County	26.3
From Metro to Street	43.9

Bethesda South Entrance Elevator Analysis

Time Period	AM Peak
Option	3: Bi-County Transitway
No. of cabs required	**5**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2453			
From Street to Metro	1540.0	377.8		167.0	210.8
From Street to Bi-County	315.0	77.3	34.2		43.1
From Bi-County to Metro	819.0	200.9			424.1
From Bi-County to Street	1383.0	339.2	86.2		323.9
From Metro to Bi-County	352.0	86.3			179.3
From Metro to Street	862.0	211.4		53.7	201.9

Trail Access Proportion	
Boardings	0.442
Alightings	0.254

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis

Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
253.9	50.8	3.4	Passengers enter at street level		3.4	3.4	3.4
			Doors close		3.1	6.5	3.4
			Travel to Bi-County level	24.5	8.2	14.7	3.4
			Doors open		3.1	17.8	3.4
43.1	8.6	0.6	Passengers exit at Bi-County level		0.6	18.4	2.8
424.1	84.8	5.6	Passengers enter at Bi-County level		5.6	24.0	8.4
			Doors close		3.1	27.1	8.4
			Travel to Metro level	98	20.8	47.9	8.4
			Doors open		3.1	51.0	8.4
634.9	127.0	8.4	Passengers exit at Metro level		8.4	59.5	0.0
381.2	76.2	5.1	Passengers enter at Metro level		5.1	64.5	5.1
			Doors close		3.1	67.6	5.1
			Travel to Bi-County level	98	20.8	88.4	5.1
			Doors open		3.1	91.6	5.1
179.3	35.9	2.4	Passengers exit at Bi-County level		2.4	93.9	2.7
323.9	64.8	4.3	Passengers enter at Bi-County level		4.3	98.2	7.0
			Doors close		3.1	101.4	7.0
			Travel to street level	24.5	8.2	109.6	7.0
			Doors open		3.1	112.7	7.0
525.9	105.2	7.0	Passengers exit at street level		7.0	119.7	0.0
			TOTAL CYCLE TIME			119.7	
			PEAK PASSENGER LOAD				8.4

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	23.9
From Street to Metro	59.5
From Street to Bi-County	18.4
From Bi-County to Metro	41.1
From Bi-County to Street	25.7
From Metro to Bi-County	34.5
From Metro to Street	60.2

Bethesda South Entrance Elevator Analysis

Time Period	PM Peak
Option	3: Bi-County Transitway
No. of cabs required	**5**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2103			
From Street to Metro	885.0	186.1		47.3	138.8
From Street to Bi-County	1420.0	298.6	75.9		222.8
From Bi-County to Metro	349.0	73.4			141.2
From Bi-County to Street	305.0	64.1	28.4		45.8
From Metro to Bi-County	812.0	170.8			395.5
From Metro to Street	1487.0	312.7		138.2	223.4

Trail Access Proportion	
Boardings	0.254
Alightings	0.442

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis

Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
361.6	72.3	4.5	Passengers enter at street level		4.5	4.5	4.5
			Doors close		3.1	7.6	4.5
			Travel to Bi-County level	24.5	8.2	15.8	4.5
			Doors open		3.1	18.9	4.5
222.8	44.6	2.8	Passengers exit at Bi-County level		2.8	21.7	1.7
141.2	28.2	1.8	Passengers enter at Bi-County level		1.8	23.4	3.5
			Doors close		3.1	26.6	3.5
			Travel to Metro level	98	20.8	47.4	3.5
			Doors open		3.1	50.5	3.5
280.1	56.0	3.5	Passengers exit at Metro level		3.5	53.9	0.0
618.9	123.8	7.7	Passengers enter at Metro level		7.7	61.6	7.7
			Doors close		3.1	64.8	7.7
			Travel to Bi-County level	98	20.8	85.6	7.7
			Doors open		3.1	88.7	7.7
395.5	79.1	4.9	Passengers exit at Bi-County level		4.9	93.6	2.8
45.8	9.2	0.6	Passengers enter at Bi-County level		0.6	94.1	3.3
			Doors close		3.1	97.3	3.3
			Travel to street level	24.5	8.2	105.5	3.3
			Doors open		3.1	108.6	3.3
269.2	53.8	3.3	Passengers exit at street level		3.3	111.9	0.0
			TOTAL CYCLE TIME			111.9	
			PEAK PASSENGER LOAD				7.7

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	22.4
From Street to Metro	53.9
From Street to Bi-County	21.7
From Bi-County to Metro	32.3
From Bi-County to Street	18.3
From Metro to Bi-County	39.6
From Metro to Street	58.0

Appendix I: Metrorail Station Infrastructure Analysis

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	1: No-Build
Entrance	North

Infrastructure Analysis

		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	3090	5120	8210	4968	3149	8117		
L	Passengers, 30-min peak	758	1256	2014	1045	662	1707		**K** x **D**
M	Boarding passengers per minute		41.86			22.07			**L** / 30
	Alighting passengers per minute	64.68			89.15				**A** x 2**L** / 30
P	Platform Escalators Required	0.78	0.50	2	1.07	0.27	3	**3**	**M** / **B**
Q	Farecard Vendors Required		6.08	7		3.21	4	**7**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	2.02	1.31	5	2.79	0.69	4	**5**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			8			7	**8**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	2: South Entrance
Entrance	North

Infrastructure Analysis		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	2182	3612	5794	3505	2224	5729		
L	Passengers, 30-min peak	535	886	1421	737	468	1205		**K** x **D**
M	Boarding passengers per minute		29.53			15.59			**L** / 30
	Alighting passengers per minute	45.67			62.90				**A** x 2**L** / 30
P	Platform Escalators Required	0.55	0.36	2	0.76	0.19	2	**2**	**M** / **B**
Q	Farecard Vendors Required		4.29	5		2.26	3	**5**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	1.43	0.92	3	1.97	0.49	3	**3**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			6			6	**6**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	2: South Entrance
Entrance	South

Infrastructure Analysis

		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	975	1611	2586	1563	993	2556		
L	Passengers, 30-min peak	239	395	634	329	209	538		**K** x **D**
M	Boarding passengers per minute		13.17			6.96			**L** / 30
	Alighting passengers per minute	20.41			28.05				**A** x 2**L** / 30
P	Platform Escalators Required	0.25	0.16	2	0.34	0.08	2	**2**	**M** / **B**
Q	Farecard Vendors Required		1.91	2		1.01	2	**2**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	0.64	0.41	2	0.88	0.22	2	**2**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			5			5	**5**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	3: Bi-County Transitway
Entrance	North

Infrastructure Analysis		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	1929	3453	5382	3334	1980	5314		
L	Passengers, 30-min peak	473	847	1320	701	416	1118		**K** x **D**
M	Boarding passengers per minute		28.23			13.88			**L** / 30
	Alighting passengers per minute	40.38			59.83				**A** x 2**L** / 30
P	Platform Escalators Required	0.49	0.34	2	0.72	0.17	2	**2**	**M** / **B**
Q	Farecard Vendors Required		4.10	5		2.02	3	**5**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	1.26	0.88	3	1.87	0.43	3	**3**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			6			6	**6**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

	Input		
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	3: Bi-County Transitway
Entrance	South

Infrastructure Analysis

		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	1214	2359	3573	2299	1234	3533		
L	Passengers, 30-min peak	298	579	876	483	260	743		**K** x **D**
M	Boarding passengers per minute		19.29			8.65			**L** / 30
	Alighting passengers per minute	25.41			41.26				**A** x 2**L** / 30
P	Platform Escalators Required	0.31	0.23	2	0.50	0.10	2	**2**	**M** / **B**
Q	Farecard Vendors Required		2.80	3		1.26	2	**3**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	0.79	0.60	2	1.29	0.27	3	**3**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			5			6	**6**	**R** + **S** + 10%

Appendix J: NFPA-130 Evaluation

Analysis period	AM	Option			
		Existing 2004	1 No-Build	2 S. Entr.	3 Bi-Co
Entraining Load	Peak 3-hr period	3298	5120	5223	5308
	Peak 1-hr period	1507	2339	2386	2425
	0.4568				
	Peak 15-min period	482	748	763	776
	1.28				
	Headway (min)	2.5	2.5	2.5	2.5
	Entraining Load for analysis	161	249	254	259
	Cars per train	6	8	8	8
	Car capacity	120	120	120	120
	Link load, peak direction	720	960	960	960
	Off-peak direction factor	0.4	0.4	0.4	0.4
	Link load, off-peak direction	288	384	384	384
	Total Occupant Load	**1169**	**1593**	**1598**	**1603**
	Time to Clear platform (min)	**15.3**	**20.9**	**7.0**	**7.0**
	Wait time at platform esc				
	North Portal	13.5	19.1	5.8	5.8
	South Portal			6.2	6.2
Split	***Trips to portal***				
0.7	North Portal	1169	1593	1119	1122
0.3	South Portal			480	481
	Faregate flow time				
	North Portal	2.4	3.3	2.3	2.3
	South Portal			1.3	1.3
	Wait time at faregates				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Street esc flow time				
	North Portal	5.1	7.0	4.9	4.9
	South Portal			6.3	6.3
	Wait time at street esc				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Total exit time				
	North Portal	18.6	24.2	10.3	10.3
	South Portal			10.4	10.4
	Evacuation Time (min)	**18.6**	**24.2**	**10.4**	**10.4**

WITHOUT SOUTH PORTAL				
Platform to mezzanine capacity				
	No.	width	pim	p/min
Stairs	0	0	1.59	0
Escalators*	1	48	1.59	76.32
Total				76.32
% Escalators:	100%			
Faregate capacity				
North Portal				
Faregates	8	8	50	400
Service gate	1	36	2.27	81.72
Total				481.72
Mezzanine to street capacity				
North Portal				
Escalators	3	144	1.59	228.96
Walking time for longest route				
North Portal				
	ft	ft/min	minutes	
Platform	358	200	1.79	
Escalator	13	50	0.26	
Mezzanine	200	200	1	
Escalator	100	50	2	
Street	10	200	0.05	
Total			5.1	

WITH SOUTH PORTAL				
Platform to mezzanine capacity				
	No.	width	pim	p/min
Stairs	1	48	1.59	76.32
Escalators*	2	96	1.59	152.64
Total				228.96
% Escalators:	67%			
Faregate capacity				
North Portal				
Faregates	8	8	50	400
Service gate	1	36	2.27	81.72
Total				481.72
South Portal				
Faregates	6	6	50	300
Service gate	1	36	2.27	81.72
Total				381.72
Mezzanine to street capacity				
North Portal				
Escalators	3	144	1.59	228.96
South Portal				
Stairs**	1	48	1.59	76.32
Walking time for longest route				
North Portal				
	ft	ft/min	minutes	
Platform	242	200	1.21	
Escalator	13	50	0.26	
Mezzanine	200	200	1	
Escalator	100	50	2	
Street	10	200	0.05	
Total			4.52	
South Portal				
Platform	150	200	0.75	
Escalator	13	50	0.26	
Mezzanine	225	200	1.125	
Stair	98	50	1.96	
Street	10	200	0.05	
Total			4.145	

* One escalator is assumed to be out of service.

** Elevators are assumed to be out of service for evacuation purposes.

Analysis period	PM	Option			
		Existing	1	2	3
		2004	No-Build	S. Entr.	Bi-Co
Entraining Load	Peak 3-hr period	2672	3149	3217	4285
	Peak 1-hr period	1238	1460	1491	1986
	0.4635				
	Peak 15-min period	396	467	477	636
	1.28				
	Headway (min)	2.5	2.5	2.5	2.5
	Entraining Load for analysis	132	156	159	212
	Cars per train	6	8	8	8
	Car capacity	120	120	120	120
	Link load, peak direction	720	960	960	960
	Off-peak direction factor	0.4	0.4	0.4	0.4
	Link load, off-peak direction	288	384	384	384
	Total Occupant Load	**1140**	**1500**	**1503**	**1556**
	Time to Clear platform (min)	**14.9**	**19.6**	**6.6**	**6.8**
	Wait time at platform esc				
	North Portal	13.1	17.9	5.4	5.6
	South Portal			5.8	6.0
Split	***Trips to portal***				
0.7	North Portal	1140	1500	1052	1089
0.3	South Portal			451	467
	Faregate flow time				
	North Portal	2.4	3.1	2.2	2.3
	South Portal			1.2	1.2
	Wait time at faregates				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Street esc flow time				
	North Portal	5.0	6.5	4.6	4.8
	South Portal			5.9	6.1
	Wait time at street esc				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Total exit time				
	North Portal	18.2	23.0	9.9	10.1
	South Portal			10.0	10.2
	Evacuation Time (min)	**18.2**	**23.0**	**10.0**	**10.2**

WITHOUT SOUTH PORTAL					WITH SOUTH PORTAL				
Platform to mezzanine capacity					***Platform to mezzanine capacity***				
	No.	width	pim	p/min		No.	width	pim	p/min
Stairs	0	0	1.59	0	Stairs	1	48	1.59	76.32
Escalators*	1	48	1.59	76.32	Escalators*	2	96	1.59	152.64
Total				76.32	Total				228.96
% Escalators:	100%				% Escalators:	67%			
Faregate capacity					***Faregate capacity***				
North Portal					*North Portal*				
Faregates	8	8	50	400	Faregates	8	8	50	400
Service gate	1	36	2.27	81.72	Service gate	1	36	2.27	81.72
Total				481.72	Total				481.72
					South Portal				
					Faregates	6	6	50	300
					Service gate	1	36	2.27	81.72
					Total				381.72
Mezzanine to street capacity					***Mezzanine to street capacity***				
North Portal					*North Portal*				
Escalators	3	144	1.59	228.96	Escalators	3	144	1.59	228.96
					South Portal				
					Stairs**	1	48	1.59	76.32
Walking time for longest route					***Walking time for longest route***				
North Portal					*North Portal*				
	ft	ft/min	minutes			ft	ft/min	minutes	
Platform	358	200	1.79		Platform	242	200	1.21	
Escalator	13	50	0.26		Escalator	13	50	0.26	
Mezzanine	200	200	1		Mezzanine	200	200	1	
Escalator	100	50	2		Escalator	100	50	2	
Street	10	200	0.05		Street	10	200	0.05	
Total			5.1		Total			4.52	
					South Portal				
					Platform	150	200	0.75	
					Escalator	13	50	0.26	
					Mezzanine	225	200	1.125	
					Stair	98	50	1.96	
					Street	10	200	0.05	
					Total			4.145	

* One escalator is assumed to be out of service.

** Elevators are assumed to be out of service for evacuation purposes.

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

GALLERY PLACE / CHINATOWN – METRO CENTER
PEDESTRIAN PASSAGEWAY

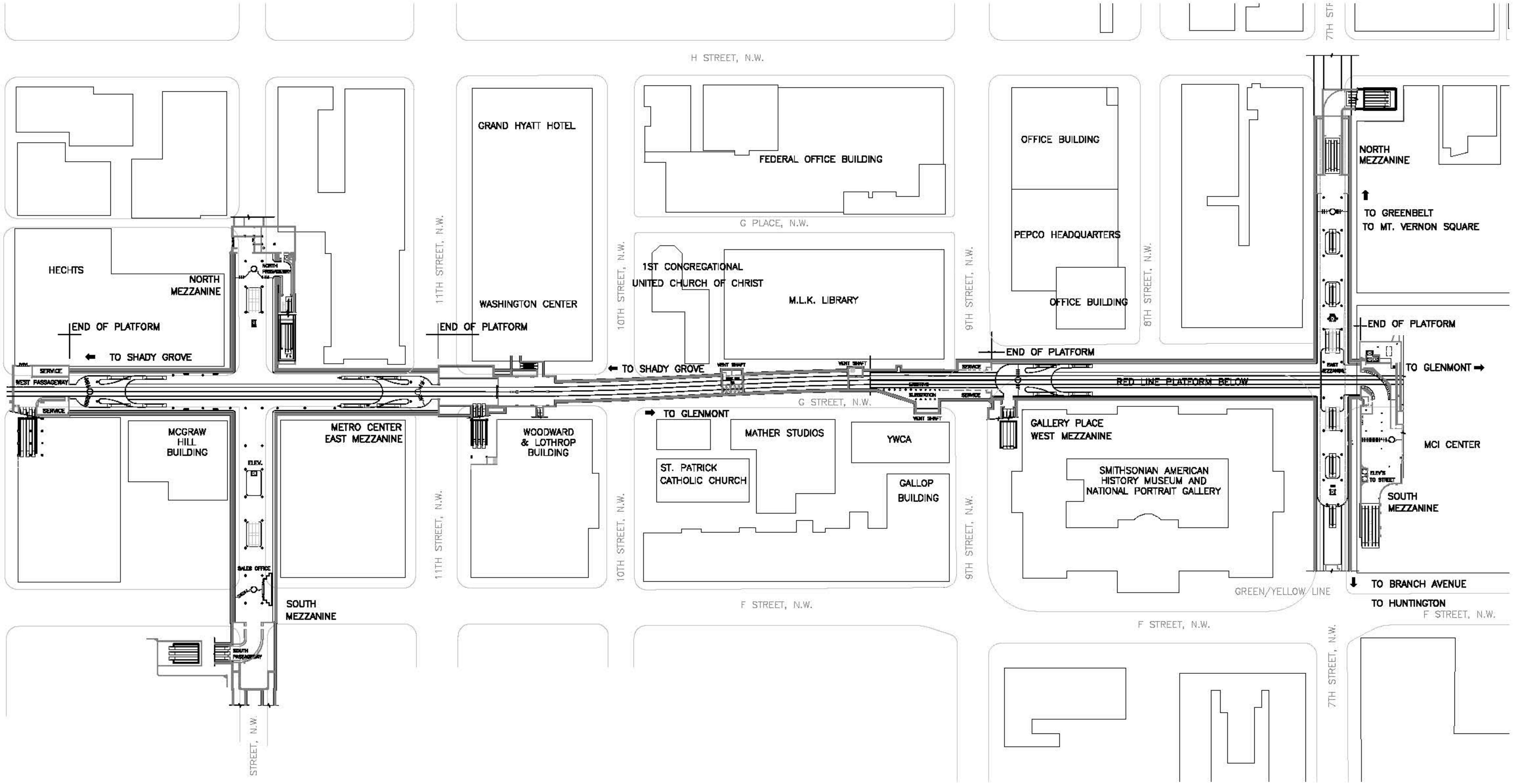
PREPARED FOR THE WMATA OFFICE
OF PLANNING AND PROJECT DEVELOPMENT
JULY 2005

KGP DESIGN STUDIO

PARSONS TRANSPORTATION GROUP

DRAWING INDEX

APPENDIX



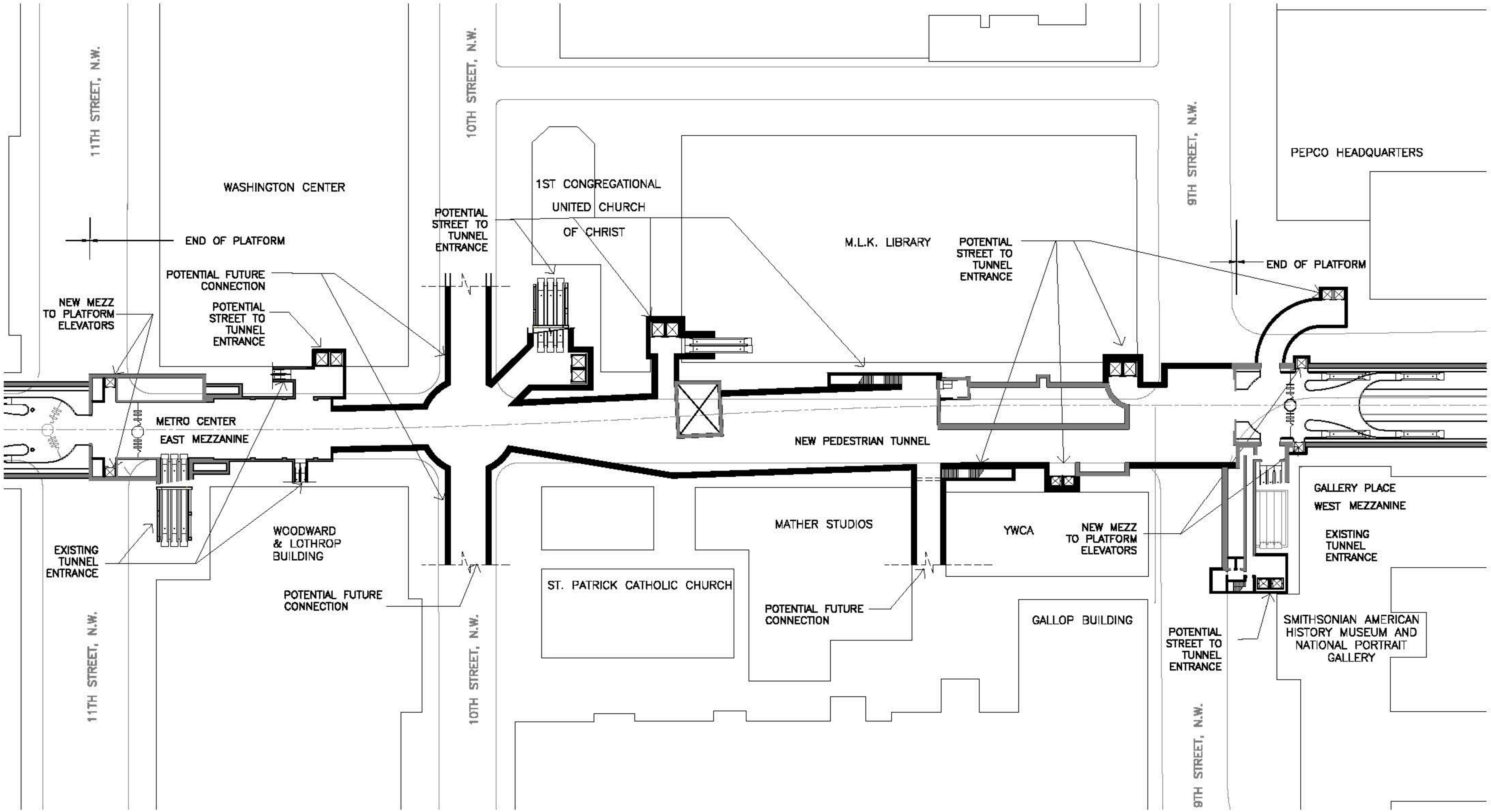
EXISTING PLAN (MEZZANINE LEVEL)

SCALE: 1"= 160'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

WMATA
DWG A-1

40 0 40 80



POTENTIAL PEDESTRIAN TUNNEL ENTRANCES

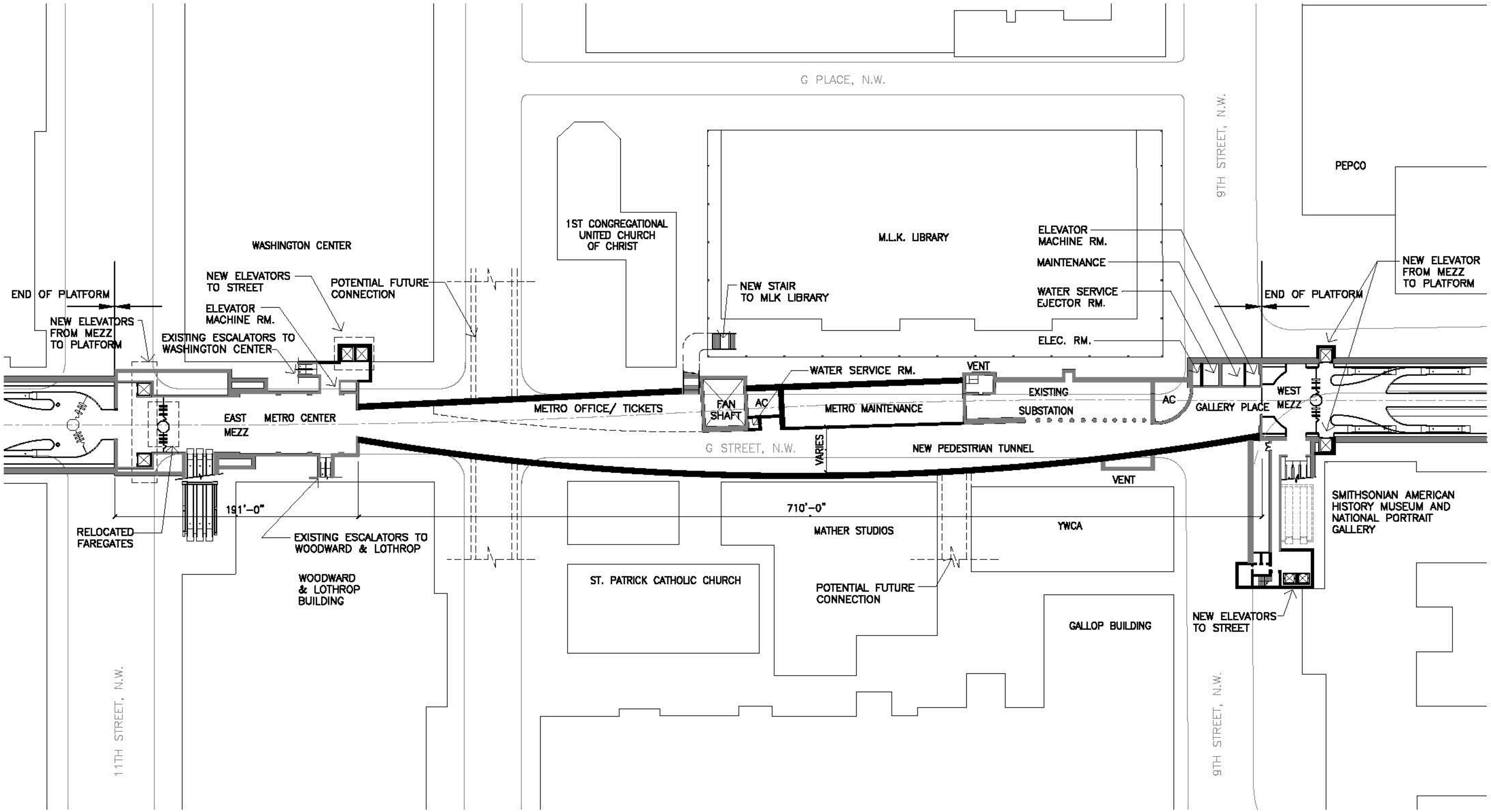
SCALE: 1"= 80'-0"

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

WMATA
DWG A-2

20 0 20 40



PASSAGEWAY PLAN ALTERNATIVE 1 PEDESTRIAN TUNNEL

SCALE: 1"= 80'-0"

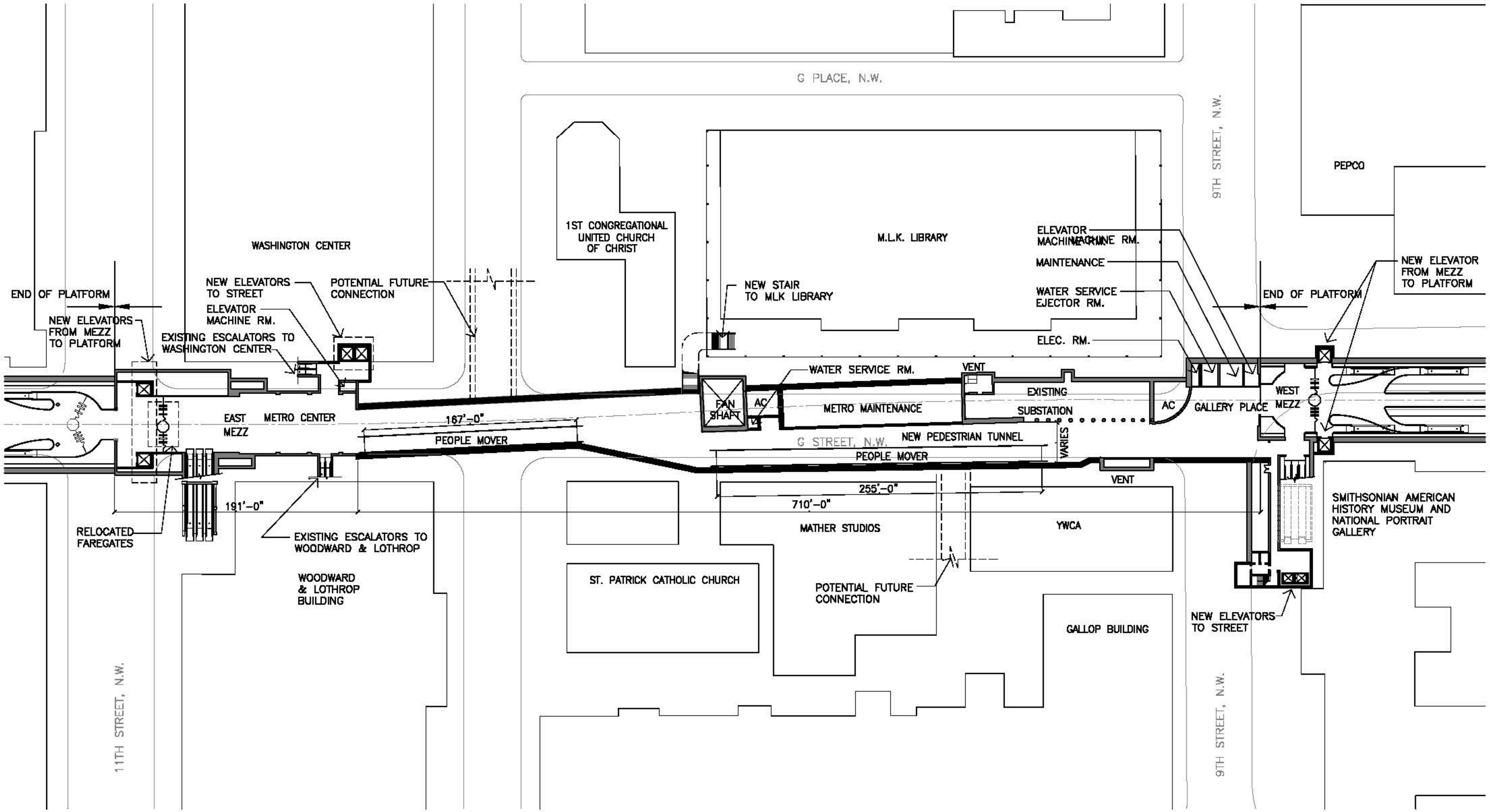
KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

metro

WMATA
DWG A-3

20 0 20 40



PASSAGEWAY PLAN ALTERNATIVE 2 – PEDESTRIAN TUNNEL WITH MOVING WALKWAY

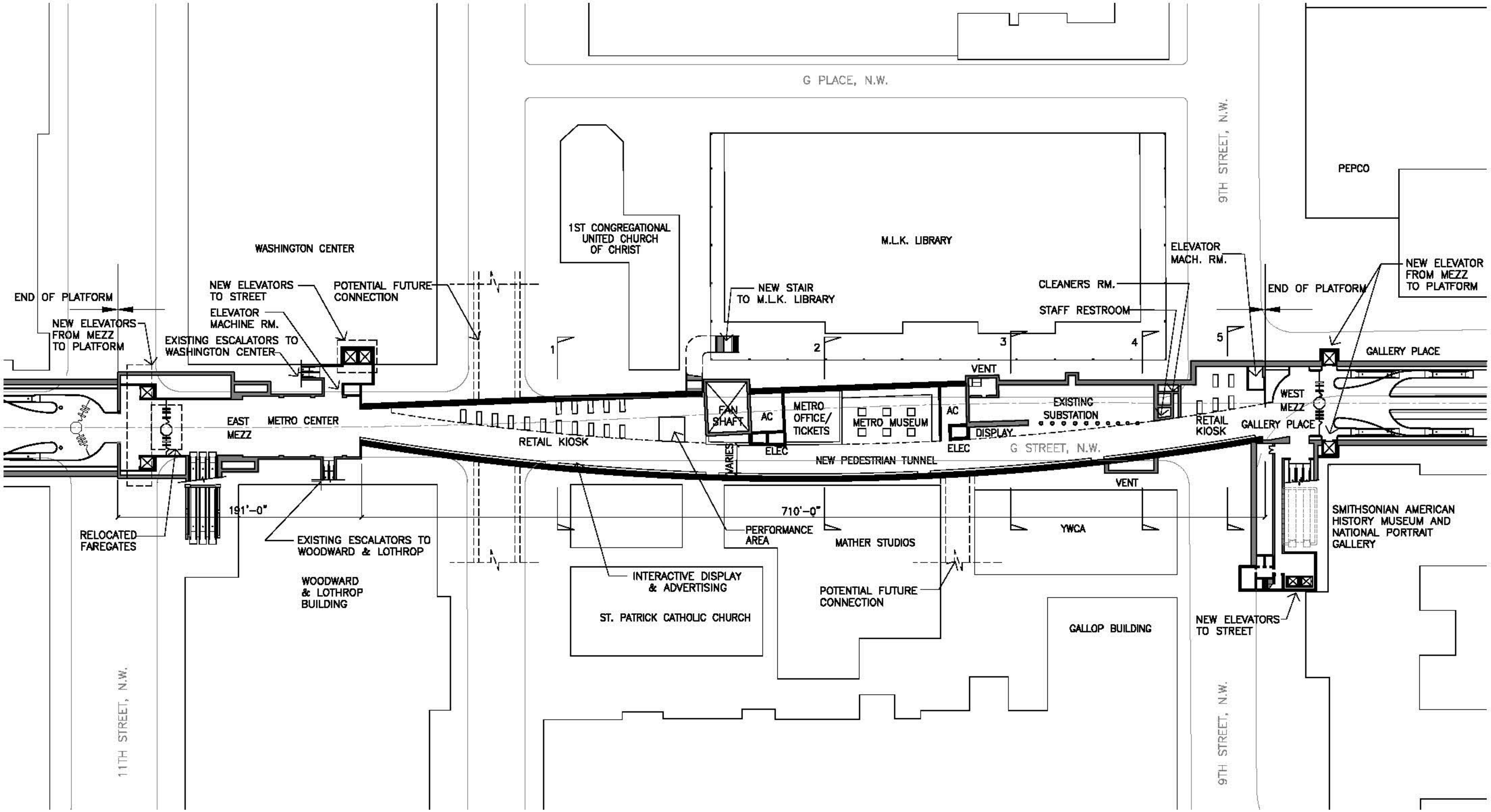
SCALE: 1"= 80'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-4

20 0 20 40



PASSAGEWAY PLAN ALTERNATIVE 3 – PEDESTRIAN TUNNEL WITH COMMERCIAL SPACE

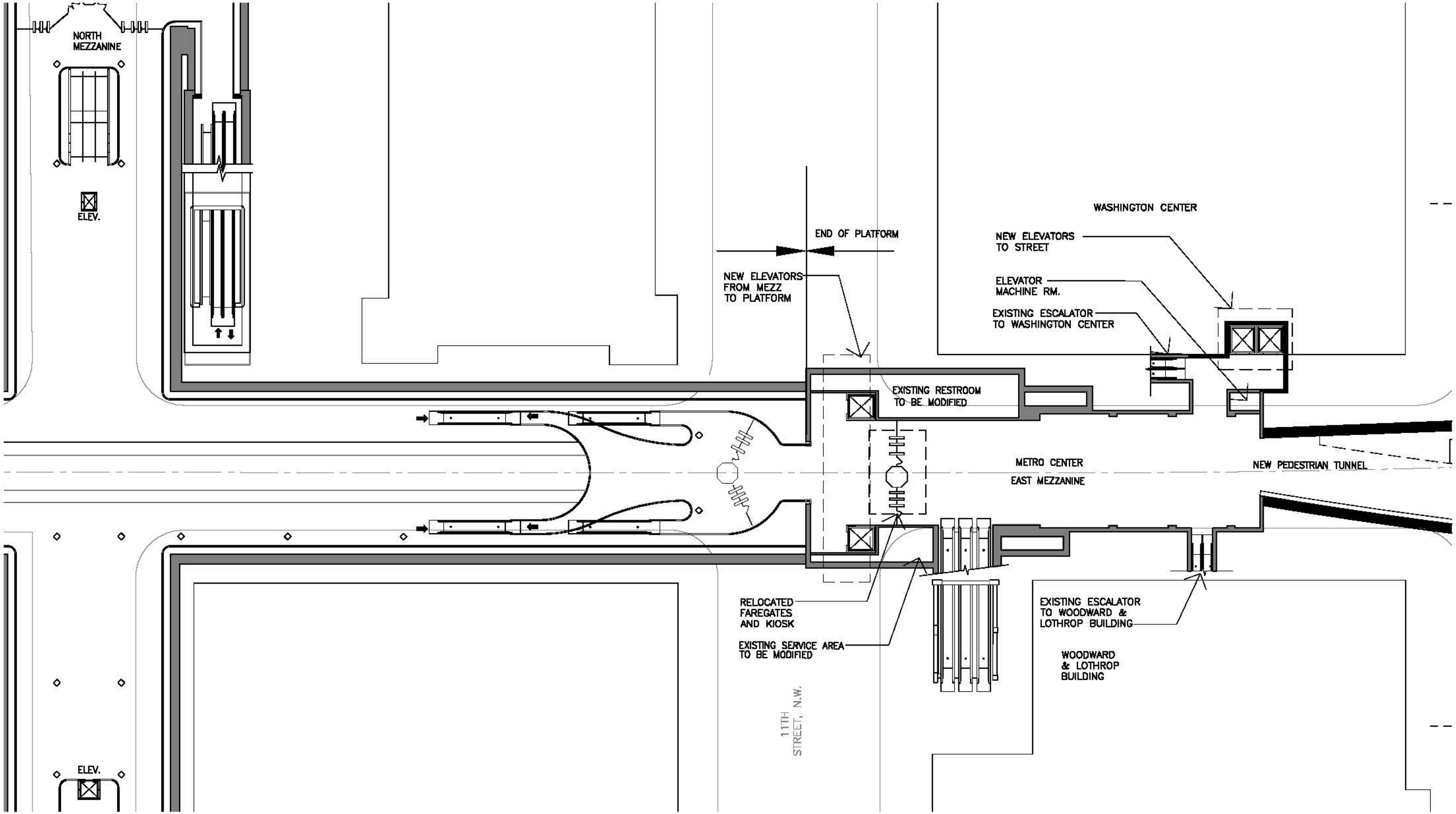
SCALE: 1"= 80'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-5

20 0 20 40



METRO CENTER MEZZANINE PLAN FOR ALTERNATIVE 3

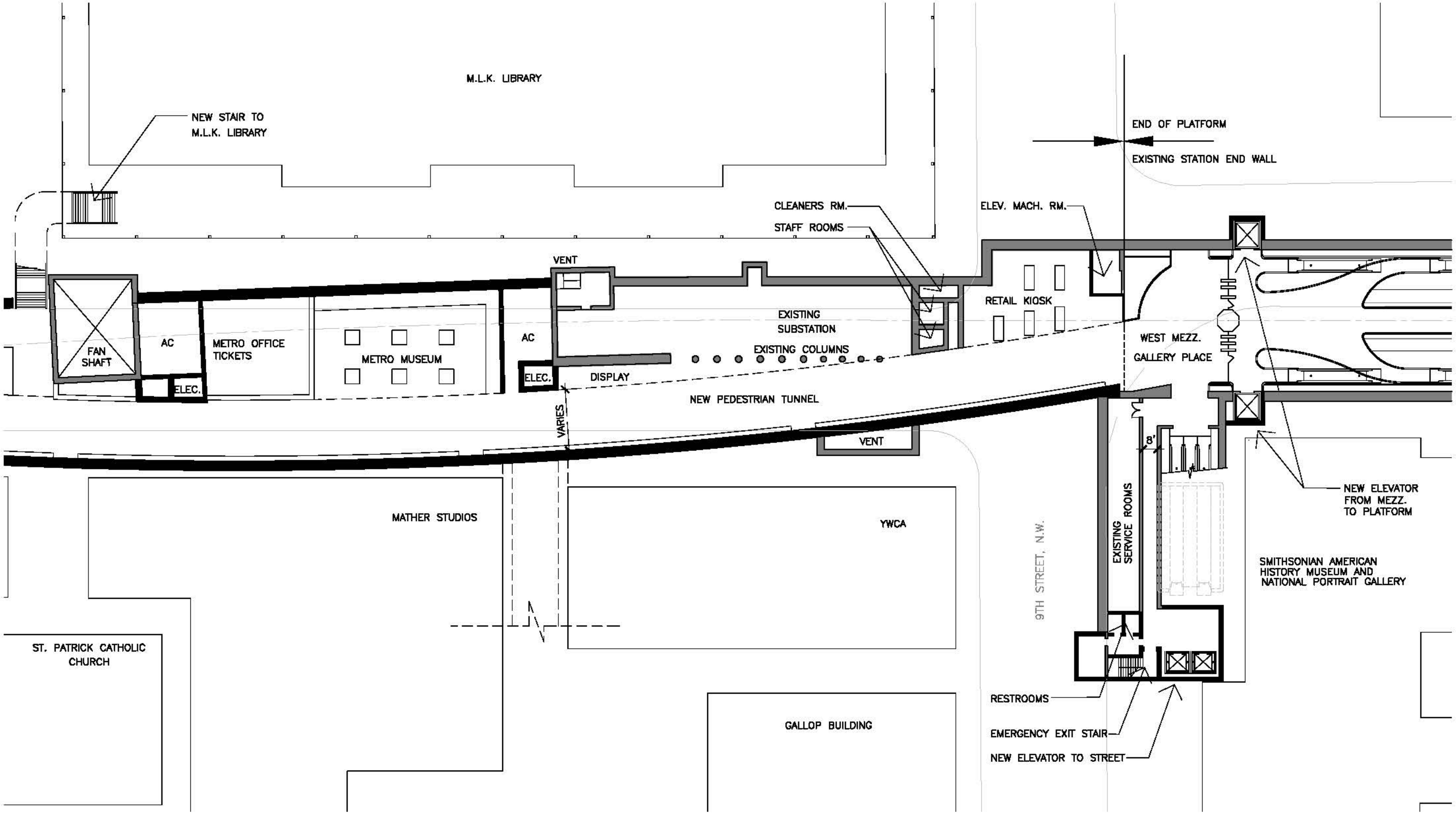
SCALE: 1"= 40'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A–6

10 0 10 20



GALLERY PLACE MEZZANINE PLAN FOR ALTERNATIVE 3

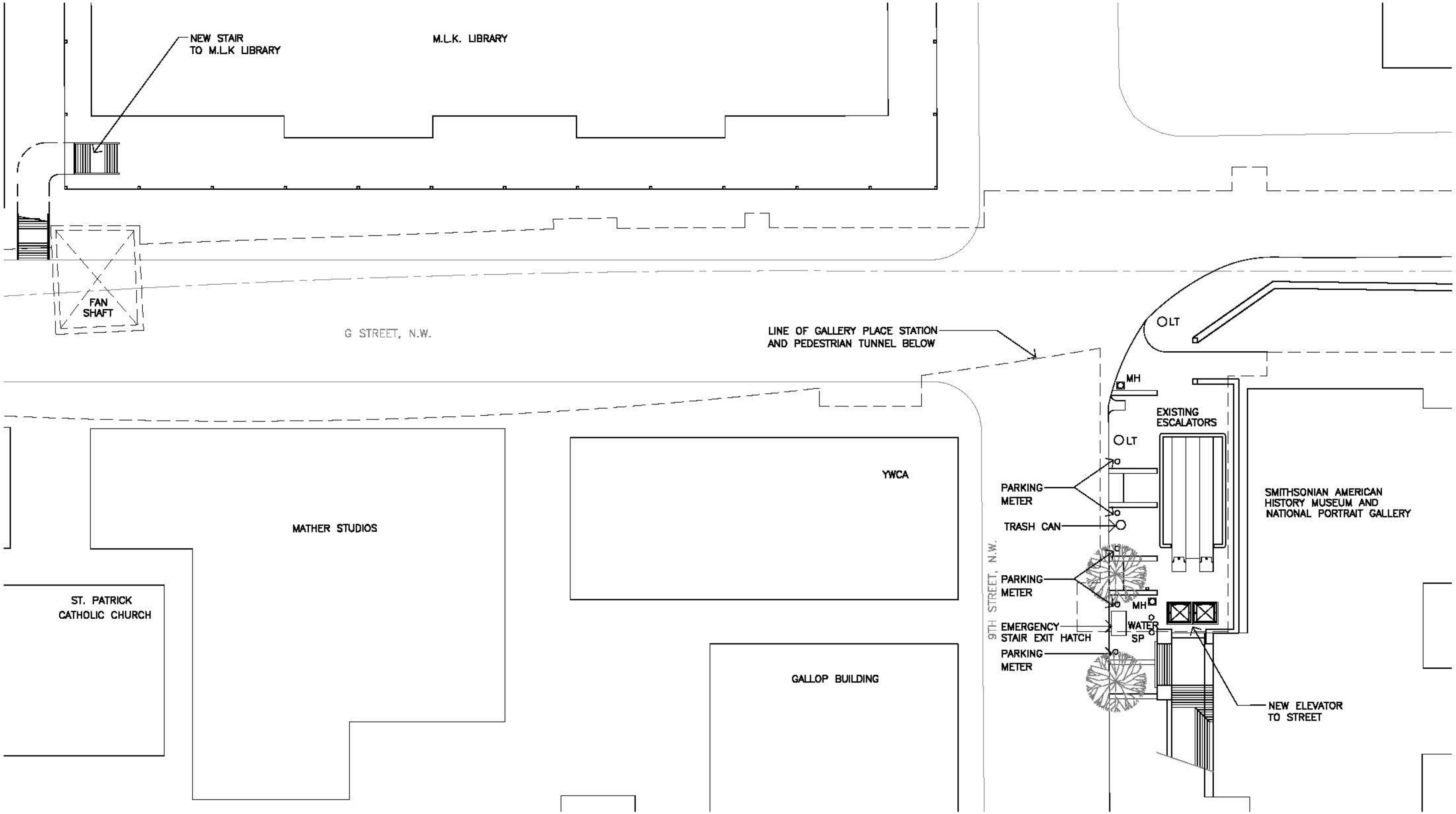
SCALE: 1"= 40'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-7

10 0 10 20



GALLERY PLACE STATION ENTRY PLAN OPTION A

SCALE: 1"= 40'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-8

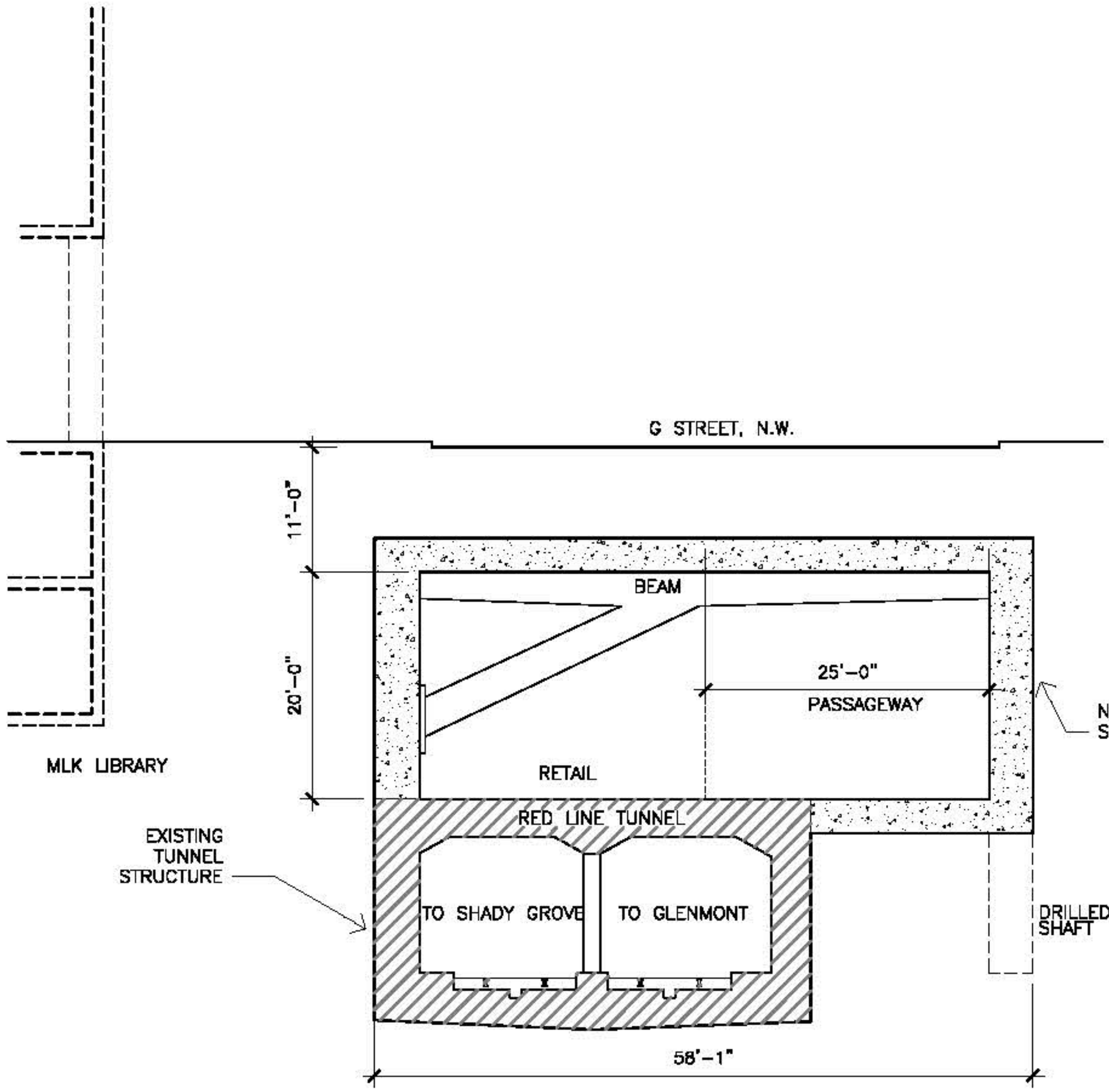
10 0 10 20

GALLERY PLACE STREET LEVEL PERSPECTIVE

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

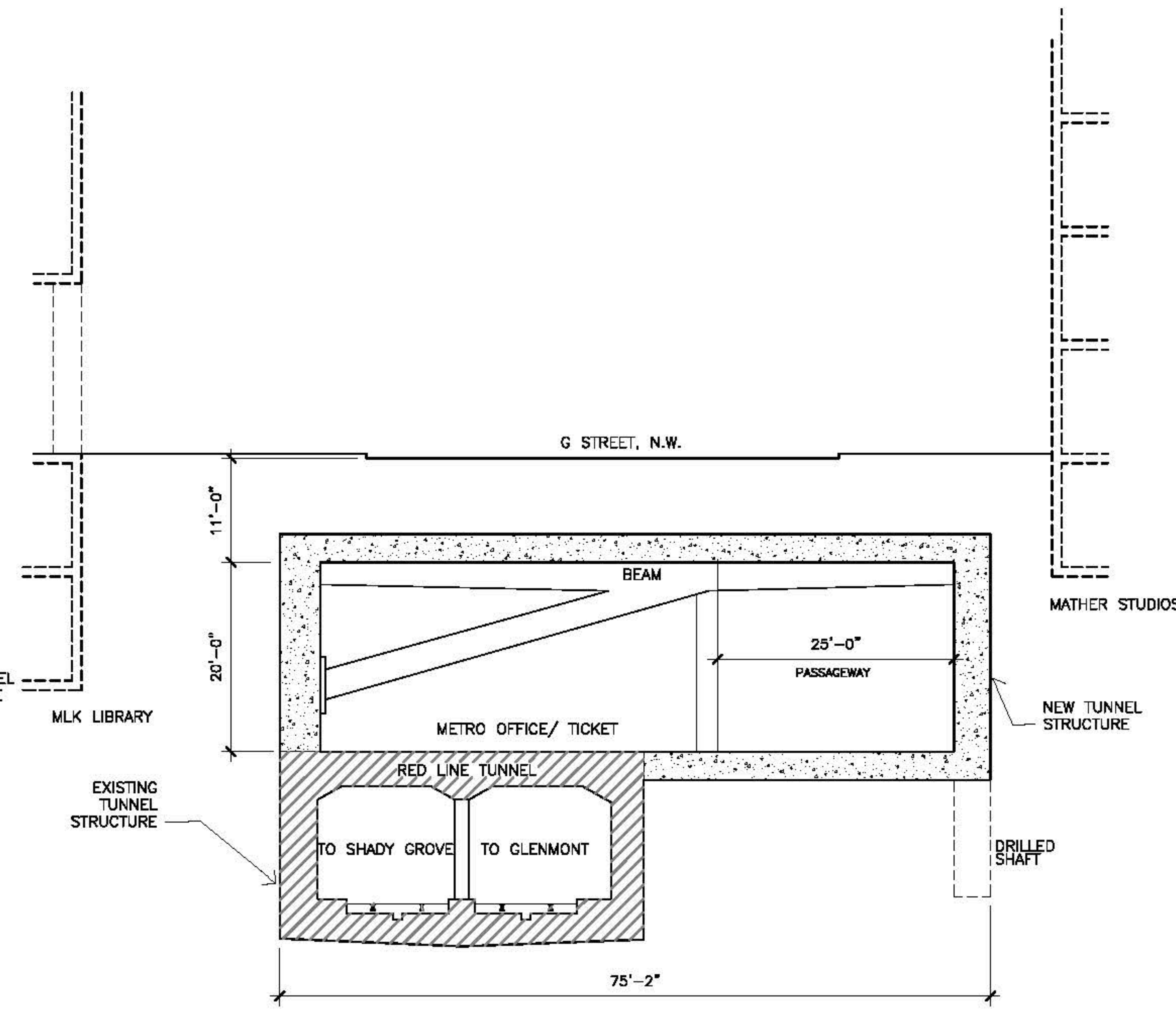
METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-9



PASSAGEWAY CROSS SECTION 1/A5

SCALE: 1/16" = 1'-0"



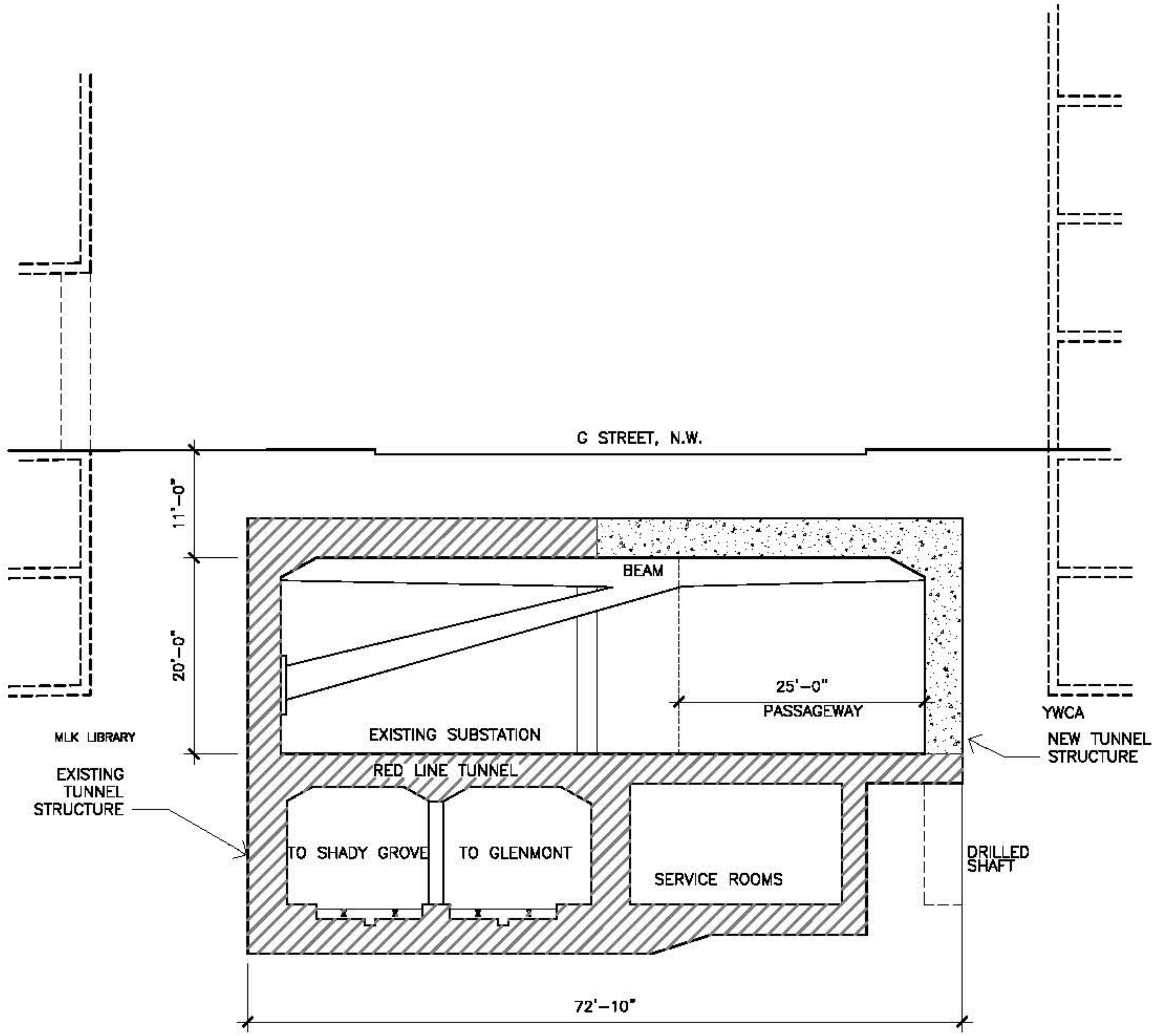
PASSAGEWAY CROSS SECTION 2/A5

SCALE: 1/16" = 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

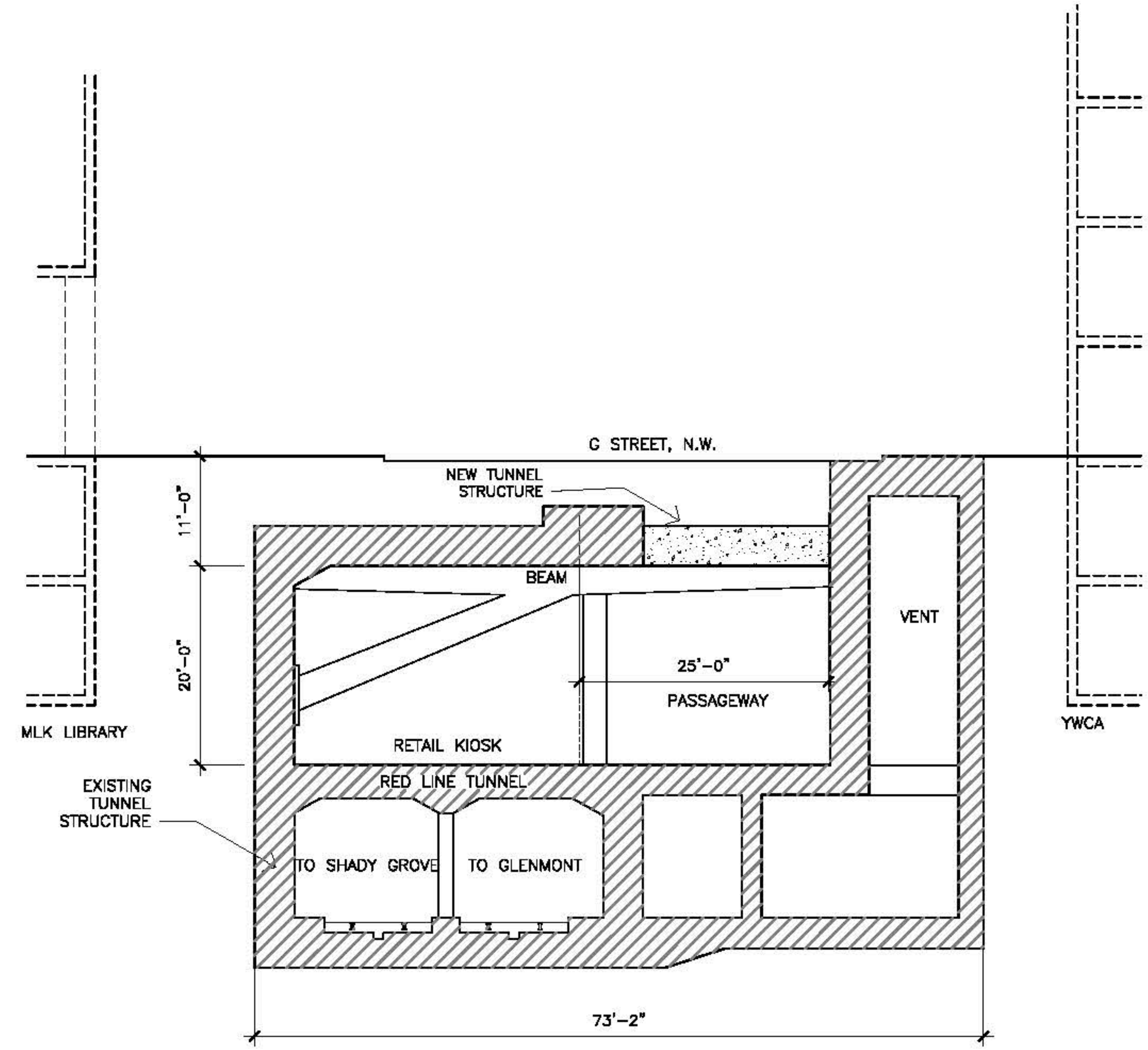
METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-10



PASSAGEWAY CROSS SECTION 3/A5

SCALE: 1/16" = 1'-0"



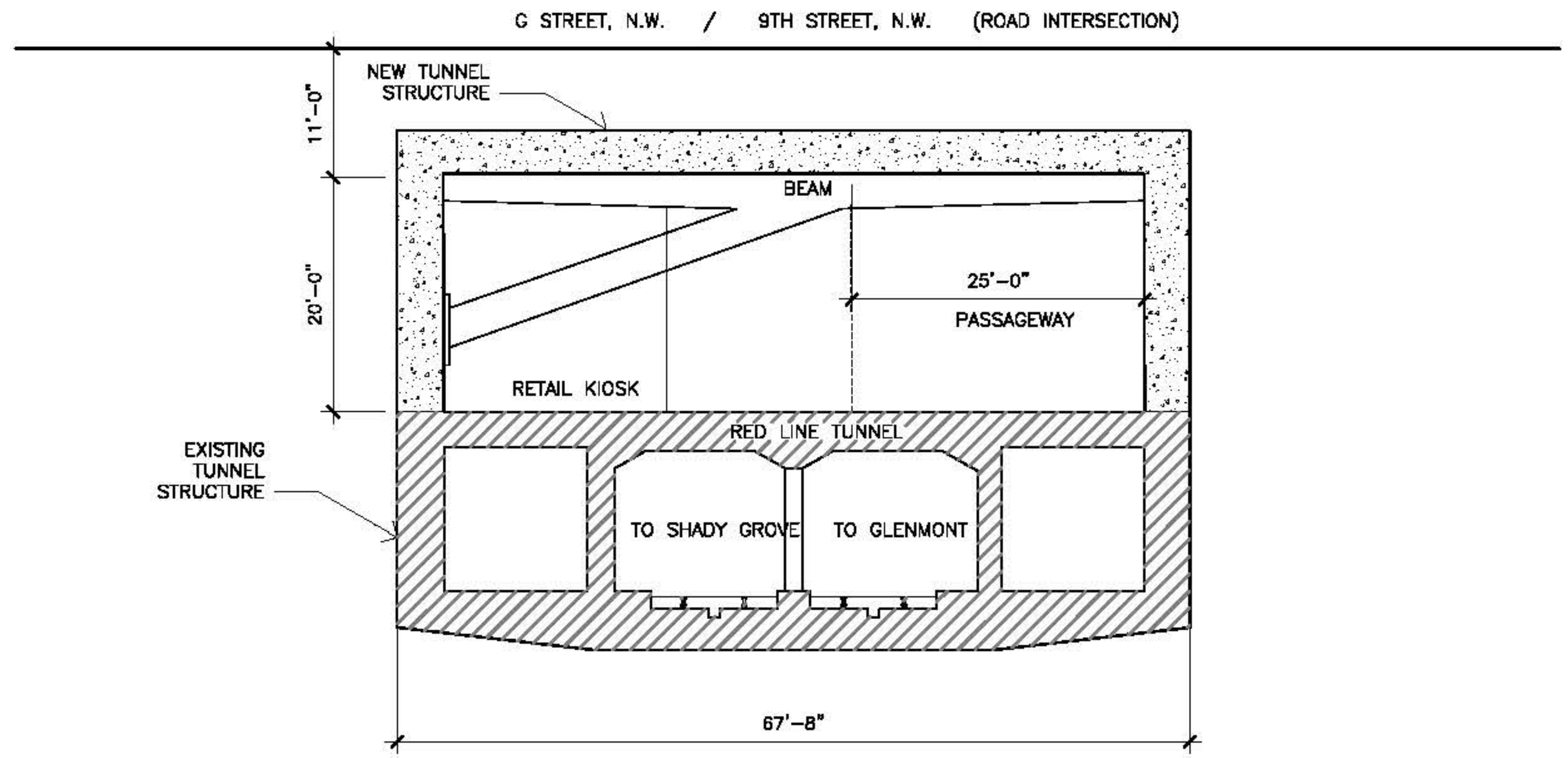
PASSAGEWAY CROSS SECTION 4/A5

SCALE: 1/16" = 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-11



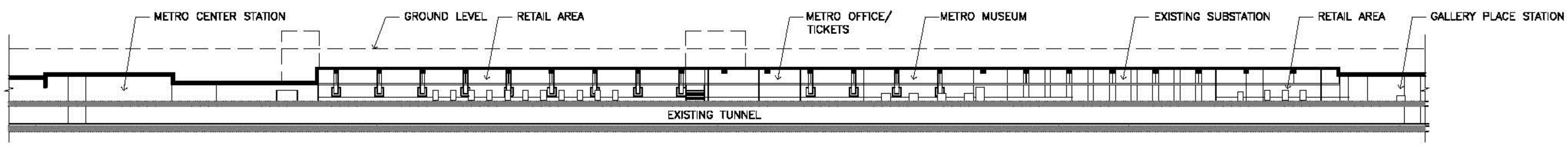
PASSAGEWAY CROSS SECTION 5/A5

SCALE: 1/16" = 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-12



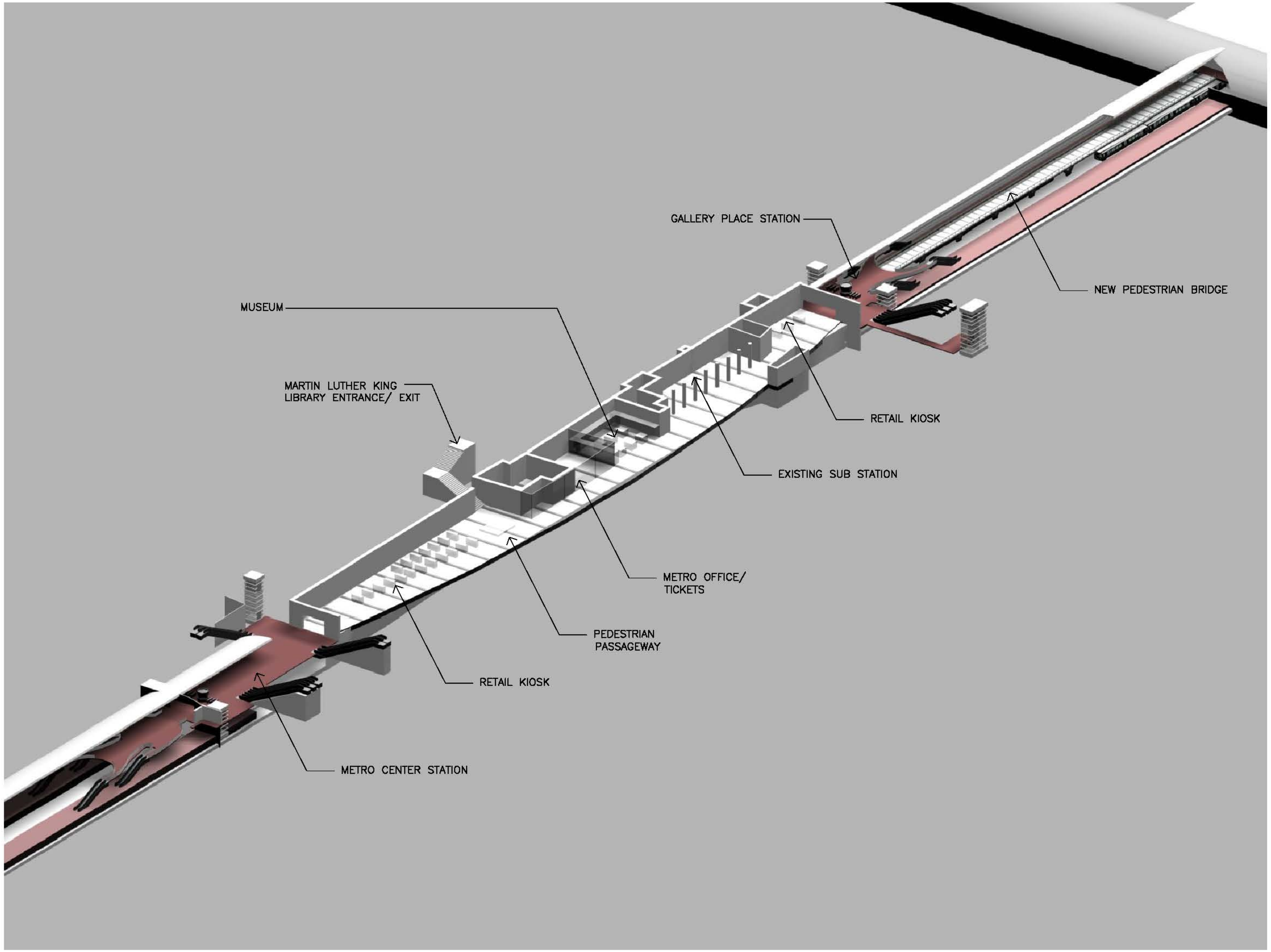
PASSAGEWAY LONGITUDINAL SECTION
SCALE: 1"= 80'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-13

20 0 20 40



PASSAGEWAY PLAN ALTERNATIVE 3 AXONOMETRIC

SCALE: NTS

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

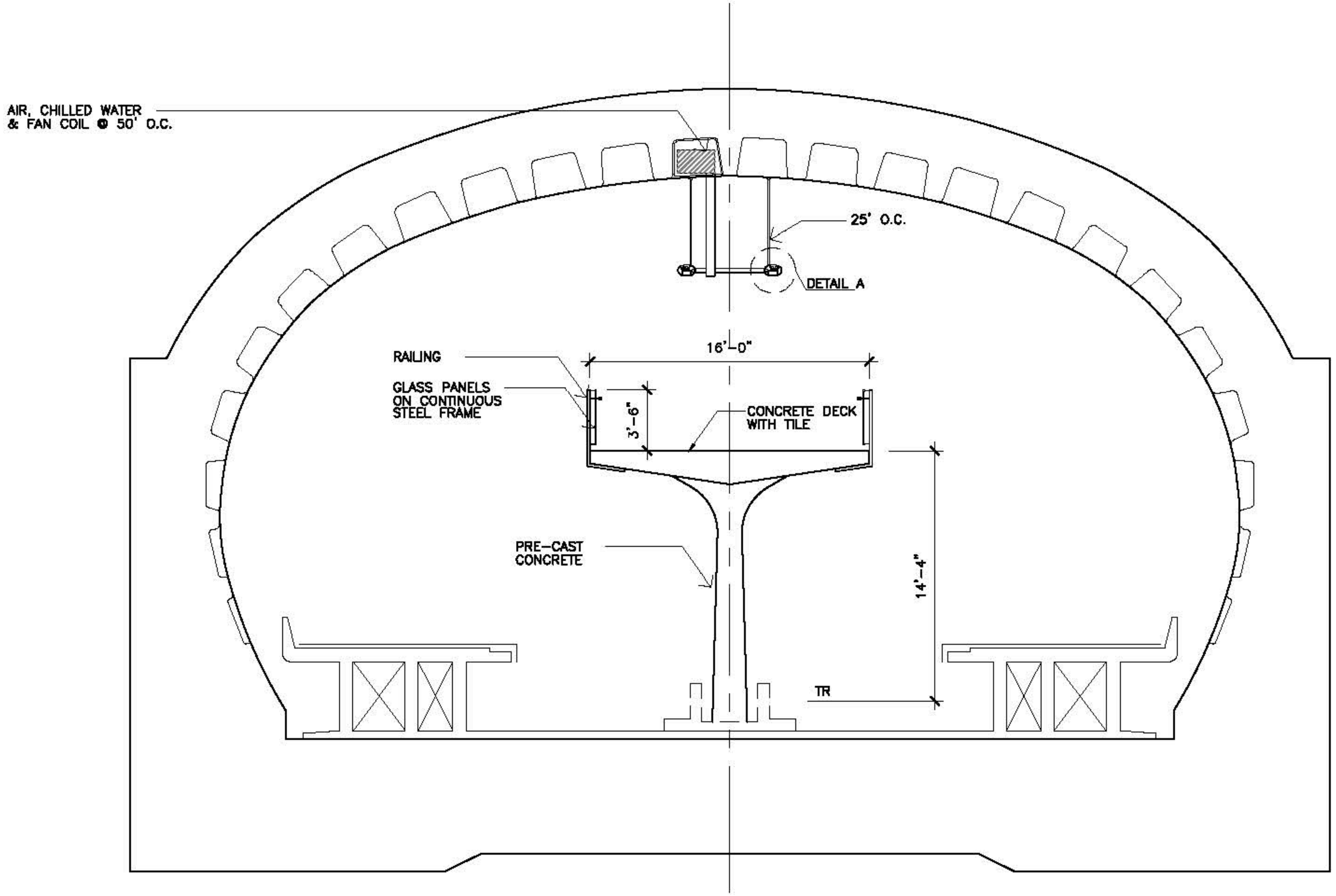
WMATA
DWG A–14

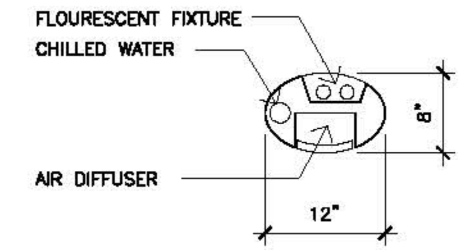
PASSAGEWAY ALTERNATIVE 3 – TUNNEL PERSPECTIVE

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A–15





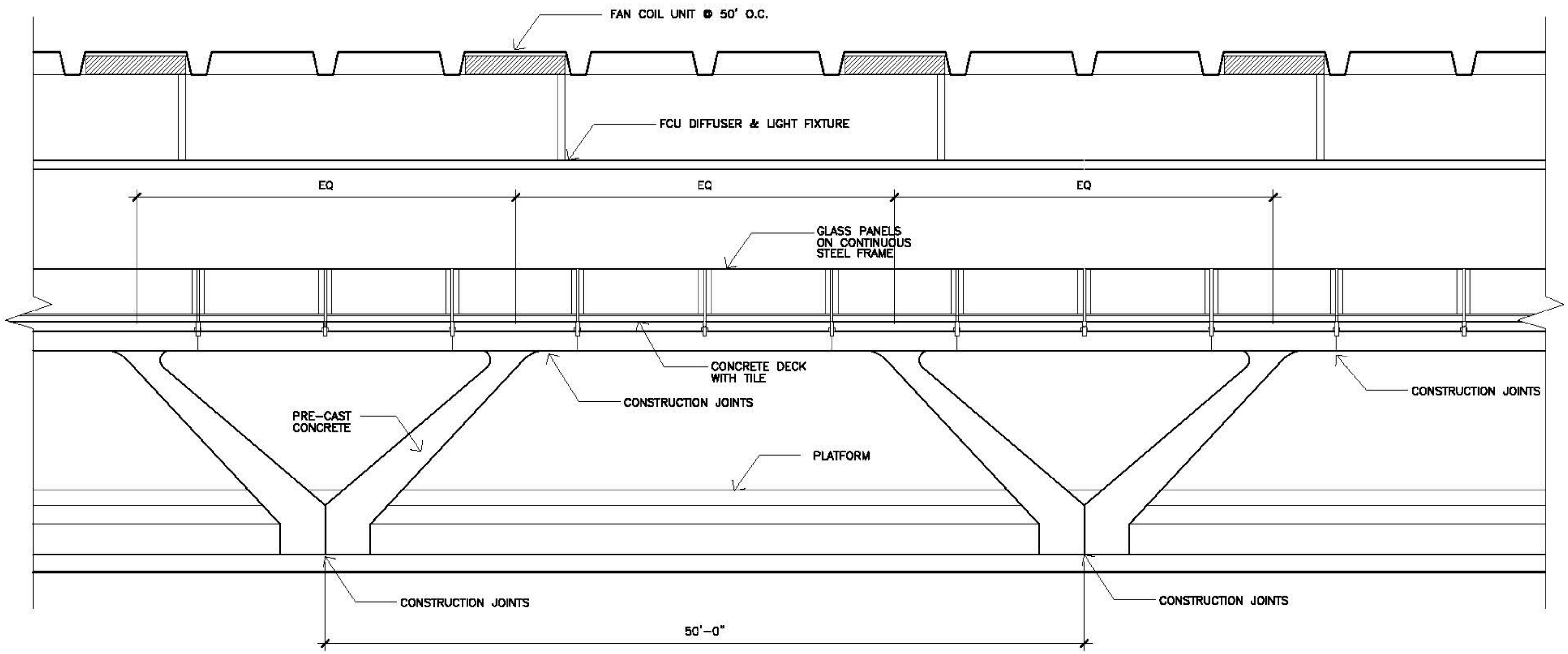
DETAIL A
NTS

PEDESTRIAN BRIDGE OPTION 1 – GALLERY PLACE CROSS SECTION
SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-16



PEDESTRIAN BRIDGE OPTION 1 – GALLERY PLACE LONGITUDINAL SECTION
SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-17

PEDESTRIAN BRIDGE OPTION 1 – GALLERY PLACE PERSPECTIVE

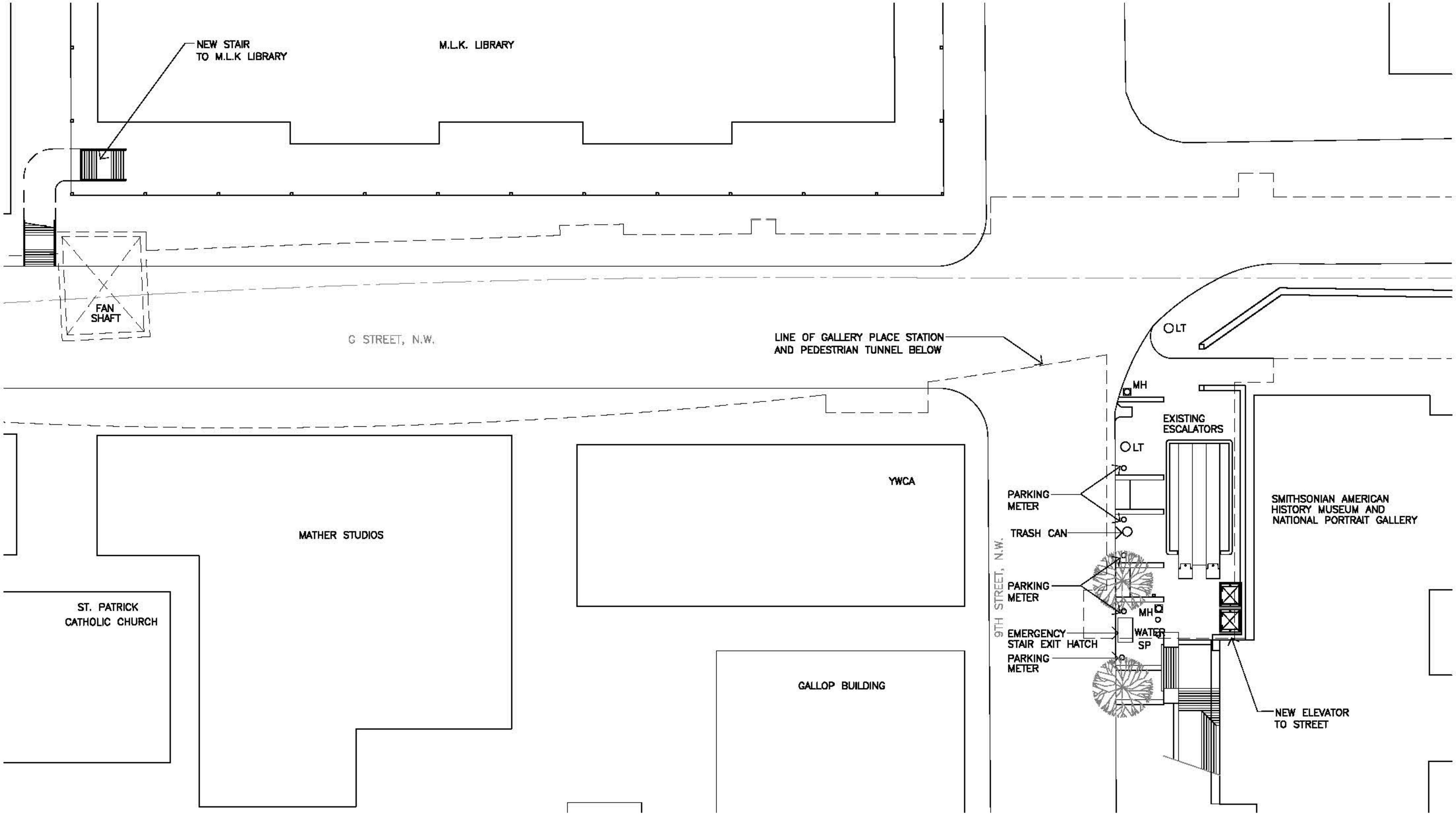
KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

metro

WMATA
DWG A–18

APPENDIX



GALLERY PLACE STATION ENTRY PLAN OPTION B

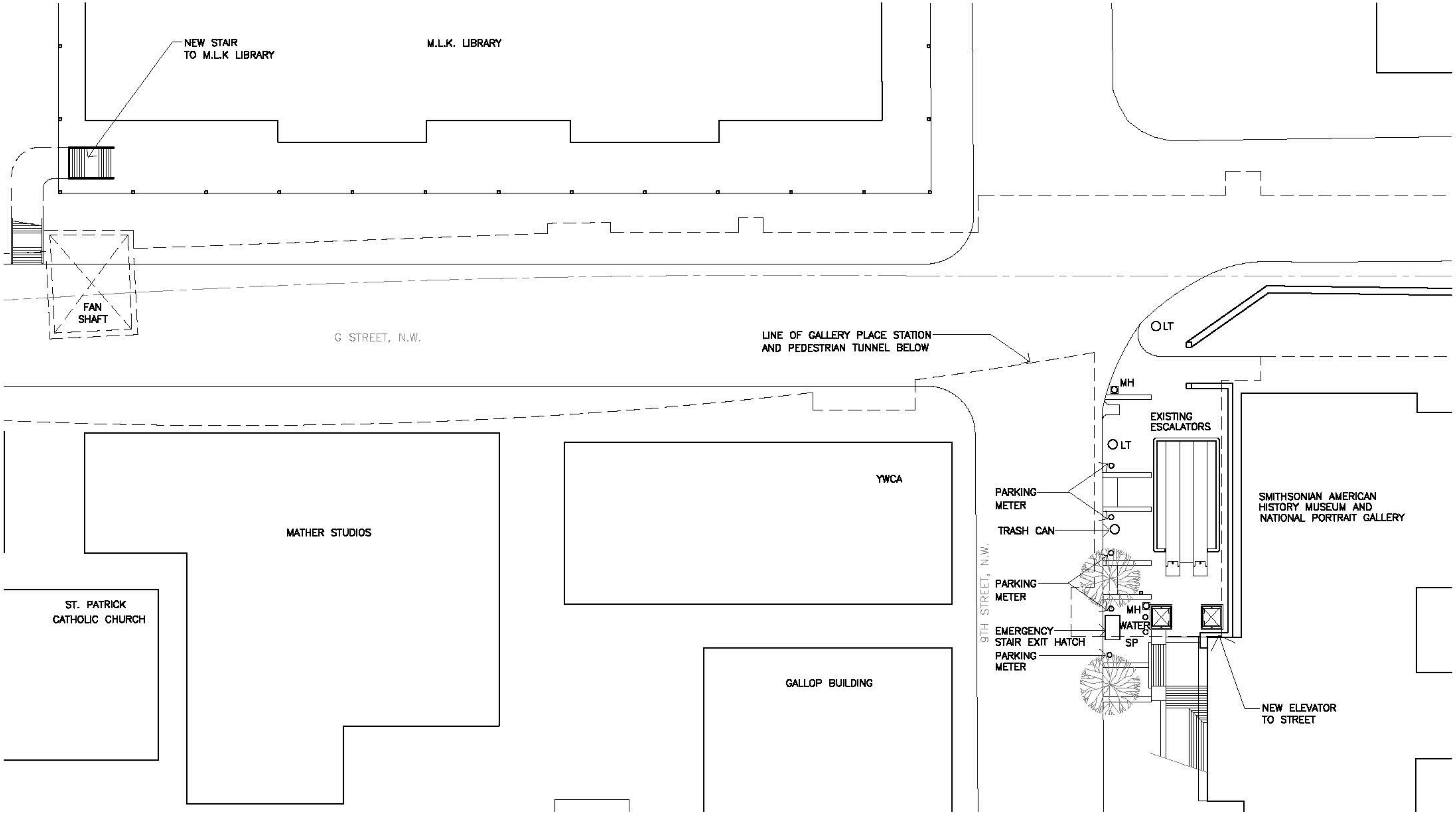
SCALE: 1"= 40'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A–19

10 0 10 20



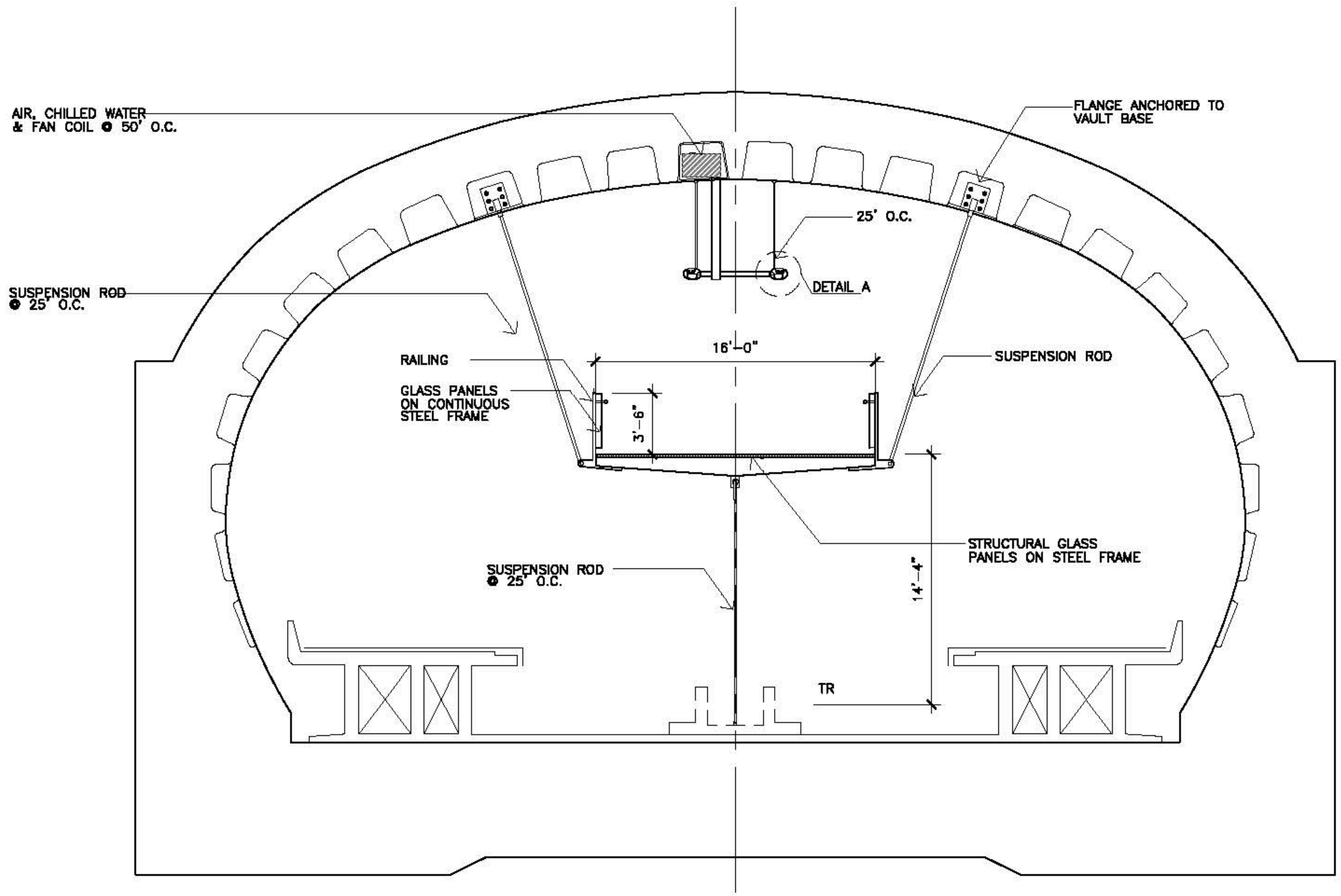
GALLERY PLACE STATION ENTRY PLAN OPTION C
SCALE: 1"= 40'-0"

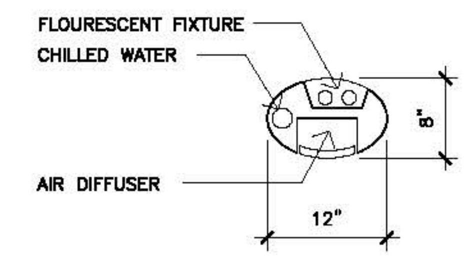
KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-20

10 0 10 20





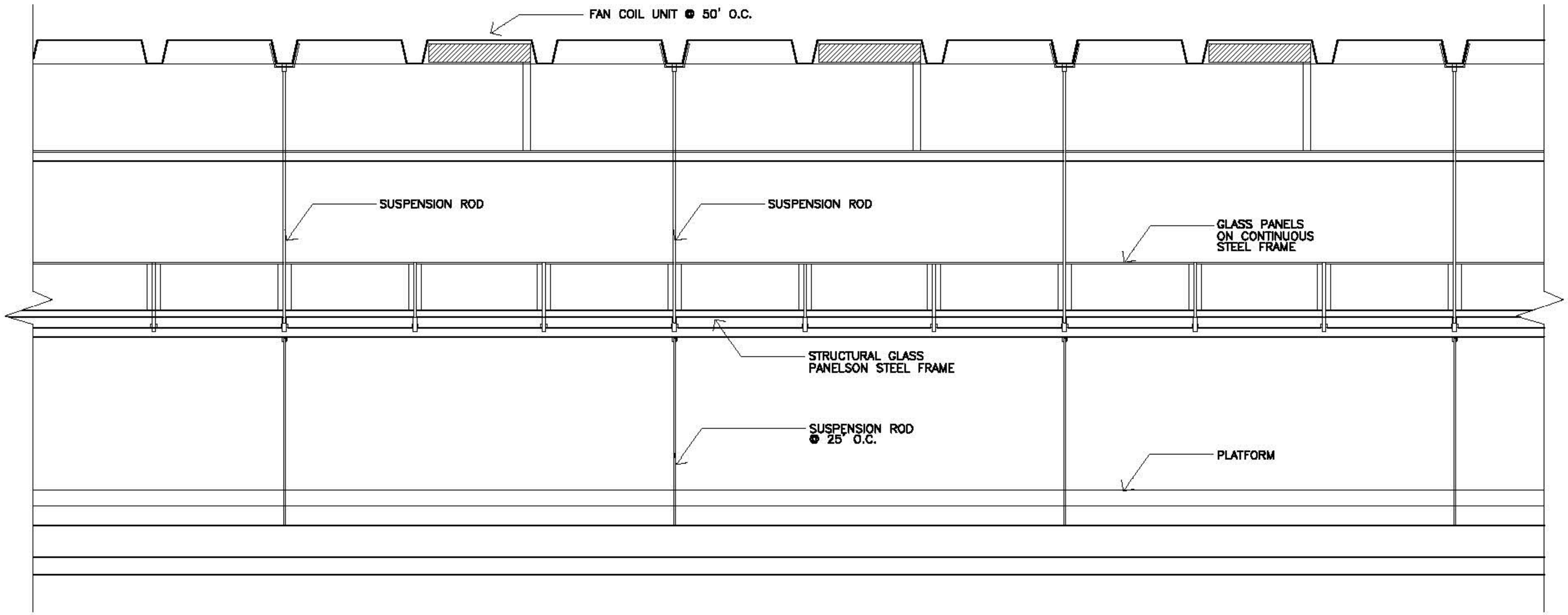
DETAIL A
NTS

PEDESTRIAN BRIDGE OPTION 2 – GALLERY PLACE CROSS SECTION
SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-21



PEDESTRIAN BRIDGE OPTION 2 – GALLERY PLACE LONGITUDINAL SECTION

SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

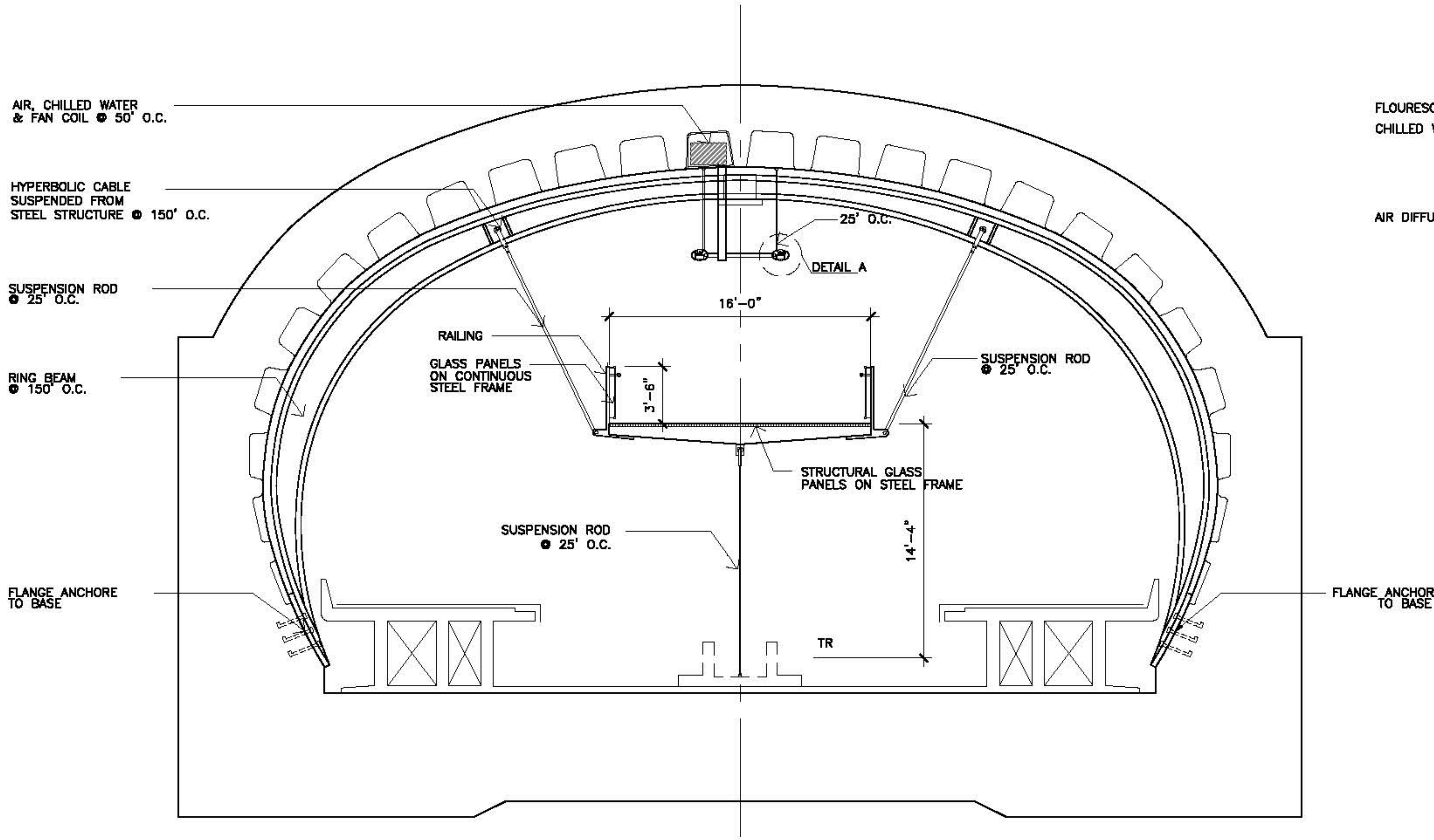
WMATA
DWG A-22

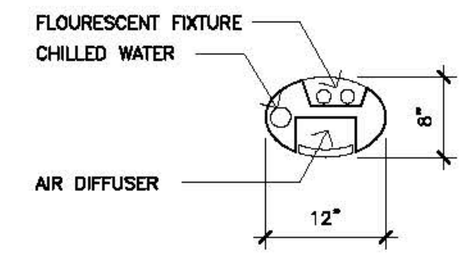
PEDESTRIAN BRIDGE OPTION 2 – GALLERY PLACE PERSPECTIVE

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A–23





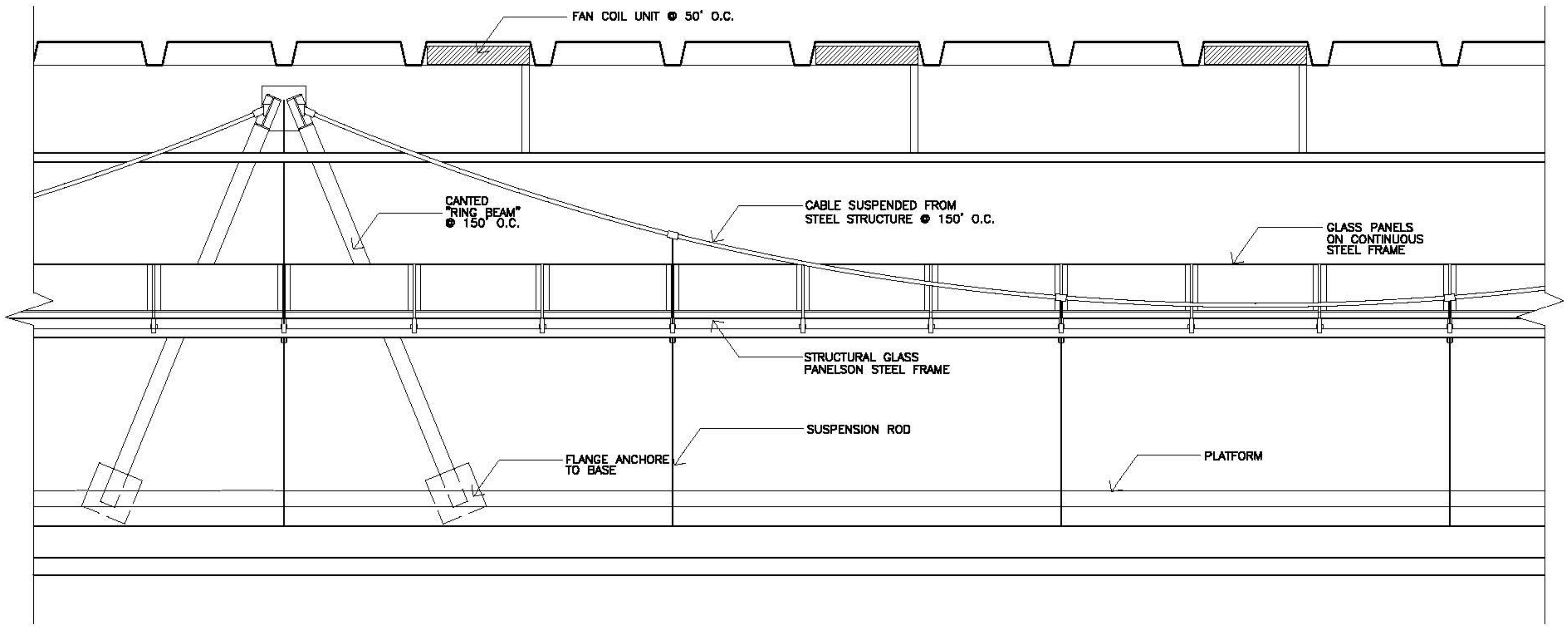
DETAIL A
NTS

PEDESTRIAN BRIDGE OPTION 3 – GALLERY PLACE CROSS SECTION
SCALE:1/8"= 1'–0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A–24



PEDESTRIAN BRIDGE OPTION 3 – GALLERY PLACE LONGITUDINAL SECTION

SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-25

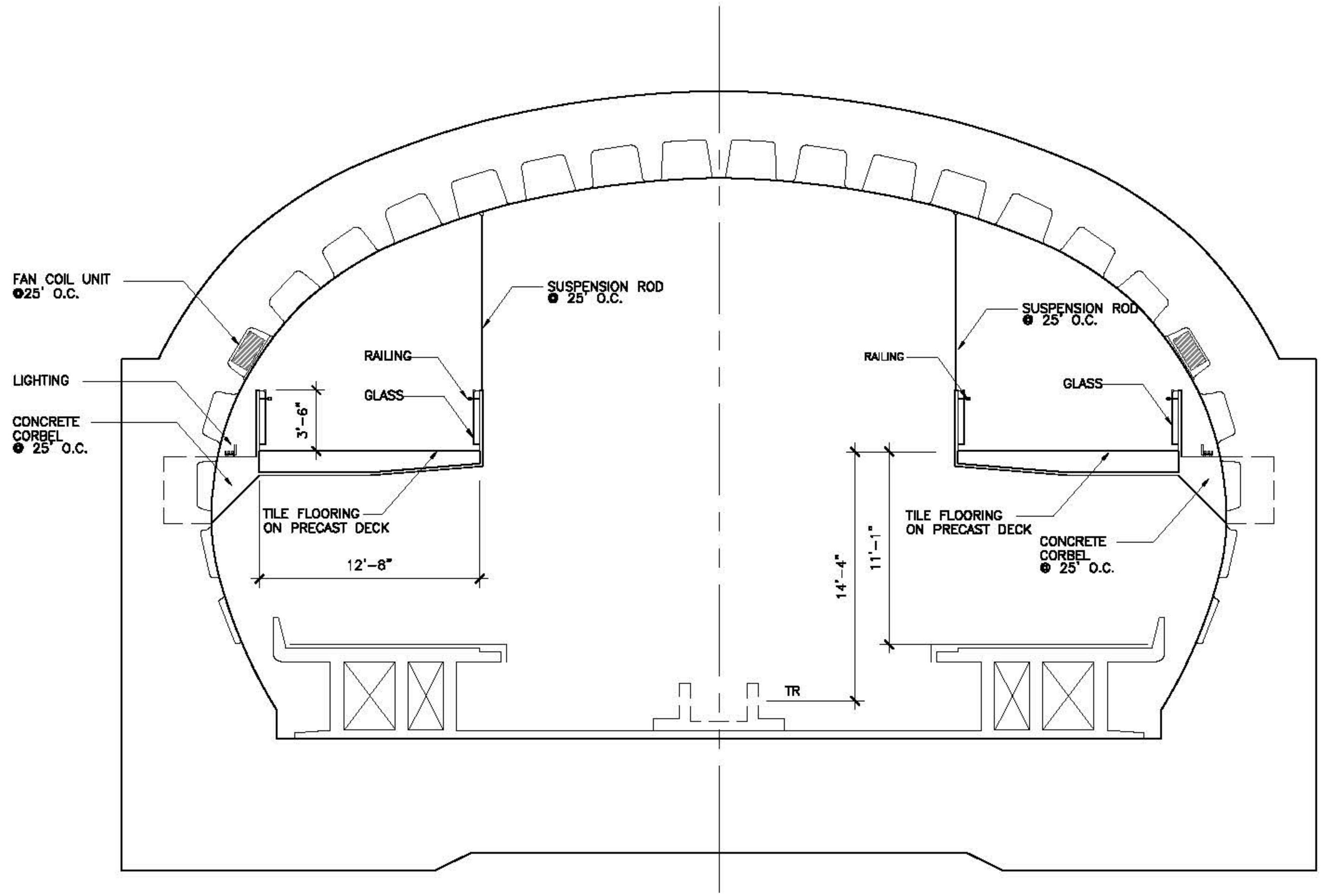
1 0 1 2 3 4 5

PEDESTRIAN BRIDGE OPTION 3 – GALLERY PLACE PERSPECTIVE

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A–26



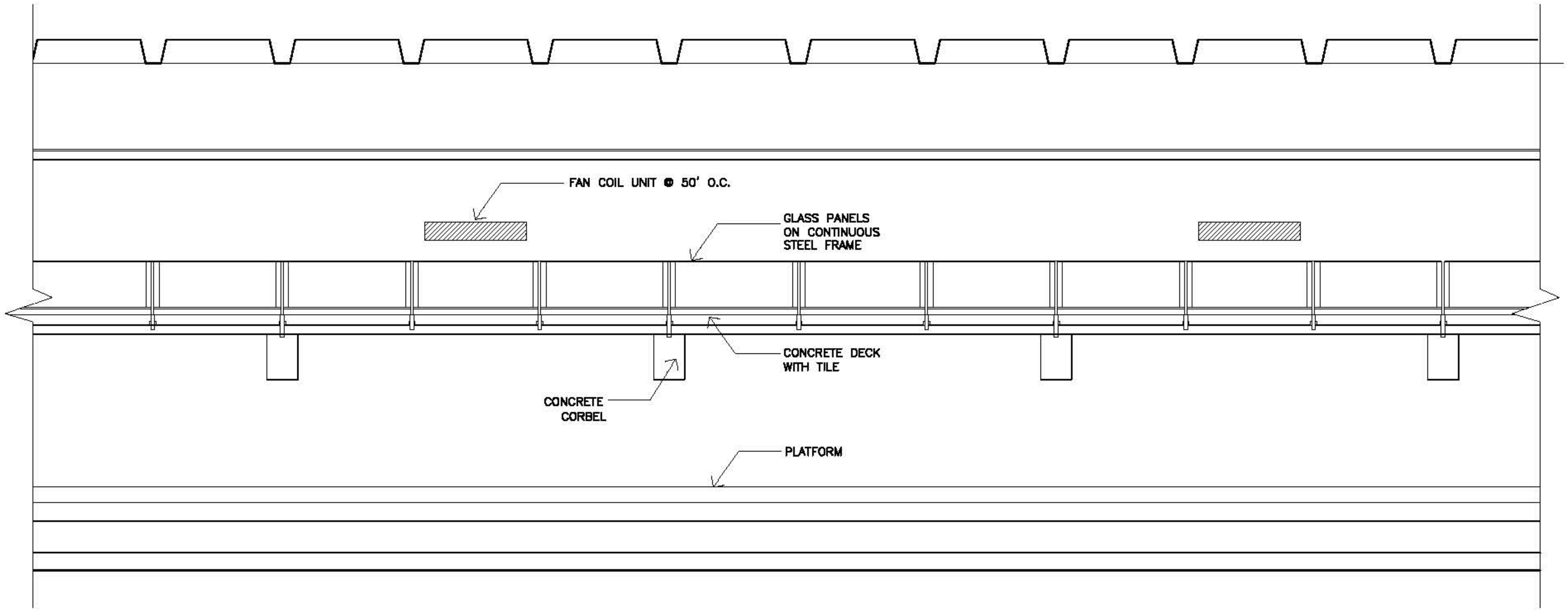
PEDESTRIAN BRIDGE OPTION 4 – GALLERY PLACE CROSS SECTION

SCALE: 1/8" = 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-27



PEDESTRIAN BRIDGE OPTION 4 – GALLERY PLACE LONGITUDINAL SECTION
SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-28

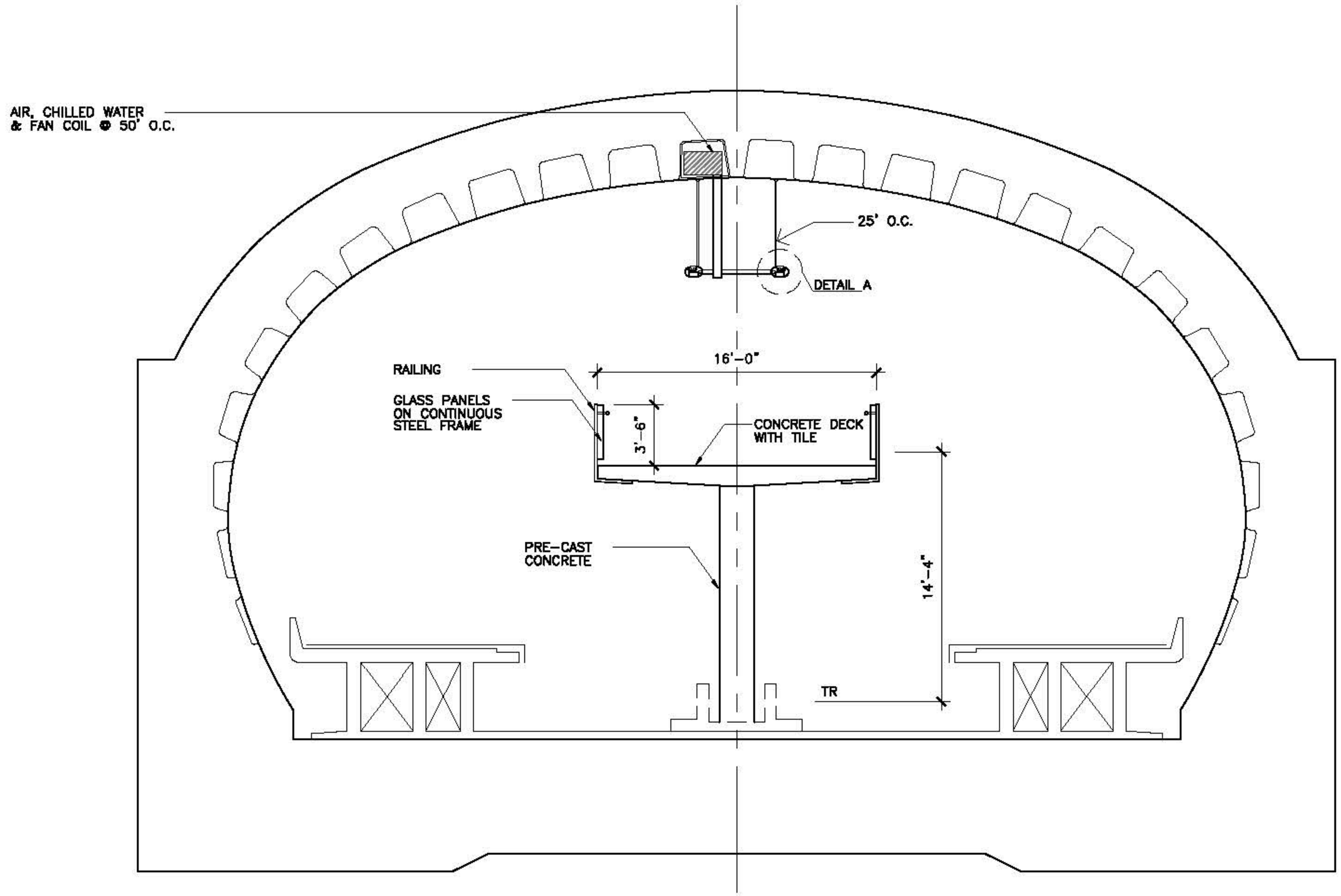
PEDESTRIAN BRIDGE OPTION 4 – GALLERY PLACE PERSPECTIVE

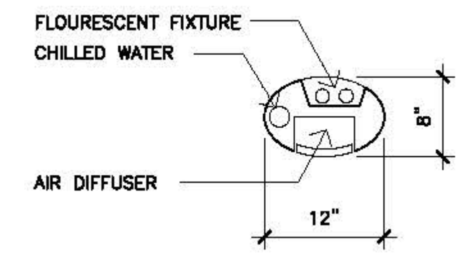
KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

metro

WMATA
DWG A–29





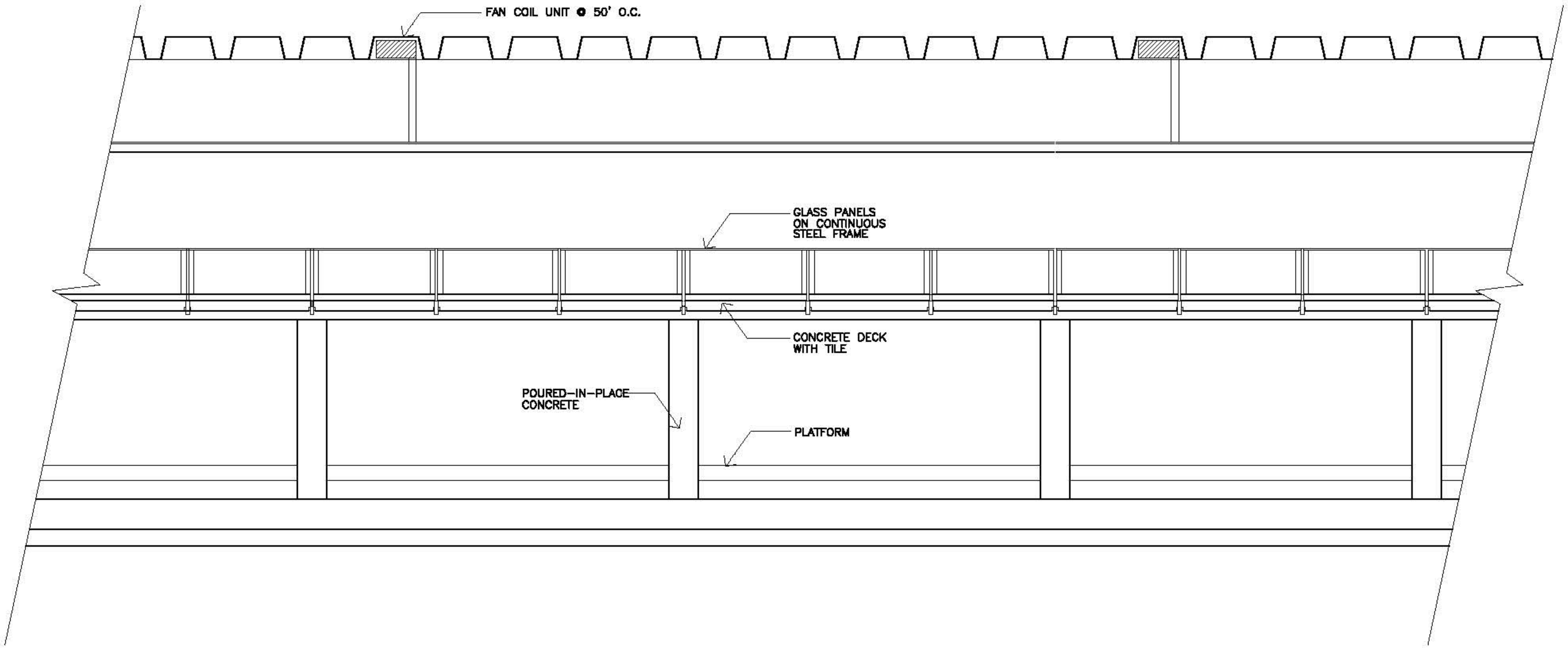
DETAIL A
NTS

PEDESTRIAN BRIDGE OPTION 5 – GALLERY PLACE CROSS SECTION
SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A-30



PEDESTRIAN BRIDGE OPTION 5 – GALLERY PLACE LONGITUDINAL SECTION

SCALE:1/8"= 1'-0"

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

metro

WMATA
DWG A-31

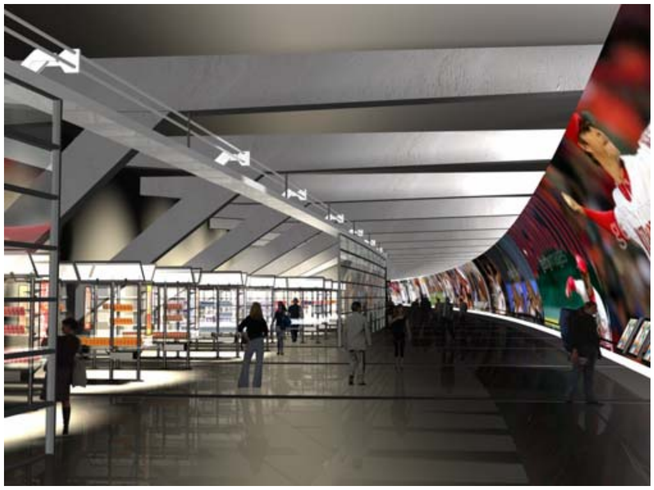
PEDESTRIAN BRIDGE OPTION 5 – GALLERY PLACE PERSPECTIVE

KGP DESIGN STUDIO
PARSONS TRANSPORTATION GROUP
DATE: 06/30/05

METRO CENTER – GALLERY PLACE
PEDESTRIAN PASSAGEWAY TUNNEL

WMATA
DWG A–32

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY



GALLERY PLACE / CHINATOWN - METRO CENTER PEDESTRIAN PASSAGEWAY TUNNEL STUDY

metro

Prepared for

THE WMATA OFFICE OF PLANNING AND PROJECT DEVELOPMENT

July 2005

Prepared by:
Parsons
KPG Design Studio
Basile Baumann Prost & Associates

TABLE OF CONTENTS

I. Introduction and Description of Project

The Pedestrian Connection between Metro Center and Gallery Place is conceived as a free area (outside the paid area of the Metro System) that will connect not only these two Red Line Stations but also the Blue, Orange, Yellow and Green Lines that pass through these two stations. This connection will allow patrons to transfer between all these lines without having to wait for a red line train. This is especially beneficial when there are events at the MCI Center where patrons are headed to or from the Orange and Blue lines by eliminating the one stop ride on the Red Line. The connection is anticipated to carry approximately 12,000 patrons a day by 2030 with increases as ridership continues to grow.

The free tunnel concept assumes an adjustment to the fare card system that allows patrons to leave through one fare gate and enter another at the other end of the passage without being charged a fee.

The pedestrian tunnel connects the east mezzanine at Metro Center to the west mezzanine at Gallery Place. There is an intermediate stair connection to G Street with an entrance located under the arcade of the Martin Luther King Library. As part of this project a mezzanine to mezzanine bridge connection is proposed in Gallery Place Station to ease congestion on the Red Line Platforms for patrons walking from Gallery Place to Metro Center and vise-versa. When an event is taking place at MCI the Red Line Platforms become very crowded. The bridge over the platforms will prevent people pushing their way from one end of the station to the other to walk toward Metro Center. This bridge will help the pedestrian tunnel passage but is not essential to the construction of the tunnel.

The passageway and bridge are designed for ADA accessibility at both stations. New street elevators are added at Metro Center from the passageway to the north side of G Street, next to the escalators at the Grand Hyatt Hotel entrance and are located in the Washington Center Building. Elevators are also added from the same passageway to both Red Line platforms. The kiosk and fare gates are moved east to place the new platform elevators in the paid area. At the Gallery Place end of the passageway there are new street elevators located next to the 9th and G Street entrance. New mezzanine to platform elevators are added to each Red Line platform just inside the existing fare gates. The passage is basically level between the two stations but due to the structural depth of the slab over the existing tunnel the floor of the passageway will have a ramp at each end to adjust the structural levels. This change in level will meet ADA accessibility requirements.

All elevators are WMATA standard elevators except the two street elevators at 9^{th} and G Street. These elevators meet ADA requirements but are minimal in size to accommodate the existing structure of the west entrance to the Smithsonian National Portrait and American Art Museums. 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.

Next to the elevator at 9^{th} and G Streets is an emergency exit stair to the surface. The stair comes out a “pedestrian hatch” located in the sidewalk along 9^{th} Street. This is a standard escape hatch used in many WMATA stations in the system.

There are station information panels 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 alternatives: 1) pedestrian tunnel, 2) pedestrian tunnel with moving walkways in both directions and 3) pedestrian tunnel with commercial space. The three tunnel alternatives 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 including locations of entrance stairs, escalators and elevators. 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 Alternatives

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

The following outlines the connections at each station, the tunnel alternatives between the connections and the bridge options between the mezzanines at Gallery Place.

A. Connections at Metro Center

The tunnel connection at Metro Center is through the existing east passageway end-wall just beyond the connection to the Grand Hyatt Hotel and former Woodies Department Store. Due to a difference between passageway and mezzanine floor elevations, a sloped floor is required to accommodate the higher level of the passageway. These floor elevations need to be determined exactly for final design. The tunnel connection has no direct impact on the station or its operation.

The elevators to the street are placed in the same lobby area being used for the escalator to the Grand Hyatt Hotel. An elevator machine room is located next to the elevators at the mezzanine level. This location will allow some flexibility for the exact location depending on the owners of the Washington Center Building. An optional location is on the south side of G Street in the Woodies Building.

Elevators from the Mezzanine to the Platform are placed in the existing service rooms. This will require some rearrangement but adequate space can be found within the existing service areas by moving the rest rooms and cleaner's room on the north east mezzanine as well as moving and replacing some mechanical equipment in all the other rooms. A new elevator machine room is located in this same area. See Mechanical Section for more details. The elevators will be entered from a new hallway at the mezzanine level and from a passageway thru the end-wall at platform level.

Modifications are needed to the fare gate arrangement to accommodate the new platform elevators. The kiosk and fare gates will be moved east out of the train room into the existing passageway. This will allow the new platform elevators to be inside the paid area and create more queuing space at the fare gates.

B. Connections at Gallery Place

The connection to the tunnel is through the west end wall of the station above the tracks and service rooms. The floor will slope to accommodate the higher level of the passageway due to the existing tunnel section below. The exact tunnel roof height must still be determined in relationship to the existing mezzanine. An extension to the mezzanine floor is required in the station room to connect to the new pedestrian passage.

The elevators to the street are placed next to the existing escalators in an area that has a WMATA easement just outside the Smithsonian American Art Museums and National Portrait Gallery on 9th Street. These elevators connect below grade to an enlarged passageway, through an existing service area, that connects to the existing west mezzanine at the same point where the escalators connect. Service rooms in this area will need to be modified to accommodate the passageway. The elevator machine room will be located on a second level. Due to the length of the connection to the elevators a new emergency stair will be placed next to the elevators that will lead up to the elevator machine room on the second level and on to the street through a standard WMATA street emergency hatch. This stair contains an area of rescue for persons not able to climb the stairs. This new passage reflects the typical metro entrance passage with curved concrete base and bronze railings.

In the existing Gallery Place Station 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 room is located at the mezzanine level, in the new pedestrian tunnel.

C. Pedestrian Tunnel Alternatives

The new pedestrian tunnel plan is not able to follow the simplest solution, which would be to remain on top of the existing train tunnel, due to the substation and the fan shaft both located over the tracks. For this reason the tunnel veers off to the south side of the tunnel. The simple tunnel, (1), and commercial tunnel, (3), follow a long shallow curve to keep sight lines as direct as possible. This shape provides visual connection from Metro Center or Gallery Place throughout the tunnel. The tunnel with moving walkway, (2), is straight due to the mechanics of the moving walkway.

All the tunnel alternatives follow the same general esthetic with concrete walls and concrete floors, a look that is different from the existing metro system. The intent is to create something that compliments Metro without copying its design. This passage is not part of the paid system and the design is meant to be different and to stimulate interest and activity. The concept is to make this feel like an interactive museum announcing events, shows and performances as well as selling tickets for many different venues around town.

The tunnel alternatives are all a simple concrete tunnel with beams and supporting concrete braces along the north wall that will reduce the overall span of the structure of the roof. These angled braces will be spaced at approximately 33’-4” feet on center. The width of the walkway in all cases is approximately 27 feet and the length of the new construction is approximately 710 feet long. At the Metro Center end of the tunnel there is an existing 191-foot passageway that will become part of this connection making the total length between stations approximately 840 feet. The ceiling is approximately 20 feet high for the length of the new tunnel section except where an air duct crosses at the Gallery Place West Vent Shaft.

Lighting in the tunnel is meant to be "theatrical" with up and down lighting along the south wall where advertising, displays, murals and interactive displays will be placed the length of the tunnel. This wall will be protected by a railing, or shelf that is approximately 36 inches above the floor, which will be part of the exhibition/display area. The north wall will vary with each of the three tunnel schemes.

Mechanical ducts are located along the north wall as well as acoustic panels and down lights used to highlight specific areas. Behind several of the ceiling acoustic panels are the AC return grills that will be used as exhaust in emergencies.

1. <u>Alternative 1 – Pedestrian Tunnel</u>
   The simple tunnel shifts to the south side of the tunnel in the same shallow curve. At the Metro Center end the tunnel becomes wider as it moves east due to the structural limitations of building on top of the existing train tunnel. The foundation of the south wall is south of the existing train tunnel, while the north wall is located on top of the existing train tunnel wall. This space allows the Metro Center Ticket Office to be moved to this location. There will also be additional space for the ac mechanical room, electric room, storm water ejector room, storage, maintenance or other uses.

   The center section of this tunnel is located completely south of the existing train tunnel from the fan shaft to the substation but uses the south train tunnel wall as a foundation for the new north passage wall above. The area on top of the train tunnel in this area will have to be excavated to support the construction of the wall on top of the south train tunnel wall. This area will remain excavated and be used by WMATA maintenance. At the substation the existing south wall will be used as the new passage north wall and will need to be "finished" with concrete or plaster depending on existing conditions. A new wall will have to be built along portions of the substation, which is open to the vent shaft at this time.

   At the east end of the tunnel the space again becomes large due to the train tunnel below. Service rooms will be located in this area including an elevator machine room, an ac mechanical room and an electrical room.

2. <u>Alternative 2 – Pedestrian Tunnel with Moving Walkway</u>

This tunnel is similar to Alternative 1 but is straight with a central jog and has a bigger section and two moving walkways, one in each direction. This tunnel needs to be in straight sections due to the moving walkway. The jog in the middle is located where the stair to G Street provides a new entrance into the tunnel. People will be able to access the moving walkways in either direction from this point. The moving walkway stops before Gallery Place Station due to the existing vent shaft. There is not enough clearance to go past this point in the tunnel.

The tunnel is 39 feet wide with 2 walkways, which are 12 feet. The walkways are both located on the south side of the tunnel. This is required to allow room for the mechanical operation that needs approximately 3 feet below the walking surface. There is no room in the middle of the tunnel due to the roof of the existing train tunnel below.

AC air ducts, lighting and general esthetics are similar to Alternative 1. Additional lighting is required in the ceiling due to the extra width of the tunnel.

3. <u>Alternative 3 – Pedestrian Tunnel with Commercial Space</u>

The Commercial tunnel is similar to the other alternatives and takes the shape of the shallow curve. At the Metro Center end of the tunnel the commercial space begins along the north wall and becomes larger as the walkway curves away from the train tunnel below. This area can be used for carts, displays or small shops (possibly set up by the museums, theaters, sporting arenas) that would be oriented toward activities in the city. Once the tunnel has become approximately 50 feet wide an area is reserved for venders with tickets for concerts, plays, sporting events, museums, and other activities in the DC area. Just past this area is the G Street Stair leading to the Martin Luther King Library arcade. Beyond the existing fan shaft the west ac mechanical and electrical rooms are located along with the Metro offices and ticket area. Adjacent to this is the Metro Museum. (A similar museum has just opened in New York for the MTA.) The museum is a space that can display the construction methods and technology of the stations, lines and systems. There are fantastic construction photos, equipment (part of the mol) and even formwork that could be displayed in this area. This space would also be used as a Metro Museum shop with maps, hats, model trains, T-shirts, etc. Next to this are the east ac mechanical and electrical rooms.

Moving toward Gallery Place, the wall of the existing substation that was open prior to the pedestrian tunnel might be glazed to allow views into the room that powers the system and give the public a view of the internal engineering of the train system. A large “train board” could be mounted that would locate the trains as they travel throughout the system with colored lights indicating each train line.

Beyond this point the tunnel becomes lower where an existing mechanical duct passes over the pedestrian tunnel. The employee restrooms and cleaner’s room are located on the north side of the passage. Once past this point the tunnel opens into a large room with retail along the north wall. This space is visible when coming from the 9th and G Streets entrance.

The commercial tunnel is similar to Alternatives 1 and 2 with concrete walls and ceiling. The north wall is generally behind an enclosure wall of glass and steel. This wall, which almost completely opens during hours of operation, separates the passage from the commercial, ticket and museum spaces.

The commercial space will have floating acoustic panels hung from the ceiling with lighting directed toward displays. Mechanical ducts will be worked into the panels and the main duct will float near the dividing wall to supply both the commercial areas and the passage.

The walls behind the commercial will have advertising and displays that will work in a system with lighting provided from the ceiling above or from back lit panels.

Commercial vending carts will be used in the space just east of Metro center. The size of the vending carts may vary, but the general space allowed is 10 feet by 16 feet. These spaces will be arranged in the commercial area and each location will be provided with power and communication connections.

D. Bridge Connections Between Mezzanines at Gallery Place Station

The pedestrian bridge between mezzanines is designed to relieve pedestrian congestion along the Red Line Platforms in Gallery Place Station specifically before and after an event at the MCI arena. This bridge will allow free flow from MCI through Gallery Place Station to Metro Center and vise versa. The new Pedestrian Tunnel can be an independent project from the Pedestrian Bridge.

Safety on the bridge is a concern for patrons in the station but the existing mezzanines in the stations present the same set of potential hazards. The railings and floor materials will all meet code and safety standards to minimize any risk to patrons.

The bridge spans approximately 450 feet between mezzanines. Due to the continuous operation of the Red Line, the bridge components will be prefab as much as possible and brought in on a work train. This includes floor panels, columns, brackets, cables, etc. The only major work in the station will be the foundations for the central column scheme and the installation of cables and supports in the other schemes.

Due to the height of the bridge in the station air conditioning is required to keep patrons cool and to circulate air in this area. All the schemes will affect the lighting of the station and additional fixtures will be required.

To keep the open feeling of the stations the railings will be glass (possibly metal mess) with a bronze railing on top to match the others in the station. This will allow maximum views and light penetration between spaces. The floor is meant to be as light as possible and allow light to penetrate. For this reason, the floor will be frosted structural glass panels set into steel frames that are prefabricated for installation.

There are four structural options each with advantages and disadvantages. They all function exactly the same way, but the structure, air conditioning and lighting vary.

1. <u>Option 1 (Recommended) – Center Bridge with Diagonal Columns</u>
   This bridge is supported from the center of the tracks with diagonal columns spaced at 50 feet on center. Foundation work for these columns will need to take place during non-revenue hours and will affect the central lighting in the station. The bridge structure is also steel and fabricated in sections that can be assembled in the station.

   All the central bridge schemes will have two oval tubes hanging over the edge of the bridge, which will contain a chilled water line for AC and a continuous air duct diffuser with continuous fluorescent lighting on the top shining up into the vault.

   Air conditioning will be furnished by installing fan coil units in coffers every 25 feet located above the bridge. The chilled water pipe will be routed through one hanging tube and air will be supplied through the other tube in an alternating pattern every 25 feet.

2. Option 2 – Center Bridge with Hangers
   To help eliminate major work in the center of the tracks, a hanging scheme was developed where a hole would be drilled though the upper vault ribs (behind the acoustical panels), that would allow cables to be hung from each side of the rib. These would connect to steel outriggers along the bridge every 25 feet. These connections correspond to the fan coil connections.

   The only work required to take place in the station prior to assembling the system would be to drill the holes through the ribs in the vault and mount a bracket between the tracks used to secure a tie rod every 25' that will stabilize the bridge. The construction method is very simple in this case with very little work required between the tracks.

3. Option 3 – Center Bridge Hung from Arched Frame
   In this case the concept is to hang the bridge from a frame placed inside the vault which is only attached to the vault at the lowest point on the outside of the platform parapet. Again a prefabricated "arched ring" would be brought into the station and assembled along with the cables, hangers and bridge structure during non-revenue hours.

   Lighting and air-conditioning are provided by the same method as in Alternative 1.

4. Option 4 – Side Bridges with Corbels and Hangers

   To eliminate all conflict with the train operation and lower the impact on the station lighting the side bridges were studied. In this case the bridges are supported from a corbel attached to the vault along the side every 25 feet, (similar to the central mezzanine at Farragut North). To help stabilize the bridges hangers are installed every 25 feet at the outer edge over the platform. At the east mezzanine the bridges come directly off the mezzanine while on the west mezzanine the bridge begins just outside the escalators and curves toward the wall to align with the platform below.

   In this case the air-conditioning fan coil units are set in a coffer on the side of the bridge and the chilled water lines at the edge of the bridge structure near the vault. The fan coil units would blow directly onto the walkway without ductwork. Lighting would be added to the vault side of the bridge on an outrigger to allow up-light on the vault similar to the parapet lighting along the parapet over the Green and Yellow Lines at the lower east end of the station.

5. <u>Option 5 – Center Bridge with Columns</u>

   As a base line solution that would match the construction of the existing mezzanines, the simple center column bridge was studied. In this case there are concrete columns every 25 feet with a concrete bridge on top. To soften the impact a glass railing is used which will allow light and views to continue through to the vault. The air-conditioning and lighting will be the same as in Option 1.

   The amount of work between the tracks is greatest in this scheme due to the number of columns required to support the structure. This work will have to be preformed during non revenue hours, which will limit the available time to work.

III. Codes and Data

The Codes that were analyzed included NFPA 130, (Appendix D) and the District of Columbia International Building Code, 2000 edition. 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 additional stair entrance along G Street improves egress from both stations and conforms to NFPA regulations. The emergency stair added also improves egress and provides an exit from an otherwise “dead end corridor”. This stair is 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

Due to the configuration of the existing sub-station and fan vent shaft and the buildings along G Street the decision was easily made to move the pedestrian tunnel to the south side of the existing train tunnel. A discussion took place with all the engineering consultants considering alternatives that would move these service areas but cost and continued train operation made any alteration very impractical. The decision was made that tunnel would follow along the existing train tunnel as much as possible and shift to the south to avoid the service rooms. The end walls of the east Metro Center Passageway and the west Gallery Place Mezzanine made the shortest connections for the tunnel and the easiest method for construction.

The alternative with the moving walkway required mechanical space below the floor so this scheme starts south with the existing tunnel to allow room for the mechanical equipment. There were no other choices.

Several tunnel options were studied with jogs, angles and curves but the gradual curve was selected for the best site lines between the stations and the simple esthetics of the tunnel.

The “free tunnel” verses the “paid tunnel” was discussed. Due to the existing entrances to the Hyatt Hotel, Woodies and other proposed entrances and knockout panels the decision was to make the tunnel a “free tunnel”, outside the Metro Paid Area, to make allowances for these access points. If the tunnel had been a “paid tunnel” each of these entrances would require fare gates and possibly a kiosk, which made that solution impractical.

The general tunnel shape and “free tunnel” decision was agreed to by representatives of WMATA, the consultants, NCPC, Office of Planning, DDOT and the Commission of Fine Arts.

B. Entrances to the tunnel

Many entrance options were examined to determine exactly where new escalator, stair and elevator entrances would work best. All options were placed in the 1st discussions which took place with representatives of WMATA, the consultants, NCPC, Office of Planning, DDOT and the Commission of Fine Arts and SHPO.

The stair/escalator options included new entrances at the northeast corner of 10th and G Streets, entrances on the north and south side of the center of the 900 block of G Street, the northeast corner of 9th and G Streets. All these entrances had options of stairs and escalators.

The decision was made to only create one new entrance from the tunnel to the street. This entrance would be located central to the tunnel and come to the street level under the arcade of the Martin Luther King Library at the west end of the building. This was the least intrusive entrance and would not require a canopy. The decision was made to use stairs only to eliminate the escalator problem and to create maximum exiting capacity under the NFPA 130 guidelines.

Knock out panels were discussed and located at both the north and south side of 10th Street. The north knockout panel would serve a connection to future development at the old Convention Center Site and the south knockout panel would serve a connection to development along F Street. Another panel is located between the YWCA Building and the Mather Condo Building where a current air-conditioning unit is located for the YMCA. This might lead to new development along F Street.

Elevators placed near existing station entrances were considered necessary design features. Elevators coinciding with main station entrances enable passengers who require elevator access to readily find and use the elevators. At the Metro Center end of the tunnel it was agreed that elevators located in the Washington Center Building were the most desirable and least intrusive in the surrounding context. If this location were not accepted, the Woodies building across the street would be examined.

At the Gallery Place end of the tunnel every corner was discussed for the elevator entrance. The public sidewalk areas on all four corners were considered too narrow to house the elevator head-house. The YWCA corner was the most desirable from an aesthetic and tunnel convenience viewpoint, but the building configuration with low floors and the lobby on the corner did not allow easy installation of the elevators. Elevators were discussed at the Martin Luther King Library but CFA, NCPC and SHPO did not want elevators in front of this historic building. The PEPCO building plaza was discussed but the newly designed plaza and restaurant would have been greatly altered to allow the elevators to be placed in this location. Also a long curved tunnel would have been required underground to access this location. . A mid tunnel solution was considered with the elevators located just west of the Martin Luther King Library in the same passageway as the new stair entrance. The problem with the elevators located in this position was the distance from WMATA personnel if someone was caught in the elevator and for general safety of the patrons. The final solution was elevators located adjacent to the existing escalator at the Smithsonian site.

All these options are shown on drawing A-2 and in the appendix drawings. These decisions were made with the help of all the advisors and the staff of the Smithsonian who preferred the elevators as close to their building as possible to help their goal of increasing patrons to the museums.

V. STRUCTURAL FEATURES

A. Modification of Metro Center Station East Entrance and Ancillary Area

Minimal modification will be required within the platform area inside the Metro Center Station for the three alternatives. The existing kiosk and fare gates at the mezzanine level at the east end of the station will be relocated eastward to the existing passageway. The removal of the existing kiosk and fare gates will have minimal impact on the 1'-8½" deep reinforced concrete mezzanine slab. The proposed kiosk and fare gates will be constructed on the 1'-10½" concrete slab at the existing east passageway.

Two proposed elevators from the platform level to the mezzanine level would be constructed on each side of the existing east service room near the proposed fare gate area. Openings will be provided at the 1'-6" mezzanine slab for the elevators. Edge beams will be constructed around the opening for the elevators. Openings at the station end wall will be constructed to provide access from the station platform to the proposed elevators. The construction will be performed inside the service rooms, the work area will be enclosed to control dust from the construction activities.

Two elevators from the mezzanine level to the Washington Center Building lobby will be furnished at the northeast corner of the ancillary area near the existing escalator. A machine room may be constructed at the mezzanine level. Openings will be constructed at the existing building for the elevators and edge beams will be constructed around all openings. The existing building will be monitored for any movement for the entire duration of construction.

B. Modification of Gallery Place - Chinatown Station West Entrance and West Mezzanine

Proposed elevators will be provided at both platforms of the station to mezzanine level at approximately 60 feet from 2'-0" thick west end wall of the station. The openings for the elevator doors will be located between the vault ribs to minimize the impact to the existing concrete vault. 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 shaft will provide additional structural strength for the existing vault with elevator openings. The construction of the elevator shafts will be performed from the street level at the intersection of G Street and 9th Street. Temporary support of the excavation such as soldier piles and lagging will be used. Based on existing available soil boring information, the water table appears to be around 15 feet below ground, dewatering may be required during construction. 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 southwest corner of the station adjacent to the Smithsonian National Portrait Gallery and American Art Museums near the existing escalator. The area adjacent to the existing service rooms will be modified at the mezzanine level to provide access to the elevators. A proposed passageway will be built leading to the proposed elevator lobby at the mezzanine level. An emergency stair will be built adjacent to the proposed elevators at 9^{th} Street sidewalk. Additional beams and walls will be constructed to support the shafts. It appears that the room extension and the elevator shaft foundation will be spread footing. The construction will be performed at the 9^{th} Street sidewalk on the street level. The water table appears to be around 18 feet below ground, dewatering may be required. Portion of the Portrait Gallery Museum below grade may be exposed during the construction of elevator shaft. The adjacent museum building will be braced and monitored during construction to ensure the safety of the structure. Portion of the 9^{th} Street sidewalk will be closed to pedestrian traffic for the duration of the construction.

C. Pedestrian Bridge Between Mezzanines – Gallery Place-Chinatown Station

A proposed pedestrian passageway will be constructed connecting the mezzanines at both sides of the station. The following options of passageway supporting schemes have been considered:

1. Option 1 - Center Bridge with Diagonal Columns

   The 16’ wide center bridge with frosted structural glass floor would be supported on steel beams with diagonal columns spaced at 50 feet along the center of the vault. The columns, either structural steel with precast concrete cladding or precast concrete, will be constructed along the existing lighting trough between the third rails along the station. The construction will be performed during non-revenue hours and portion of the existing central lighting inside the trough will be removed. The proposed for the support of ventilation and lighting system above the bridge will be hung from the ribs of the vault near the crown of the vault.

2. Option 2 - Center Bridge with Hangers

   The 16’ wide center bridge with frosted structural glass floor supported on steel beams will be hung from the 2’-0” wide upper vault concrete ribs.

Holes will be drilled through the ribs between the #11 reinforcing bars to connect the hangers. The hangers will support the steel beam at approximately 25 feet along the vault.

3. Option 3 - Center Bridge Hung from Arched Frame

   Structural steel arch rings connecting to the vault wall behind the existing platform parapet will be constructed along the vault. The bridge will be hung similar to Option 2 but from the arch rings instead of the vault ribs.

4. Option 4 - Side Bridge with Corbels and Hangers

   Two 13’ wide side bridges will be constructed above the existing platforms. The bridges will be supported on corbels spaced at 25’ on one side of the bridge and with hangers hung from the vault ribs on the other.

The four options were investigated and it was concluded that option 1, consisting of a center bridge with diagonal columns, is recommended.

D. Pedestrian Passageway between Stations

Three (3) different passageway alternatives are presented in this report. Alternative 1 has a pedestrian walkway connecting the stations. Alternative 2 has a passageway and a moving walkway at the south side of the passageway. Alternative 3 has passageway with commercial space option at the north sides of the walkway.

The passageway for all three alternatives will be connecting the east entrance and ancillary area of the Metro Center Station to the west entrance of the Gallery Place Station.

The proposed pedestrian passageway in general will be constructed above the existing Red Line concrete box structure along G Street, cut-and-cover type of construction method is recommended. Temporary support of the excavation such as soldier piles and lagging or slurry walls may be used. G Street will be closed to traffic for the duration of the passageway construction. Concrete or timber decking can be utilized at the G Street and 9th Street intersection to minimize the impact to the 9th Street traffic during construction of the passageway. Pedestrian traffic on the sidewalks along the G Street will be maintained during construction.

Based on existing available soil boring information, the water table varies from fifteen to thirty feet below grade. Dewatering may be required during construction. Underpinning of adjacent buildings may be required due to the close proximity of construction to the adjacent buildings. Possible displacement of the adjacent buildings should be monitored for the entire duration of construction.

The soil around the invert slab of the passageway is mainly silty clay with blow count of less than ten blows per foot. It is recommended that the south side of proposed passageway to be supported by 10 to 15 feet of drill shafts.

Alternative 1 – Pedestrian Tunnel

The north wall of the proposed structure will rest on exterior north wall of the existing structure while the south wall of the structure will be a curved wall as shown in Figure A-02. The horizontal clearance of the proposed structure is approximately 33 feet at the east end wall of the Metro Center station. The 2'-3" minimum thick existing reinforced concrete top slab will serve as the bottom slab of the proposed passageway. The 2'-0" thick existing exterior concrete walls will be extended to become the proposed exterior wall with pilaster of the passageway. A concrete top slab with beams and diagonal bracings at 25 feet spacing designed to support soil load and live load will be constructed connecting the two proposed exterior walls.

The proposed tunnel will become wider as it is further east from the Metro Center Station. The southern portion of the proposed passageway will overhang from the existing vertical wall below. As the width of the tunnel becomes larger, drilled shafts will be constructed to support portion of proposed box structure. Knockout panel will be constructed the proposed walls below 10th Street for potential future connection.

The existing fan shaft will remain in place. The north wall of the proposed tunnel will connect to the existing fan shaft walls. The proposed south tunnel curved wall will be supported on drill shafts. An egress stair will be constructed at the north tunnel wall west of the fan shaft, the construction will be performed on the G Street sidewalk.

The proposed passageway structure will continue to be above the existing structure. The north wall of proposed tunnel will be on the top of the existing north wall. The south wall of the tunnel will be supported on drill shafts.

The northern part of the substation will remain in place and portion of the existing south wall at the substation will be demolished to provide room for the passageway. The interim columns in the substation will remain in place. The passageway will be extended to the Gallery Place Station as shown on Figure A-02.

Alternative 2 – Pedestrian Tunnel with Moving Walkway

The primary difference between Alternative 1 and Alternative 2 is the moving walkway at the south side of the passageway for Alternative 2. The south wall of the proposed tunnel will be straight to accommodate the moving walkways.

The north wall of the proposed tunnel will rest on exterior north wall of the existing structure while the south wall of the proposed structure will be a straight wall at the south side of the existing structure as shown in Figure A-03. The southern portion of the bottom slab will be approximately three (3) feet lower than the northern portion of the slab to support the moving walkway mechanical operation.

The proposed tunnel will become wider at the existing fan shaft. The proposed passageway will be on the south side of the existing structure. The north portion of the passageway will support regular pedestrian live load while the south side of the tunnel will support the moving walkway and pedestrian. The east end of the tunnel will be wider in this alternative and modification will be made at the existing service room at the west entrance of the Gallery Place Station. The south wall of the tunnel will mainly be supported on drill shafts.

Alternative 3 – Pedestrian Tunnel with Commercial Space

The proposed structure configuration for Alternative 3 as shown in Figure A-04 is similar to the structure for Alternative 1. The north wall of the proposed tunnel will connect to the north wall of the existing structure. Top slab will be constructed on reinforced concrete beam to form a tee-beam to reduce the slab thickness. The proposed south wall will be curved and will be supported on drilled shafts.

VI. UTILITIES

There are a number of public/private utilities in the study area that must be dealt with during the construction of any pedestrian passageway tunnel alternative. Based on the available utility record, these utilities are shown on the Utility Plans. The smaller lines can be temporarily relocated to the sides of the tunnel during construction:

A. Gas

There are two 12” diameter gas lines that run along 9th Street, both within 8’ of the west curb line. Another 8” diameter gas line runs along 9th Street approximately 24’ from the east curb and turns west, 31.5’ north of the south curb line on G Street and continues to the west of 11th Street. Running parallel to this gas line is a 8” diameter gas line that tees off of one of the 9th street gas lines and runs west, 2’ north of the south curb line, then turns southwest and runs under the south sidewalk area thru the 10th Street intersection before turning back under the roadway close to the south curb line until it turns south at the 11th Street intersection. A 6" diameter gas line runs along 10th Street near the centerline and becomes 4" thru the G Street intersection. A 3rd gas line runs along G Street 5' south of the north curb line and turns northward at the 11th Street intersection. There are additional lines running under the roadway along 11th Street but should be clear of any future construction. All other lines mentioned will need to be supported or relocated during construction depending on the final design. There are a number of abandoned (or remnants of) gas lines, primarily along G Street between 9th and 10th Streets that may be removed.

B. Electric

There are 2 underground Pepco power distribution lines that run under G Street between 9th and 10th Street approximately 15' apart and feed the street light system. A single line runs between 10th and 11th Street and beyond. Just prior to 11th Street it splits off 2 additional lines that continue north and south under 11th Street. The lines below G Street and additional lines running under 9th and 10th Street will be directly impacted by the tunnel construction and will have to be supported or relocated during construction depending on the final design. The Pepco power distribution lines that run along 11th may be affected by the tunnel construction depending on final design details. There are additional electric lines under the sidewalk areas north of G Street that may remain in place. Overhead electric lines exist but only between 2 poles at the northwest corner of 11th and G Streets.

C. Sanitary Sewer/Stormdrain

There is a 54" diameter stormdrain pipe that runs under 9th Street approximately 24' west of the east curb line and becomes 48" above G Street and 5' x 4'9" below G Street. From this main, an 18" diameter storm drain line tees off and runs under G Street, approximately 24' north of the south curb line, ending at a manhole about halfway to 10th Street. A 12" diameter sanitary sewer line crosses diagonally across the roadway in the same area and becomes 24" as it turns and runs parallel under the curb-line and sidewalk area then continues down 9th Street. A 2' x 3' box stormdrain pipe runs under 10th Street approximately 18' west of the east curb line. These lines will not clear the proposed tunnel and will have to be relocated to the side of any future pedestrian tunnel alternative. A 36" diameter storm drain line runs under 11th Street approximately 12' west of the east curb line and becomes 18" north of G Street. This line may not be affected during construction.

D. Water

There is a 16" diameter water main that runs along 9th and a 12" diameter water main that runs along 10th and 11th Streets. The 11th Street line may be unaffected by the construction because it is above the existing Metro Center Station area but the 9th and 10th Street lines will cross the proposed pedestrian tunnel and will have to be supported during construction if they clear the tunnel limits. Along G Street, there is a 12"diameter water main that tees off of the 9th Street line and runs under the south sidewalk, then turns northwest and continues parallel just inside of the south curb-line past 11th Street. An 8" diameter water main tees off of the 10th Street line and runs just inside of the north curb line. It crosses 11th Street and continues running under G Street. These lines will need to be supported or relocated during construction depending on the final design. There are a number of abandoned (or remnants of) water lines, primarily along G Street that may be removed.

E. Other Utilities

There may be some fiber optic communication, underground cable TV and telephone lines that will require relocation during the future pedestrian tunnel construction. The Fiber optic lines run primarily along 9th Street.

VII. MECHANICAL FEATURES

A. General Mechanical Issues Common to All Alternatives

1. Passageway Air Conditioning

All three passageway alternatives will be air conditioned. Heating is typically not provided for WMATA station public areas and will be used only for Passageway Alternative three where the potential exists for people to spent significant amounts of time in the passageway. However, sufficient electrical capacity will be provided to allow for future addition of heating for the non commercial alternatives in the event that experience shows that it is required. Options for a suitable air conditioning system consist of the following:

- An air conditioning system utilizing the existing station chilled water systems. The components involved would consist of the additional chilled water piping, air handling units and/or fan coil units. Unless the capacity of the chiller plants serving Gallery Place and Metro Center station 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 station chilled water capacity would require an upgrade to the Jackson Graham Building (JGB) chiller plant that serves Gallery Place Station and the chiller plant that serves Metro Center station. In addition to Gallery Place, the JGB chiller plant also serves Judiciary Square and Archives stations. The Metro Center chiller plant serves Federal Triangle and Smithsonian 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 water 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.

2. Gallery Place Mezzanine Bridge Air Conditioning

All four bridge alternatives will be air conditioned. Heating is typically not provided for WMATA station public areas. Options for a suitable air conditioning system consist of the following:

- An air conditioning system utilizing the existing Gallery Place station chilled water system. The components involved would consist of additional chilled water piping and fan coil units. This air conditioning option would also require an increase in Jackson Graham Building chiller plant capacity to prevent a reduction to the cooling provided in the remainder of Gallery Place station.
- 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 both the passageway and the bridge. The components involved would consist of the chiller, associated chilled water piping, chilled water pump and fan coil units spaced along the bridge.

Of the passageway and mezzanine bridge air conditioning options listed above, the air cooled chiller air conditioning system option is preferred and is included in the cost estimate. This system would utilize an air cooled chiller located either on the roof of an adjacent building or possibly in the alleyway adjacent to the YWCA building. This chiller would be sized for the total cooling load associated with the selected passageway and mezzanine bridge alternatives. The passageway would be served by two air conditioning units equipped with chilled water coils, while the mezzanine bride would be cooled with fan coil units. This option was selected for the following reasons:

- The split system and the self contained air conditioning system options are not suitable for the mezzanine bridges. Provisions for directing self contained unit condenser discharge air to a point outside of the conditioned space are not practical. Split system air conditioning systems units require a mechanical space to accommodate the evaporator unit while space outside of the station is required for placement of the air cooled condensers.
- Rebalancing the existing chilled water systems will result in a reduction in the chilled water available for cooling other areas in Metro Center and Gallery Place stations, and will also reduce the cooling provided to the to the other station served by Metro Center and the JGB chilled water plants. A capacity increase at both the JGB and Metro Center would be necessary to accommodate the additional cooling load.
- The use of the air cooled chiller option would not impact the existing chilled water systems.
- Using chilled water fan coils for the mezzanine bridge eliminates the need for additional mechanical space in Gallery Place station and minimizes the amount for exposed ductwork required.
- The use of chilled water air conditioning units for passageway cooling provides a simple means of providing outside air to pedestrians using the passageway and to people employed in the commercial area associated with passageway alternative 3.

The primary disadvantage of this option is the requirement for space within or adjacent to an existing building.

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 alternatives. 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 Alternative 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.

3. Station Mechanical Room Modifications

Required modifications to existing Metro Center station east platform level mechanical equipment rooms consist of the following:

- Relocate the existing station platform air conditioning unit serving both platforms (ACU-3 and ACU-4) 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.

Required modifications to existing Gallery Place station west mezzanine level mechanical equipment room consists of the following:

- Relocate the existing station mezzanine air conditioning unit (ACU-5) 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-1 serving the west 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.

Required modifications to existing Gallery Place Traction Power Substation ventilation system consist of the following:

- Relocate the existing ventilating units (V-6 and V-7) serving the substation to a level above the passageway ceiling. Due to the apparent age and condition of this equipment item, new units should be provided. In addition, a means of servicing the new units will need to be incorporated into the final design.

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 Metro Center and Gallery Place 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 Metro Center or Gallery Place station.

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 Alternative 3, which is the only alternative that contains commercial areas and washrooms. Sprinklers are not provided in Alternative 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 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 Alternative 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 Alternative

All three alternatives require modification of the existing Metro Center east platform level mechanical rooms and the Gallery Place station west mezzanine level mechanical rooms. Specific mechanical work associated with each alternative is described below.

1. Passageway Alternative 1

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

- The pedestrian passage will be air conditioned with two air handling units equipped with chilled water coils. The estimated air conditioning requirement is approximately 107 tons with each unit having a nominal capacity of 55 tons. This is based on a floor area of approximately

26,000 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.
- Two mechanical rooms are required and associated air intake and exhaust shafts are required to house the air conditioning equipment and provide 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. Passageway Alternative 2

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

- The pedestrian passage will be air conditioned with two air handling units equipped with chilled water coils. The estimated air conditioning requirement is approximately 136 tons with each unit having a nominal capacity of 68 tons. This based on a floor area of approximately 33,000 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.
- Two mechanical rooms are required and associated air intake and exhaust shafts are required to house the air conditioning equipment and provide 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. Passageway Alternative 3

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

   - The pedestrian passage will be air conditioned with two air handling units equipped with chilled water coils. The estimated air conditioning requirement is approximately 180 tons with each unit having a nominal capacity of 90 tons. This based on a floor area of approximately 39,000 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.
   - Two mechanical rooms are required and associated air intake and exhaust shafts are required to house the air conditioning equipment and provide 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.

4. The mechanical, plumbing and fire protection features associated with the Gallery Place mezzanine bridge alternatives consist of the following:

   - The pedestrian bridge will be air conditioned with fan coil units equipped with chilled water coils. This system is similar to that used at both Forest Glen and Wheaton stations and is preferred since additional mechanical room space at Gallery Place station is not necessary. The estimated air conditioning requirement is based on WMATA station air conditioning criteria.
   - <u>Option 1 (recommended) – Center Bridge with Diagonal Columns -</u> The bridge will be air conditioned with 18 fan coil units mounted on approximately 25 foot centers. The estimated air conditioning requirement is approximately 22 tons with each unit having a nominal capacity of 14,500 btuh. This based on a floor area of approximately 7,200 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.
   - <u>Option 2 – Center Bridge with Hangers -</u> The air conditioning requirements for Alternative 2 are the same as for Alternative 1.
   - <u>Option 3 – Center Bridge hung from Arched Frame -</u> The air conditioning requirements for Alternative 3 are the same as for Alternative 1.
   - <u>Option 4 – Side bridges with Corbels and Hangers -</u> The pedestrian passage will be air conditioned with 36 fan coil units mounted on 25 foot centers. The estimated air conditioning requirement is approximately 33 tons with each unit having a nominal capacity of 11,000 btuh. This based on a floor area of approximately 10,800 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.

VIII. ELECTRICAL/SYSTEMS FEATURES

A. General Electrical Issues Common to All Alternatives

All three passageway options will require the following:

1. 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.
2. 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.

Adjacent to Gallery Place entrance, the new pedestrian tunnel infringes into the traction power substation room. Traction power equipment will not have to be moved because they are in an area of the room not being disturbed. Ventilation equipment and associated duct work serving the substation will have to be relocated. The new pedestrian tunnel will impact traction power feeders that go down to the tracks through cable slots in the floor. The traction power cables will have to be replaced from the DC switchgear to the tracks. This will involve cutting new cable slots in the substation floor. Other items such as the existing cable tray and some wall mounted panels will also have to be relocated.

B. Electrical Work Associated with Each Alternative

1. Alternative 1

   - No additional electrical equipment is anticipated for this alternative.

2. Alternative 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. Alternative 3

   - The commercial area will require some additional electrical equipment within the service rooms. Power for additional heating will come from the passenger station's non-essential switchboards. There will also be additional lighting and mechanical equipment loads specifically for the commercial areas.

C. General Systems Issues Common to all Alternatives

All three passageway Alternatives 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 Alternative

1. Alternative 1

   - No additional system equipment is anticipated for this alternative.

2. Alternative 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. Alternative 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 vendors will require a dedicated telephone closet.

E General Electrical Issues for Bridge Connection between Mezzanines at Gallery Place Station.

1. Additional lights and mechanical equipment require new electrical circuits 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.

F General System Issues for Bridge Connection between Mezzanines at Gallery Place Station.

1. Closed-Circuit Television (CCTV) cameras to monitor 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.

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

3. New and/or modification of public address speakers. Conduits/cables will be required between the speakers and the corresponding communication room.

4. Modifications to kiosks in both passenger stations to accommodate additional CCTV camera and communication equipment.

IX. RIDERSHIP ANALYSIS

A. Market Definitions

All Metrorail trips were assigned to one of 12 “markets” based on their origin and destination stations. Trips in the same market are expected to have similar likelihood of using the pedestrian tunnel. The markets were defined as follows:

1. Part A: Non-users

   - **Market 0** consists of riders whose routes do not pass near Gallery Place or Metro Center and riders who do not transfer at either station. Most Metrorail trips fall into this market.

2. Part B: Passengers transferring between Orange/Blue Lines and Green/Yellow Lines

   - **Market 1** consists of riders who travel between a Green Line station north of Gallery Place and an Orange Line Station west of Metro Center. The shortest-distance path for these trips involves transfers at both Metro Center and Gallery Place, with only a short ride on a Red Line train between the two stations. By using the tunnel, these riders could eliminate the Red Line portion of their trips. (Example trip: Greenbelt to Vienna.)

   - **Market 2** consists of riders who travel between the Federal Triangle Station and a Green Line station north of Gallery Place, and riders who travel between the Archives Station and an Orange Line Station east of Metro Center. This market is similar to Market 1, because the shortest trip for Market 2 riders involves a three-train trip with only a short trip on the Red Line, but Market 2 riders can also choose to transfer at L’Enfant Plaza, reducing their number of transfers but increasing their trip length. The tunnel would allow these riders to either avoid a three-train trip, as in Market 1, or to shorten their two-train trips by avoiding a transfer at L’Enfant Plaza. (Example trip: Archives to Vienna.)

   - **Market 3** consists of riders who travel between a Blue Line station south of King Street and a Green Line Station north of Mount Vernon Square. The shortest-distance trip for these riders is a three-train trip using the Yellow Line between the Pentagon and L’Enfant Plaza. The proposed tunnel would be unlikely to affect a large number of Market 3 trips, but it could cause some trips to divert through Rosslyn, reducing the number of transfers but lengthening the trips by four stations. (Example trip: Greenbelt to Van Dorn.)

- **Market 4** consists of riders who travel between the Arlington Cemetery Station and a Green Line Station north of Mount Vernon Square. Much like Market 3, Market 4 riders must make a three-train trip, using either the Yellow Line over the Potomac River or the Red Line between Gallery Place and Metro Center. The tunnel would allow these riders to choose a two-train trip through the tunnel, although the trip would be two stations longer than the three-train trip using the Yellow Line. (Example trip: Arlington Cemetery to Greenbelt.)

3. Part C: Passengers using only the Red Line, entering or exiting the system near the tunnel

- **Market 10** consists of riders who pass through Metro Center on the Red Line and enter or exit the system at Gallery Place, and riders who pass through Gallery Place and enter or exit the system at Metro Center. Some Market 10 riders may choose to shorten their train trips by using the tunnel. (Example trip: Dupont Circle to Gallery Place.)

- **Market 11** consists of riders who enter or exit the system at Metro Center without passing through Gallery Place, and riders who enter or exit the system at Gallery Place without passing through Metro Center. These riders may already be choosing to shorten their train trips by walking at street level parallel to the tunnel for at least a portion of their walk. Some of these riders may choose to use the tunnel instead. (Example trip: Dupont Circle to Metro Center.)

4. Part D: Passengers entering or exiting the system near the tunnel whose trips involve a Metrorail transfer

- **Market 20** consists of riders who transfer at Metro Center to enter or exit the system at Gallery Place, and riders who transfer at Gallery Place to enter or exit the system at Metro Center. Some Market 20 riders may be convinced to use the tunnel to eliminate the Red Line portion of their trips. (Example trip: Vienna to Gallery Place.)

- **Market 21** consists of riders who enter or exit the system at Metro Center without passing through Gallery Place, and riders who enter or exit the system at Gallery Place without passing through Metro Center. These riders may already be choosing to avoid using the Red Line by walking at street level parallel to the tunnel for at least a portion of their walk. Some of these riders may choose to use the tunnel instead. (Example trip: Vienna to Metro Center.)

- **Market 22** consists of riders who travel between Metro Center and a Yellow or Blue Line Station between the Pentagon and King Street, inclusive. Market 22 riders' shortest-distance trip would involve using the Yellow Line over the Potomac and a transfer at Gallery Place. However, Market 22 riders could also reach Metro Center on a longer single-train trip via the Blue Line through Rosslyn. The proposed tunnel could allow some Market 22 riders to access Metro Center on the shorter Yellow Line trip, eliminating the Gallery Place transfer. (Example trip: National Airport to Metro Center.)

- **Market 23** consists of riders who travel between Gallery Place and an Orange or Blue Line Station east of L'Enfant Plaza. These riders' shortest trip includes a transfer at L'Enfant Plaza. The tunnel could cause some riders to avoid the transfer, instead lengthening their trips by one station via Federal Triangle. (Example trip: New Carrollton to Gallery Place.)

- **Market 24** consists of riders who travel between Gallery Place and Arlington Cemetery. These riders' shortest trip includes a transfer at the Pentagon. The tunnel may cause some Market 24 riders to divert through Rosslyn and use the tunnel, lengthening their trips by two stations but eliminating a transfer.

The number of Metrorail trips in each of the 12 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 in 2003, the study's baseline analysis year.

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 proposed tunnel as riders entering at Dunn Loring, West Falls Church, and all other Orange Line stations east of Metro Center. By grouping stations, the complete O-D matrices were reduced to 18-by-18 grids.

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

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 “McPherson Square” applies to the Orange Line Stations between McPherson Square and Vienna, 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 O-D trip pairs fall into Market 0; in fact, about 91 percent of O-D pairs belong to Market 0 and would thus not use the proposed 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 1: Market Types of Groups of Metrorail O-D Pairs

Origin Station Group	Destination Station Group: McPherson Square	Metro Center	Federal Triangle	Smithsonian	L'Enfant Plaza	Largo Town Center	Van Dorn	Pentagon	Huntington	Arlington Cemetery	Waterfront	Archives	Gallery Place	Mt. Vernon Square	Georgia Ave	Greenbelt	Glenmont	Farragut North	McPherson Square
McPherson Square	0	21	0	0	0	0	0	0	0	0	0	2	20	1	1	1	0	0	0
Metro Center	21	21	21	21	21	21	21	22	20	21	20	20	10	20	20	20	10	11	21
Federal Triangle	0	21	0	0	0	0	0	0	0	0	0	0	20	2	2	2	0	0	0
Smithsonian	0	21	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
L'Enfant Plaza	0	21	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0
Largo Town Center	0	21	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0
Van Dorn	0	21	0	0	0	0	0	0	0	0	0	0	21	0	3	3	0	0	0
Pentagon	0	22	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0
Huntington	0	20	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0
Arlington Cemetery	0	21	0	0	0	0	0	0	0	0	0	0	24	0	4	4	0	0	0
Waterfront	0	20	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0
Archives	2	20	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	2
Gallery Place	20	10	20	20	21	23	21	21	21	24	21	21	21	21	21	21	11	10	20
Mt. Vernon Square	1	20	2	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	1
Georgia Ave	1	20	2	0	0	0	3	0	0	4	0	0	21	0	0	0	0	0	1
Greenbelt	1	20	2	0	0	0	3	0	0	4	0	0	21	0	0	0	0	0	1
Glenmont	0	10	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0
Farragut North	0	11	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0

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

Market	***Time Period***				
	AM Peak	***Midday***	***PM Peak***	***Evening***	***Total***
0	184,809	105,126	189,925	70,158	**550,018**
1	2,349	1,180	2,166	935	**6,631**
2	431	272	492	96	**1,291**
3	118	85	132	90	**425**
4	10	23	19	6	**57**
10	5,553	4,351	6,835	2,680	**19,418**
11	6,681	4,429	7,376	2,966	**21,451**
20	2,985	1,703	3,277	1,153	**9,118**
21	9,288	6,376	10,782	4,143	**30,589**
22	899	654	1,153	448	**3,153**
23	672	697	828	297	**2,494**
24	3	21	19	1	**45**
MARKETS 1-24	**28,988**	**19,791**	**33,078**	**12,815**	**94,672**
MARKETS 0-24	**213,797**	**124,917**	**223,003**	**82,973**	**644,690**

Exhibit 2 shows that about 85 percent of Metrorail trips fall in Market 0. Markets 1 through 4, the transfer markets, account for a combined total of about 1 percent of trips. Markets 10 and 11, the single-line local trips, account for about 6 percent of trips, and Markets 20 through 24, the multi-line local trips, account for the remaining 7 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:

1. 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]

2. The three Metrorail stations that opened in 2004 (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 tunnel would tend to be higher than forecast in this study.)

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.

---

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.

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

Market	***Time Period***				
	AM Peak	***Midday***	***PM Peak***	***Evening***	***Total***
0	271,571	152,866	277,241	103,333	**805,011**
1	3,421	1,785	3,152	1,354	**9,712**
2	632	372	712	137	**1,852**
3	181	129	196	134	**641**
4	13	32	24	7	**77**
10	10,508	8,892	13,425	5,638	**38,463**
11	11,652	7,882	13,257	5,334	**38,124**
20	5,732	3,633	6,487	2,423	**18,275**
21	19,097	12,281	22,079	8,610	**62,067**
22	1,217	937	1,613	632	**4,398**
23	2,266	1,976	2,612	920	**7,774**
24	7	56	50	4	**117**
MARKETS 1-24	**54,726**	**37,974**	**63,609**	**25,193**	**181,502**
MARKETS 0-24	**326,298**	**190,840**	**340,850**	**128,525**	**986,513**

Trips in the Metrorail system as a whole are predicted to grow by 53 percent between 2003 and 2030. However, Market 0 trips are expected to grow by 46 percent, a slightly lower rate than the system-wide average. Markets 1 through 4 are also expected to grow at below-average rates of between 34 and 51 percent. Markets 10 and 11 are faster-growing, at 78 to 98 percent growth, but Markets 20 through 24 are the fastest-growing, with average growth rates of 104 percent. By 2030, Market 0 is expected to account for about 82 percent of all Metrorail trips, down from the 85 percent in 2003.

C. 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. A primary factor is travel time savings, but 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:

1. 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.

2. 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.

3. 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 determined 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.

Pedestrians using the tunnel would experience changes in travel time from the following three sources:[2]

1. **Train travel time.** Time spent traveling on a train and making intermediate stops.

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

3. **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.

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.

Train Travel Time

Metrorail train travel times were collected for segments relevant to the markets under study. 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

Metrorail Line	***Metrorail Trip***	***Average Train Travel Time (minutes)***
Red	Metro Center – Gallery Place	2
Green/Yellow	Archives – Gallery Place	2
	Archives – L'Enfant Plaza	2
Orange/Blue	Federal Triangle – L'Enfant Plaza	3
	Federal Triangle – Metro Center	2
Yellow	Pentagon – Gallery Place	8
Blue	Arlington Cemetery – Pentagon	3
	Arlington Cemetery – Metro Center	10

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. Transfer times were determined at four Metrorail stations relevant to the markets, based on the configuration of the stations' platforms, escalators and stairways and the position of stopped trains. Average transfer walk times are presented in Exhibit 5.

Transfer walk times are assumed to remain unchanged in 2030.

Exhibit 5: Average Transfer Walk Times

Transfer Station	*Transfer Direction*	*Transfer Movement*	*Average transfer walk time (minutes)*
Pentagon	Upstairs	From outbound trains to inbound trains	1
	Downstairs	From inbound trains to outbound trains	1
Metro Center	Upstairs	From Orange/Blue Lines to Red Line	1
	Downstairs	From Red Line to Orange/Blue Line	1
Gallery Place	Upstairs	From Green/Yellow Lines to Red Line	1
	Downstairs	From Red Line to Green/Yellow Lines	2
L'Enfant Plaza	Upstairs	From Orange/Blue Lines to Green/Yellow Lines	1
	Downstairs	From Green/Yellow Lines to Orange/Blue Lines	1

At a walking speed of 4 feet per second, the proposed 800-foot pedestrian tunnel could be navigated in 3.3 minutes. However, for passengers transferring between the Green/Yellow Lines at Gallery Place and the Orange/Blue lines at Metro Center, the actual travel distance is much longer than the tunnel's length. The Green/Yellow Line platform is about 1700 feet from the Orange/Blue Line platform, and a transfer movement would need to traverse this entire distance. In addition, a transfer movement using the tunnel would need to make four distinct vertical movements to move from lower to upper platform, to mezzanine/tunnel level, to upper platform, and again to lower platform. The tunnel's transfer walk time is forecast to be 7 minutes, in addition to the appropriate transfer walk times at both Metro Center and Gallery Place.

The speed of moving walkways is assumed to be 3 feet per second, and it is assumed that average passenger speeds relative to the walkways would also be 3 feet per second, for a total average speed of 6 feet per second (4.1 mph). At these speeds, 600 feet of moving walkway segments would reduce the tunnel's transfer time from 7 minutes to 6 minutes.

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 2030, for both peak and off-peak operations; average wait times were computed from these headways and are presented in Exhibit 6. A passenger's wait time depends on whether the passenger has a preference about which train to board. For instance, a passenger may be waiting for the Orange Line or the Blue Line, or may be waiting for whichever train arrives first, as noted in Exhibit 6.

Exhibit 6: Average Waiting Times

Metrorail Line	***Average Waiting Time (minutes)***	
	Peak	***Off-peak***
Yellow	3	7
Blue	3	7
Orange	2	6
Red	2	5
Green	3	7
Yellow/Green	2	5
Orange/Blue	1	4
Blue/Yellow	2	5

D. Use Rates by Market Type

1. Market 1

During peak hours, the travel time to use the tunnel would nearly equal the travel time to use the Red Line because of the high frequency of Red Line service and the relatively long walking distance required. During off-peak hours, the tunnel offers slightly faster travel time, by about one minute, because of the lower frequency of train service.

The MWCOG model predicts that the tunnel would be used by 46 percent of passengers during peak periods and 53 percent during off-peak periods, increasing by two percent if moving walkways are installed. The MWCOG model tends to overestimate use rates of undesirable trips and underestimate use rates of shorter trips. As such, for the purposes of this analysis, the use rates were adjusted to 40 percent during peak periods and 55 percent during off-peak periods. The two-percent gain for moving walkways was retained for all periods.

2. Markets 2 and 3

   The travel time differences and the MWCOG model's use rate predictions are nearly identical for Markets 2 and 3. For both markets, the tunnel would require a longer overall trip time than at least one other path. The difference in trip time ranges from 2 to 5 minutes, depending on specific route, time of day, and presence of walkways.

   Despite the longer trip time, the MWCOG model predicts use rates of 25 to 26 percent in the tunnel during peak periods and 27 to 33 percent during off-peak periods. Again, moving walkways tend to increase use rates by about two percent. For this study, the MWCOG rates were reduced to 15 percent during peak periods and 20 percent during off-peak periods.

3. Market 4

   Market 4 passengers are also unlikely to reduce total travel time much by using the tunnel. The tunnel would offer a savings of about one minute over the existing shortest path in the best case—off-peak conditions with moving walkways. During peak periods with no walkways, the tunnel travel time becomes about two minutes longer than the shortest path.

   The MWCOG model predicts 29 percent use rate during peak hours and 32 percent during off-peak hours. The travel time savings in Market 4 are similar to Market 1, but the MWCOG use rates are lower because there are two viable alternative routes to the tunnel in Market 4; Market 1 has only one alternative. Again in market 4, the MWCOG model suggests that use rates would increase by about 2 percent if moving walkways were installed. In this study, Market 4 rates were taken to be 30 percent for peak periods and 35 percent for off-peak periods, acknowledging the nearly equal travel times between the alternative routes.

4. Market 10

   Passengers in Market 10 are already aboard the Red Line as it passes through either Metro Center eastbound or Gallery Place westbound, deliberately riding the train parallel to the proposed tunnel to exit at the farther station. Since these passengers could already choose to exit at the nearer of the stations, it is unlikely that the tunnel would change a large number of these riders' patterns. Travel time differences are highly variable, because these riders' ultimate destination lies somewhere in the vicinity of the Metro Center or Gallery Place Stations. If these passengers used the tunnel, they would likely take advantage of intermediate entrances or exits, rather than traversing the tunnel's entire length.

WMATA faregate data shows that about 23 percent of Gallery Place patrons use the west portal, nearest the tunnel, and that about 17 percent of Metro Center patrons use the east portal, nearest the tunnel. About a third of these patrons are expected to walk parallel to the tunnel at street level for at least a portion of their trip to or from the station, for an average of about 7 percent of Metro Center and Gallery Place traffic. Market 10 riders are some of the least likely to use the tunnel because of their existing ridership patterns, but for the purposes of this study, it was assumed that 40 percent of the candidate pedestrians would use the tunnel, for a use rate of about 3 percent. This use rate would not change according to time of day, because train waiting time is not a factor.

Moving walkway usage in Market 10, as well as all other local markets, was evaluated indirectly using MWCOG model predictions. In the transfer markets, MWCOG predicted use rate increases of about 2 percent when a moving walkway was installed. This change in use rate translates to an increase of about 8 percent in passenger traffic, which was based on transfer passengers' use of the tunnel for its entire length. Local passengers are likely to enter or exit the tunnel at an intermediate point, perhaps using the walkways on average for only half their length. As such, a passenger gain of 4 percent was assumed for Market 10 and other local markets.

5. Market 11

Market 11 passengers are the complement to Market 10 passengers. They exit at either Metro Center or Gallery Place without passing through the other station on a Red Line train. Still, only about 7 percent of Gallery Place and Metro Center traffic is expected to walk in a direction that would make the tunnel useful, but a larger fraction of Market 11 trips are forecast to use the tunnel because of their ridership patterns. For this study, it is estimated that 75 percent of the candidate Market 11 trips would use the tunnel, for a use rate of 5 percent.

6. Markets 20 and 21

Market 20 passengers fit the same profile as Market 10 passengers, except that their trips include Metrorail lines other than the Red Line. Likewise, Market 21 passengers fit the same profile as Market 11 passengers, but they too make at least one transfer. However, because passengers in Markets 20 and 21 behave in the same way as passengers in Markets 10 and 11 in the vicinity of the tunnel, it is expected that the use rates will be similar. As such, a 3 percent use rate was assigned to market 20 and a 5 percent use rate was assigned to Market 21.

7. Market 22, 23 and 24

   The final three local markets are relatively small in size, and their passengers have little to gain from using the tunnel. Market 22 is similar to Market 20, except that its passengers have an additional alternative route that would avoid the need to use the tunnel. Markets 23 and 24 could use the tunnel to eliminate a transfer from their trips, but the route would require 2 to 4 minutes of additional train travel time in addition to the walking time through the tunnel. As such, low use rates were established for these three markets: 2 percent for Markets 22 and 23 and 1 percent for Market 24.

E. Use Rate Summary

Exhibit 7 presents the use rates by market type as discussed above.

F. Pedestrian Forecast Computation

With the market sizes and use rates established, the pedestrian forecast was calculated by multiplying the market size by the use rate for each market and summing the products. The daily pedestrian forecast for the year 2030 is presented in Exhibit 8 for the condition without moving walkways.

Exhibit 7: Pedestrian Tunnel Use Rates by Market Type

Market	***Without Walkways***		***With Walkways***	
	Peaks	***Off-peaks***	***Peaks***	***Off-peaks***
0	0%	0%	0%	0%
1	40%	55%	42%	60%
2	15%	20%	16%	22%
3	15%	20%	16%	22%
4	30%	35%	32%	38%
10	3%	3%	3%	3%
11	5%	5%	5%	5%
20	3%	3%	3%	3%
21	5%	5%	5%	5%
22	2%	2%	2%	2%
23	2%	2%	2%	2%
24	1%	1%	1%	1%

Exhibit 8: Pedestrian Tunnel Passenger Forecast, Without Walkways, 2030

Market	***Time Period***				
	AM Peak	***Midday***	***PM Peak***	***Evening***	***Total***
0	0	0	0	0	**0**
1	1,368	982	1,261	745	**4,356**
2	95	74	107	27	**303**
3	27	26	29	27	**109**
4	4	11	7	3	**25**
10	315	267	403	169	**1,154**
11	583	394	663	267	**1,906**
20	172	109	195	73	**548**
21	955	614	1,104	430	**3,103**
22	24	19	32	13	**88**
23	45	40	52	18	**155**
24	0	1	1	0	**1**
Total	**3,589**	**2,536**	**3,854**	**1,772**	**11,750**

The trip forecast shows a total of about 12,000 (11,750) pedestrians per day using the tunnel, of which the largest share are part of Market 1. Altogether, the transfer markets account for about 40 percent of trips, while local markets account for about 60 percent.

The pedestrian tunnel is expected to attract about 1,400 trips during the morning peak hour and about 700 trips in the peak half-hour (PHH), according to existing Metrorail temporal patterns. Total annual passenger traffic would measure about 3.4 million trips.

The passenger forecast for the condition with moving walkways is presented in Exhibit 9.

Exhibit 9: Pedestrian Tunnel Passenger Forecast, With Walkways, 2030

Market	***Time Period***				
	AM Peak	***Midday***	***PM Peak***	***Evening***	***Total***
0	0	0	0	0	**0**
1	1,437	1,071	1,324	812	**4,644**
2	101	82	114	30	**327**
3	29	28	31	30	**118**
4	4	12	8	3	**27**
10	328	277	419	176	**1,200**
11	606	410	689	277	**1,982**
20	179	113	202	76	**570**
21	993	639	1,148	448	**3,227**
22	25	19	34	13	**91**
23	47	41	54	19	**162**
24	0	1	1	0	**1**
Total	**3,749**	**2,693**	**4,024**	**1,884**	**12,351**

Moving walkways are predicted to increase total traffic by about 5 percent, to just over 12,000 (12,351) trips per day. Transfer traffic increases at a slightly higher rate because the walkways impart more benefit to passengers who travel longer distances. Transfer traffic increases to about 41 percent of total traffic.

More detailed forecasts, including both 2003-level and 2030-level data, are included in Appendix C.

A brief analysis of conditions in 2010, the predicted year of opening, shows that the tunnel would be expected to carry about 7,900 passengers per day without moving walkways or about 8,300 per day with moving walkways.

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 10 presents the threshold of significance for the use rate of each market type, according to the 1,000 passenger-per-day threshold.

Exhibit 10: Use Rate Sensitivity by Market Type

Market	*Weighted average use rate used for 2030 passenger forecast*	*rate that would result in a 1,000-passenger-per-day change in passenger*	*Lower boundary of significant use rate range*	*Upper boundary of significant use rate range*
1	44.8%	10.3%	34.6%	55.1%
2	16.4%	54.0%	0.0%	70.4%
3	17.1%	100.0%	0.0%	100.0%
4	32.5%	100.0%	0.0%	100.0%
10	3.0%	2.6%	0.4%	5.6%
11	5.0%	2.6%	2.4%	7.6%
20	3.0%	5.5%	0.0%	8.5%
21	5.0%	1.6%	3.4%	6.6%
22	2.0%	22.7%	0.0%	24.7%
23	2.0%	12.9%	0.0%	14.9%
24	1.0%	100.0%	0.0%	100.0%

Exhibit 10 shows that if the use rate selected for Market 1 is within plus or minus 10.3 percent of the actual use rate, the pedestrian forecast will be accurate to within 1,000 passengers per day. The right-most columns of Exhibit 10 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 some markets, such as Markets 2, 3 and 4, these markets' use rate sensitivity 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 10,11, 20 and 21, where the passenger forecast is much more sensitive to small changes in use rate. However, these markets also have very low use rates, minimizing the chance of a large difference between expected and actual use rate.

H. Tunnel Benefits

The total travel time savings produced by the tunnel are small, because no markets observe significantly shorter travel times. However, several additional benefits can be achieved through construction of the tunnel.

1. Red Line Incident Management

   In the event of a service disruption on the Red Line, the tunnel would offer an attractive alternative route for passengers who ride the Red Line only between Gallery Place and Metro Center. About 18,000 passengers per day use the Red Line exclusively for this segment, increasing to over 30,000 per day by 2030. Although few of these passengers would choose to use the tunnel under normal circumstances, the use rate would be much higher if Red Line service were limited or unavailable.

2. Reduction of Transfers

   The tunnel would reduce the number of passengers transferring at the L'Enfant Plaza Station. According to the Core Capacity Study, the L'Enfant Plaza Station is expected to handle about 265,000 transfer passengers per weekday; the tunnel would be likely to capture about 1 percent of those passengers.

   The Pentagon Station may also observe a reduction in transfer traffic, but the reduction would be of a much smaller magnitude than at L'Enfant Plaza.

3. Reduction of Platform Crowding

   At Metro Center, the proposed configuration of the tunnel would require tunnel users to navigate the east end of the Red Line platform, so tunnel users would not be expected to reduce platform congestion significantly.

   At Gallery Place, a proposed new mezzanine has been suggested that would connect the east and west ends of the station, allowing tunnel users to avoid the Red Line platform. This mezzanine would reduce the number of passengers on the Red Line platforms at Gallery Place.

   However, the effectiveness of the mezzanine would be limited by passengers' desire to minimize their trip travel time. For instance, passengers transferring from the Green/Yellow Lines to the Orange/Blue Lines would likely prefer to walk along the Red Line platform to reach the tunnel, in case a Red Line train should happen to arrive during their walk along the platform. If they were to use the mezzanine, they would not be able to catch an arriving Red Line train. This effect would be prominent for westbound transfer movements; eastbound movements would be more likely to use the mezzanine level.

Even if the mezzanine were not installed, the tunnel would allow transfer movements to choose the least-congested of the Red Line platforms at Gallery Place and Metro Center. For instance, passengers emerging from the tunnel at the Gallery Place Station would be able to observe congestion levels on both the eastbound and westbound Red Line platforms, and they could choose to avoid a heavily-congested platform, since either would allow them to reach the Green/Yellow Line platforms.

X. JOINT DEVELOPMENT ANALYSIS

A. Introduction

This report contains an evaluation of the potential for retail space in a pedestrian passageway linking the Metro Center and Gallery Place Metro Stations. This is part of an overall feasibility study of creating a 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 and projected non-transit visitor foot traffic to a potential visitor information center/Metro museum and entertainment ticket outlet/reservations center, as the passageway as currently proposed is within a fare free zone of the transit system. 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 consultants 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 reviewed publications and data from the Downtown DC

Business Improvement District (BID) that represents business interests in the area. The business improvement district is a private non-profit that provides cleaning, safety, hospitality, marketing, economic development and homeless services to Washington's city center. Its mission is to help raise Downtown to world-class standards as a commercial, cultural and residential destination. The BID has specific marketing and image enhancement strategies and has prepared a full inventory of retail and service space within the area.

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 to 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 primary market of the midpoint between the Metro Center and Gallery Place Metro Stations is generally consistent with the borders of the Downtown DC Business Improvement District (BID). The 140-block BID contains approximately 825 properties and is bounded by the National Mall to the south, Massachusetts Avenue to the north, the U.S. Capitol to the east and the White House to the west. The area encompasses all or parts of the Penn Quarter, Gallery Place, Chinatown, McPherson Square, Federal Triangle and Franklin Square neighborhoods.

The area has a strong daytime population with an order of magnitude of 175,000 employees or 26 percent of the District's total employment. A number of new residential projects have contributed to the evening population. Between 2001 and 2004, 16 projects totaling 2,079 residential units began construction within the BID. According to ESRI Business Solutions estimates, the total population in 2004 was 5,281.

The area contains approximately 600 retail and service establishments with over 8,000 employees. Estimated retail sales in 2004 were $615 million. A majority of the retail component are classified as eating and drinking establishments. Sales at these establishments accounted for approximately $300 million in 2004 or nearly half of the total sales within the BID.

The area is well served with convenience type retail establishments that would normally be found within transit areas such as the pedestrian tunnel. Various coffee, snack and convenience stores are located proximate to station portals. Reflecting the daytime orientation of the retail environment, these limited service (i.e. convenience) restaurants catering to workers generated $210 million in sales or 70 percent of total eating and drinking sales.

The number of restaurants and retailers appealing to the growing nighttime resident population of renters, condominium dwellers and lodgers within the BID's 9,336 hotel rooms is increasing. New restaurants have been attracted by the potential to generate sales from $500 to $1,500 per square foot. New retail space at the Gallery Place project constitutes 250,000 square feet including Aveda Institute, Urban Outfitters, Benetton, City Sports, Ann Taylor Loft, and a 14-screen Regal Cinemas.

There is approximately 1.9 million square feet of potential ground floor retail and services space within the BID, 265,000 square feet or 14 percent of which is reported to be vacant. 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. Median store sizes are approximately 2,500 square feet.

2. Transit Retail

Given the nature of retail in the area and the potential 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 1,500 square feet. Most of the retail operations are found **outside** of the fare zone. The **highest sales performances**, 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 $1,400 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” or funneling the transit patron by the retail establishments appears to optimize revenue potential. Riders are not likely to deviate from their normal pedestrian path to make impulse purchases. An average of 5,000 transit patrons per day appears also to be the " 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 primarily be derived from primary and secondary transfer market.

Passenger tunnel users who enter or exit the systems at Gallery Place or Metro Center have so many more convenience retail options that it is highly unlikely they would go out of their way to patronize retail facilities within the tunnel unless they offered specialty goods or services. This assumes that the market for convenience retail activities exists primarily during the AM, midday and PM peaks. With relatively limited retail activity beyond these periods, it would be unlikely that the retail operator would choose to remain open during weekends and after 7 PM on weekdays (All the transit retail use agreements we examined restricted time of retail operation to the hours of transit service but did not require merchants to remain open during the entire service period).

The presence of year-round activity generators including a visitor information center/Metro museum and entertainment ticket outlet/reservations center as well as the relatively high proportion of non-work trips which might occur at and between these two stations may result in operators opting to extend hours both on weekdays and the weekends.

Given the tourist and destination orientation of the proposed retail component, retail activity with the Gallery Place-Metro Center pedestrian tunnel could benefit significantly from strong demand during the theatre runs of popular productions at any one of the participating venues and during large conventions, holidays, and other high visitation periods (e.g. National Cherry Blossom Festival). Given the seasonality of activity, many retail carts/kiosks may operate only on a seasonal basis. Higher rents could be charged during peak seasons to offset off-season vacancies.

For analysis purposes we have utilized a 2030 projected average daily potential pedestrian tunnel retail client figure of approximately 6,000 per business day (1.7 million passengers per year) which represents approximately half of the overall pedestrian tunnel passenger forecast.

The presence of selected destination activities including a one-stop visitor information center and Metro museum should attract additional non-transit foot traffic. Located on the lower level of Hallidie Plaza near the Powell Street Bay Area Rapid Transit District (BART) station, San Francisco's Visitor Information Center attracts approximately 400,000 visitors annually. With its comparable tourist activity (e.g. number of annual overnight visits in 2003), the District could also eventually draw a large number of visitors to a transit related visitors center. Since a potential subterranean pedestrian tunnel location is less accessible and visible, it is assumed that it could attract 200,000 visitors per year, or half of the annual traffic at the BART-related facility. This could generate an average of approximately 550 non-transit pedestrians through the tunnel per day.

In addition to foot traffic generated by a potential visitor information center and Metro Museum, an entertainment ticket outlet (e.g. TICKETplace in the Seventh Street Arts Corridor, TicketMaster) and reservation center could also attract a significant number of non-transit pedestrians to the tunnel. The range of potential visitors to such an outlet will vary substantially depending on the selection of tickets, prices (e.g. half-price day-of-show, full-price), and venues. A well established reduced-price day-of-show outlet such as TKTS in New York can sell up to 20 percent of a theatre district’s total annual tickets and generate 10 percent of its annual sales at an average of $40 ticket.

Attendance at the five primary theatre venues within the Downtown BID was 838,152 in 2003. Assuming a conservative capture rate of 5 percent of ticket sales, a ticket outlet in the pedestrian tunnel could generate an additional 42,000 non-transit pedestrians per year or approximately 115 per day.

Despite offering free covered passage, few other non-transit passengers are expected to use the tunnel to avoid walking at street level. A free tunnel would potentially offer pedestrians a grade-separated passageway between 9th and 11th Streets. However, the route 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.

The destination nature of the visitors center/Metro museum and the ticket outlet should have retail spillover effects. Given the competing retail at ground level, however, average retail sales per pedestrian within the pedestrian tunnel are expected to be at the lower end for transit systems. For the adjusted transit and non-transit pedestrians we have assumed annual retail sales per passenger of $0.10. In addition, we have assumed ticket outlet patrons will spend an average of $25 per person on tickets.

In 2030, a combined total of approximately 2 million tunnel pedestrians could generate an estimated $200,000 in annual retail sales (2005 constant dollars). The 42,000 ticket outlet patrons could generate an additional $1.1 million in ticket sales. Assuming targeted sales volume in the $500 to $600 per square foot range, reflective of both transportation system and mall kiosk midpoints, approximately 300 to 400 square feet of retail space could be supported in addition to the visitor information center/Metro museum and entertainment ticket outlet/reservation center.

C. Likely Retail Market Venue

1. Concepts

The pedestrian connection would primarily:

- Serve as a transfer point between the two stations,
- Commercial space would include two larger spaces of approximately 3,600 square feet (120 x 30) and 6,000 square feet (240 x 25) and a number of smaller spaces at the Gallery Place end of the tunnel
- Create an activity generator by attracting approximately 550 daily or 200,000 annual visitors to a visitors center/Metro museum,
- Support relatively limited retail space beyond the potential visitors center/Metro museum and ticket outlet/reservation center,
- Experience periodic sales jumps during high visitation periods and

fluctuate significantly depending on venue offerings.

- Discourage the sale of food items,
- Operate in a relatively constrained space (height/width), and
- Present a high quality image but would have no natural light

It is our understanding that in addition to generating revenue, the pedestrian tunnel and its commercial component should:

- Create a unique tourist attraction and information center and a retail destination for visitors and residents alike,
- Provide services to transit patrons which will reduce the amount of travel required to purchase convenience goods and services,
- Create visual connections including lighting, visitor center and Metro museum signage and posters, and advertising to draw pedestrians through the tunnel,
- Increase transit ridership to reduce air quality impacts, traffic congestion, and energy consumption,
- Enhance the perception of safety and security by generating additional activity at and between stations, and
- Introduce development opportunities for the private sector and small and minority businesses.

Assuming the potential visitors center/Metro Museum and ticket outlet occupy the larger commercial spaces, we have explored a focus on small retail facilities for the more modest commercial spaces closer to the Gallery Place end of the pedestrian tunnel, 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

To meet the retail objectives listed above, the pedestrian tunnel could implement a number of strategies to attract transit and non-transit pedestrians alike. Small vendors are not likely to attract destination traffic by themselves. Unique tourist and retail destinations unavailable at street level, on the other hand, could anchor the commercial component and could help support small retailers by generating non-transit foot traffic.

i. Visitors Center/Metro Museum

Many visitors to the Washington, DC metropolitan area utilize Metro to access the region's many tourist attractions and landmarks. Given the high ridership levels among tourists, it makes sense to locate a satellite visitors center in direct relation to and accessible by the Metro system. Although the capture rate of non-transit riding visitors is likely to be significantly lower, the presence of a visitor center with a unique exhibit could draw additional tourist traffic to the tunnel.

Through exhibitions, tours, educational programs and workshops, national and international transit museums (e.g. New York, London) present the cultural, social and technological history of public transportation. As a leading example of modern efficient, urban transportation since its inception as "America's subway" in the late 1960s, the Metro system has the potential for a museum of its own by highlighting its planning, engineering, construction, operations, and its impact on the built environment (e.g. transit oriented development). Located within the system itself, a Metro museum developed in conjunction with a visitors center could attract a significant number of transit and non-transit riding visitors to the pedestrian tunnel. Advertising and historic photos related to the museum can also help draw visitors through the tunnel to other commercial areas and the two Metro stations.

ii. Entertainment Ticket Outlet/Reservation Center

Another potential attraction and service for transit and non-transit pedestrians is a one-stop entertainment ticket outlet and reservation center serving area performing arts venues, ticketed attractions, and restaurants. Similar vendors in other major cities have helped generate tourist activity and increase revenues for theatre exhibitors by offering both convenience and value (e.g. reduced-price day-of-show sales) for patrons. A dining reservations component would increase the appeal by providing recommendations and contact information for area restaurants. An outlet of this type can be expected to attract visitors to the area and residents alike.

In addition to these unique activity generators, there are a variety of retail 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, 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 products. Kiosks occupy slightly more space than carts and are generally less mobile than carts.

c. Retail Merchandising Units (RMU)

Retail Merchandising Units (RMU) serve as “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. Dual Use Security/Merchandising Carts

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

e. 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.

f. 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 RMUs 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
- Mobile 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/hats
- T-shirts/boxers
- Umbrellas
- 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 noted above, a variety of retail configuration could be utilized. 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.

   The most likely configuration would be kiosks likely 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 may be 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, and create a more attractive and interesting walk for pedestrians.

The 20 foot lengths would allow for the cart and a stool and provide space between the carts. Given the market demand for 1,400 to 1,650 square feet, 4 to 5 sales units could be supported.

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 hookups for credit card and Internet connections. This design would likely not require storage space. The provision of exclusively nonfood vendors would reduce any maintenance, health, and trash requirements. Servicing of the retail facilities would be by elevators during non-transit operating hours.

2. Lease Revenues

Likely lease rates will reflect a combination of transit type lease rates, kiosk lease rates, lease rates for smaller square footage operators within the downtown area, and 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 Downtown DC area generally are in the $50 to $85 per square foot range. Transit agency lease rates vary greatly. For smaller spaces, 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. Off-season monthly rates generally range from approximately $800 to $2,400 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 9 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 feet 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.

Assuming a midpoint of 350 square feet of retail space (in addition to the larger spaces for the visitors center/museum and ticket outlet/reservation center) are supportable within the pedestrian connection, projected lease rates sales volumes as a percentage of sales (10 to 18 percent) would range in the $57 to $102 per square foot rate. In monthly terms this would range from approximately $1,650 to $3,000. 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 $1450 to $1750 per month.

This rate combined with the provision of a ready-to-operate retail facility should attract potential operators and potentially create incubator opportunities for small and disadvantaged businesses. The potential seasonal nature of retail sales and operations should be taken into consideration in order to encourage lively activity approaching and including the holiday season. In addition to 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.

Assuming the public oriented visitor center/ museum and ticket outlet/reservations center pay only nominal fees, projected lease rates for retail space would generate annual revenues for the transit agency of $17,400 to $21,000 in 2005 constant dollars, based on 350 square feet leased and excluding any percentage rents or premium for holiday rentals.

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.

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.

4. Advertising Revenues

In addition to creating visual interest and connections to commercial areas, advertising in the pedestrian tunnel creates the opportunity to generate additional revenue for WMATA. Metro related advertising provides opportunities to reach the out-of-home market in the Washington metropolitan area. The Metrobus and Metrorail system covers all of the District of Columbia and the suburbs of Maryland and Northern Virginia. According to Metro marketing materials, for instance, exterior bus advertising penetrates 90% of the daily population and provides exposure throughout the region’s business districts, residential areas, and tourist attractions.

Advertising in the Metrorail system between the Gallery Place and Metro Center stations provides a unique opportunity to strategically target the large volume of demographically diverse business executives, federal employees, tourists, destination retail shoppers, conventioneers, and entertainment patrons. In addition to backlit advertising dioramas at and near station platforms, poster displays and banners are available in Metro stations.

The sale of advertising for the Metro system is currently under contract with the advertising division of Viacom, the global media conglomerate. Viacom Outdoor is the world's largest out-of-home media company with a major North American presence throughout the United States. It currently serves a majority of the large transit systems in the nation’s major media markets including New York, Chicago, Boston, Philadelphia, Los Angeles, and San Francisco.

A potential advertising medium within a pedestrian tunnel could be 2-sheet (46” x 60”) posters. Based on interviews with Viacom Outdoor, these posters penetrate major retail and trade zones and are well suited for targeting key transit demographics including higher income commuters and ethnic audiences as they move along platforms and through passageways. Posters would have to adhere to Metro standards and would not advertise competitors of the tunnel’s retail component.

As of 2005, Viacom Outdoor’s rate card, or “published rate”, for a 2-sheet poster in the Metro system is $1,000 per month. Discussions with industry professionals suggest that these rates can vary significantly with supply and demand. During lower traffic periods such as January and February, rates can drop to as low as $500 per month.

Assuming one side of the pedestrian tunnel consists of the visitor’s center/Metro museum, ticket outlet/reservation center, an existing substation, retail kiosk space and a potential performance area, there is a total of 840 linear feet for potential advertising on the opposite side.

At a spacing of four feet, the commercial and noncommercial sides of the tunnel could **theoretically** accommodate up to 95 posters. Assuming the low end of $500 per month per poster, the tunnel could potentially generate total advertising revenues of approximately $47,500 per month or $570,000 per year. Since more than 80 percent of transit agencies have contracts that call for a percentage of the annual net billings and most of these are in the 50 to 60 percent range, advertising in the pedestrian tunnel could **theoretically** generate up to $28,500 per month or $342,000 per year for WMATA. Given the untested nature of extended pedestrian tunnel advertising within the Metro system, it is assumed that revenues could be between $34,200 and $85,500 per year or 10 and 25 percent of these theoretical estimates.

A second advertising scenario assumes the pedestrian tunnel could support a multimedia advertising campaign. In addition to potentially generating additional advertising revenue, linear campaigns with unified design themes could help draw pedestrians through the tunnel and to commercial areas by creating a sense of excitement. According to Viacom Outdoor, its “Station Saturation”, or “Station Domination”, offering enables a single advertiser to blanket the traditional media products of a station and to enhance the display with special sites strategically placed in high-traffic areas.

The overall concept of “Station Saturation” is to create a “surround-site” experience. The result is a virtual exhibit that surrounds the consumer with multiple messages throughout their commute. Using a multimedia approach in a high profile station, these potential sponsorship venues are attractive to advertisers who have an umbrella message to impart with multiple facets.

On behalf of Metro, Viacom Outdoor currently offers “Station Saturation” packages at seven of the Metrorail stations. Included among these stations are Gallery Place-Chinatown and Metro Center. For $60,000 gross per month, a multimedia saturation investment at Gallery Place-Chinatown includes twenty six (26) backlit dioramas, twenty seven (27) 2-sheet posters, 2 medium banners (6’ x 11’4”), and 2 small banners (4’ x 10’). For $85,000 gross per month, a multimedia saturation investment at Metro Center includes thirty six (36) backlit dioramas, thirty seven (27) 2-sheet posters, and 2 large banners (7’ x 18’).

The pedestrian tunnel connecting the two stations could potentially support a more linear “Station Saturation” environment. Banners could be mounted on either end of the tunnel and a well designed combination of 2-sheet posters and backlit dioramas along the noncommercial wall could tie their advertising message together. With strategic marketing, the tunnel's ability to convey a continuous linear advertising theme could potentially be more attractive to advertisers than the stations themselves.

A more exciting and ambitious advertising campaign for the pedestrian connection could utilize some of the latest developments in transit related media. Instead of a traditional series of 2-sheet posters and dioramas, the Gallery Place-Metro Center tunnel could be wrapped with dramatic floor-to-ceiling backlit stable or moving advertising images. One of the most revolutionary technologies being employed are motion picture displays. Transit riders in major global markets are exposed to fifteen second-long motion-picture advertisements in and along pedestrian connections and within subway tunnels themselves. Independent studies demonstrate that these unique displays have the highest recall rate of all transit advertising, with exceptional value in branding. This creative media is currently being used in systems across the globe including New York City, Atlanta, Tokyo and Hong Kong, with new displays unveiling soon in major cities in the U.S., South and Central America, Europe, and Asia.

Although a multimedia advertising campaign could take a number of unique forms, the noncommercial side of the tunnel could **theoretically** accommodate the traditional "Station Saturation" equivalent of 95 posters and backlit dioramas. Assuming the mix includes 50 posters at the low end of $500 per month, the tunnel could potentially generate poster revenues of approximately $25,000 per month or $300,000 per year. As of 2005, Viacom Outdoor's rate card for a backlit diorama in the Metro system is $1,120 to $1,500 per month depending on the number displayed and the campaign's duration. Assuming the mix includes 45 dioramas at the low end of $1,120 per month, the tunnel could potentially generate diorama revenues of approximately $50,400 or $604,800 per year. Total revenues could be up to $75,400 per month or $904,800 per year.

Since more than 80 percent of transit agencies have contracts that call for a percentage of the annual net billings and most of these are in the 50 to 60 percent range, advertising in the pedestrian tunnel could **theoretically** generate up to $45,240 per month or $542,880 per year for WMATA. Given the untested nature of "Station Saturation" pedestrian tunnel advertising within the Metro system, it is assumed that revenues could be between $54,288 and $135,720 per year or 10 and 25 percent of these theoretical estimates. This range would approximate 1 to 2 months of traditional "Station Saturation" campaigns at individual Metro's stations.

5. Feasibility Issues

While there is no established track record for retail within the Washington Metro system, based on the experience of other transit systems, the unique development program, and the likely level of pedestrian traffic through the proposed Gallery Place and Metro Center connector, there appears to be sufficient activity to attract and incubate retail operators over time.

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 limited to the holiday season. Prospective lease revenues of 10 percent of sales would be feasible from a tenant's prospective, particularly given the minimum required startup capital requirements.

The key from the transit agency's perspective is to attract the 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 $17,400 to $21,000. Over time even modest increases in annual sales volumes could double these revenues over approximately a 20 year timeframe.

This broad and somewhat speculative potential revenue stream must be measured in terms of any incremental capital and operating cost to effectuate the retail operations. The primary cost is any incremental capital costs to construct and/ or adopt the underground retail area. The incremental cost of the Pedestrian Tunnel with retail is approximately $1.9 million more than a pedestrian tunnel only ($32.6 million vs. $30.7 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 year’s 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 costs 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 and advertising opportunities within the transit connector. These initially would generate modest annual retail lease revenues in the $17,400 to $21,000 range and advertising revenues of $34,200 to $135,720. With a successful operation retail lease revenues could be expected to more than double over a 20 to 25 year timeframe. With utilization of retail kiosks, flexible lease terms (monthly lease arrangements), and lease rates of approximately 10 percent of projected sales there should be private sector interest.

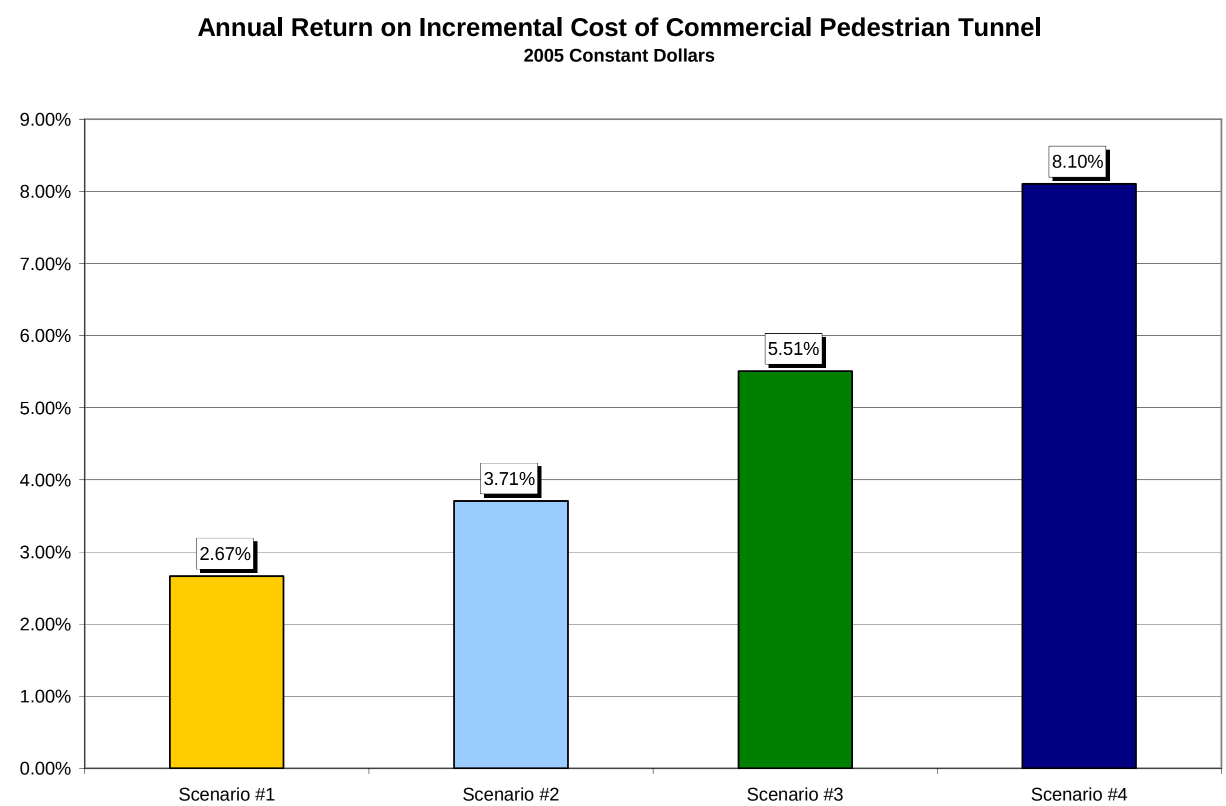
The potential transit agency revenues are relatively modest and must be weighed against relatively modest operating costs and capital costs associated with obtaining carts or kiosks and adapting space to accommodate them. The most significant costs would be the incremental costs of constructing additional underground space. Operating and management issues must also be carefully examined as they obviously are not typical Metro functions. Retail lease revenues must also be compared to the potential loss in advertising revenues to competing retailers.

The table and chart below displays the projected annual returns for the incremental investment on a pedestrian tunnel with capacity for commercial operations. Scenario #1 assumes the low end of projections for retail lease and traditional advertising revenues (i.e. 2-sheet posters). Scenario #2 assumes the low end of projections for retail lease and “Station Saturation” advertising revenues. Scenario #3 assumes the high end of projections for retail lease and traditional advertising revenues. Scenario #4 assumes the high end of projections for retail lease and “Station Saturation” advertising revenues. For an incremental investment of $1.9 million, the potential annual returns are likely to range from 2.67% (Scenario #1) to 8.10% (Scenario #4).

Table :
Annual Return on Commercial Pedestrian Tunnel Incremental Cost
Gallery Place - Metro Center Pedestrian Tunnel
2005 Constant Dollars

Impact	Scenario #1	Scenario #2	Scenario #3	Scenario #4
Annual Lease Revenue	$17,400	$17,400	$21,000	$21,000
Annual Advertising Revenue	$34,200	$54,288	$85,500	$135,720
Total Revenue	$51,600	$71,688	$106,500	$156,720
Incremental Cost	$1,934,000	$1,934,000	$1,934,000	$1,934,000
Annual Return on Incremental Capital Cost	2.67%	3.71%	5.51%	8.10%

Source: BBP Associates



XI COST ESTIMATE

ALTERNATIVE 1 – PEDESTRIAN TUNNEL ONLY

Architectural	$ 4,477,000
Structural	$18,159,000
Utilities	$ 5,250,000
Mechanical	$ 1,371,000
Electrical/Systems	$ 1,396,000
Total (Includes 25% Contingency)	$30,653,000

ALTERNATIVE 2 – PEDESTRIAN TUNNEL WITH MOVING WALKWAY

Architectural	$ 5,602,000
Structural	$17,898,000
Utilities	$ 5,250,000
Mechanical	$ 1,477,000
Electrical	$ 1,589,000
Total (Includes 25% Contingency)	$31,816,000

ALTERNATIVE 3 – PEDESTRIAN TUNNEL WITH COMMERCIAL SPACE

Architectural	$ 5,695,000
Structural	$18,030,000
Utilities	$ 5,250,000
Mechanical	$ 2,006,000
Electrical	$ 1,606,000
Total (Includes 25% Contingency)	$32,587,000

GALLERY PLACE MEZZANINE WALKWAY – CENTER WITH COLUMNS

Structural/Architectural	$ 1,085,000
Utilities	----
Mechanical	$ 248,000
Electrical	$ 803,000
Total (Includes 25% Contingency)	$ 2,136,000

NOTES:

1) Architectural/Structural costs include all structures, finishes, escalators/elevators, dewatering, instrumentation, street decking, support of excavation, temporary shoring of existing structures, and site installation.

2) Utilities cots include maintain existing utilities and relocation of existing utilities.

3) Mechanical costs include HVAC, plumbing, drainage and fire protection.

4) Electrical costs include relocation of traction power cables, electrical power, lighting, fire and intrusion alarms and CCTV.

APPENDIX A

Stations Included in Station Groups

Station Group Name	***Stations in Group***
McPherson Square	Vienna Dunn Loring West Falls Church East Falls Church Ballston Virginia Square Clarendon Courthouse Rosslyn Foggy Bottom Farragut West McPherson Square
Metro Center	Metro Center
Federal Triangle	Federal Triangle
Smithsonian	Smithsonian
L'Enfant Plaza	L'Enfant Plaza
Largo Town Center	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 Largo Town Center
Van Dorn	Franconia-Springfield Van Dorn
Pentagon	King Street Braddock Road National Airport Crystal City Pentagon City Pentagon
Huntington	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
Gallery Place	Gallery Place
Mt. Vernon Square	Mt. Vernon Square
Georgia Ave	Shaw U St/Cardozo Columbia Heights Georgia Ave
Greenbelt	West Hyattsville Prince George's Plaza College Park Greenbelt
Glenmont	Judiciary Square Union Station New York Ave Rhode Island Ave Brookland Fort Totten 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

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%		

Gallery Place - Metro Center Pedestrian Tunnel Passenger Forecast based on 2003 data

Without Moving Walkways

		Market Type												TOTALS	
		0	1	2	3	4	10	11	20	21	22	23	24	**MARKETS 1-24**	**MARKETS 0-24**
Size of Market (passengers per day)	AM Peak	184,809	2,349	431	118	10	5,553	6,681	2,985	9,288	899	672	3	**28,988**	**213,797**
	Midday	105,126	1,180	272	85	23	4,351	4,429	1,703	6,376	654	697	21	**19,791**	**124,917**
	PM peak	189,925	2,166	492	132	19	6,835	7,376	3,277	10,782	1,153	828	19	**33,078**	**223,003**
	Evening	70,158	935	96	90	6	2,680	2,966	1,153	4,143	448	297	1	**12,815**	**82,973**
	TOTAL	**550,018**	**6,631**	**1,291**	**425**	**57**	**19,418**	**21,451**	**9,118**	**30,589**	**3,153**	**2,494**	**45**	**94,672**	**644,690**
Use rate	AM Peak	0%	40%	15%	15%	30%	3%	5%	3%	5%	2%	2%	1%	**7.3%**	**1.0%**
	Midday	0%	55%	20%	20%	35%	3%	5%	3%	5%	2%	2%	1%	**7.5%**	**1.2%**
	PM peak	0%	40%	15%	15%	30%	3%	5%	3%	5%	2%	2%	1%	**6.7%**	**1.0%**
	Evening	0%	55%	20%	20%	35%	3%	5%	3%	5%	2%	2%	1%	**8.1%**	**1.3%**
	AVERAGE	**0.0%**	**44.8%**	**16.4%**	**17.1%**	**32.5%**	**3.0%**	**5.0%**	**3.0%**	**5.0%**	**2.0%**	**2.0%**	**1.0%**	**7.2%**	**1.1%**
Tunnel Users per day	AM Peak	0	940	65	18	3	167	334	90	464	18	13	0	**2,111**	**2,111**
	Midday	0	649	54	17	8	131	221	51	319	13	14	0	**1,478**	**1,478**
	PM peak	0	867	74	20	6	205	369	98	539	23	17	0	**2,217**	**2,217**
	Evening	0	514	19	18	2	80	148	35	207	9	6	0	**1,039**	**1,039**
	TOTAL	**0**	**2,970**	**212**	**73**	**19**	**583**	**1,073**	**274**	**1,529**	**63**	**50**	**0**	**6,844**	**6,844**
Percent of Users by Time Period	AM Peak	0%	45%	3%	1%	0%	8%	16%	4%	22%	1%	1%	0%	**100%**	**100%**
	Midday	0%	44%	4%	1%	1%	9%	15%	3%	22%	1%	1%	0%	**100%**	**100%**
	PM peak	0%	39%	3%	1%	0%	9%	17%	4%	24%	1%	1%	0%	**100%**	**100%**
	Evening	0%	50%	2%	2%	0%	8%	14%	3%	20%	1%	1%	0%	**100%**	**100%**
	AVERAGE	**0%**	**43%**	**3%**	**1%**	**0%**	**9%**	**16%**	**4%**	**22%**	**1%**	**1%**	**0%**	**100%**	**100%**
Users per:	AM PHH	0	186	13	4	1	33	66	18	92	4	3	0	**417**	**417**
	AM Pk Hr	0	362	25	7	1	64	129	35	179	7	5	0	**814**	**814**
	Year	0	856,105	61,487	20,943	5,465	168,895	310,322	79,057	442,807	18,271	14,517	133	**1,978,002**	**1,978,002**

Gallery Place - Metro Center Pedestrian Tunnel Passenger Forecast based on 2030 data

Without Moving Walkways

		Market Type												TOTALS	
		0	1	2	3	4	10	11	20	21	22	23	24	**MARKETS 1-24**	**MARKETS 0-24**
Size of Market (passengers per day)	AM Peak	271,571	3,421	632	181	13	10,508	11,652	5,732	19,097	1,217	2,266	7	**54,726**	**326,298**
	Midday	152,866	1,785	372	129	32	8,892	7,882	3,633	12,281	937	1,976	56	**37,974**	**190,840**
	PM peak	277,241	3,152	712	196	24	13,425	13,257	6,487	22,079	1,613	2,612	50	**63,609**	**340,850**
	Evening	103,333	1,354	137	134	7	5,638	5,334	2,423	8,610	632	920	4	**25,193**	**128,525**
	TOTAL	**805,011**	**9,712**	**1,852**	**641**	**77**	**38,463**	**38,124**	**18,275**	**62,067**	**4,398**	**7,774**	**117**	**181,502**	**986,513**
Use rate	AM Peak	0%	40%	15%	15%	30%	3%	5%	3%	5%	2%	2%	1%	**6.6%**	**1.1%**
	Midday	0%	55%	20%	20%	35%	3%	5%	3%	5%	2%	2%	1%	**6.7%**	**1.3%**
	PM peak	0%	40%	15%	15%	30%	3%	5%	3%	5%	2%	2%	1%	**6.1%**	**1.1%**
	Evening	0%	55%	20%	20%	35%	3%	5%	3%	5%	2%	2%	1%	**7.0%**	**1.4%**
	AVERAGE	**0.0%**	**44.8%**	**16.4%**	**17.1%**	**32.5%**	**3.0%**	**5.0%**	**3.0%**	**5.0%**	**2.0%**	**2.0%**	**1.0%**	6.5%	1.2%
Tunnel Users per day	AM Peak	0	1,368	95	27	4	315	583	172	955	24	45	0	**3,589**	**3,589**
	Midday	0	982	74	26	11	267	394	109	614	19	40	1	**2,536**	**2,536**
	PM peak	0	1,261	107	29	7	403	663	195	1,104	32	52	1	**3,854**	**3,854**
	Evening	0	745	27	27	3	169	267	73	430	13	18	0	**1,772**	**1,772**
	TOTAL	**0**	**4,356**	**303**	**109**	**25**	**1,154**	**1,906**	**548**	**3,103**	**88**	**155**	**1**	**11,750**	**11,750**
Percent of Users by Time Period	AM Peak	0%	38%	3%	1%	0%	9%	16%	5%	27%	1%	1%	0%	**100%**	**100%**
	Midday	0%	39%	3%	1%	0%	11%	16%	4%	24%	1%	2%	0%	**100%**	**100%**
	PM peak	0%	33%	3%	1%	0%	10%	17%	5%	29%	1%	1%	0%	**100%**	**100%**
	Evening	0%	42%	2%	2%	0%	10%	15%	4%	24%	1%	1%	0%	**100%**	**100%**
	AVERAGE	**0%**	**37%**	**3%**	**1%**	**0%**	**10%**	**16%**	**5%**	**26%**	**1%**	**1%**	**0%**	**100%**	**100%**
Users per:	AM PHH	0	270	19	5	1	62	115	34	189	5	9	0	**709**	**709**
	AM Pk Hr	0	528	37	10	2	122	225	66	368	9	17	0	**1,384**	**1,384**
	Year	0	1,256,191	87,850	31,579	7,361	334,740	551,660	158,606	897,785	25,501	45,157	349	**3,396,780**	**3,396,780**

APPENDIX C

APPENDIX C

Gallery Place - Metro Center Pedestrian Tunnel Passenger Forecast based on 2003 data

With Moving Walkways

		Market Type												TOTALS	
		0	1	2	3	4	10	11	20	21	22	23	24	**MARKETS 1-24**	**MARKETS 0-24**
Size of Market (passengers per day)	AM Peak	184,809	2,349	431	118	10	5,553	6,681	2,985	9,288	899	672	3	**28,988**	**213,797**
	Midday	105,126	1,180	272	85	23	4,351	4,429	1,703	6,376	654	697	21	**19,791**	**124,917**
	PM peak	189,925	2,166	492	132	19	6,835	7,376	3,277	10,782	1,153	828	19	**33,078**	**223,003**
	Evening	70,158	935	96	90	6	2,680	2,966	1,153	4,143	448	297	1	**12,815**	**82,973**
	TOTAL	**550,018**	**6,631**	**1,291**	**425**	**57**	**19,418**	**21,451**	**9,118**	**30,589**	**3,153**	**2,494**	**45**	**94,672**	**644,690**
Use rate	AM Peak	0%	42%	16%	16%	32%	3%	5%	3%	5%	2%	2%	1%	**7.6%**	**1.0%**
	Midday	0%	60%	22%	22%	38%	3%	5%	3%	5%	2%	2%	1%	**8.0%**	**1.3%**
	PM peak	0%	42%	16%	16%	32%	3%	5%	3%	5%	2%	2%	1%	**7.0%**	**1.0%**
	Evening	0%	60%	22%	22%	38%	3%	5%	3%	5%	2%	2%	1%	**8.7%**	**1.3%**
	AVERAGE	**0.0%**	**47.7%**	**17.7%**	**18.5%**	**35.0%**	**3.1%**	**5.2%**	**3.1%**	**5.2%**	**2.0%**	**2.0%**	**1.0%**	**7.6%**	**1.1%**
Tunnel Users per day	AM Peak	0	987	69	19	3	173	347	93	483	18	13	0	**2,206**	**2,206**
	Midday	0	708	60	19	9	136	230	53	332	13	14	0	**1,573**	**1,573**
	PM peak	0	910	79	21	6	213	384	102	561	23	17	0	**2,315**	**2,315**
	Evening	0	561	21	20	2	84	154	36	215	9	6	0	**1,109**	**1,109**
	TOTAL	**0**	**3,166**	**229**	**79**	**20**	**606**	**1,115**	**284**	**1,591**	**63**	**50**	**0**	**7,203**	**7,203**
Percent of Users by Time Period	AM Peak	0%	45%	3%	1%	0%	8%	16%	4%	22%	1%	1%	0%	**100%**	**100%**
	Midday	0%	45%	4%	1%	1%	9%	15%	3%	21%	1%	1%	0%	**100%**	**100%**
	PM peak	0%	39%	3%	1%	0%	9%	17%	4%	24%	1%	1%	0%	**100%**	**100%**
	Evening	0%	51%	2%	2%	0%	8%	14%	3%	19%	1%	1%	0%	**100%**	**100%**
	AVERAGE	**0%**	**44%**	**3%**	**1%**	**0%**	**8%**	**15%**	**4%**	**22%**	**1%**	**1%**	**0%**	**100%**	**100%**
Users per:	AM PHH	0	195	14	4	1	34	69	18	95	4	3	0	**436**	**436**
	AM Pk Hr	0	380	27	7	1	67	134	36	186	7	5	0	**851**	**851**
	Year	0	912,633	66,298	22,676	5,886	175,651	322,735	82,219	460,519	18,271	14,517	133	**2,081,538**	**2,081,538**

Gallery Place - Metro Center Pedestrian Tunnel Passenger Forecast based on 2030 data

With Moving Walkways

		Market Type												TOTALS	
		0	1	2	3	4	10	11	20	21	22	23	24	**MARKETS 1-24**	**MARKETS 0-24**
Size of Market (passengers per day)	AM Peak	271,571	3,421	632	181	13	10,508	11,652	5,732	19,097	1,217	2,266	7	**54,726**	**326,298**
	Midday	152,866	1,785	372	129	32	8,892	7,882	3,633	12,281	937	1,976	56	**37,974**	**190,840**
	PM peak	277,241	3,152	712	196	24	13,425	13,257	6,487	22,079	1,613	2,612	50	**63,609**	**340,850**
	Evening	103,333	1,354	137	134	7	5,638	5,334	2,423	8,610	632	920	4	**25,193**	**128,525**
	TOTAL	**805,011**	**9,712**	**1,852**	**641**	**77**	**38,463**	**38,124**	**18,275**	**62,067**	**4,398**	**7,774**	**117**	**181,502**	**986,513**
Use rate	AM Peak	0%	42%	16%	16%	32%	3%	5%	3%	5%	2%	2%	1%	**6.9%**	**1.1%**
	Midday	0%	60%	22%	22%	38%	3%	5%	3%	5%	2%	2%	1%	**7.1%**	**1.4%**
	PM peak	0%	42%	16%	16%	32%	3%	5%	3%	5%	2%	2%	1%	**6.3%**	**1.2%**
	Evening	0%	60%	22%	22%	38%	3%	5%	3%	5%	2%	2%	1%	**7.5%**	**1.5%**
	AVERAGE	**0.0%**	**47.8%**	**17.6%**	**18.5%**	**35.0%**	**3.1%**	**5.2%**	**3.1%**	**5.2%**	**2.1%**	**2.1%**	**1.0%**	6.8%	1.3%
Tunnel Users per day	AM Peak	0	1,437	101	29	4	328	606	179	993	25	47	0	**3,749**	**3,749**
	Midday	0	1,071	82	28	12	277	410	113	639	19	41	1	**2,693**	**2,693**
	PM peak	0	1,324	114	31	8	419	689	202	1,148	34	54	1	**4,024**	**4,024**
	Evening	0	812	30	30	3	176	277	76	448	13	19	0	**1,884**	**1,884**
	TOTAL	**0**	**4,644**	**327**	**118**	**27**	**1,200**	**1,982**	**570**	**3,227**	**91**	**162**	**1**	**12,351**	**12,351**
Percent of Users by Time Period	AM Peak	0%	38%	3%	1%	0%	9%	16%	5%	26%	1%	1%	0%	**100%**	**100%**
	Midday	0%	40%	3%	1%	0%	10%	15%	4%	24%	1%	2%	0%	**100%**	**100%**
	PM peak	0%	33%	3%	1%	0%	10%	17%	5%	29%	1%	1%	0%	**100%**	**100%**
	Evening	0%	43%	2%	2%	0%	9%	15%	4%	24%	1%	1%	0%	**100%**	**100%**
	AVERAGE	**0%**	**38%**	**3%**	**1%**	**0%**	**10%**	**16%**	**5%**	**26%**	**1%**	**1%**	**0%**	**100%**	**100%**
Users per:	AM PHH	0	284	20	6	1	65	120	35	196	5	9	0	**740**	**740**
	AM Pk Hr	0	554	39	11	2	126	234	69	383	10	18	0	**1,446**	**1,446**
	Year	0	1,339,369	94,689	34,191	7,928	348,130	573,727	164,950	933,696	26,521	46,964	363	**3,570,529**	**3,570,529**

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 Metro Center and Gallery Place 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 Metro Center and Gallery Place. 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 Metro Center and Gallery Place 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 Metro Center and Gallery Place 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.

<u>5.5.3.3.3.1 Doors and Gates:</u>

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

<u>Conclusion</u>: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

<u>5.5.3.3.4.Fare Collection Gates:</u>

<u>Requirement</u>: (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.

<u>Conclusion</u>: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

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

<u>Conclusion</u>: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

<u>Requirement</u>: (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.

<u>Conclusion</u>: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

<u>5.5.4 Escalators</u>:

<u>Requirement</u>: (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.

<u>Conclusion</u>: Incorporate WMATA criteria updated to comply with new 2003 NFPA 130 requirements.

<u>Requirement</u>: (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:	11/09/04
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	COMPANY:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Gallery Place/Metro Center Kick-off Meeting FILE NO: 645536 50030

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357
Jane Engvall	WMATA/ENGA	202.962.1521
Bill Gallagher	KGP	202.822.2102
David Starnes	BBP Associates	410.266.7800
Jonathan McIntyre	NCPC	202.482.7233
Dave Glen	Parsons	703.247.4454
Randy Dittberner	Parsons	202.775.6088
David Robinson	WMATA	202.962.2432
Alex Eckmann	DC DOT	202.671.0537
Perrilyn Faufulik	WMATA	202.962.5115
James Darmody	WMATA	202.962.2091
Tom Harrington	WMATA/BPPD	202.962.2294
Dan Hertz	WMATA/LAND	202.962.2108
Eddie Chang	WMATA/ENGA	202.962.1746
John Bumanis	Parsons	703.247.4447
Prakash Patel	Parsons	202.775.6020
Kwong Tse	Parsons	202.775.3409
Deirdre Smith	Parsons	202.775.3396

The Kick-off meeting for the Gallery Place – Metro Center Pedestrian Passageway Tunnel project took place at the WMATA offices on October 26, 2004.

After the team introductions were made, the scope and purpose of the study was reviewed. A few clarifications were made to the scope.

- Parsons may already have the necessary asbuilts for Task 1 (Data Collection and Analysis). If additional data is needed, a visit to WMATA will be made.
- Task 3 (Ridership Analysis) will use the data for the years 2003 – 2030.

A copy of the plan used in the Core Capacity Study was distributed and discussed.

- The connector tunnel to the Convention Center Development is included in the scope of work.
- The new flying mezzanine at the Metro Center Station and the new extended mezzanines at Gallery Place are not included in the scope.
- **The new surface entrances along the tunnel between the stations and the tunnel to the Convention Center Development are included.**

The site visit will be scheduled to take place in two weeks. The next Team Meeting will take place in approximately three weeks.

APPENDIX E

Parsons

		DATE:	12/21/04
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	COMPANY:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Gallery Place/Metro Center Progress Meeting FILE NO: 645536 50030

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357	jmagarelli@wmata.com
Glenn Millis	WMATA/ADAP	202.962.1631	glmillis@wmata.com
Rayann Otto	WMATA/ADAP	202.962.2504	rotto@wmata.com
Ed Riley	WMATA/ENGA	202.962.1384	eriley@wmata.com
Kwong Tse	Parsons	202.775.3409	kwong.tse@parsons.com
Dave Glen	Parsons	703.247.4454	glend@ctcmetro.com
John Bumanis	Parsons	703.247.4447	bumanisj@ctcmetro.com
Bill Gallagher	KGP	202.822.2102	bgallagher@kgpds.com
Deirdre Smith	Parsons	202.775.3396	deirdre.a.smith@parsons.com
Jonathan McIntyre	NCPC	202.482.7233	jonathon.mcintyre@ncpc.gov
Kanti Patel	WMATA/ENGA	202.962.1104	kbpatel@wmata.com
M. Nasir Nasim	WMATA/ENGA	202.962.1397	mnasim@wmata.com
Scott Peterson	WMATA/BPPD	202.962.1458	speterson@wmata.com
Nadeem Tahir	WMATA/ENGA	703.247.6521	ntahir@wmata.com

The progress meeting for the Gallery Place – Metro Center Pedestrian Passageway Tunnel project took place at the WMATA offices on December 16, 2004.

After the team introductions were made, the status of the project's tasks were given by John Magarelli. Task 1 (Data Collection and Analysis) is essentially complete. Task 2 (Passageway Conceptual Plans) is well underway and the concepts developed were shown and discussed later in the meeting. Task 3 (Ridership Analysis) has begun as well as Task 4 (Joint Development Analysis).

Bill Gallagher then reviewed the basic tunnel alignment along G Street. The existing fan shaft, traction power substation, and vent shaft are physical constraints that effect the tunnel alignment.

A number of potential tunnel connections were also shown. These connections are not going to be part of this project, but shall not be precluded from being developed at a later date. Knock-out panels will be shown at the connection locations. The first connection is shown through the alley between the YWCA and U.D.C. building. The other two are on the north and south sides of the tunnel along 10th Street. They are along the west side of 10th Street to avoid the buried utilities.

Potential street entrance locations (stairs/escalators and/or elevators) were also shown for discussion purposes. There is concern about the location of one entrance at the corner of 9th and G Streets on the sidewalk in front of the M.L.K. Library. It was felt that it would be highly unlikely that an entrance would be allowed there as the Library has the possibility of being placed on the Historic Registry since it was the last building designed by Meese.

A detailed discussion took place concerning the elevators at Gallery Place. Ed Riley suggested that the elevator (from Mezzanine to Platform) shown within the service rooms could be moved outside of the vault, similar to what was done at Ballston. This would avoid having to relocate any of the mechanical ductwork.

A decision will need to be made as to whether the tunnel will be “free” or “paid”. If there are multiple entrances the tunnel will be free. If there are only entrances at the station areas, then the tunnel will be “paid”.

Glenn Millis indicated that from a disability perspective there was a need for redundancy in elevators at both stations. The question arose about the possibility of using smaller than WMATA standard sized elevators in areas where there were severe space limitations. The proposed elevators would still be ADA compliant. We were able to use these elevators in a similar situation on the recently completed Farragut North/West Pedestrian Tunnel Study. Ed Riley said that it was possible to go to the Design Control Board to request a variance in elevator size.

It was reiterated at this meeting that the tunnel and entrance concepts were based upon the WMATA’s Core Capacity Study. The Core Capacity Study is an integral part of this study.

Various technical issues were discussed and are as follows:
Mechanical:

- The ventilation system within the traction power substation will need to be redone to accommodate the tunnel.
- The mechanical room at Metro Center is spacious and does not provide any problems.
- The mechanical room at Gallery Place is extremely crowded. As a result, equipment would need to be relocated to accommodate the elevators.

APPENDIX E

Structural:

- ❖ The planned method of tunnel construction is to be cut and cover with decking. Even though it is felt that the tunnel is too short and shallow with inadequate soil conditions to hand mine, the hand mined method will be still be evaluated.

Jonathan McIntyre recommended that we get in touch with DC SHPO (State Historic Preservation) and the Commission of Fine Arts to find out about the historic nature of the surrounding buildings.
John Magarelli requested that the attendees please compile their comments and send them to him as soon as possible. The next Team Meeting will take place in mid-January.

APPENDIX E

Parsons

		DATE:	2/1/05
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	COMPANY:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Gallery Place/Metro Center Meeting w/NCPC & CFA FILE NO: 645536 50030

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357	jmagarelli@wmata.com
John Bumanis	Parsons	703.247.4447	bumanisj@ctcmetro.com
Bill Gallagher	KGP	202.822.2102	bgallagher@kgpds.com
Deirdre Smith	Parsons	202.775.3396	deirdre.a.smith@parsons.com
Jonathan McIntyre	NCPC	202.482.7233	jonathon.mcintyre@ncpc.gov
Frederick Lindstrom	CFA	202.504.2200	flindstrom@cfa.gov
Kristina Penhoet	CFA	202.504.2200	kpenhoet@cfa.gov

A meeting with The National Capital Planning Commission (NCPC) and The U.S. Commission of Fine Arts (CFA) took place at the WMATA offices on February 1, 2005. The State Historic Preservation Office (SHPO) was invited to attend but was unable to attend.

The purpose of the meeting was to show the CFA, SHPO, and NCPC the different options for the various entrance locations and to receive their comments and opinions.

Bill Gallagher reviewed the possible street-to-mezzanine elevator locations for the Gallery Place Station at the intersection of G Street and 9th Street. One possible elevator location was in the vicinity of the sculpture owned by the Pepco building. It was recommended by the CFA that the elevators be moved up against the adjacent building or recessed into them. This would result in the extension of the tunnel length and require an emergency exit. One reason the elevator could not be placed as show on the plans was that there is a parking garage located underneath the sculpture and this would conflict with the tunnel passageway for the elevator. CFA felt that placing the elevators on the northeast corner of the intersection (M.L.K. Building) would never be approved.

The only option involving the M.L.K. Building that has any chance of being approved would be to recess the elevators into the corner of the building. The approval of this option has an extremely remote probability. An alternative elevator location is within the alley on the west side of G Street between the YWCA and the U.D.C. building or within the YWCA building itself.

The plans also show two stair entrances, one on either side of G Street, aligned with the alley between the YWCA and the U.D.C. building. The opposition to this arrangement was the stairs on the west side of G Street interfered with the view of the U.D.C. building. The stairs on the east side interfered with the view of the M.L.K. Library. The alternative location for the stairs on the west side of G Street that was recommended was to place it in the alley between the YWCA and the U.D.C. building. For the east side of G Street, locate the stairs in the alley between the church and the M.L.K. Library.

The CFA recommended getting the Downtown BID involved, especially since we were studying a tunnel option that included commercial.

APPENDIX E

Parsons

		DATE:	2/3/05
TO:	John Magarelli, P.E.	FROM:	Deirdre Smith, P.E.
COMPANY:	WMATA	COMPANY:	Parsons
PHONE:	202.962.1357	PHONE:	202.775.3396

SUBJECT: Gallery Place/Metro Center Progress Meeting FILE NO: 645536 50030

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357	jmagarelli@wmata.com
John Bumanis	Parsons	703.247.4447	bumanisj@ctcmetro.com
Bill Gallagher	KGP	202.822.2102	bgallagher@kgpds.com
Deirdre Smith	Parsons	202.775.3396	deirdre.a.smith@parsons.com
Alex Eckmann	DDOT	202.671.0536	alex.eckmann@dc.gov
Evelyn Bandoh	DDOT	202.671.0537	evelyn.bandoh@dc.gov
Randy Dittberner	Parsons	202.775.6088	randy.dittberner@parsons.com
Kwong Tse	Parsons	202.775.3409	kwong.tse@parsons.com
Jim Prost	BBPA	301.970.2298	jprost@bbpa.com
Dan Hertz	WMATA	202.962.2108	dhertz@wmata.com
Rayann Otto	WMATA	202.962.2504	rotto@wmata.com
Ed Riley	WMATA	202.962.1384	eriley@wmata.com
John Grimm	WMATA	202.962.2775	jgrimm@wmata.com
Karina Ricks	DC-OP	202.442.7607	karina.ricks@dc.gov
M. N. Nasim	WMATA	202.962.1397	mnasim@wmata.com

The progress meeting for the Gallery Place – Metro Center Pedestrian Passageway Tunnel Project took place at the WMATA offices on February 3, 2005.

The meeting provided an opportunity to show the different options for the various entrance locations and to receive comments and opinions, in addition to receiving an update of the ridership and economic analyses.

The Paid vs. Free options were shown and discussed. The Paid option required a significant number of faregates to be added, while the Free option only required the relocation of existing faregates. Also shown at Gallery Place was a new mezzanine that followed along the Red Line platform and connected the two existing mezzanines. The following comments were made with respect to the tunnel layout plans:

- A midtunnel access is not needed. – K. Ricks
- There isn't any need for a street to mezzanine elevator at Gallery Place – E. Riley
- A preference for retail to be on the street and not in the tunnel – K. Ricks
- Security for a Free tunnel is a concern – J. Grimm
- The existing escalator on the corner of 9th and G Streets will be getting a canopy – E. Riley
- Since this is the entertainment area of the city, the tunnel design should be more artistic. WMATA may also want to consider selling permits to artists so that they could perform within the tunnel alternative that has a commercial component. – K. Ricks
- Would the flying mezzanine at Gallery Place trigger NFPA 130? The existing station is grandfathered in but is adding the mezzanine a significant enough change to trigger it?

Randy Dittberner provided an update on the ridership analysis. There are 12 markets that make up the analysis. His preliminary calculations indicate that approximately 12,000 people will be using the tunnel in the year 2030. His handout goes into further detail. It was requested that the final report indicate alternate scenarios (that were not included in the analysis) that would effect ridership numbers, i.e. in the event of the shutdown of the Red line, the passengers would have alternative route.

Jim Prost had a handout that went into detail about the retail opportunities and constraints within the tunnel. He had been in contact with the Downtown BID and they do not want retail within the tunnel as they are trying to encourage it along the street. The BID saw the tunnel as a major advertising promotion opportunity.

John Magarelli requested that if anyone had any comments to please send them to him. He will notify everyone of the date and time of the next meeting.

APPENDIX E

Parsons

		DATE:	3/18/05
TO:	John Magarelli, P.E.	FROM:	John Bumanis, P.E.
COMPANY:	WMATA	COMPANY:	Parsons
PHONE:	202.962.1357	PHONE:	703.247.4447

SUBJECT: Gallery Place/Metro Center Progress Meeting FILE NO: 645536 50030

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357	jmagarelli@wmata.com
John Bumanis	Parsons	703.247.4447	bumanisj@ctcmetro.com
Bill Gallagher	KGP	202.822.2102	bgallagher@kgpds.com
Frederick Lindstrom	CFA	202.504.2200	flindstrom@cfa.gov
Kristina Penhoet	CFA	202.504.2200	kpenhoet@cfa.gov
David Maloney	DC SHPO	202.442.8841	david.maloney@dc.gov
Evelyn Bandoh	DDOT	202.671.0537	evelyn.bandoh@dc.gov

The progress meeting for the Gallery Place – Metro Center Pedestrian Passageway Tunnel Project took place at the WMATA offices on March 14, 2005.

The meeting provided an opportunity to summarize the different options for locating two new elevators (street to mezzanine) serving the west end of Gallery Place station. These options consist of elevators placed at the following locations:

- At the northwest corner of 9th and G Street in front of the Martin Luther King Library.
- At the northeast corner of 9th and G Street in front of the PEPCO Building.
- Adjacent to the YWCA building on G Street
- At the southeast corner of 9th and G Street in front of the existing Gallery Place station entrance and the Portrait Gallery.

The last location is preferred since this will consolidate the existing escalators and the new elevators in one location. It is envisioned that the elevator enclosure will be designed to complement the escalator canopy planned for this location.

APPENDIX E

After Bill Gallagher distributed sketches showing the proposed location, comments and discussion during the meeting were as follows:

- At this point the Free option is preferred since this significantly simplifies existing faregate configuration – J. Magarelli
- This may be a viable location provided that that the Smithsonian Institution, which operates the Portrait Gallery, concurs. The contact at the Smithsonian Institution is the Facilities Manager, Harry Rombach. – F. Lindstrom
- The elevator locations shown at the Portrait Gallery on the sketches were discussed and it was determined that adjustments to the locations shown would not produce any improvements.
- In terms of historical significance, the Portrait Gallery is the most sensitive building in the area. As such, placing the elevators at this location is problematical. – D. Maloney
- Due to potential problems associated with locating elevators at the Portrait Gallery, an elevator location along G Street in the alley adjacent to the YWCA building may still be necessary – K. Penhoet
- A computer rendering of the proposed elevator location in front of the Gallery will be provided by KGP – B. Gallagher
- The need for a knockout panel for a future connection to the retail development located on F Street between 9th and 10 Streets was questioned - D. Maloney
- The new entrance stairway located at the church on the northeast corner of 10th and G Street should be incorporated into the Martin Luther King Library Arcade. - F. Lindstrom
- The plans should also include a streetscape showing the existing features (e.g. light poles) along G Street - K. Penhoet
- The proposed flying mezzanine at connecting the east and west mezzanines at Gallery Place was also described by B. Gallagher in reference to potential walkway locations (i.e walkway located over the trackways versus walkways located over the platforms).

A meeting with the Smithsonian will be arranged to discuss the proposed entrance elevator locations at the southeast corner of 9th and G Street in front of the existing Gallery Place station entrance and the Portrait Gallery. John Magarelli will notify the appropriate people of the date and time of the next meeting.

APPENDIX E

Parsons

		DATE:	4/19/05
TO:	John Magarelli, P.E.	FROM:	Bill Gallagher.
COMPANY:	WMATA	COMPANY:	KGP
PHONE:	202.962.1357	PHONE:	202.822.2102

SUBJECT: Gallery Place/Metro Center Progress Meeting FILE NO: 645536 50030

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357	jmagarelli@wmata.com
Bill Gallagher	KGP	202.822.2102	bgallagher@kgpds.com
Thomas Luebke	CFA	202.504.2200	tluebke@cfa.gov
Frederick Lindstrom	CFA	202.504.2200	flindstrom@cfa.gov
Kristina Penhoet	CFA	202.504.2200	kpenhoet@cfa.gov
David Maloney	DC SHPO	202.442.8841	david.maloney@dc.gov
Evelyn Bandoh	DDOT	202.671.0537	evelyn.bandoh@dc.gov
Jonathan McIntyre	NCPC	202.482.7233	jonathan.mcintyre@ncpc.gov
Jane Passman	SI FMP	202.275.0234	passmj@si.edu
Scott Peterson	WMATA	202.962.1458	speterson@smata.com

The progress meeting for the Gallery Place – Metro Center Pedestrian Passageway Tunnel Project took place at the WMATA offices on April 18, 2005.

The meeting provided an opportunity to summarize 1), the three different tunnel options, 2), the new stair entrance near the center of the tunnel under the arcade of the MLK Library, 3), the bridge between mezzanines at Gallery Place (to allow patrons to pass from one mezzanine to the other without having to travel down the crowded platforms after a MCI event), and 4), the location of two new elevators (street to mezzanine) serving the west end of Gallery Place station. All options were discussed with elevators placed at the following locations:

- At the northwest corner of 9th and G Street in front of the Martin Luther King Library.
- At the northeast corner of 9th and G Street in front of the PEPCO Building.
- Adjacent to the YWCA building on G Street
- At the southeast corner of 9th and G Street in front of the existing Gallery Place station entrance and the Portrait Gallery.

APPENDIX E

The Gallery Place station entrance was looked at in detail with 3 elevator location options and renderings relating the elevators, canopy and the Portrait Gallery.

After presenting the drawings of the tunnel alternatives, the alternatives for the Portrait Gallery elevators and the bridge the discussions during the meeting went as follows:

- The Portrait Gallery location was not liked as a solution to the problem. It was thought that the site was too tight and too busy and the elevators would add more clutter to this area. There was no strong objection by the Smithsonian, but CFA, NCPC and SHPO suggested moving the elevators to various other sites.
- In terms of historical significance, the Portrait Gallery is the most sensitive building in the area. As such, placing the elevators at this location is problematical. – D. Maloney
- The elevator locations shown at the Portrait Gallery on the sketches were discussed and it was determined that adjustments to the locations shown would not produce any improvements.
- It was suggested to talk to the YWCA to see if they have any plans for redevelopment of the site and to provide a place for the elevators.
- It was suggested to located the elevators at the PEPCO building plaza
- Due to potential problems associated with locating elevators at the Portrait Gallery, an elevator location along G Street in the alley adjacent to the MLK and church building would be desirable.
- There was an overall agreement to move the Metro Ticket office from Metro Center to this new tunnel where patrons from all the lines could easily come to get tickets. In addition one of the ideas for the tunnel would be for Tickets to various events in the area, a “ticket tunnel” where MCI, plays, museums, and others could all advertise and sell tickets. This would also add a safety factor to the central stairs in the tunnel.
- The large curved tunnel was liked and thought to be good for site lines, safety and general aesthetics.
- The proposed flying mezzanine connecting the east and west mezzanines at Gallery Place was discussed and thought to be problematic for the aesthetics of the station vault. Various options will be studied to resolve this issue.

At the conclusion, elevators might be moved to the central location with only 2 new street elevators instead of the 4 planned. An internal staff meeting will take place to determine the exact direction of the future locations and further refinement of the bridge structure at Gallery Place Station.

APPENDIX E

KGP Design Studio

		DATE:	4/22/05
TO:	John Magarelli, P.E.	FROM:	Bill Gallagher.
COMPANY:	WMATA	COMPANY:	KGP
PHONE:	202.962.1357	PHONE:	202.822.2102

S U B J E C T : Gallery Place/Metro Center Progress Meeting F I L E N O : 645536 50030

Attendees:

John Magarelli	WMATA/BPPD	202.962.1357	jmagarelli@wmata.com
Bill Gallagher	KGP	202.822.2102	bgallagher@kgpds.com
Jane Passman	SI FMP	202.275.0234	passmj@si.edu
Harry Rombach	SI FMP	202.275.0250	rombah@ic.si.edu
Stephen di Girolamo	SI FMP	202.275.1801	digirolamos@npg.si.edu

The progress meeting for the Gallery Place – Metro Center Pedestrian Passageway Tunnel Project took place at the Smithsonian Offices, 750 9th St NW Suite 5200 on April 22, 2005.

The meeting provided an opportunity to summarize the current planning for the new pedestrian tunnel including the following: 1), the three different tunnel options, commercial, moving walkway and simple tunnel 2), the new stair entrance near the center of the tunnel under the arcade of the MLK Library, 3), the bridge between mezzanines at Gallery Place (to allow patrons to pass from one mezzanine to the other without having to travel down the crowded platforms after a MCI event), and 4), the location of two new elevators (street to mezzanine) serving the west end of Gallery Place station. Options were discussed with elevators placed at the following locations:

- At the northwest corner of 9th and G Street in front of the Martin Luther King Library.
- At the northeast corner of 9th and G Street in front of the PEPCO Building.
- Adjacent and inside the YWCA building on G Street
- At the southeast corner of 9th and G Street in front of the existing Gallery Place station entrance and the Portrait Gallery
- Center of the tunnel between the MLK Library and the Church at 10th and G Sts.

The Gallery Place station entrance was looked at in detail with 3 elevator location options. Plans and renderings relating the elevators, canopy and the Portrait Gallery were discussed.

After presenting the drawings the discussions were as follows:

APPENDIX E

- The previous discussions about the entrance elevators for all locations were addressed to give some background to the overall nature of the problem of locating the elevators.
- Everyone agreed in terms of historical significance, the Portrait Gallery does appear to be the most sensitive building in the area being the 3rd or 4th oldest government building in the city.
- The elevator locations shown at the Portrait Gallery on the sketches were discussed. After looking at the options Scheme A, elevators centered on and facing the escalators seemed to be the most appropriate location.
- Although this area may be used for future signage for the gallery, this was the preferred location
- The construction schedule was discussed and it was determined that the tunnel and elevator construction would be sometime after the completion of the current renovation to the Portrait Gallery.
- Actual construction was also discussed. The elevators and tunnel construction would not have any adverse affect on the work being completed at this time except for some utility relocation required in the area of the elevators (and a lot of utility work on G St. in the 900 block away from the Museum).
- There was an overall agreement about the future use of the tunnel for tickets and advertising of events in the museums and around the city. This new tunnel is located where patrons from all the transit lines could easily come to get tickets and information about events. This activity would increase safety to the tunnel by providing staff.
- From the point of view of the Smithsonian, the pedestrian tunnel and elevators were seen as positive influence on the Portrait Gallery. These connections would further the goals of the Smithsonian to provide as much access as possible to the museum. The pedestrian tunnel and elevators would make the Portrait Gallery more readily accessible.
- The location of the existing Metro entrance with future canopy and elevators was discussed and thought to be not a significant location in relation to the views of the building because it was not on the North or South facade of the building where the 8th St vista was very important.
- The location of the elevators next to the escalators was discussed and thought to be a positive location for the many tourists that visit the city who are unable to identify the location of the elevators when they are remote from the escalator entrance.

The conclusion of the meeting was that the elevators located at 9th and G St., Portrait Gallery corner were not a significant negative impact on the Smithsonian. The functional location (next to the escalators) was considered positive for Metro and Smithsonian patrons.

It was concluded that this location would remain as the primary alternative location for the elevators at Gallery Place Station but all the other locations discussed will be included in the report for future evaluation as alternatives.

M
metro

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

ROCKVILLE STATION ACCESS IMPROVEMENT STUDY

Final Report
August 2005

Washington Metropolitan Area Transit Authority
Department of Planning and Information Technology
Office of Business Planning & Project Development

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

FOREWORD

In the greater Washington metropolitan area, steady growth, particularly around Metrorail stations, has generated increased transit ridership, but has also led to more vehicular traffic in station areas. As a result, the different modes of access to transit often come into conflict in station areas. WMATA and local jurisdictional planners have recognized that many existing Metrorail stations designed twenty-five to thirty years ago, such as the Rockville station, need a new assessment to determine if existing conditions for pedestrian access, bus operations, and vehicular traffic are adequate to meet existing capacity and future demand. In addition, with the increased interest in WMATA's Joint Development program and projections of continued ridership growth, it is crucial that good access to Metrorail station is maintained, and even improved.

Improving access to and from Metro is critical to meeting ridership goals and serving customer needs. Potential riders may be lost or choose other means of travel if any of the following conditions exist: Pedestrian paths are indirect and fragmented; high traffic volumes and traffic conflicts in and around the station; bus service is unavailable due to a lack of bus bays and storage space; pick-up/drop-off space is inconvenient or limited and access is not provided for shuttle buses; short-term and long-term parking spaces are full or unavailable.

Potential riders may also be lost if access constraints mean that the door-to-door journey involving Metro becomes more time consuming, unreliable or frustrating than an alternative means of travel, such as driving the entire way. Ultimately, the goal of improving station access is to attract additional customers by: enhancing the pedestrian experience with a safer and more attractive walking environment, maintaining a good level of service for transit access to the site, which includes buses and other transit vehicles, accommodating future access needs, which include vehicular traffic growth, and making transit use more convenient and attractive as a travel mode.

This study is the seventh of a series of station access improvement studies that WMATA has conducted for the jurisdictions

ROCKVILLE STATION ACCESS IMPROVEMENT STUDY

TABLE OF CONTENTS

1. INTRODUCTION

Background

In October 2001, the Mayor of Rockville and the City Council adopted the Rockville Town Center Master Plan, a mixed-use commercial, residential, retail and entertainment development that will create a pedestrian-oriented downtown. The Town Center is located northwest of the Rockville Metrorail Station, directly across the heavily traveled, regional arterial Hungerford Drive/MD-355. One of the goals of the Town Center Master Plan is to give the Metro station a recognizable presence in the Town Center, by favoring mixed-use development on both sides of the station that would be connected to the Town Center via a “pedestrian promenade”, which would replace the existing pedestrian bridge across MD-355.

During the planning process for the Town Center Master Plan, it was recognized that congestion on MD-355 would impact vehicular and pedestrian access to both the Town Center and to the Metrorail station. At that time, the Maryland State Highway Administration (SHA) was considering plans for improvements along MD-355 adjacent to the Metrorail Station to accommodate growth in traffic but deferred continuing planning at the key intersection at East Middle Lane/Park Road and Monroe Place/Church Street until the Washington Metropolitan Area Transit Authority (WMATA) could determine access requirements for transit facilities if development were to occur on the station site.

This Rockville Metrorail Station Access Improvement Study is being conducted by WMATA for the Maryland Department of Transportation, in conjunction with the City of Rockville, SHA, and Montgomery County Department of Public Works and Transportation (DPW&T) in support of the Rockville Town Center Master Plan and other transportation projects in the station vicinity.

Diagram 1-1: Study Area

Study Area

The study area consists of the Rockville Metrorail Station including the east side bus facility and parking, the adjacent Amtrak and Marc Station, the west side bus facility and parking, the surface parking lot north of the station, and the pedestrian bridge over Rockville Pike. In addition, the study area includes the intersections Middle Lane/Park Road, Monroe Place/Church Street, Route 28 and the intersection of First Street at Viers Mill Road. Also, intersections along Park Road and South Stone Street Avenue.

1. INTRODUCTION

The primary objective of this study is to provide the City of Rockville and SHA with a report to use as a baseline for their planning efforts on transportation and development projects and to provide WMATA with a baseline for operational needs before any other project or a WMATA Joint Development Solicitation goes forward. Other goals and objectives for the study include:

- Survey existing facilities and traffic conditions, analyze existing traffic studies, and identifying access deficiencies;
- Develop conceptual Master Plan for the station site which reflects the design goals of the Rockville Town Center Master Plan: mixed-use development, improvements for pedestrians and buses accessing the station, and inter-modal connectivity;
- Coordinate this study's Master Plan, the subsequent reconfiguration of transit facilities, and station access with the City of Rockville's Master Plan, SHA requirements for access along MD-355, and Montgomery County plans for future growth in their bus service at the station;
- Coordinate transit station site facilities with the City of Rockville's master plans for the east and west sides of the station;
- Identify neighborhood and business concerns;
- Maximize the convenience and the levels of service at the Metrorail Station while enabling Joint Development that is acceptable to WMATA, The City of Rockville and the community.

Periodic meetings were held with the stakeholders group that included WMATA, MDOT, the City of Rockville, Montgomery County Department of Public Works and Transportation and the Maryland State Highway Administration. In addition, one community outreach meeting was held in Rockville to introduce the study and collect input from the neighborhood community.

2. EXISTING CONDITIONS

Location

The Rockville Metro Station is located on the Red Line between the Shady Grove Metro Station to the north and the Twinbrook Metro Station to the south. Located between Park Road and Church Streets, the station site is bisected by the Metrorail and CSX railroad tracks with frontage on Hungerford Drive (MD Rt. 355) on the west side of the station and South Stonestreet Avenue on the station's east side.

Metrorail Station

The Rockville Metrorail Station is an aerial station with a center platform that connects to the mezzanine at grade level with two escalators and one elevator. A pedestrian tunnel, at mezzanine level connects the east and west sides of the station as shown on Diagram 2-3. Access from the east is from grade level while the west access is via a circulation tower that connects the grade and pedestrian bridge levels to the mezzanine by two elevators and two banks of stairs. The MARC and Amtrak trains run on tracks just east of the Metrorail tracks and have side platforms, accessible from two stairs at the station mezzanine level and an exterior elevator on the east side of the station.

Station Facilities

The existing station site is divided into the east and west sides of the railroad tracks. The east side contains 4 bus bays, used by Montgomery County Ride-On buses, and two bus layover spaces, entered and exited from Park Road. A storm water retention pond is in the center of the bus loop. In addition, 15 Kiss & Ride spaces and 524 Park & Ride spaces are accessed from Stonestreet Avenue. The entire parcel is approximately 6 acres with the south end of the site being approximately 30' higher than the north end, as shown on diagram 2-4. Access to Metrorail, MARC and Amtrak trains is at the mezzanine level, approached from sidewalks along Park Road and South Stonestreet Avenue on the station's east side and from the elevator/stair tower on the west side. The station site facilities on the west side consists of 6 bus bays and a Kiss & Ride lot with 34 spaces, entered from Park Road and Church Street and exiting onto Church Street only. The bus facility functions as a one-way loop with the Kiss & Ride parking in the center of the site, with mixed bus and automobile traffic. Pedestrians enter the station via the elevator/stair tower at grade level, then proceed down to the mezzanine level or up to the pedestrian bridge that crosses over MD 355, Hungerford Drive.

There is also an auxiliary parking lot, north of Park Road that contains 123 spaces for long term parking. The lot can be entered/exited from Park Road and exited to MD 355 at its north end.

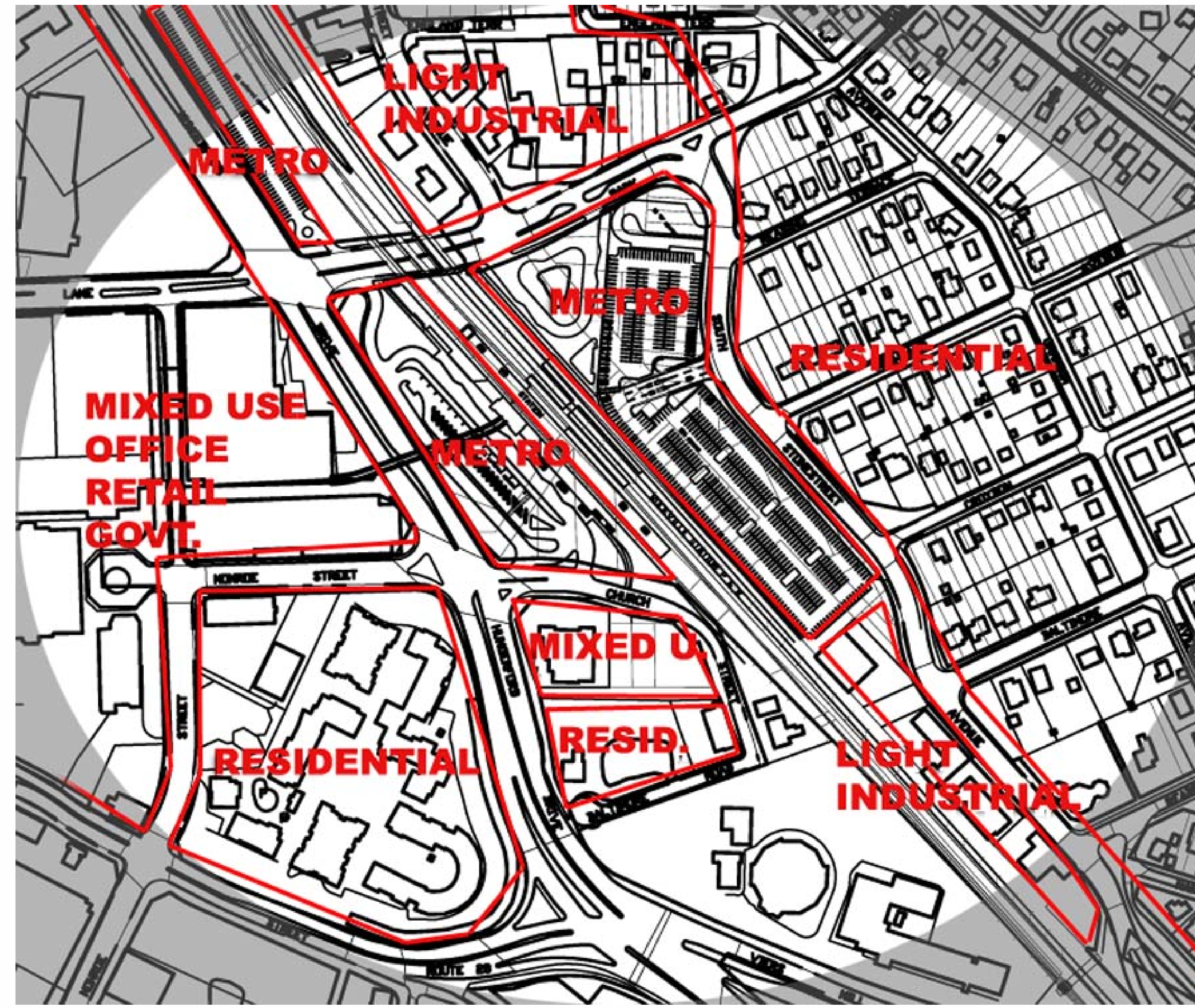


Diagram 2-1: Surrounding Land Use

ROCKVILLE STATION ACCESS IMPROVEMENT STUDY

2. EXISTING CONDITIONS

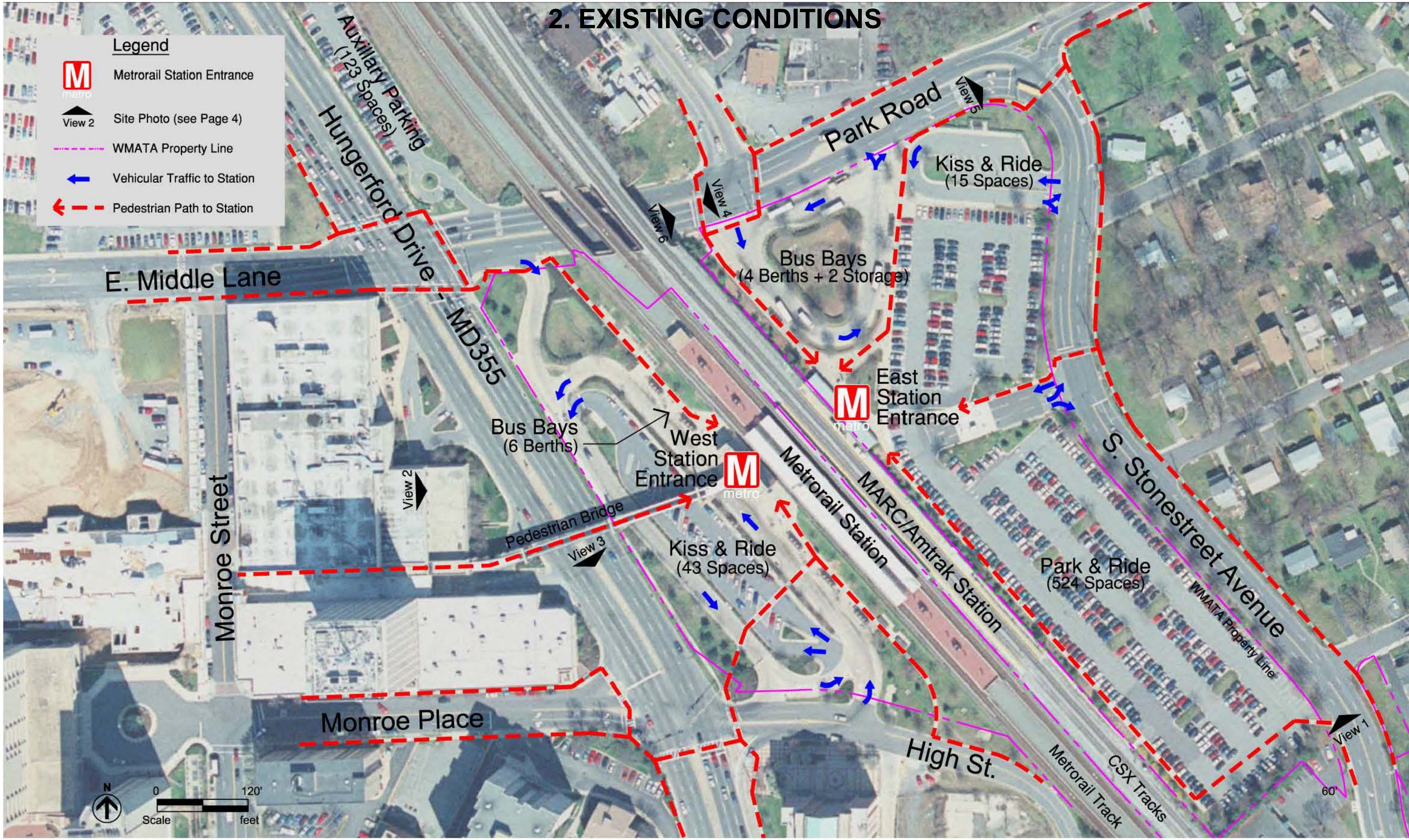


Diagram 2-2: Station Vicinity Aerial Photo

ROCKVILLE STATION ACCESS IMPROVEMENT STUDY

2. EXISTING CONDITIONS

View 1: North Stonestreet Avenue Looking North

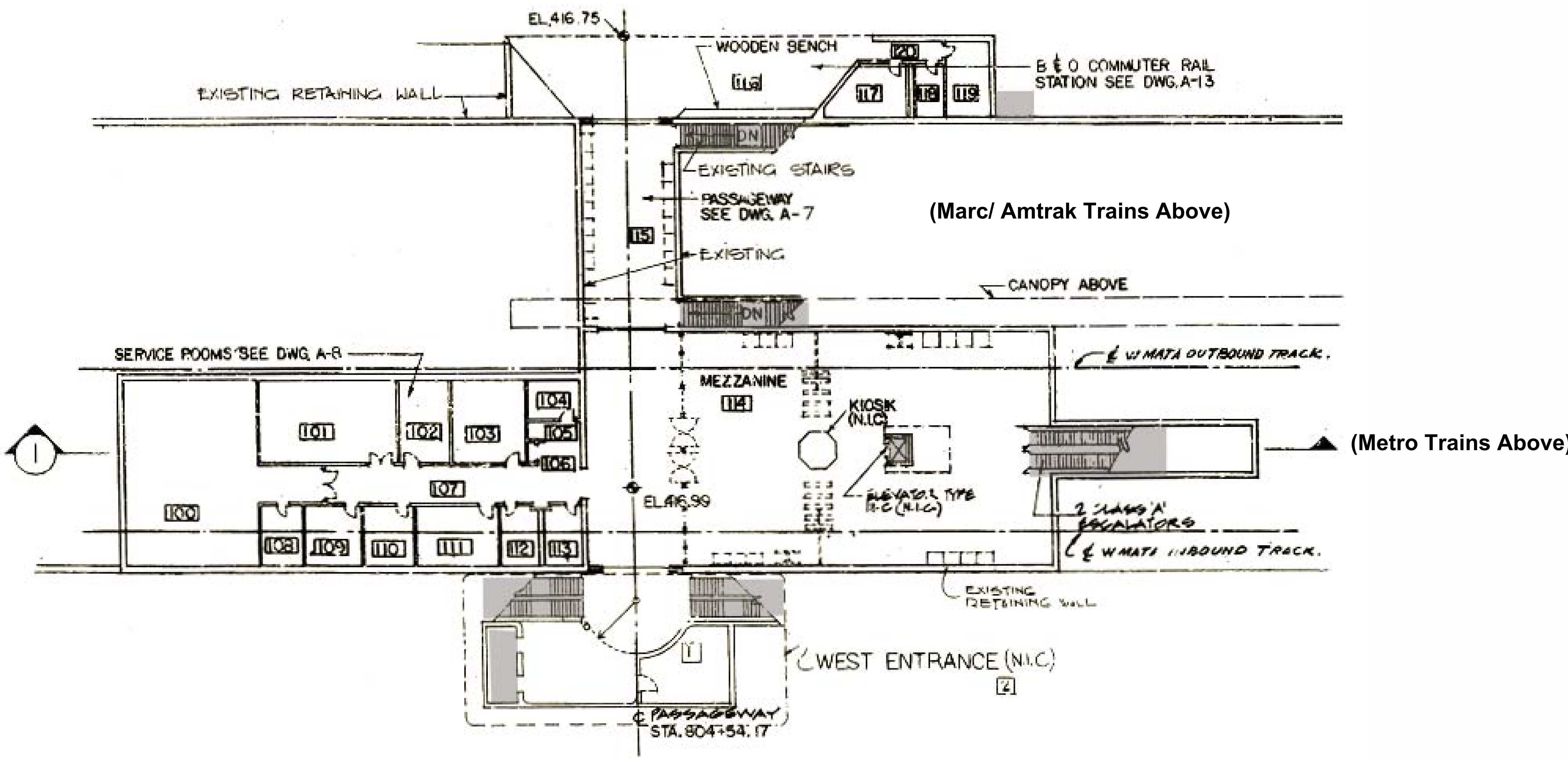
View 2: Pedestrian Bridge and Station

View 3: Hungerford Drive Looking South

View 4: Park Road Looking West/Rail Overpass Above

View 5: North Stonestreet Avenue/Park Road Intersection

View 6: Park Road/Bus Access Intersection Looking East



Station Entrance

Diagram 2-3: Existing Station Mezzanine Plan

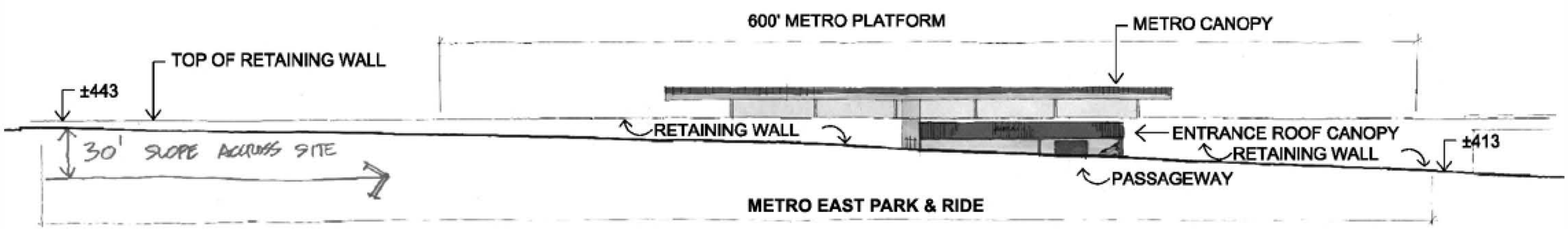


Diagram 2-4: Site Longitudinal Section- Looking West

3. ANALYSIS

Before beginning development of a new master plan for the station site, the City of Rockville's master plans were analyzed along with the existing conditions for the station site facilities, as well with other documents described in the Traffic Analysis section of this report. The analysis developed from this effort was used to establish 'design precepts', or general design principles, for station site and access improvements which were coordinated with the study's stakeholders.

Rockville Town Center Master Plan

The Rockville Town Center Master Plan envisions a revitalized downtown for the City of Rockville with a mixed-use development that creates a vibrant, pedestrian friendly environment that would become a destination point for civic, business, leisure and cultural activities. The Plan recognizes the importance of the Rockville Metrorail Station to the success of the plan's overall success and recommends a strong, appealing connection to the Town Center with both a wide pedestrian promenade and with at-grade connections. The plan calls for "the land immediately west of the station, adjacent to MD-355 should be redeveloped over time with a higher density mixed-use structure, with a major employment or office component". The Plan recommends depressing MD-355 below grade along the frontage to the Metrorail station to allow the pedestrian promenade to span the heavily congested MD-355 at the same elevation as the existing street level, mitigating pedestrian/vehicle conflicts at the E. Middle Lane/Park Road and Monroe Place/Church Street intersections that exist today. The Plan also envisions connecting any development on the station's west side to the East Rockville neighborhoods with an air rights development over the CSX and Metrorail tracks. Zoning for the parcels on both sides of the Metrorail station would be changed from Industrial use to Mixed use to allow Transit-Oriented development. The plan also emphasizes easy and safe pedestrian/bicycle access.

East Rockville Neighborhood Study

To the east of the station are the Croydon Park and Lincoln Park neighborhoods. These are low density residential areas composed mostly of single family dwellings from the first part of the 20th century. These neighborhoods are separated from the station property by S. Stonestreet Avenue. The City has recently adopted the *East Rockville Neighborhood Plan* that states that the east side of the Rockville Metro Station property should be redeveloped into a mixed-use area containing retail, office and residential uses. The density and scale of this new development is intended to compliment the neighborhood as well as take advantage of its location as a transit stop. The plan also calls for the southern portion of the Metro property along S. Stonestreet Avenue should consist of single-family attached (townhouse) units, with any parking structures to not be visible from the neighborhood. The Plan also recommends that access be improved to allow safe pedestrian and bicycle flow to the station. A traffic circle is also proposed at the realigned intersection of South Stonestreet Avenue and Park Road. The neighborhood study proposes other recommendations for station improvements on the east side of the station that would be implemented in the Joint Development process:

- Limit traffic impacts from development to neighborhood streets, restrict vehicular access to a garage for Metro and residential parking with a one-way entrance from E. Stonestreet Avenue and a one-way exit to Park Road and also a one-way exit to Church Street on the west side of the station via a new tunnel below the CSX and Metrorail tracks.
- Design for access to station parking facilities that directs vehicular traffic to and from the Veirs Mill Road ramps.
- Provide distinctive trolley service from the neighborhood traveling through the station area an on to the Town Center.
- Extend the station platform north across Park Road to a new station entrance.
- Provide a traffic circle to replace the two intersections at Park Road/N. Stonestreet Avenue and at Park Road/S. Stonestreet Avenue.

3. ANALYSIS

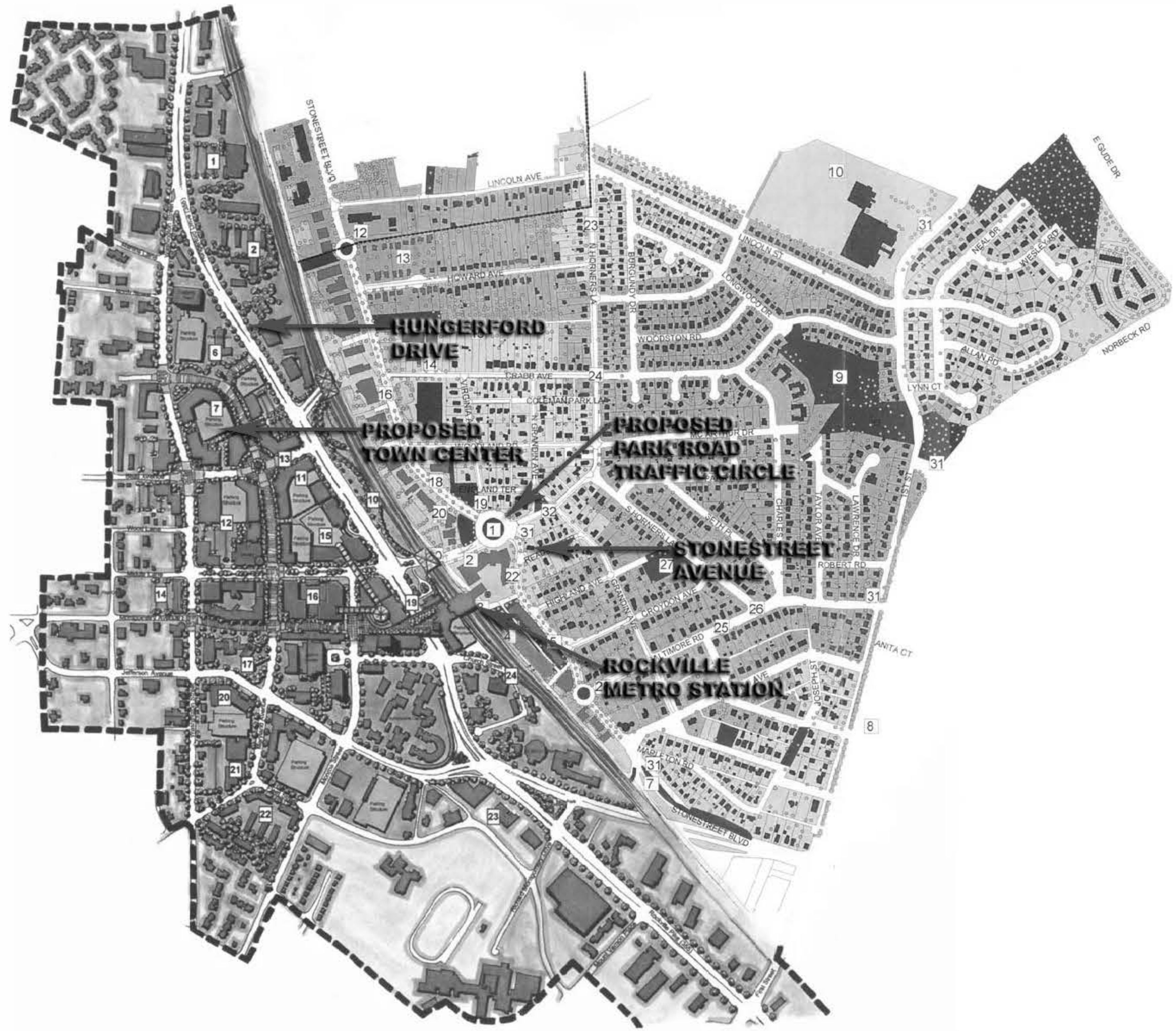


Diagram 3-1: Rockville Town Center & East Rockville Neighborhood Master Plans

Diagram 3-2: Enlarged Plan

Pedestrian Access

Pedestrian and bicycle access to the Metrorail station is given primary importance in the Rockville Town Center Master Plan, the East Rockville Neighborhood Plan, and also in WMATA's overall goal for improving overall access to stations. For pedestrian pathways connecting to a station site, it is generally recognized that providing a safe and convenient walking environment that includes clear, un-fragmented, and integrated pedestrian paths to the station will encourage more customers to walk (refer to Diagram 3-5 for missing sidewalks around the station). Good pedestrian access to the station entrance is essential in station site and access planning since all transit customers, that aren't walking to the station, will ultimately become pedestrians when transferring between modes.

The pedestrian mode of access was examined in depth with visual assessments and actual pedestrian counts around the entire station site. Pedestrians and bicycles access the station's west side via at-grade crossings and the pedestrian bridge over MD-355/Hungerford Drive. The at-grade crossings are generally recognized as deficient with inadequate crosswalk markings and crossing light timing. High speed and heavy vehicular traffic on MD-355 present challenges for pedestrians accessing the station from the west and south with many pedestrians jaywalking across MD-355, causing unsafe conditions. Table 3-1 illustrates pedestrian counts of pedestrians accessing the station during a morning and evening peak time period, at grade and on the pedestrian bridge. The highest counts during both time periods occur approaching from the west. The highest counts were recorded on the pedestrian bridge in both the morning and evening. In all, 789 pedestrians were counted accessing the station in both the morning and evening peak times.

Bicycle paths leading to the station are limited to posted shared roadways, as shown on Diagram 3-4.

Table 3-1: Pedestrian Counts- accessing station
(Counts taken Wednesday April 21, 2004)

Morning counts- 7:30 AM - 9:00 AM
West Side of Station

Location	Count	Percent
1. Pedestrian Bridge	176	50%
2. Park Rd. /Hungerford Dr.	104	30%
3. Church Rd. /Hungerford Dr.	72	20%
TOTAL	**352**	**100%**

East Side of Station

Location	Count	Percent
1. Park Rd. /N. Stonestreet Ave.	57	42%
2. Park Rd. /S. Stonestreet Ave.	29	21%
3. Highland Ave. /S. Stonestreet Ave.	13	10%
4. Croydon Ave. /S. Stonestreet Ave.	37	27%
TOTAL	**136**	**100%**

Evening counts- 4:30 PM – 6:00 PM
West side of station

Location	Count	Percent
1. Pedestrian Bridge	139	58%
2. Church St. /Hungerford Dr.	60	25%
3. Park Rd. /Hungerford Dr.	40	17%
TOTAL	**239**	**100%**

East side of station

Location	Count	Percent
1. Park Rd. /N. Stonestreet	26	42%
2. Park Rd. /S. Stonestreet	17	27%
3. Highland Ave. S. Stonestreet	5	08%
4. Croydon Ave. /S. Stonestreet	14	23%
TOTAL	**62**	**100%**

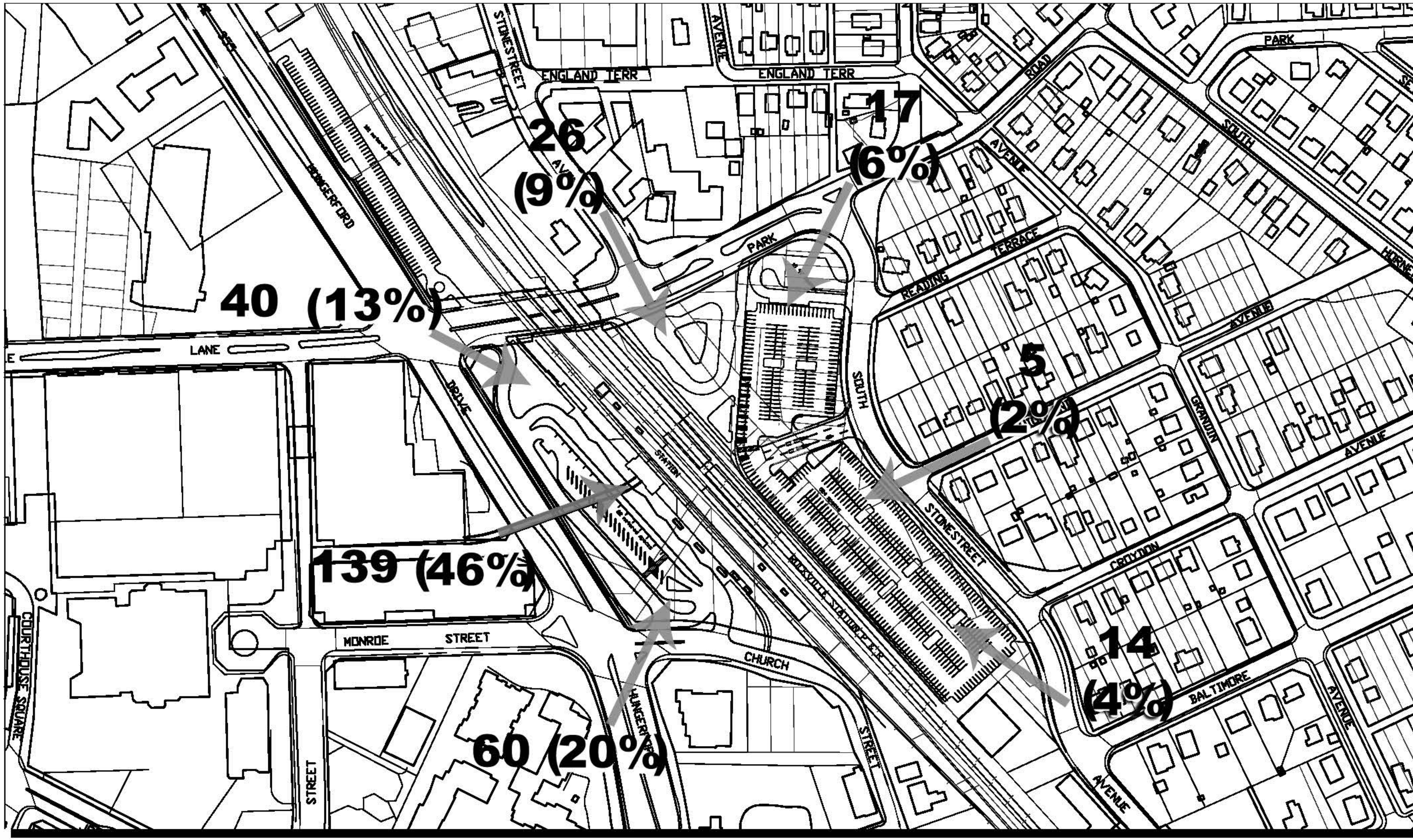


Diagram 3-3: Evening Peak Period Pedestrian Counts

3. ANALYSIS

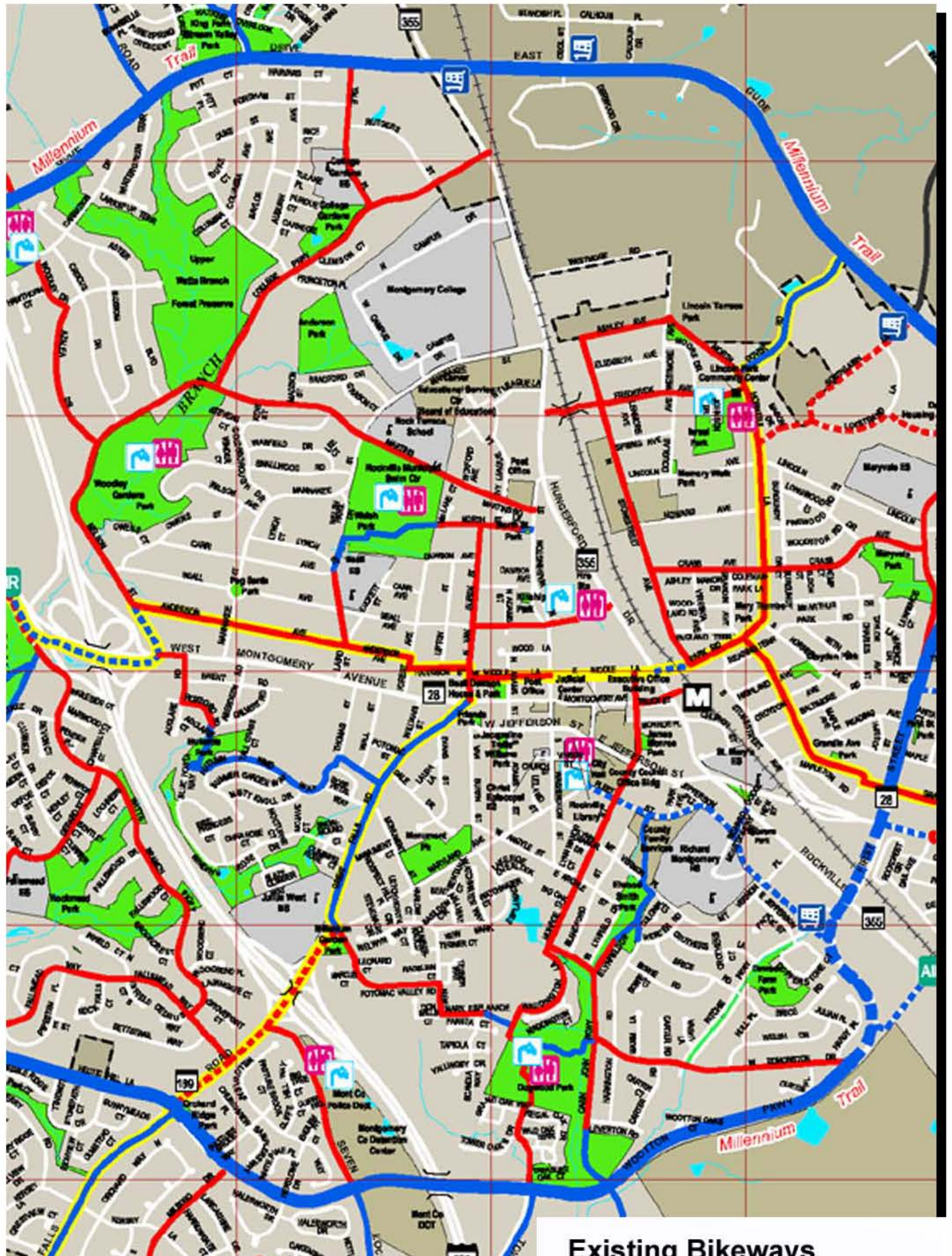


Diagram 3-4: Bicycle Paths

Existing Bikeways
- county bikeway connection
- shared use path
- signed shared roadway

Planned Bikeways
- shared use path
- signed shared roadway
- through city routes

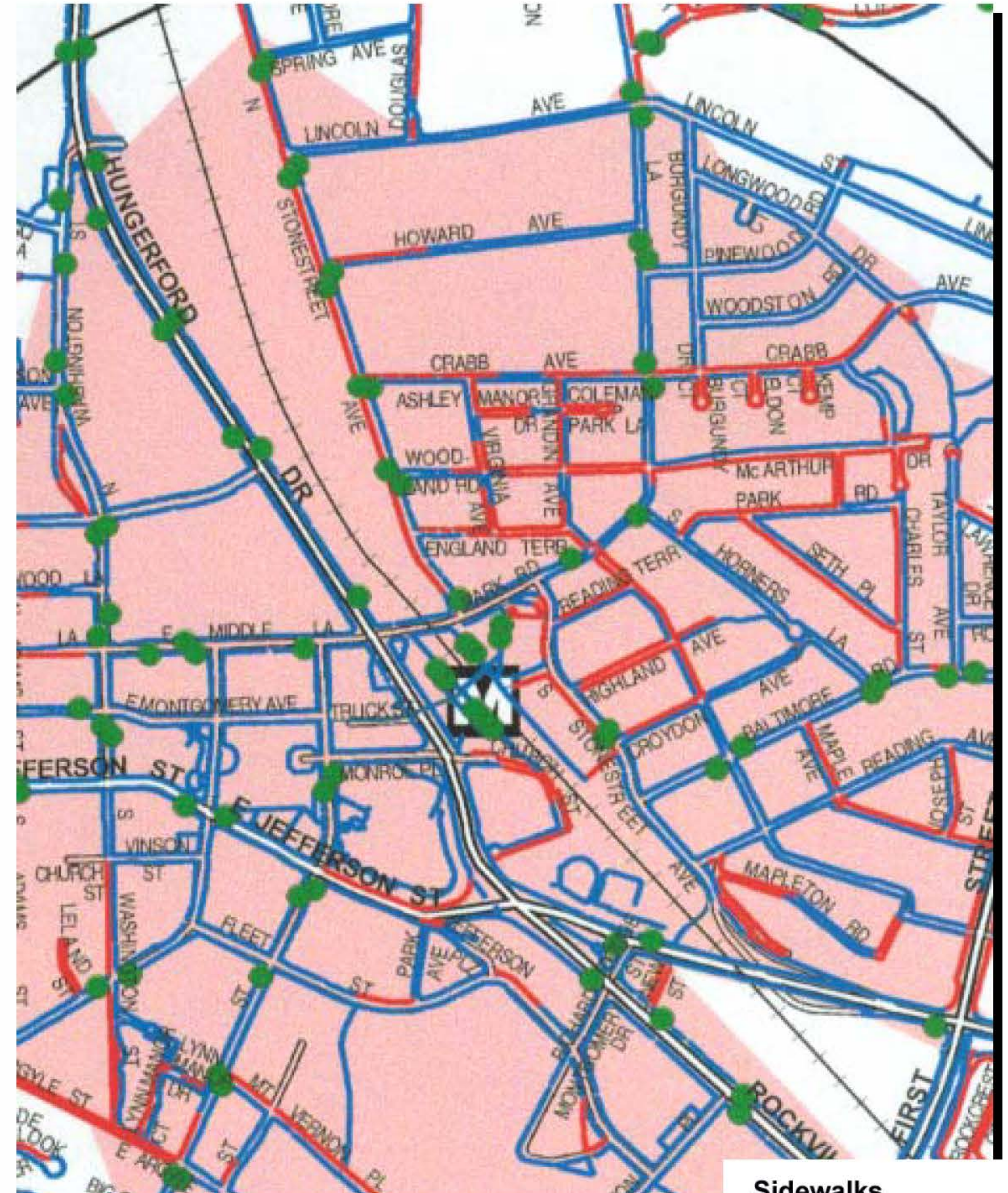


Diagram 3-5: Sidewalks

Sidewalks
- existing sidewalk
- missing sidewalk
- bus stops

Design Principles

Before a conceptual master plan was developed, several meetings and workshops were conducted with the jurisdictional stakeholders, WMATA, and their consultants to establish ‘Design Principles’, or general design goals for planning station site improvements and the development program:

- Provide pedestrian promenade in the same location and elevation as the existing pedestrian bridge. (SHA would later dropped the plan for depressing MD-355 from future consideration due to difficulties foreseen with construction, maintenance of traffic, and access).
- Provide wide, distinctly marked crosswalks on all sides of each intersection along MD-355. Wide crosswalks would add capacity and facilitate movement of pedestrians.
- Present alternatives for new station entrances to divert pedestrians away from congestion points within and around the station site and to increase station capacity to meet future ridership projections which are discussed in the *Station Capacity Analysis* part of this section.
- Expand the number of bus bays and layover spaces on both sides of the station to accommodate Montgomery County’s Strategic Transit Plan which calls for Pulse operations at Metrorail stations. (Pulse bus operations require additional bus bays so all buses may arrive and leave the station at the same time, bus-to-bus transfers can be streamlined, and wait times reduced). Provide space for additional BRT service on the east side of the station.
- Maximize the density of the development on both sides of the station to achieve the highest and best use of WMATA property and make development more viable for a potential developer, who must bear the cost for improvements to transit facilities.
- Maintain the existing number of Park & Ride and Kiss & Ride parking spaces. To meet current demand, increase the number of spaces for taxis to eight spaces on the west side of the station. Provide curb space for private shuttle buses to accommodate anticipated growth in that mode share.

In principle, it is WMATA’s objective in this study to meet the design goals that were proposed in the Rockville Town Center Master Plan and the East Rockville Neighborhood Study. However, some of the major design recommendations presented in these studies conflict with the constraints of existing site conditions, WMATA guidelines and standards, or WMATA operational and access requirements:

- Diverting vehicles exiting from the parking structure directly to Park Road on the east side of the station would require automobiles traveling through the preferred location for the bus facility. Connecting the parking structure to Church Street on the west side of the station may be unfeasible, given high cost impacts for tunneling below the CSX and Metrorail tracks and traffic impacts on the already congested Church Street/MD-355 intersection.
- The proposal to extend the pedestrian promenade over the Metrorail station and the CSX tracks and the goal to connect both sides of the station with development above the tracks was not considered for the study due to the difficulties foreseen in negotiating air-rights development with CSX, Inc.. Both sides of the station are already connected with an at-grade passageway on the station mezzanine level.
- A traffic circle for Park Road and Stonestreet Avenue was considered early in this study, but was removed from consideration when the alternative was dropped in the City of Rockville’s on-going Stonestreet Avenue study.

Station Capacity Analysis:

Currently, the Rockville Metrorail Station serves an average 4,300 rail boardings on a typical weekday. This represents a 27% increase in ridership over the last ten years. Based on the 2004 Dulles Corridor EIS Patronage Forecast Report, ridership at the Rockville Station is projected to increase to 7,760 daily boardings in year 2025, a 55% increase in ridership over 20 years. Given that the station has only the minimal vertical transportation systems: two escalators and one elevator, assessment of existing and future demand is warranted to determine if the station capacity can meet future ridership projections.

To verify if the escalators will have an acceptable Level of Service (LOS) to meet future demand, existing conditions were analyzed. The escalator LOS is based on the platform clearance time, the maximum passenger queuing length, and the total passenger wait time for boarding an escalator immediately after a train is unloaded. Trains arriving in the peak direction generate the largest surge of passengers accessing the escalators, so the highest number of passengers unloading in the peak period is used when calculating the escalator LOS.

The platform clearance analysis of the existing conditions, shown on Table 3-2, indicates a platform clearance time of 64.4 seconds, a queuing length of six passengers, and a maximum queuing time of 4 seconds, all within an acceptable LOS. The platform clearance analysis projected for year 2025, shown on Table 3-3, indicates a platform clearance time of 103 seconds, a queuing length of 58 passengers, and a maximum queuing time of 43 seconds, none of which are within an acceptable LOS. A queuing length of 58 passengers would occupy approximately 26 linear feet of platform space in front of the escalator, more than the standard queuing distance for an escalator.

If the station facilities are to accommodate growth in ridership, then additional vertical circulation to the platform should be provided. At least one additional escalator or stair should be added to the existing system. A wide stairway is preferred because it can handle the capacity requirements of an escalator while affording the benefit of lower installation, maintenance and operating costs. It also would eliminate service disruptions associated with escalator service, which is a major inconvenience to Metro customers. An additional platform elevator should also be added to provide redundancy and continuous accessibility to the station platform for customers using wheelchairs during periods of service disruptions for repairs and maintenance.

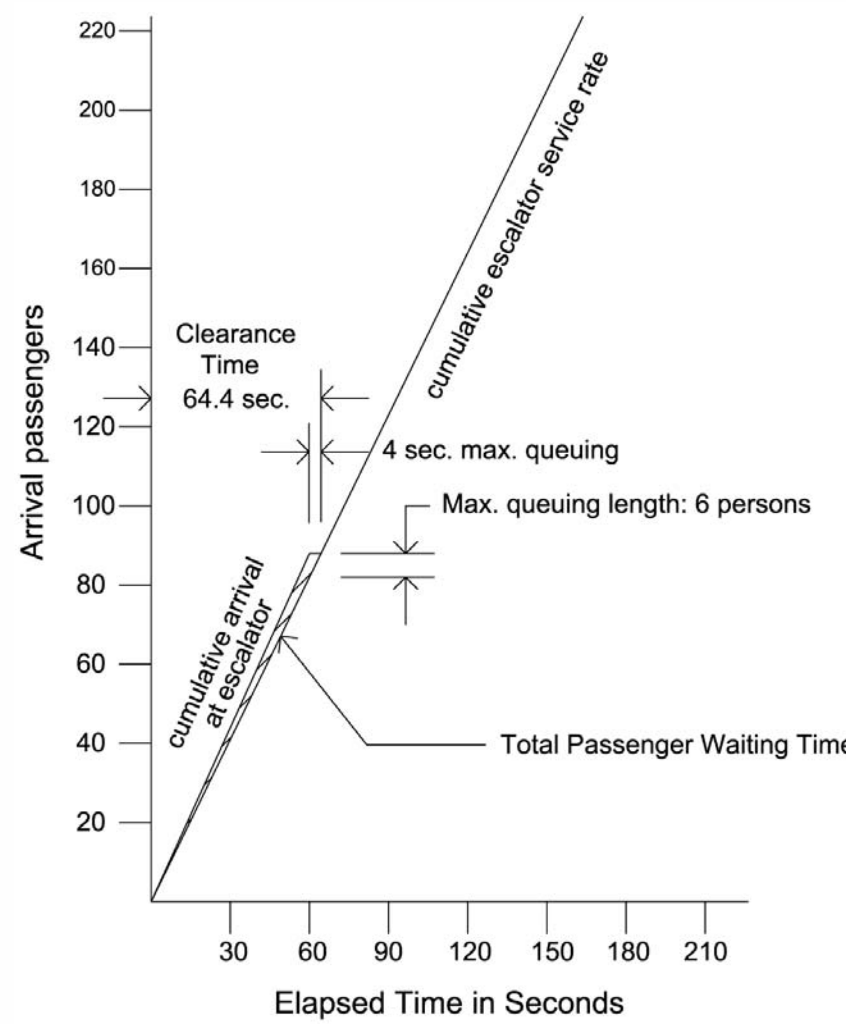


Table 3-2: Platform Clearance Time - Existing

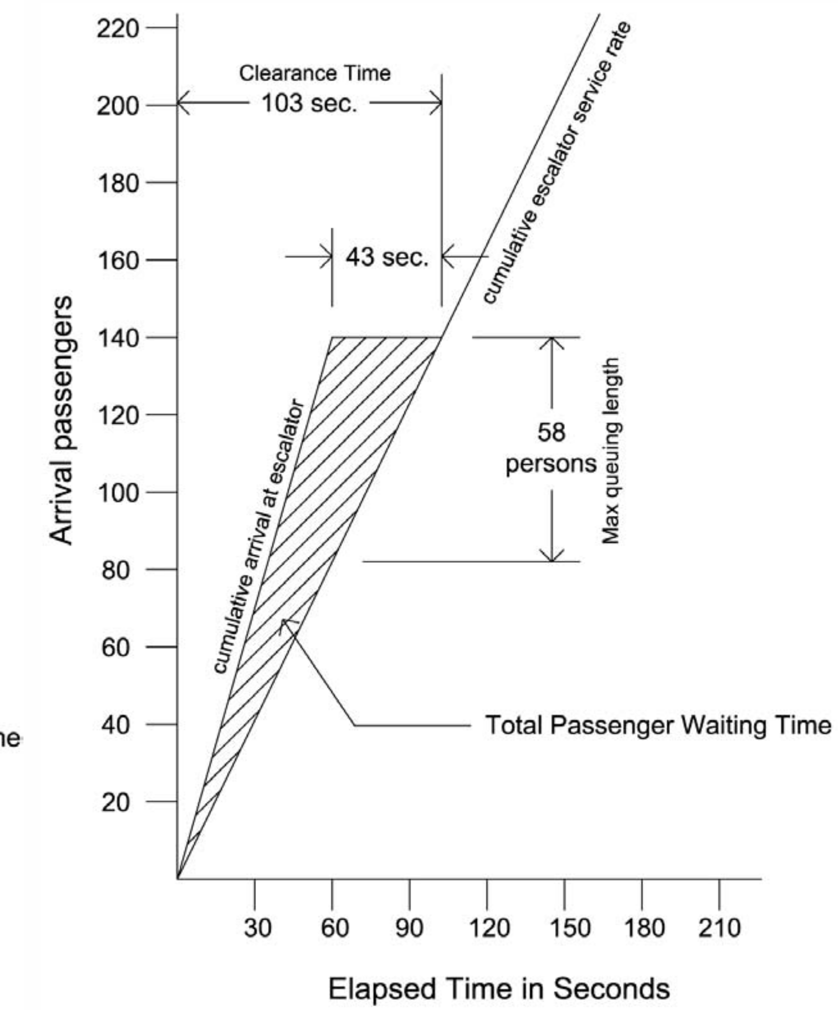


Table 3-3: Platform Clearance Analysis - Year 2025

4. MASTER PLAN

One of the primary goals of this study is to develop a conceptual mater plan for the station site which reflects the design goals from of the Rockville Town Center Master Plan and the Design Principles established in stakeholders meetings mentioned in the previous Section. The Master Plan, as shown at the end of this section, is based on an analysis of existing conditions (pedestrian access, traffic, ridership, surrounding land uses, etc.), approved City of Rockville master plan recommendations, future ridership projections, community input, and the Development Program (Table 4-1). The end goal of the study Master Plan is to provide any potential future developer with clear guidelines and objectives for meeting the requirements of established Design Principles that has been coordinated with the jurisdictional stakeholders and with various WMATA offices and departments involved in planning and operating transit facilities.

Pedestrian/Bicycle Access

One of the primary goals of the study is to identify and make recommendations for improving station access for pedestrians, bicycles, and vehicles. Pedestrian counts were performed and analyzed with vehicular traffic data. With most of the pedestrian traffic coming from the west, it is obvious that crossing Hungerford Drive/MD-355 is a major point of pedestrian/vehicular conflict. Therefore, intersections at Middle Lane/Park Road and Hungerford Drive and Monroe Street/Church Street and Hungerford Drive should be improved to enhance pedestrian safety, capacity, and facilitate vehicular traffic flow along MD-355. Besides widening, crosswalks need to be timed with count down signals, have a larger median refuge area and special paving materials to visibly mark the crossings. The same criteria should be applied to the intersections on the east side of the station. Eliminating the existing bus exit at Park Road and North Stonestreet Avenue will improve pedestrian crossings. The traffic light at this intersection should be maintained. Any new intersection created by Joint Development on South Stonestreet Avenue should also include pedestrian crosswalks on every corner of the intersection, unlike existing conditions. Traffic lights at these intersections would require additional traffic analysis beyond the scope of this study.

The heaviest counts for pedestrian traffic were recorded on the pedestrian bridge over Hungerford Drive/MD-355. The City's Town Center Master Plan calls for the existing bridge to be replaced with a “promenade” that is “a visually stimulating architectural statement that provides a positive entry at the transit site”. While this study agrees with this concept as a way to create an important link to the Town Center, this element would fall out of the scope of any future Joint Development solicitation due to foreseen high cost which could compromise the development potential of the site if the cost was borne by the Developer. Therefore, this study assumes that the replacement of the pedestrian bridge beyond the boundaries of WMATA property would be constructed by others.

To coordinate pedestrian access to the west station entrance with the realignment of the bus bays, a new vertical circulation core would need to replace the existing stair/elevator tower. The new core would be on the west side of the bus bays to allow bus passengers to deboard and access the station entrance at the Mezzanine level without crossing the bus lanes.

Vehicular Access

The Plan recommends improvements for vehicular access, including automobiles and buses. To accommodate additional bus bays and additional area for development the west bus facility must be realigned in the opposite direction of the existing facility with a relocated entrance on Park Road and a relocated exit on Church Street. The exit on Church Street will have a dedicated right turn lane for buses turning north onto MD-355. The entrance to an underground parking garage for the development is located at mid-block on Hungerford Drive with right turn in/right turn only access. A second entrance to the parking garage is shown on Church street accessing the Kiss & Ride facility and parking levels for the development. Access to the surface parking lot north of Park Road remains unchanged.

The east bus facility is a two-way system with an entry/exit on Park Road and another entry/exit on South Stonestreet Avenue as shown. To accommodate the recommendation in the City's Town Center Master Plan, a public plaza is located on the north end of the site and would have vehicular access from South Stonestreet Avenue. The location of entrances to the parking structure on the south part of the site, with shared development and transit use, will depend on design coordination with the stakeholders during the Joint Development process. A minimum of two entrances will be required from South Stonestreet Avenue to serve each use.

Joint Development

The Master Plan is considered a concept design for Joint Development on both sides of the Rockville Metro Station. The Master Plan is based on the following assumptions:

- Any potential Joint Development must accommodate the established Design Principles from this study;
- Satisfy community and business interest groups;
- Improved pedestrian/bicycle and vehicular access to the station;
- Accommodate future ridership growth at the station.

The study's Master Plan was developed and coordinated with the local jurisdictional stakeholders and WMATA for the use and benefit of any potential future WMATA Joint Development partner, for the benefit of the jurisdictional stakeholders, and the Rockville community. To help achieve the highest and best use of WMATA property (a primary goal of the WMATA Joint Development program), the study's Development Program and Master Plan depicts the site as developed to its highest density and full development potential. Planning for the highest and best use of WMATA property is in the interest of maximizing the value of the land to attract development interest, and to attract additional transit ridership. As this study will demonstrate, the use of land and the density of any future development on the station site must be carefully weighed against the impacts to traffic on the adjacent street infrastructure.

Station East Side

The development proposed for the east side of the station incorporates the majority of development planning principles described in the East Rockville Neighborhood Study. To maximize the area for development and to accommodate Ride-On's program for expanded bus service, a two-way, linear bus facility was chosen for it's efficient layout and for convenient bus access from both Park Road and S. Stonestreet Avenue. Sidewalks connect the station entrance to all areas of the site and to all the municipal sidewalks and crosswalks on adjacent streets. To limit parking space requirements, and thus the size of the parking structure, development on the east side is shown as all residential use with street level retail on the north end of the site. Any commercial development could significantly impact parking requirements. A public space is provided in a plaza within the retail/residential development which includes street parking for retail use and pick-up/drop-off curb lanes for transit use. The residential units consists of three to six levels above the ground floor retail space. The residential development on the south end of the site is governed by a *residential proximity slope*, as shown on Diagram 4-1, which limits building heights to 35 feet adjacent to S. Stonestreet Avenue but increases to 65 feet beyond a 90 foot setback. To provide a transition from the single-family dwellings to high density development, the height and facade of the residential units along S. Stonestreet Avenue shall replicate a single-family townhouse design. The parking structure, with combined transit and residential use, is located behind the residential development to obscure the structure from view of the neighborhood across S. Stonestreet Avenue. For the size of the parking structure shown, six parking levels is required to accommodate the estimated 984 parking spaces for the residential/retail use and the replacement parking for transit customers.

Station West Side

Too meet the goals of the Rockville studies, the plan for west side of the station envisions high density development with a strong pedestrian connection from the Metrorail station entrance to the Rockville Town Center via a pedestrian promenade. In the proposed plan, the pedestrian promenade over MD-355 becomes a retail galleria within the development that would create a significant design component and a positive entrance to the transit station. This primary pedestrian link to the station entrance innately creates two separate building towers which could have separate uses. A hotel use was selected for the study to maximize the highest and best use of the property for such a narrow lot width without competing with development uses in the nearby Town Center. Residential use was also considered because parking space requirements are less than for both office use and a hotel. The development program and the plans show two alternatives for building heights that are allowed by the current zoning ordinance. The Base Method limits the building height on the station's east side to 100 feet, while the Optional Method allows a 225 feet building height.

Because the potential for vehicular access along MD-355 is constrained with heavy traffic volumes during the peak rush hours, the amount of programmed parking on the station's west side is limited to 1,000 spaces for study purposes. Due to the site's irregular geometry, the narrow width, and bus facility requirements, parking is shown located below grade although it is recognized that above-grade, structured parking is more economically viable. Also, the soils report from the original station contract indicates a high water table and a small area of solid rock below the site which would likely impact the cost of construction. Two access ramps to the parking garage, one from MD-355 and one from Church Street allow cars the opportunity to access the station and the development from either direction on MD-355, and vise versa.

To provide the optimum amount of space for a development footprint on the station's east side, it was determined that the existing elevator/stair tower from the pedestrian bridge to the station entrance level should be replace with a new tower located on the opposite side of the new bus facility to allow the bus lane to be shifted closer to the station abutment. Bus passengers transferring to rail or to the buses on the station's west side would use the stairs or elevators to the mezzanine level below, then cross back under the bus lanes.

New Entrances and Mezzanine Expansion Alternatives:

Although the pedestrian promenade, any new station entrance or mezzanine expansion proposed in this study would not be part of the contract for any future Joint Development project, they are nevertheless, an important component in how well the overall station functions when considering the projected growth in transit ridership. To accommodate the projected growth in ridership at the Rockville Station (discussed in the Station Capacity Analysis), the station's vertical circulation capacity to the station platform should be increased by either expanding the existing facilities or by adding an additional entrance. As part of the study Master Plan, three alternatives for expanding the station capacity are presented:

Alternative 1 - Mezzanine Extension: This alternative involves cutting through the existing concrete wall structure on both sides of the existing escalator way in the station mezzanine, extending the mezzanine to accommodate a new elevator and a wide stair to the platform. The platform canopy would also be extended to cover the stair and elevator. This Alternative affords the greatest redundancy in vertical circulation and capacity from the mezzanine to the platform, but does not reduce walking distances for customers accessing the station platform from the Rockville Town Center, as do the other Alternatives.

Alternative 2 - New Station Entrance at Pedestrian Promenade: This alternative includes a new mezzanine with a manned station manager kiosk, four faregates, one elevator, and a stair that connects the proposed pedestrian promenade directly to the existing station platform. The objective of this Alternative is to provide the most convenient access from the Town Center to the station platform to divert customers that would normally access the existing station entrance via the crosswalks on MD-355 to the pedestrian bridge, thus reducing pedestrian conflicts with vehicles along the MD-355 corridor. With increased traffic generated from planned development at the Town Center and the Metro site, providing direct, convenient pedestrian access to Metrorail from the Town Center becomes critical for traffic movement and pedestrian safety on MD-355.

Alternative 3 - New Station Entrance at Park Road & MD-355: This alternative includes a new mezzanine with a manned station manager kiosk, four faregates, two platform elevators, and a stair. To connect the new entrance to the existing station platform, the service rooms at the north end of the platform must be relocated to extend the platform across the bridge above Park Road. This option provides easier, and more convenient access for customers accessing the station from the north sector of the Rockville Town Center. Also, customers would only have to cross MD-355 to access the new station entrance, instead of also having to cross Park Road to access the existing entrance. However, this Alternative would present a special challenge by building between operating Metrorail tracks.

Option - Additional Elevator to MARC Platform: This option, which can be included with any of the Alternatives, would not expand Metrorail station capacity but would provide redundancy for elevator service and improve the connection between MARC and Metrorail. An elevator installed at the north end of the inbound MARC platform could extend to an elevator vestibule located directly off of the existing passageway to the mezzanine.

These design alternatives for expanding station capacity were prepared for this study to demonstrate the basic feasibility of the concept presented. The preferred alternative would be subject to further refinement during any future design and engineering efforts should the City of Rockville and the State of Maryland decide to advance the planning process. The order of magnitude cost estimate, for the design and construction of any of the three expansion alternatives is shown on Page 49.

Table 4-1: Development Program

West Side

Transit Program

8 Bus Bays (1 articulated bay) on site
One bus pullout on Hungerford Drive (Q2 Bus)
7 layover spaces
123 existing long term spaces north of Park Rd. to remain
16 Kiss & Ride spaces (in parking garage)
4 Taxi stands (in parking garage)
Shuttle buses on Church St.

Joint Development (developed as of right at 100' base height)

Site area approximately 138,000 s.f.
Hotel- 240,000 s.f
Approximately 260 rooms
9 stories (7 room levels over two levels of retail and hotel functions)
Commercial 220,000 s.f.
9 stories (7 levels over two levels of retail and commercial space)
Retail- 25,000 s.f.
At mezzanine (ground) and pedestrian promenade levels
TOTAL DEVELOPMENT = 485,000 s.f. for an FAR of 3.6 (approx)
Parking
Hotel- 300
Commercial- 730
Retail- 0 (assume transit related retail)
TOTAL= 1030 spaces
Underground Parking- 412 spaces /level x 2.5 levels = 1030 spaces
Note: ½ of the top parking level is devoted to taxis and Kiss and Ride

Joint Development (developed with Optional Method at 235' maximum height)

North Mixed Use Tower
Hotel- 240,000 s.f.
Approximately 260 rooms
9 stories (7 room levels over two levels of retail and hotel functions)
Residential- 150,000 s.f.
Approximately 128 units
10 stories (10 room levels over hotel floors)
Totals North Tower
390,000 s.f. (does not include retail)
19 stories

South Residential Tower
Residential- 380,000 s.f
Approximately 340 units
19 stories (17 room levels over 2 levels of retail and residential amenity/lobby space
Retail- 25,000 s.f.
At mezzanine (ground) and pedestrian promenade level
TOTAL DEVELOPMENT= 795,000 s.f. for an FAR of 5.8
Parking
Hotel- 300
Residential- 700
Retail- 0 (assume transit related retail)
TOTAL= 1000 spaces
Underground parking- 412 spaces / level x 2.5 levels= 1030 spaces
(Note: ½ of the top parking level is devoted to taxis and Kiss and Ride)

East Side

Transit Program
8 Bus bays (including 2 articulated BRT bus bays)
2 layover spaces
Kiss & Ride/taxi in public plaza area
Joint Development
Site area approximately 280,000 s.f.
Commercial- 50,000 s.f
Assume ground floor retail and upper level residential
3-6 stories above retail development
North End Residential- 150-160 units or 180,000 s.f.
South End Residential- 30-60 units or 70,000 s.f.
TOTAL Development=300,000 s.f. for an FAR of 1.1 (Total of 180-220 units)
Parking
6 levels= 984 spaces
Metro- 524 spaces (includes 524 existing)
Joint Development- 460 spaces

Station Expansion

Alternative 1: Mezzanine Extension
Additional elevator and stair to station platform
Alternative 2: New Station Entrance
Stairs and elevator connecting pedestrian promenade to new mezzanine
Alternative 3: New Station Entrance
Platform extension across Park Rd. Bridge to new station entry north of Park Rd.- elevators/stairs only
Option: Elevator
Additional elevator to mezzanine passageway and MARC platform

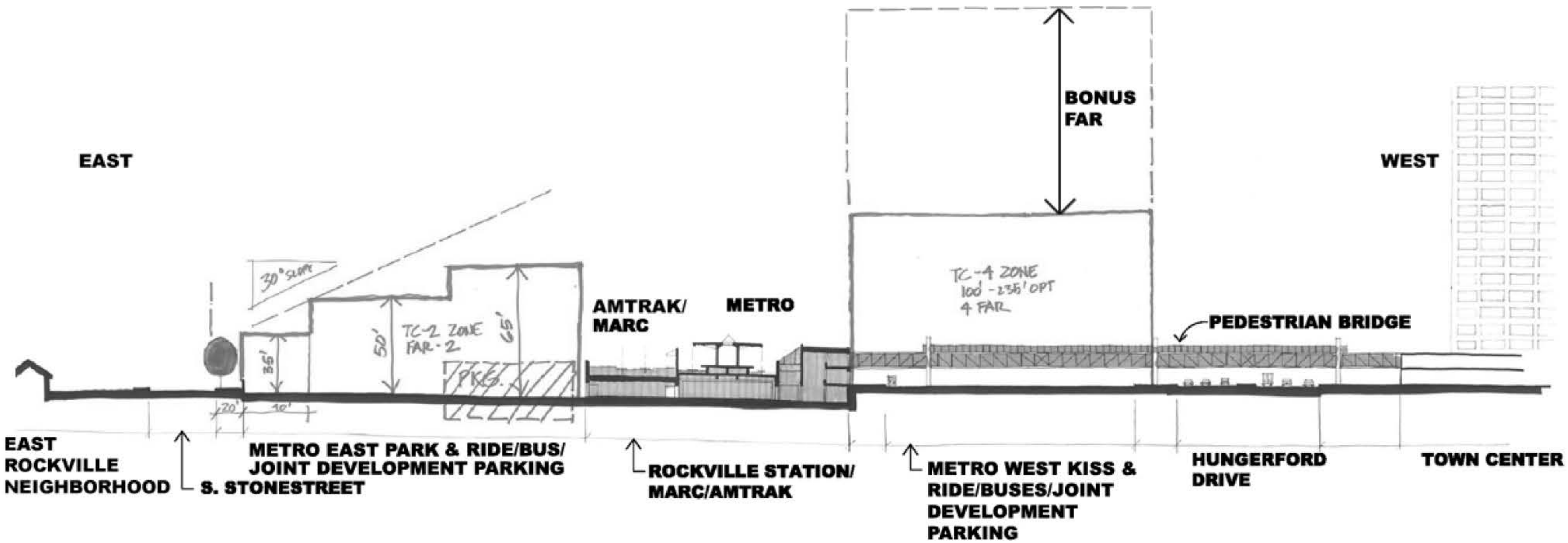
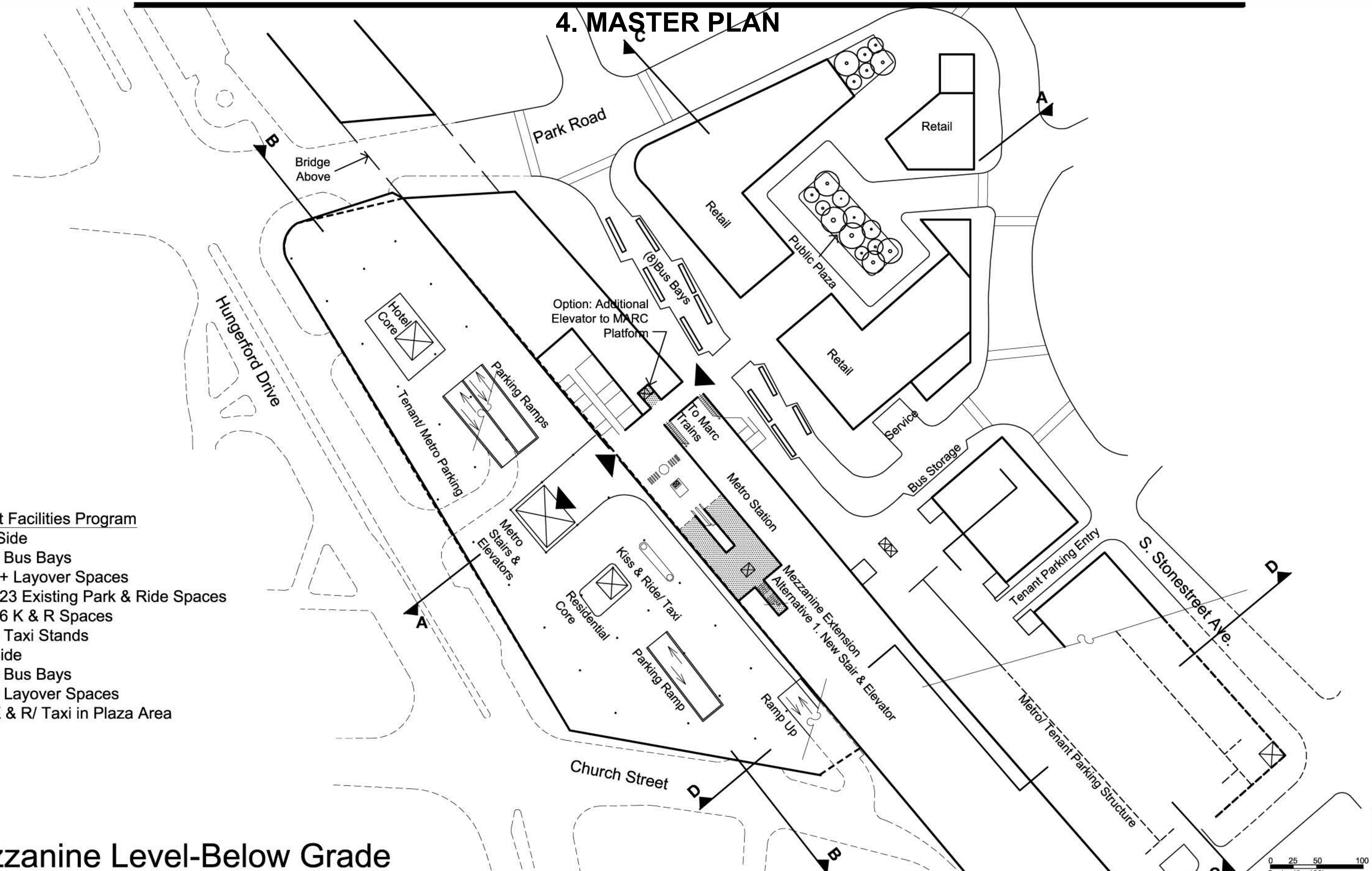


Diagram 4-1: Site Cross Section- Looking South (Based on Rockville Station Area Master Plan)



Transit Facilities Program

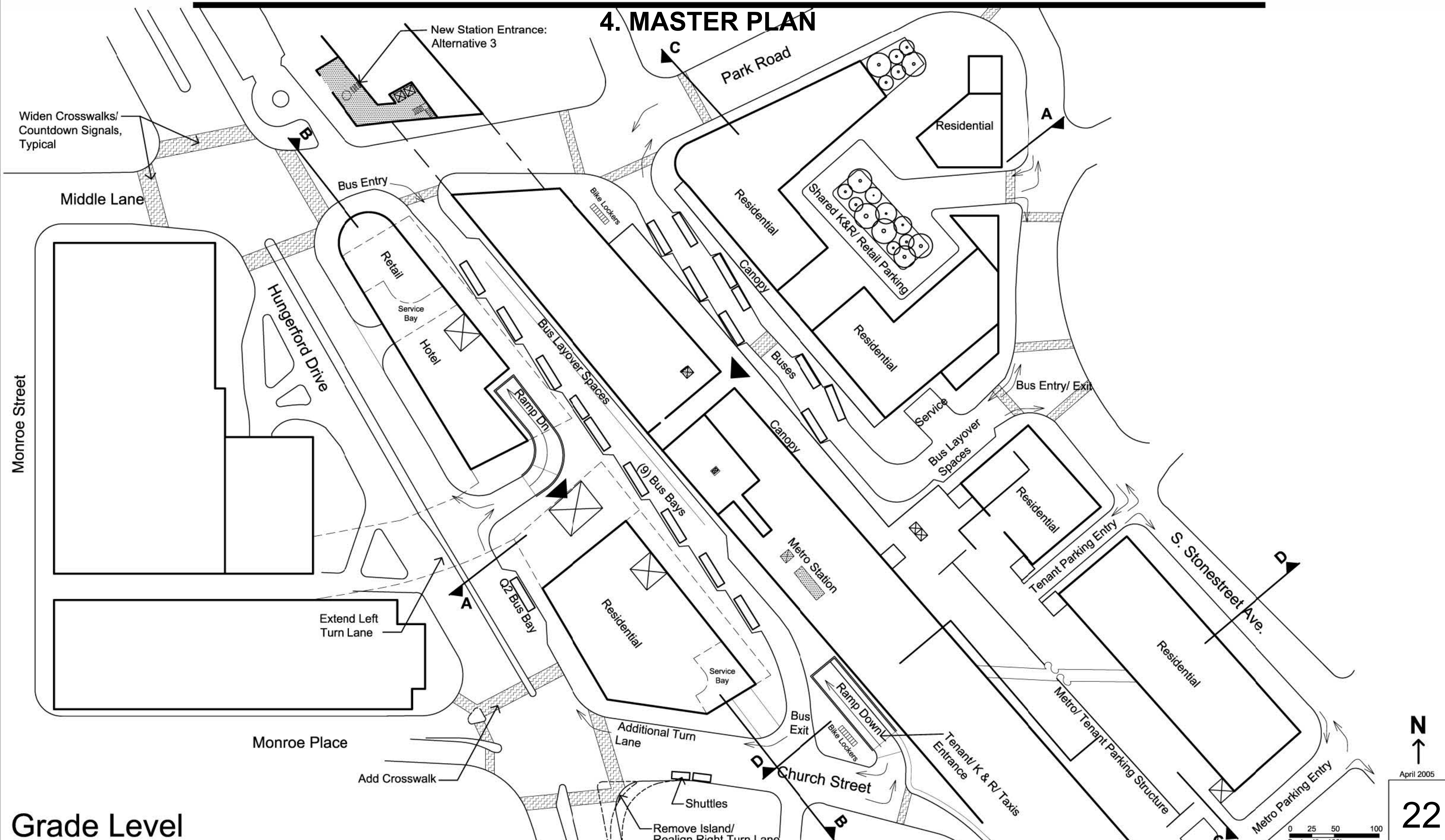
West Side
- 9 Bus Bays
- 3+ Layover Spaces
- 123 Existing Park & Ride Spaces
- 16 K & R Spaces
- 4 Taxi Stands

East Side
- 8 Bus Bays
- 2 Layover Spaces
- K & R/ Taxi in Plaza Area

Mezzanine Level-Below Grade

April 2005

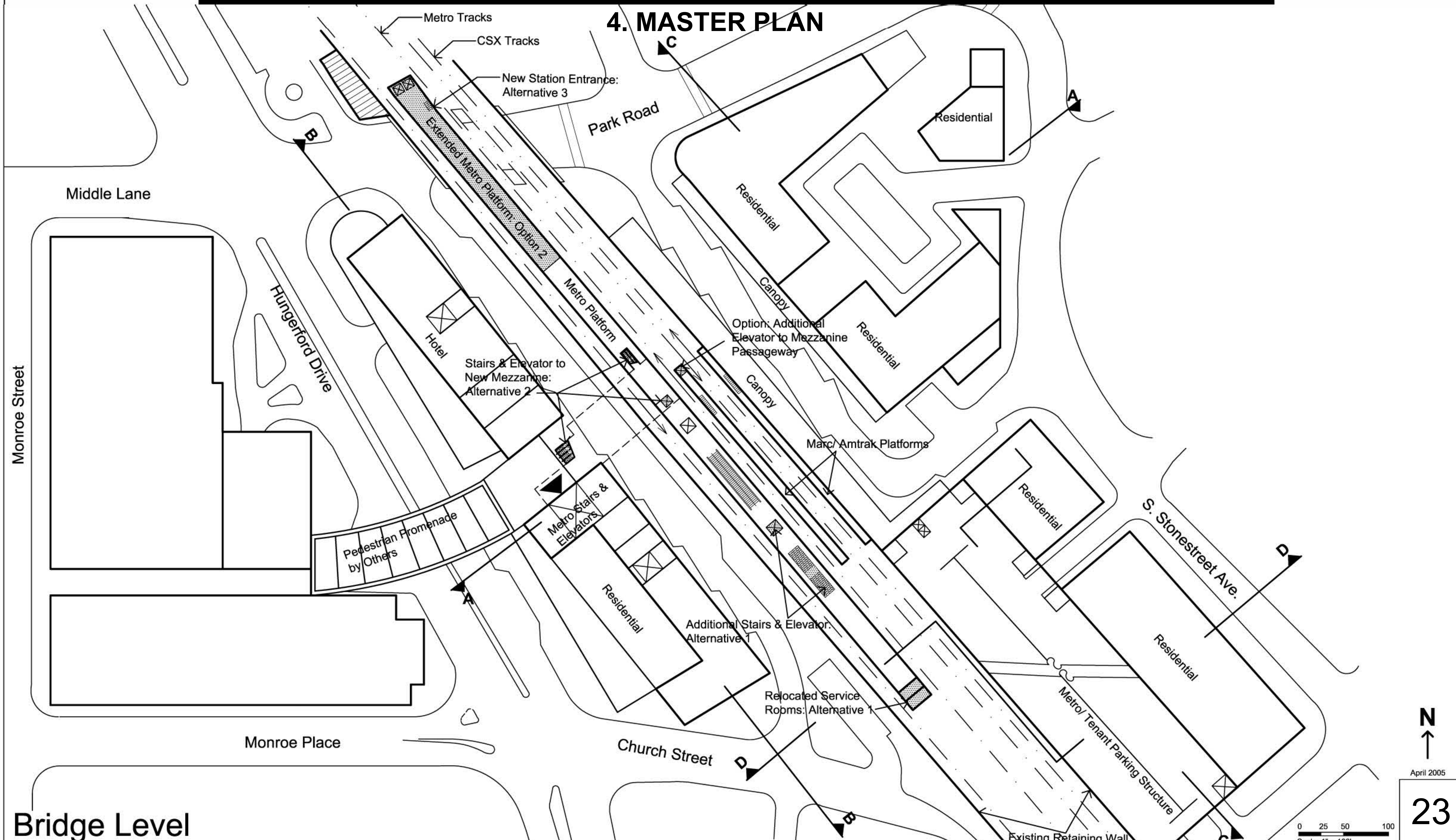
4. MASTER PLAN



Grade Level

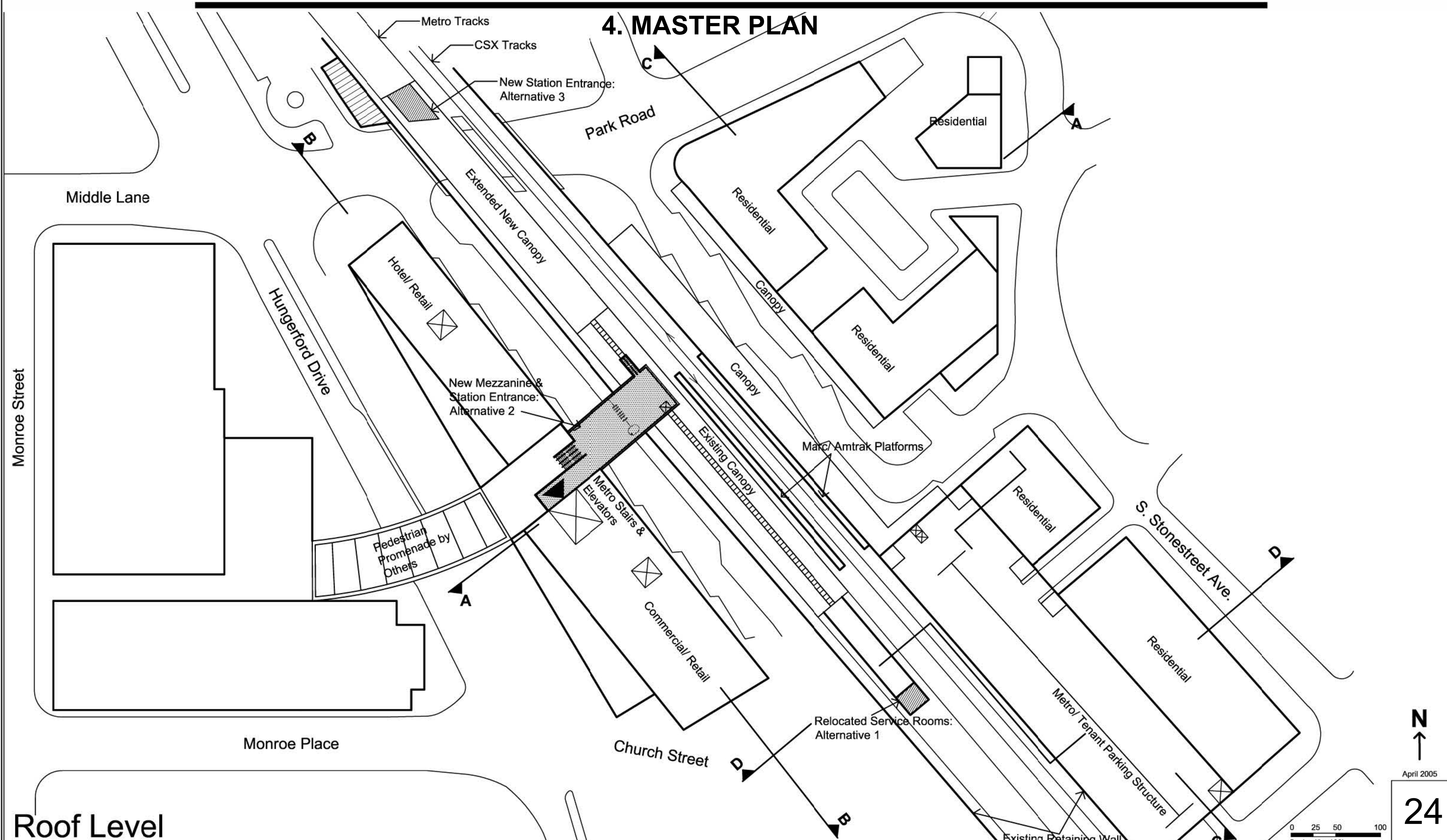
April 2005

4. MASTER PLAN



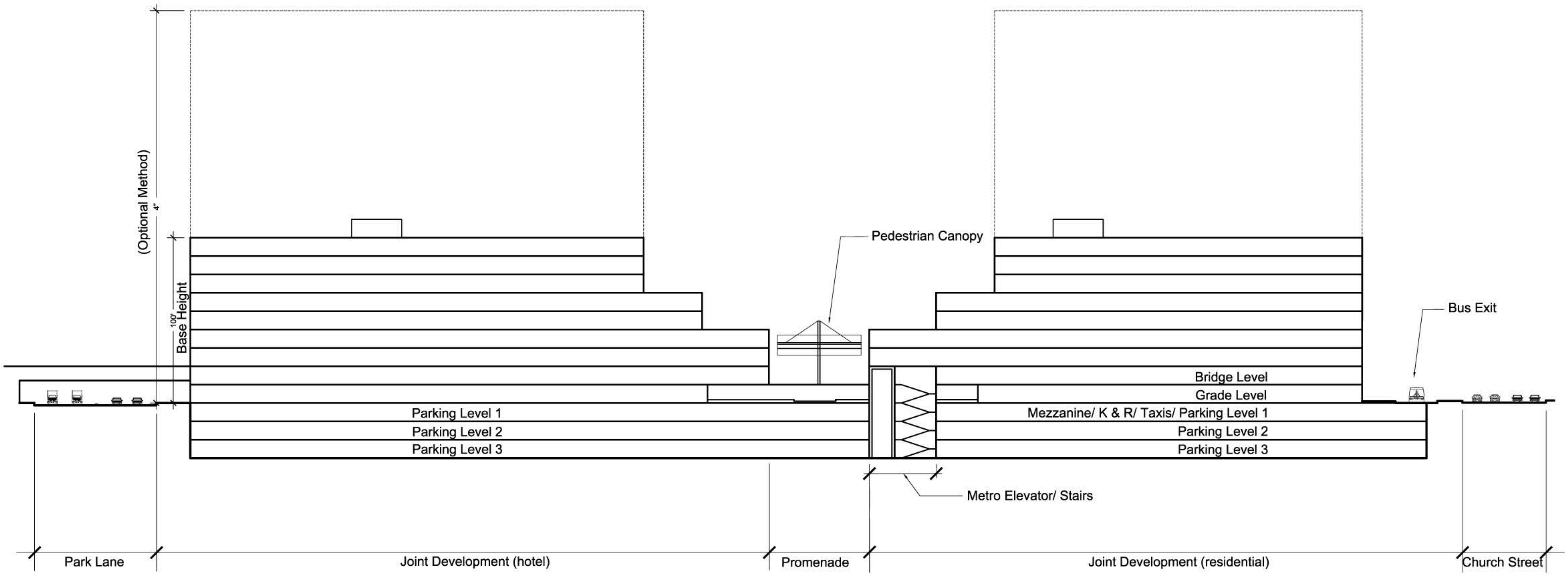
Bridge Level

April 2005



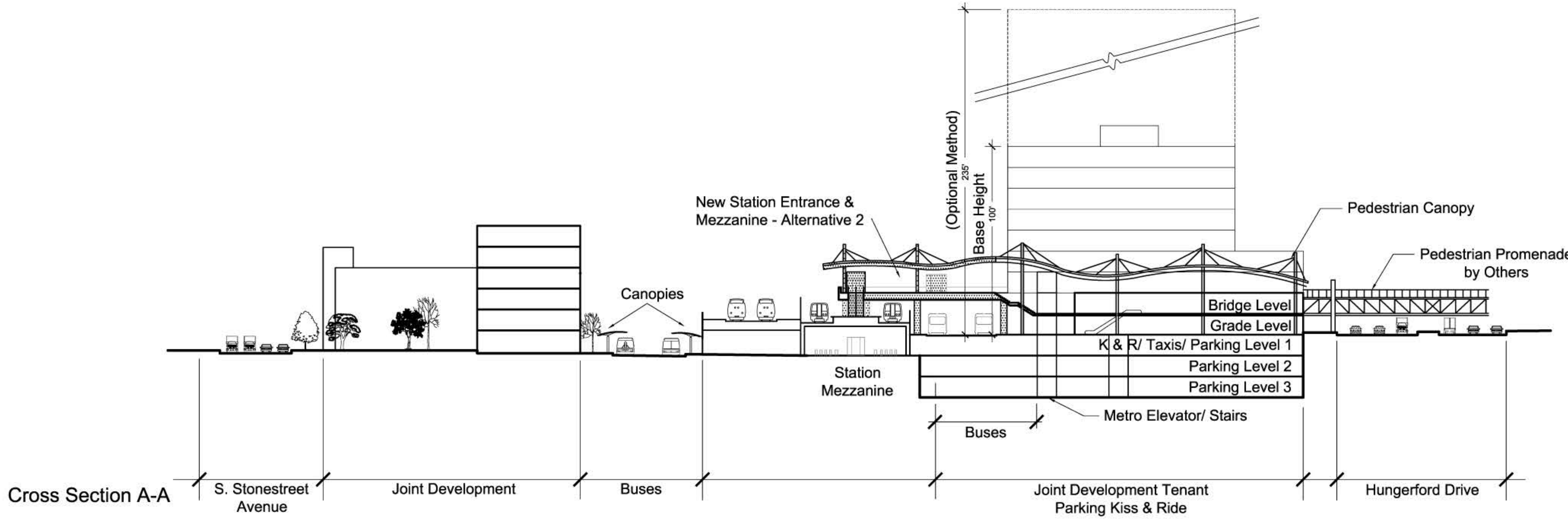
Roof Level

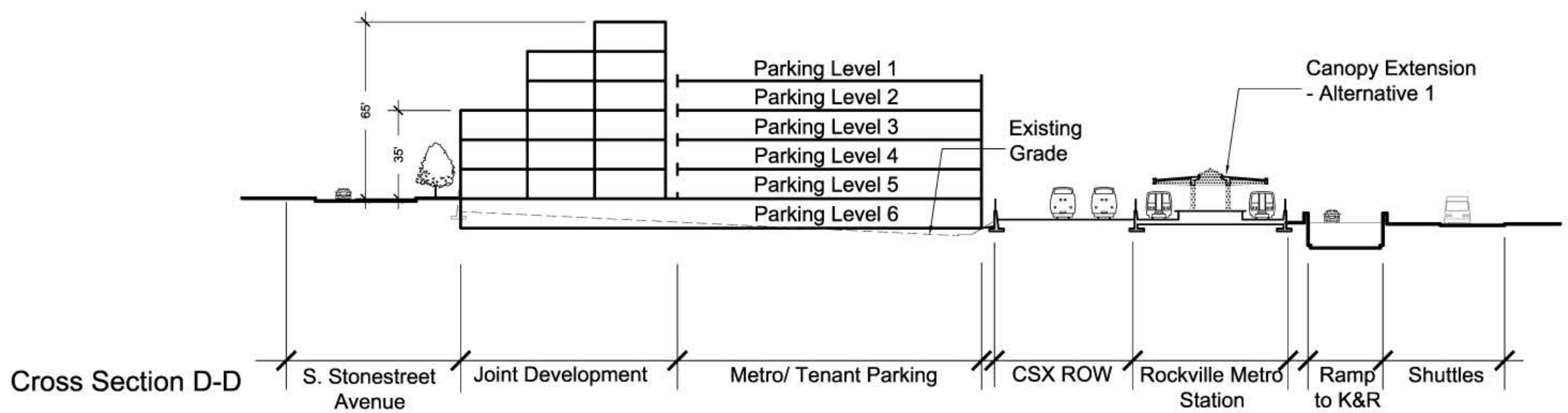
April 2005



Sept. 2004

Longitudinal Section B-B

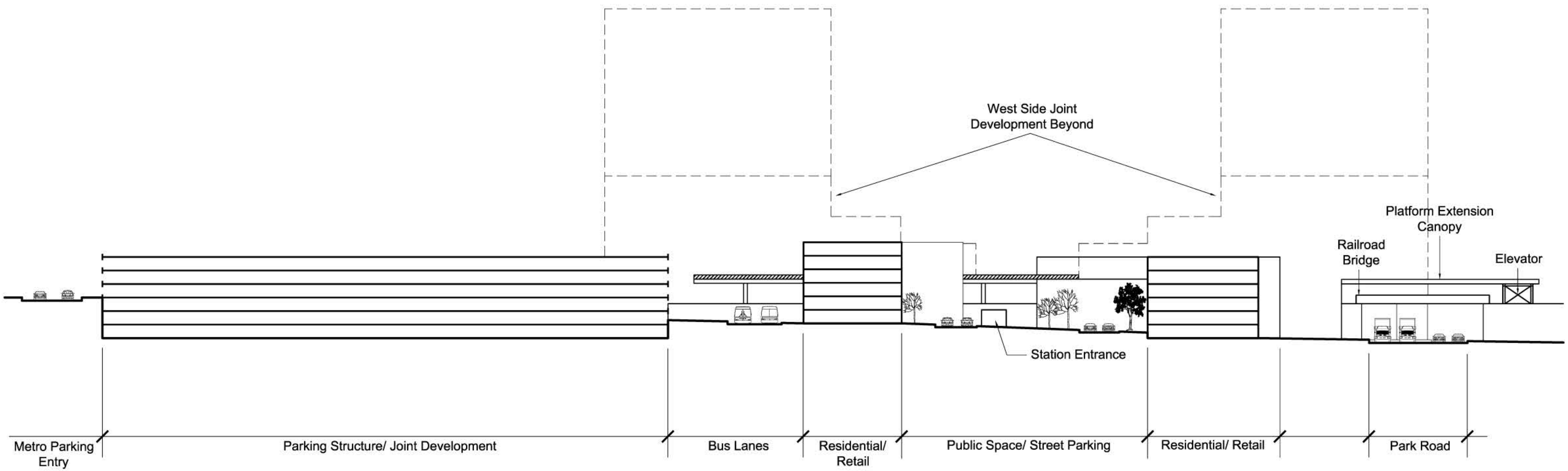




Jan. 2005

Cross Sections A-A & D-D

0 15 30 60
Scale: 1" = 60'



Site Longitudinal Section C-C

0 20 40 80
Scale: 1" = 80'

Sept. 2004

Rockville Metrorail Station Access Improvements Study
Transit Oriented Development
Traffic Analysis Technical Memorandum
Revised August 23, 2005

1. Introduction

As part of the Rockville Metrorail Station Access Improvements Study, a traffic analysis was performed on future traffic volumes that would travel in the city as a result of the Joint Development at the Rockville Metrorail Station and the Rockville Town Center. This memorandum discusses the analysis steps including site traffic estimation, future-year traffic volume determination, traffic assignment analysis, and traffic operations analysis. A summary of findings is presented at the end of the memorandum.

The study area for the Rockville Station Access Study, as shown in **Figure 1-1**, includes the Rockville Metrorail Station site, and the surrounding roadways of Hungerford Drive (Route 355), Park Road, East Middle Lane, North Stonestreet Avenue, South Stonestreet Avenue, Veirs Mill Road (Route 28), and Jefferson Street (Route 28). The Joint Development program analyzed for the station site is a mixed-use development that includes hotel, retail, and residential components, as well as parking for development and transit uses. Provisions for bus service and Kiss-and-Ride functions were also included in the analysis.

2. Existing Conditions

Much of Rockville's traffic travels on the major arterials near the Rockville Metrorail station. According to the East Rockville Neighborhood Plan, the East Rockville neighborhood and the Rockville Metrorail station are adjacent to two of the Rockville's top 10 most congested intersections: Veirs Mill Road-First Street at 109 percent of volume-to-capacity ratio, and Rockville Pike-Park Road-Middle Lane at 96 percent of capacity. Neighborhood cut-through travel is also a problem as vehicles try to escape congestion from MD 28 and MD 355 via neighborhood roads.

In the vicinity of the Rockville Metrorail station, Hungerford Drive (MD 355) carries an average of 53,600 vehicles per day (vpd) and MD 28 carries 46,500 vpd. According to the East Rockville Neighborhood Plan, First Street (MD 28) and Veirs Mill Road carry 30,000-50,000 automobile trips each day. North Stonestreet Avenue, a major neighborhood collector street serving industrial properties along the railroad, carries over 2,500 trips per day with five to eight tractor-trailers and 310 single-unit trucks. South Stonestreet Avenue carries 4,400 trips southbound and 5,500 northbound per day. Traffic counts from 2002 capture the daily volumes on South Stonestreet Avenue, reporting 4,470 vpd southbound and 5,360 vpd northbound between Croydon Avenue and Highland Avenue.

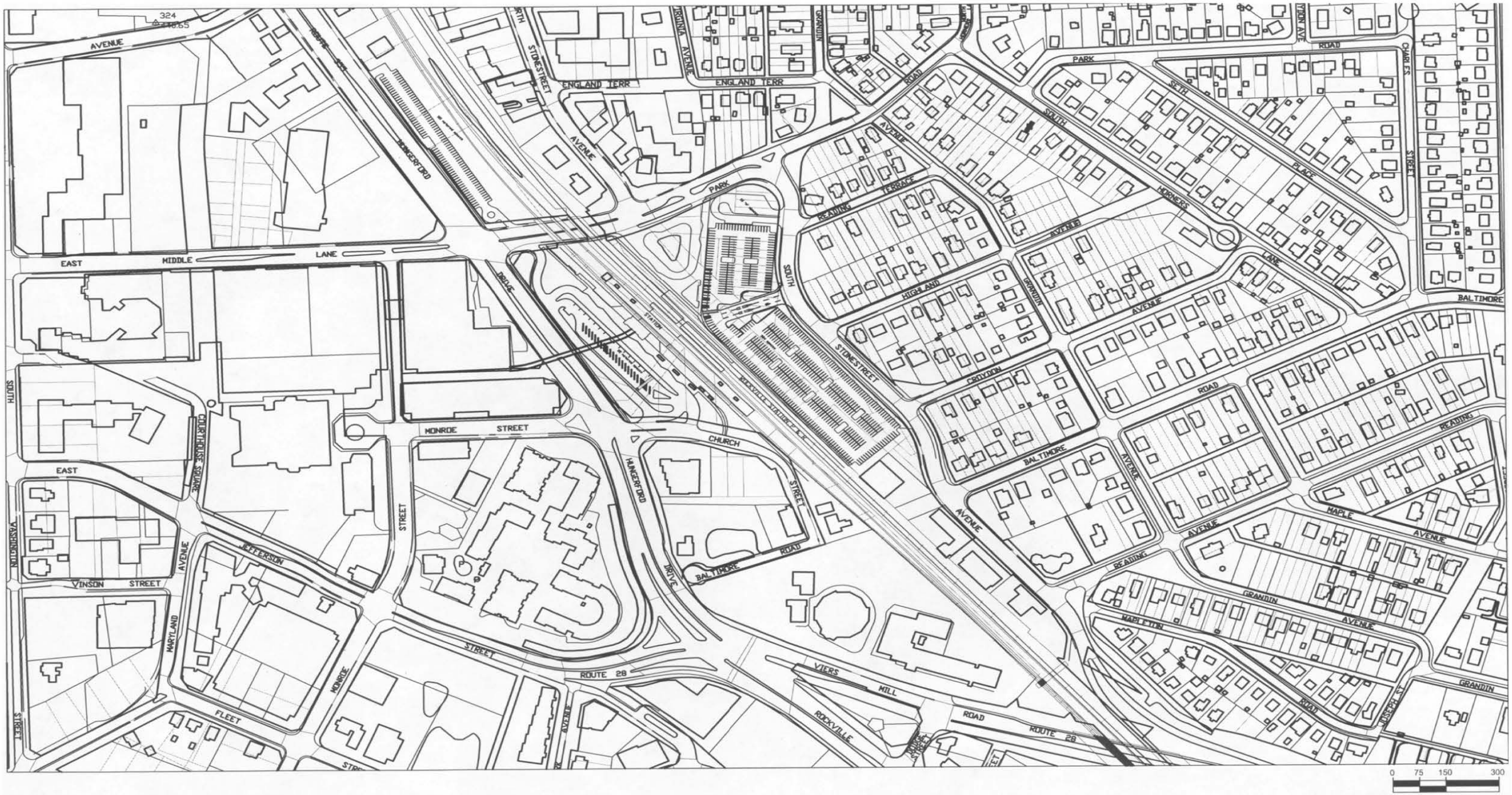
From traffic counts taken by the City of Rockville in 2001 and 2002, the morning peak period is from 7:00 am to 9:00 am. The evening peak period is 4:00 pm to 6:00 pm. The morning peak-hour volumes range from 1,600 to 2,760 vehicles per hour (vph) on Hungerford Drive (MD 355), and 1,160 to 1,880 vph on MD 28. The highest morning peak volumes occur on Hungerford Drive at Church Street. Evening peak-hour volumes range from 2,300 to 2,670 vph for MD 355, and 1,430 to 1,800 vph on MD 28. Again, the highest evening peak volumes occur on Hungerford Drive at Church Street. See **Table 2-1** and **Figure 2-1** for the peak hour volumes.

Table 2-1. Peak-Hour Volumes, 2001 and 2002
Source: City of Rockville

Link	Highest Peak-Hour Volume	
	AM	PM
SB Hungerford Dr at Church St	2760	
SB Hungerford Dr at Middle Lane		2300
NB Hungerford Dr at Middle Lane/Park Rd	1600	
NB Hungerford Dr at Church St		2670
WB MD 28 before Metro ramps	1880	1430
EB MD 28 after Metro ramps	1160	1800
NB Stonestreet at Park Rd	685	425
SB Stonestreet at Metro entrance	270	490
SB Stonestreet between Croydon Ave & Highland Ave	224	459
NB Stonestreet between Croydon Ave & Highland Ave	632	325
SB Stonestreet between Baltimore Rd & Reading Ave	310	497
NB Stonestreet between Baltimore Rd & Reading Ave	354	527

Results from the Rockville Town Center Transportation Analysis reveal that half of the intersections along MD 355 and MD 28 operate with significant delays or under failing conditions. **Table 2-2** displays the results of the intersection analyses for existing conditions. The shaded rows in the table indicate the intersections and times that have significant delays.

Figure 1-1. Study Area for Rockville Station Access Study



5. TRAFFIC ANALYSIS

Figure 2-1. Intersection Operations Near the Rockville Metrorail Station

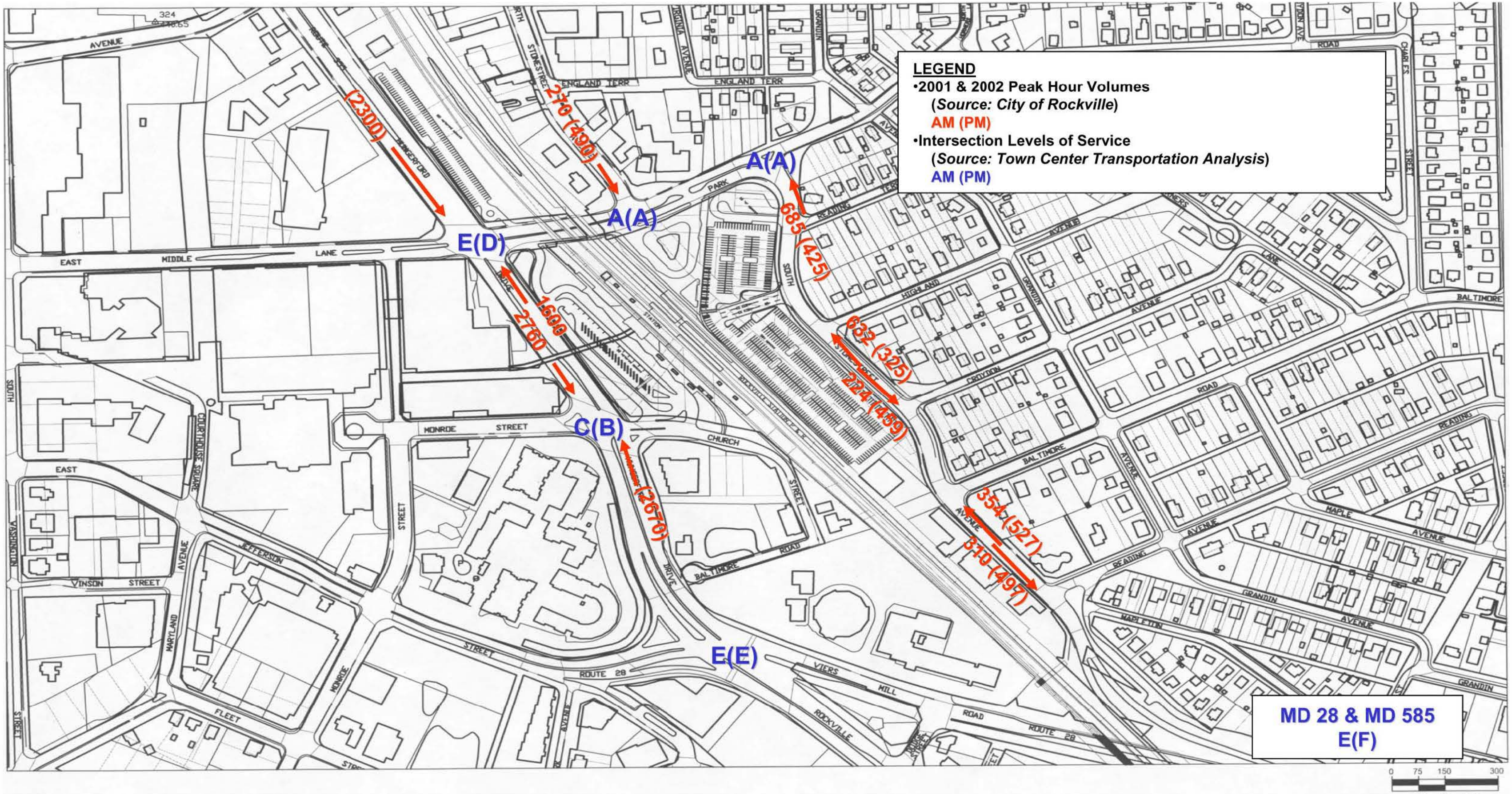


Table 2-2. Existing Conditions Intersection Analyses
Source: City of Rockville, MD. Town Center Transportation Analysis. May 2003.

Intersection	AM/PM	Fr South CLV	Fr North CLV	Fr West CLV	Fr East CLV	CLV Total	V/C Ratio	LOS[1]
E. Middle Ln & MD 355	AM	631	1027	475	382	1502	0.96	E
	PM	948	800	419	311	1368	0.88	D
Park Rd & N. Stonestreet	AM	47	50	221	704	754	0.50	A
	PM	78	82	378	511	593	0.39	A
Park Rd & S. Stonestreet	AM	0	608	179	98	885	0.59	A
	PM	0	344	329	123	797	0.53	A
MD 355 & Church St & Monroe Pl	AM	553	956	307	284	1263	0.76	C
	PM	794	733	283	340	1134	0.68	B
MD 355 & W. Jefferson & MD 28	AM	671	951	539	433	1490	0.99	E
	PM	1098	730	383	279	1481	0.98	E
MD 28 & First St (MD 585)	AM	750	645	211	529	1490	0.96	E
	PM	771	823	597	310	1730	1.11	F

From the results, the critical intersections are MD 28-MD 355, and MD 28-MD 585. During the morning peak hour, the MD 28 corridor is congested at MD 355 and MD 585, both operating at LOS E. The average delay per vehicle ranges from 55 to 80 seconds per vehicle at these two intersections. The intersections of MD 355-Middle Lane-Park Road and MD 355-MD 28 operate at LOS E. The intersection of MD 355-Church Street operates at LOS C. The Middle Lane-Park Road corridor operates with adequate capacity at South Stonestreet and North Stonestreet Avenues.

During the evening peak hour, MD 28 at the MD 355 and MD 585 intersections operates at LOS E and LOS F, respectively. A LOS F equates to drivers experiencing average delays greater than 80 seconds per vehicle. High vehicle delays occur on MD 355 at the Middle Lane-Park Road intersection, operating at LOS E, and at the MD 28 intersection, operating at LOS F. Again, the intersection of MD 355-Church Street performs at acceptable traffic operations, LOS C, during the evening peak hour. The intersections of Park Road at South Stonestreet and North Stonestreet Avenues operate at excellent levels of service.

[1] The peak-hour level of service is a measure of the adequacy of the existing lanes and/or signalization at an intersection or roadway segment for the particular peak hour. Level of service is measured on a scale of A through F, with LOS A representing the best operating conditions with little or no delay and LOS F representing the worst with unacceptable delay. **LOS A** – less than 10.0 seconds of delay per vehicle; **LOS B** – between 10.0 & 20.0 seconds of delay per vehicle; **LOS C** – between 20.0 & 35.0 seconds of delay per vehicle**; LOS D** – between 35.0 and 55.0 seconds of delay per vehicle; **LOS E** – between 55.0 & 80.0 seconds of delay per vehicle; **LOS F** – greater than 80.0 seconds of delay per vehicle.

Transit

Metrorail, Metrobus, Ride On, and MARC currently service the Rockville Metrorail station. Thirteen Ride On bus lines and two Metrobus routes stop at the station. WMATA conducted a rail passenger survey in 2002. Based on this data, the mode of access and egress for Metrorail riders at the Rockville station varies as shown below.

Table 2-3. Mode of Access and Egress by Time Period at the Rockville Metrorail Station
Source: 2002 WMATA Rail Passenger Survey

Time Period	Mode of Access / Egress											
	Metrobus	Ride On	Other bus service	Drove a car and parked	Rode with someone who parked	Dropped off by someone	Bicycle	Walk	Amtrak, MARC, or VRE	Taxi	Unknown	Total
AM Access	43	173	0	1,040	26	329	35	373	295	0	0	2,314
AM Egress	144	323	0	9	0	25	9	303	3	0	53	869
PM Access	66	309	0	94	0	103	9	243	9	9	9	851
PM Egress	106	450	14	1,136	11	285	32	476	285	18	66	2,879
Daily Access	179	692	7	1,360	40	594	44	952	304	9	9	4,190
Daily Egress	424	1,080	30	1,513	39	421	54	1,367	300	36	140	5,404
Daily % of Total	**6.3%**	**18.5%**	**0.4%**	**30.0%**	**0.8%**	**10.6%**	**1.0%**	**24.2%**	**6.3%**	**0.5%**	**1.6%**	**100.0%**

** AM Peak Period is from 5:30 am - 9:30 am; PM Peak Period is from 3 pm - 7 pm. The PM peak hour is the peak hour of bus ridership and frequency at Rockville.*

Driving to or from the Rockville station was the most common mode of access, followed by walking. Ride On was the next highest mode of access, with 18.5 percent of Rockville Metrorail riders in this category. Ride On and Metrobus riders combined comprise 24.8 percent of the Metrorail riders at the Rockville station.

WMATA provided daily Metrobus ridership at the Rockville station for this study. The T2 and Q2 routes are summarized below. Both routes service the west side of the station.

Table 2-4. Daily Metrobus Ridership at Rockville Station, 2003
Source: WMATA, November 13, 2003 email

Route	NB – MD 355		SB – MD 355	
	Boardings	***Alightings***	***Boardings***	***Alightings***
T2	272	228	*	*
Q2	297	850	805	314
Total	**569**	**1078**	**805**	**314**

** The Route T2 does not travel on southbound MD 355.*

Based on the total number of daily Metrobus boardings at Rockville and the Rail Passenger Survey data, the total number of 2003 peak-hour boardings at Rockville (Metrobus and Ride On) is approximately 875.

The present bus frequency at the Rockville station is shown below. Since several of the routes end or begin at the Rockville station, these buses were counted only once. The peak hour, from 5:00 pm through 6:00 pm, yields 36 buses on the west side of the station and 21 buses on the east side. The more active west side services several Ride On lines and the two Metrobus routes.

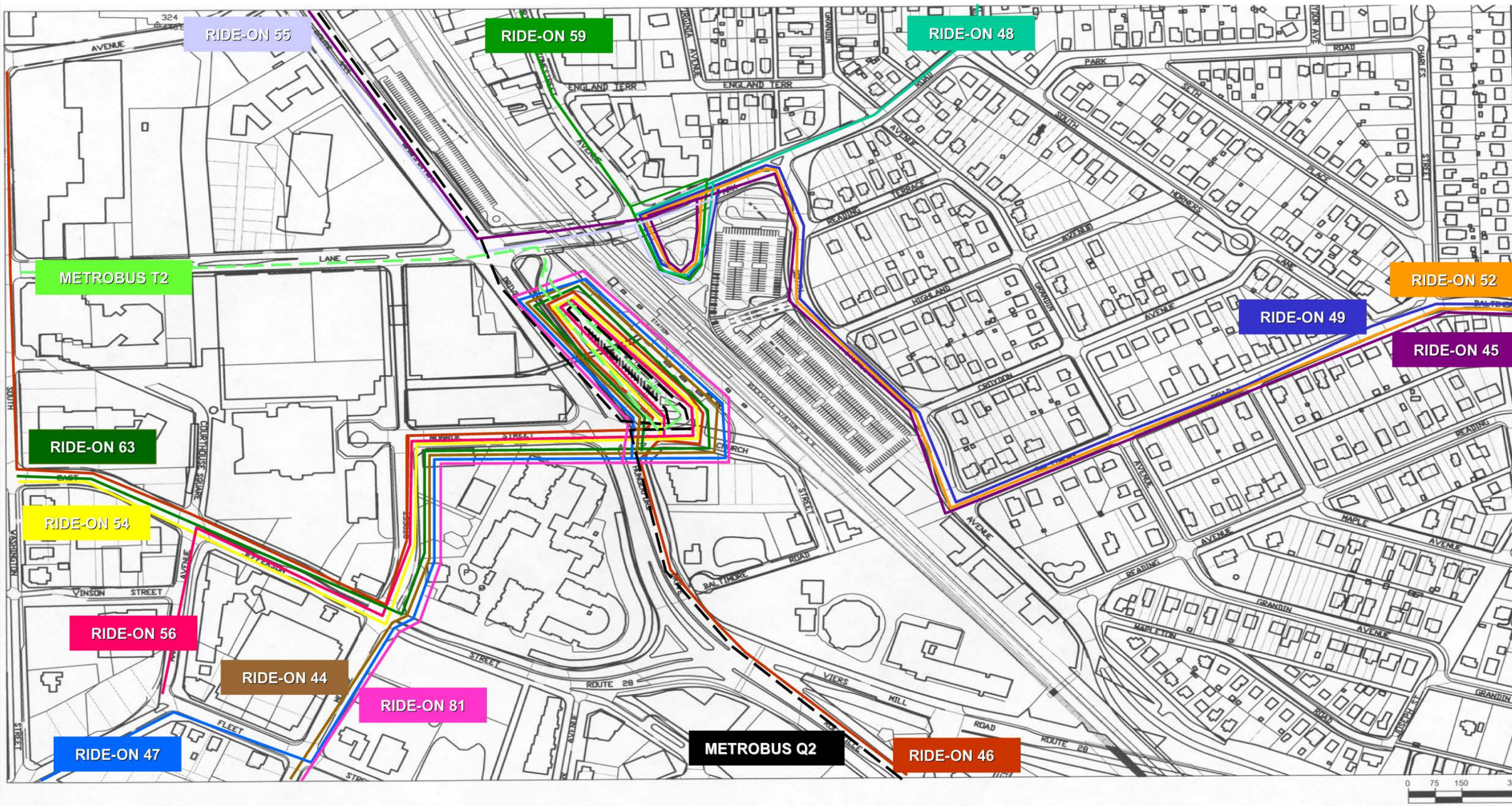
Table 2-6. Rockville Station Bus Frequency during Weekday Peak Hour by Route
Source: *www.wmata.com/timetables/timetables-state.cfm?State=MD; www.montgomerycountymd.gov/content/dpwt/transit/routesandschedules/rideonroutes.asp*

West Side	**5 Bus Bays**				***East Side***	**4 Bus Bays**			
Route	**NB AM**	**SB AM**	**NB PM**	**SB PM**	**Route**	**NB AM**	**SB AM**	**NB PM**	**SB PM**
T2	2	3	3	3	*45*	2	3	4	2
Q2	6	5	6	5	***48***	2	2	2	2
44	2	2	2	2	***49***	3	2	3	2
46	3	4	4	4	***52***	2	2	2	2
47	2	2	2	2	***55***	2	3	4	3
54	2	3	3	2	***59***	3	4	4	2
56	3	2	3	2					
63	2	1	2	2					
81	2	2	2	2					
Total	**35**		**36**		**Total**	**19**		**21**	

AM Peak: 6:30 – 7:30 AM; PM Peak: 5 – 6 PM
Note: ***Bold*** *text indicates that this route has its terminus at Rockville*

The number of buses at the Rockville station during the peak hour is currently 57 using nine bus bays. According to the information provided by WMATA, one bus bay is presently unused. **Figure 2-2** shows the bus routes accessing the Rockville Metrorail station.

Figure 2-2. Bus Routes Serving the Rockville Metrorail Station



3. Site Traffic Estimation

Several steps were performed in order to determine the amount of vehicular traffic that would be generated from the Joint Development at the Rockville Metrorail Station. The steps included trip generation, trip distribution, and traffic assignment. Each step is described below.

Trip Generation
Inputs to the vehicular trip generation activities were taken from the Development Program for the Rockville Metrorail Station Access Improvements Study. **Tables 3-1 and 3-2** show the components of the development program.

Table 3-1A. Development Program – Optional Program #1
Source: Lee and Associates, September 2004

West Side	East Side
Transit Program	
• 9 Bus Bays (1 articulated bay) on site • One bus pullout on Hungerford Drive • 7 layover spaces • 123 existing long term spaces north of Park Rd. to remain • 16 Kiss & Ride spaces (in parking garage) • 4 Taxi stands (in parking garage)	• 8 Bus bays (including 2 articulated BRT bus bays) • 2 layover spaces • Kiss & Ride/taxi in public plaza area
Joint Development	
North Mixed Use Tower • <u>Hotel</u>- 240,000 s.f. Approximately 260 rooms. 9 stories (7 room levels over two levels of retail and hotel functions). • <u>Residential</u>- 150,000 s.f. Approximately 128 units 10 stories (10 room levels over hotel floors). • **TOTALS** North Tower - 390,000 s.f. (does not include retail). 19 stories. *South Residential Tower* • <u>Residential</u>- 380,000 s.f. Approximately 340 units. 19 stories (17 room levels over 2 levels of retail and residential amenity/lobby space. • <u>Retail</u>- 25,000 s.f. At mezzanine (ground) and pedestrian promenade level • **<u>TOTAL Development= 795,000 s.f. for an FAR of 5.8</u>**	• Site area approximately 280,000 s.f. • <u>Commercial</u> - 50,000 s.f. Assume ground floor retail and upper level residential. 3-6 stories above retail development • <u>North End Residential</u> 150-160 units or 180,000 s.f. • <u>South End Residential</u> 30-60 units or 70,000 s.f. • **<u>TOTAL Development= 300,000 s.f. for an FAR of 1.1 (Total of 180-220 units)</u>**
Parking	
• Hotel - 300 • Commercial - 730 • Retail - 0 (assume transit related retail) • TOTAL= 1030 spaces • Underground Parking- 412 spaces /level x 2.5 levels = 1030 spaces • Note: ½ of the top parking level is devoted to taxis and Kiss and Ride	• Metro- 524 existing spaces • Joint Development- 460 spaces • TOTAL = 984 spaces • 7 levels = 984 spaces
Other	
• 8 pull out spaces on Hungerford Drive • Office/hotel drop off/K&R/taxi	

Table 3-1B. Development Program – Optional Program #2
Source: Lee and Associates, September 2004

West Side	East Side
Transit Program	
• Same as Optional Program #1	• Same as Optional Program #1
Joint Development	
• Same as Optional Program #1	• Same as Optional Program #1
Parking	
• Same as Optional Program #1	• Metro- 1024 spaces (includes 524 existing additional 500 Metro spaces) • Joint Development- 460 spaces • TOTAL = 1484 spaces • 7 levels = 1484 spaces
Other	
• Same as Optional Program #1	• Same as Optional Program #1

The methodology for calculating new trips to and from the joint development was found in the city's *Comprehensive Transportation Review Methodology* (CTR). Trips for each of the components were calculated using recommended trip generation rates and equations found in the *Trip Generation Manual* from the Institute of Transportation Engineers (ITE), and the *Local Area Transportation Review Guidelines* (LATR), from the Maryland National Capital Park and Planning Commission (M-NCPPC). The daily traffic volumes were calculated using the ITE Trip Generation rates and equations. The morning and evening peak-hour trips to and from the joint development were calculated using local rates and equations from the LATR.

For a conservative estimate, the high end of the range listed in the preliminary development was used for trip generation purposes. For the north end residential units on the east side of the development, 160 units were used in calculations. For the south end residential units on the east side of the development, 60 units were used in calculations.

The CTR and LATR listed the development site as a *Transit Oriented Area*, which would produce fewer vehicle trips due to its proximity to a Metrorail station. Based on the transit mode shares provided by the City of Rockville, as shown in **Table 3-2**, the amount of trip reduction for retail and residential development can be as high as 25 percent. Also, the joint development would be subject to further trip reductions because of its designation as a mixed-use development within a transit-oriented development. According to the CTR, the maximum trip reduction that could be applied is 10 percent. This percentage of trip reduction was used for office, retail, and residential trips at the development site. The parking garage associated with Metrorail use was considered as a Park-and-Ride location for the purposed of trip generation. The number of pass-by trips also reduced retail trips, which according to the ITE manual for shopping centers was a 35 percent reduction.

Table 3-2. Transit Mode Shares
Source: City of Rockville, 2005

Development Type	AM	PM	Saturday
Retail	15%	15%	15%
Residential	25%	25%	25%

According to the calculations, vehicular daily trips generated by the Joint Development ranging from 8,100 vpd to 10,400 vpd would travel on roadways near the Rockville Metrorail station. Approximately 1,200 trips would occur during the morning peak hour, and 1,300 trips would occur during the evening peak hour. **Table 3-3** shows the trip generation by site orientation. **Figure 3-1** shows the new trip volumes generated from joint development. The detailed trip generation results are shown in **Appendix A**.

Table 3-3A. Trip Generation Results for Optional Development Program #1
Source: Parsons Brinckerhoff, 2005

Joint Development	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
West Side	3,723	302	130	153	336	151	146
East Side	4,451	533	366	166	601	223	377
TOTALS	**8,174**	**835**	**496**	**319**	**937**	**374**	**523**

**Total Peak Generated Trips include pass-by and trip reductions.*

Table 3-3B. Trip Generation Results for Optional Development Program #2
Source: Parsons Brinckerhoff, 2005

Joint Development	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
West Side	**3,723**	**302**	**130**	**153**	**336**	**151**	**146**
East Side	**6,701**	**908**	**666**	**241**	**916**	**293**	**623**
TOTALS	**10,424**	**1,210**	**796**	**394**	**1,252**	**443**	**769**

**Total Peak Generated Trips include pass-by and trip reductions.*

Based on the trip generation results, the Optional Development Program #2, which incorporates 500 additional Metrorail parking spaces, would generate over 2,000 more trips per day than Optional Development Program #1. The results from the traffic operational analysis in Section 5 discuss the impacts of the additional trips on the transportation system.

Figure 3-1A. Trip Generation Results for Optional Development Program #1

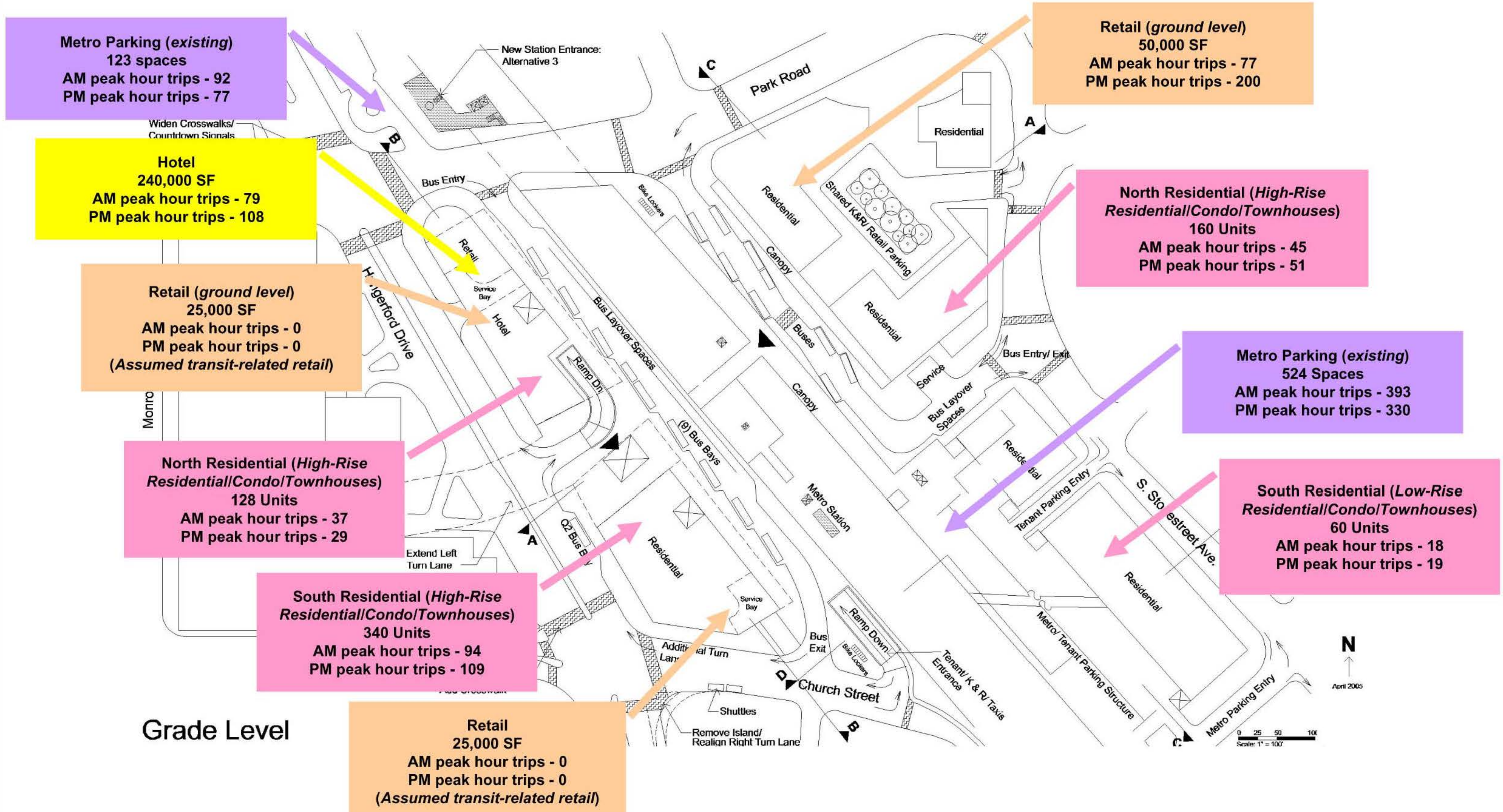
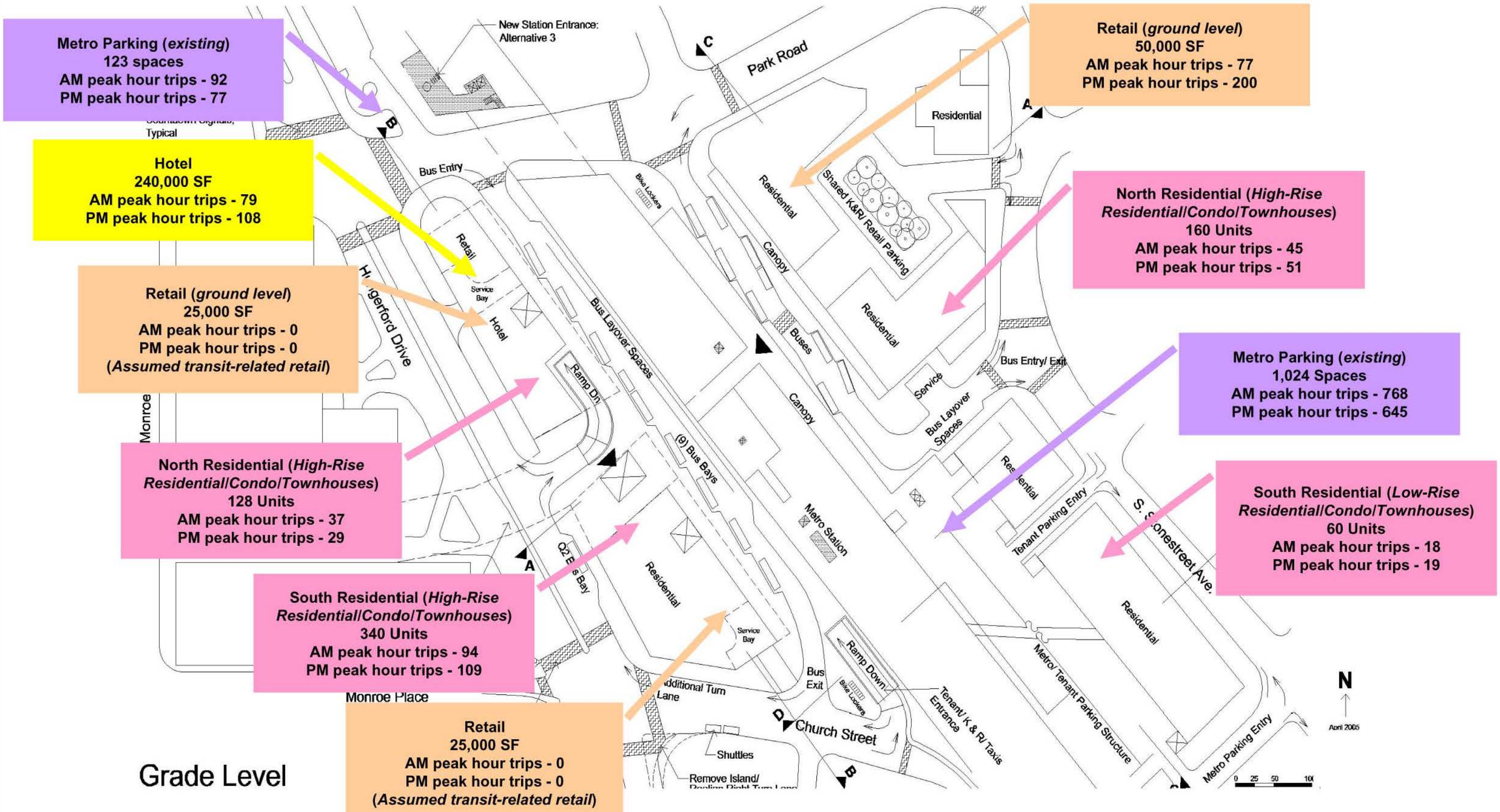


Figure 3-1B. Trip Generation Results for Optional Development Program #2



Trip Distribution and Traffic Assignment

The next step after calculating the generated vehicle trips for the Joint Development was to determine the trip distribution of the trips throughout study area, and traffic assignment of the distributed trips at individual intersections. Trip distribution specifies the destination of trips originating at the development site, and the origin of trips destined to the development site. Traffic assignment specifies the individual local area intersections used to access the development site.[2] The trip distribution and traffic assignment values were calculated using the procedures and factors noted in the LATR.

According to the LATR, the Rockville Metrorail station development site is located in the Rockville/North Bethesda Super-District, and has specific trip distribution assumptions for developments in this area. For each super-district, the assumed trip distributions for only general office developments and residential developments are listed. The assumptions include the percentage of trips from all super-districts (DC metropolitan areas of Maryland, Virginia, and DC) that will access the proposed development.

Trip distribution assumptions for the hotel development, retail development, and parking at the Metrorail station are not included in the LATR. The trip distribution assumptions for these categories were assumed based on the distribution information in the LATR. Thus, engineering and planning judgment was used to determine the percentages of traffic from various super-districts that would access the retail and parking developments at the Rockville Metrorail Station.

Once the trip distribution assumptions were determined, the distributions were spread out over assumed roadways and intersections, or traffic assignment, for each trip accessing the development site from the various super-districts. Engineering and planning judgment was used to determine the travel paths for trips to and from the development site. Finally, the trip distribution percentages and the traffic assignment percentages were combined to create the percent of total development-generated trips. The assignment data was then summed to develop an aggregate trip assignment rate for each roadway, which was combined with the trip generation results to determine roadway and intersection volumes.

The trip distribution-traffic assignment activities also accounted for the trips generated by Metrobuses and Ride On buses during the morning and evening peak hours. According to the 2004 Dulles Corridor EIS Patronage forecasts, Metrorail ridership is expected to grow by 55 percent between 2004 and 2025. Bus ridership was assumed to grow at the same rate. The number of buses at the Rockville station during the peak hour is currently 80 using 9 bus bays. The number of buses forecasted for 2010 was dependent on the current utilization, as well as the future volumes from the planned Viers Mill Road BRT service and the expanded pulse service for Ride On. Therefore, the increase in bus trips to the Rockville Metrorail station was proportional to the increase in projected ridership. For the purposes of this study, a calculation of approximately 90 buses will service the Rockville Metrorail station in year 2010 during the peak hour periods.

The bus trips were distributed to the appropriate intersections in the study area. Bus routes were assumed to be re-routed to use the new bus entrances on the west and east sides of the Metrorail station. Buses currently entering the station from eastbound Monroe Street/Church Street would be diverted to eastbound East Middle Lane, via Route 28 and South Washington Street, and would travel through the MD 355 intersection to enter the reconfigured bus facility from Park Lane. The only bus accessing the station via northbound MD 355 would be the Metrobus Q2, as it would have a dedicated stop location on MD 355. Buses would be re-routed through the Rockville Town Center, in lieu of MD 355, to minimize the vehicular turning conflicts with pedestrians at the crosswalks located to the east at the Monroe Street - MD 355 and East Middle Lane - Park Road intersections.

Figure 3-2 shows development-generated volumes at each intersection in the study area. The detailed trip distribution and traffic assignment results are shown in **Appendix B**.

4. Traffic Forecasts

The generated trips from the Rockville Station Joint Development were added to the background traffic volumes for the year of the Rockville Town Center build-out. The build-out year for the Joint Development was assumed to be 2010. The 2010 volumes were taken from the Rockville Town Center Master Plan and Transportation Analysis. The volumes in the Town Center report accounted for existing traffic volumes in the study area, background traffic data for developments that are planned or have been improved by the city including the Rockville Town Center, and traffic growth for through traffic generated solely by land uses outside the study area. The Town Center traffic accounted for traffic growth up to year 2006, and thus was increased to account for traffic growth to year 2010 by using growth factors from the City of Rockville's analysis worksheets. **Figure 4-1** shows the total volumes (background traffic + development-generated volumes) at each intersection in the study area. Detailed 2010 traffic volume data is shown in **Appendix C**.

5. Traffic Operations Analysis

A critical lane volume (CLV) analysis was performed to calculate the operational capacity at the intersections in the study area for year 2010. A CLV analysis is the preferred method of determining intersection capacity by the City of Rockville. A CLV analysis is a methodology for calculating intersection capacity and level of service (LOS) by using the intersection geometry, traffic control information, and traffic volumes. The critical lane volume is the sum of the critical movements in both the north-south and east-west approaches. The results of the CLV analysis include a volume-to-capacity ratio, which can then be used to determine the intersection LOS. **Table 5-1** shows the comparison between volume-to-capacity ratio and intersection capacity.

[2] M-NCPPC, Local Area Transportation Review Guidelines, Appendix E, pg. 56.

Table 5-1. Level of Service
Source: City of Rockville Comprehensive Transportation Review Methodology, May 2004

LOS	Range (% of Capacity)
A	< 59%
B	60% - 69%
C	70% - 79%
D	80% - 89%
E	90% - 99%
F	> 100%

According to the City of Rockville Comprehensive Transportation Review Methodology, a total of 16 intersections must be analyzed for the Rockville Station Joint Development study area.[3] The City of Rockville's analysis worksheets were used to perform the CLV analysis for the study intersections. **Figure 5-1** shows the LOS results from the CLV analysis. The CLV results are shown in **Appendix D**.

The roadway geometry used in the CLV analysis was the same geometry used in the Rockville Town Center Traffic Analysis. Operational enhancements at intersections along MD 355, as noted in the Town Center Traffic Analysis report were also included in the analysis. The feature of "Right-Turn-On-Red" was removed from the MD 355 intersections at E. Middle Lane and Church Street to accommodate safe pedestrian crossings at these intersections. A right-in/right-out access point to the hotel parking on MD 355 is provided to minimize the possibilities of any operational deficiencies on MD 355 resulting from a signalized mid-block intersection with left-in/left-out potential. The service bay entry for the hotel and retail relocated off of MD 355 is designed so that trucks can easily enter and exit the bay. Thus, northbound traffic would not have to stop while trucks back into the service dock.

The bus exit on the west side of the station is located 200 feet east of the MD 355-Church Street intersection to provide longer stacking distances for buses. An additional right-turn lane was added to the Church Street approach as an exclusive turn lane for buses. The right-turn lane would serve as a bus queue jumper lane, which would allow buses to exit the station ahead of vehicles from the parking garage, thus minimizing delays in the bus service. Thus, the Church Street approach would be analyzed with four exiting lanes – a right turn lane (buses only), a shared through and right lane, and two left turn lanes.

To allow an additional curb lane for shuttle parking, the separate right-turn lane from northbound MD 355 to Church Street was eliminated and realigned with a conventional corner radius where the existing island is deleted and the crosswalks are straightened. The existing right turn lane was originally designed for northbound buses entering the station. The only northbound bus route, the Q2, would now go straight through this intersection to access the pull-out lane along MD 355. The left turn lane for southbound MD 355 was lengthened to approximately 230 feet to allow for additional vehicular storage.

For improved pedestrian safety and convenience, the study recommends that crosswalks be widened at all intersections adjacent to the Metrorail station and additional crosswalks be added. On the Master Plan, a crosswalk was added on the north side of the MD 355/Church Street intersection for pedestrians accessing the station from the west, traveling along the sidewalk on the north side of Monroe Place. A crosswalk was added across Church Street adjacent to the K&R/Parking access ramp entry with a six-foot-wide sidewalk along the parking ramp to the Garage/Mezzanine level for pedestrian access from the south and the shuttle van parking area to the station entrance.

[3] City of Rockville, Comprehensive Transportation Review Methodology, pg. 11.

Figure 3-2A. Trip Distribution and Traffic Assignment Results for Optional Program #1

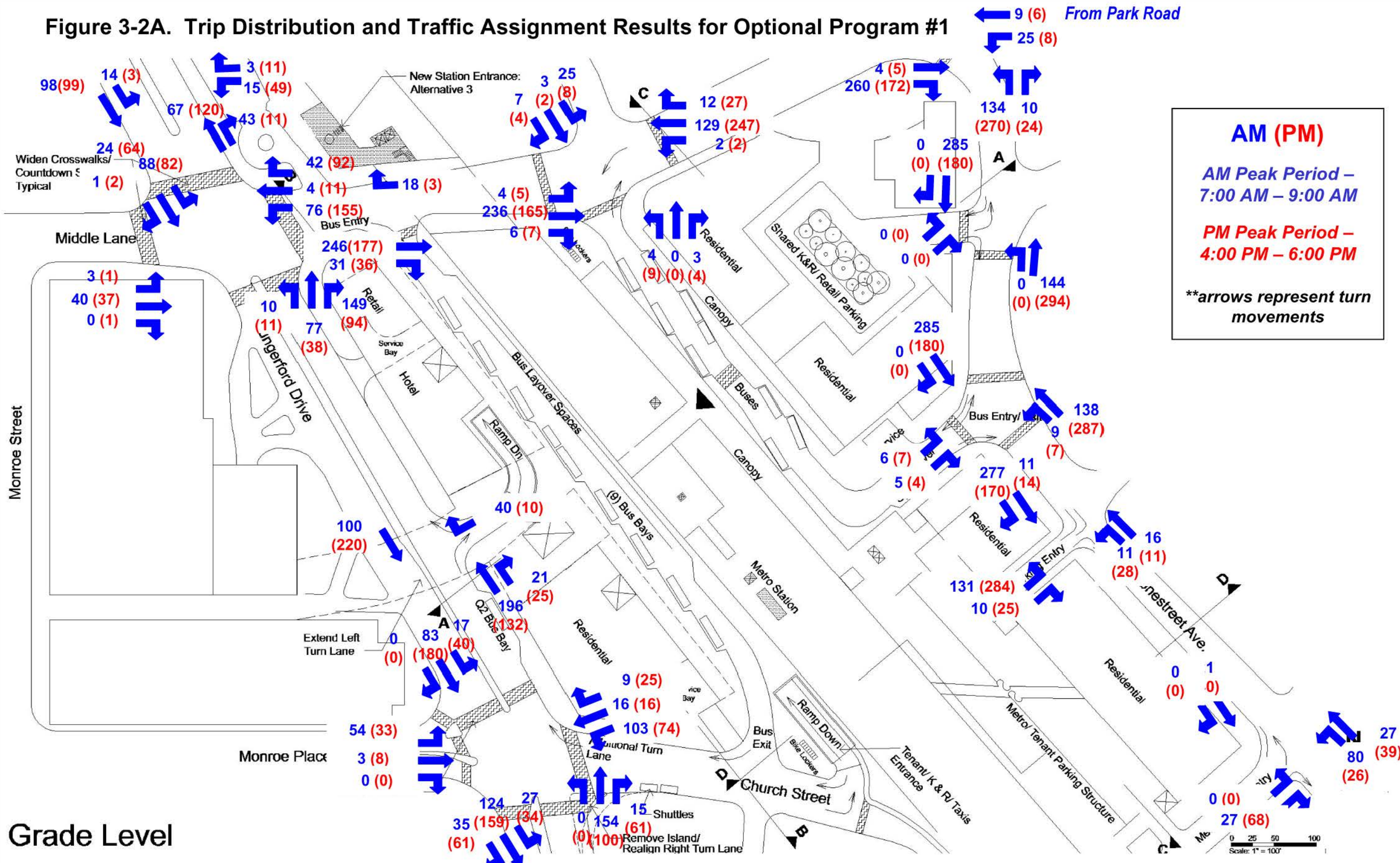
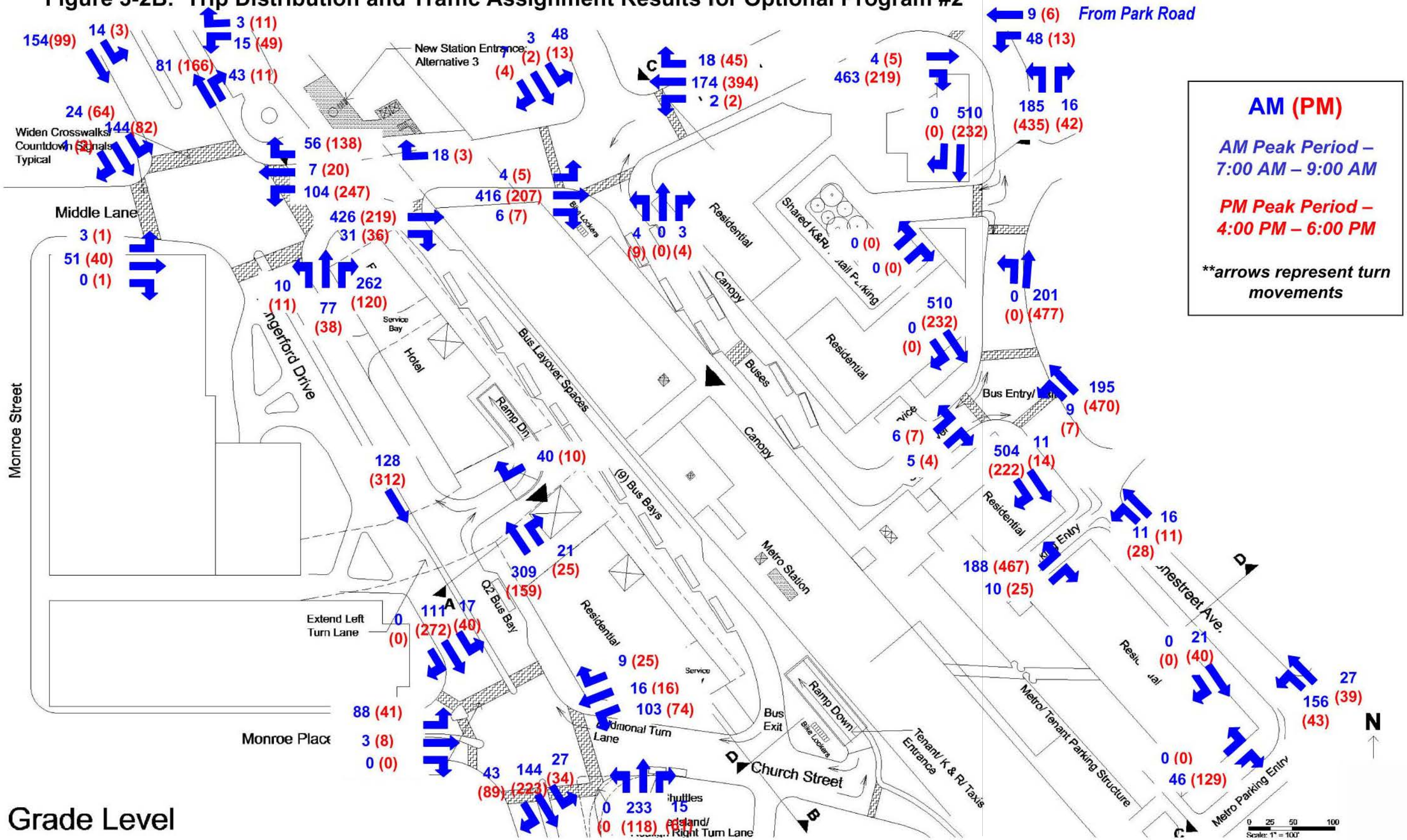


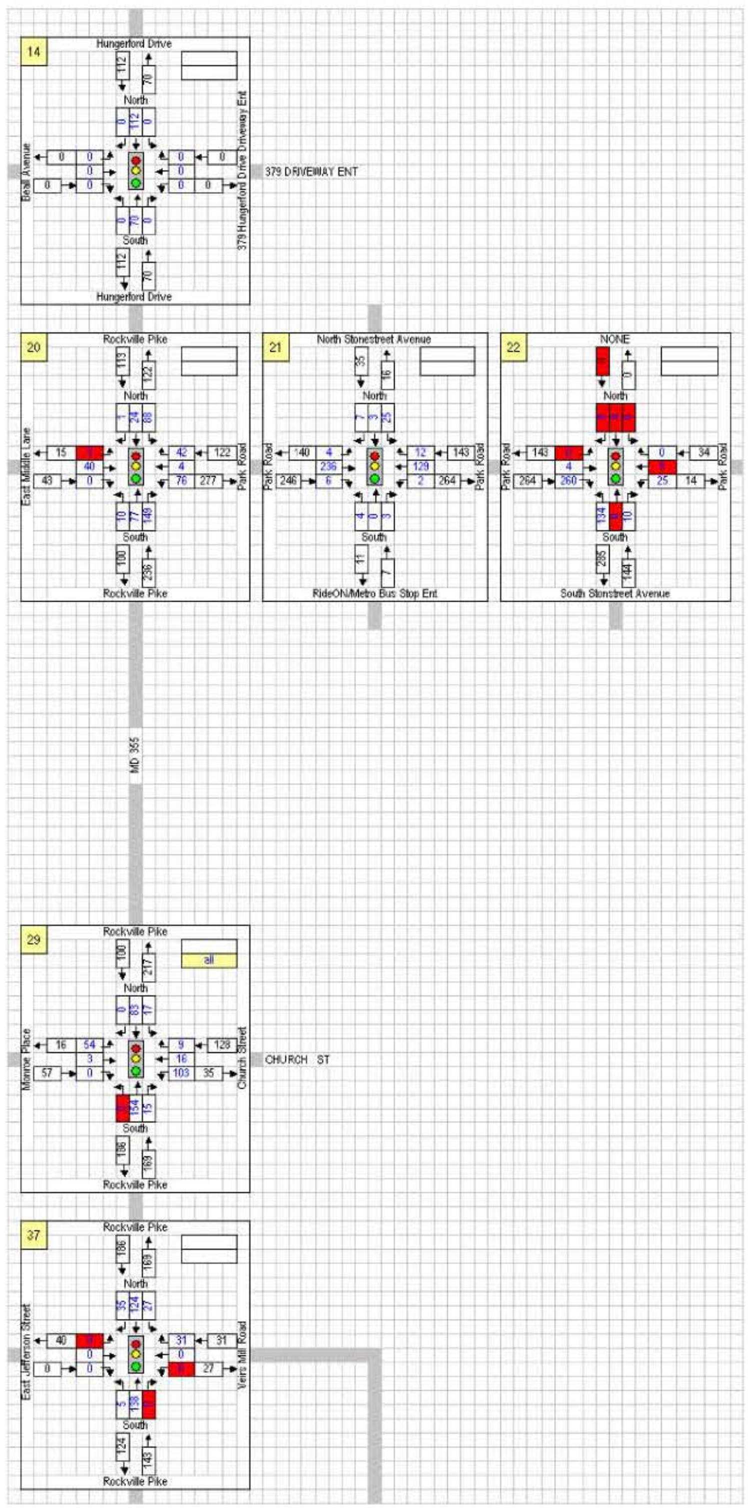
Figure 3-2B. Trip Distribution and Traffic Assignment Results for Optional Program #2



Grade Level

Figure 4-1A. 2010 Traffic Volumes for Optional Program #1
Source: City of Rockville

AM Peak Hour



PM Peak Hour

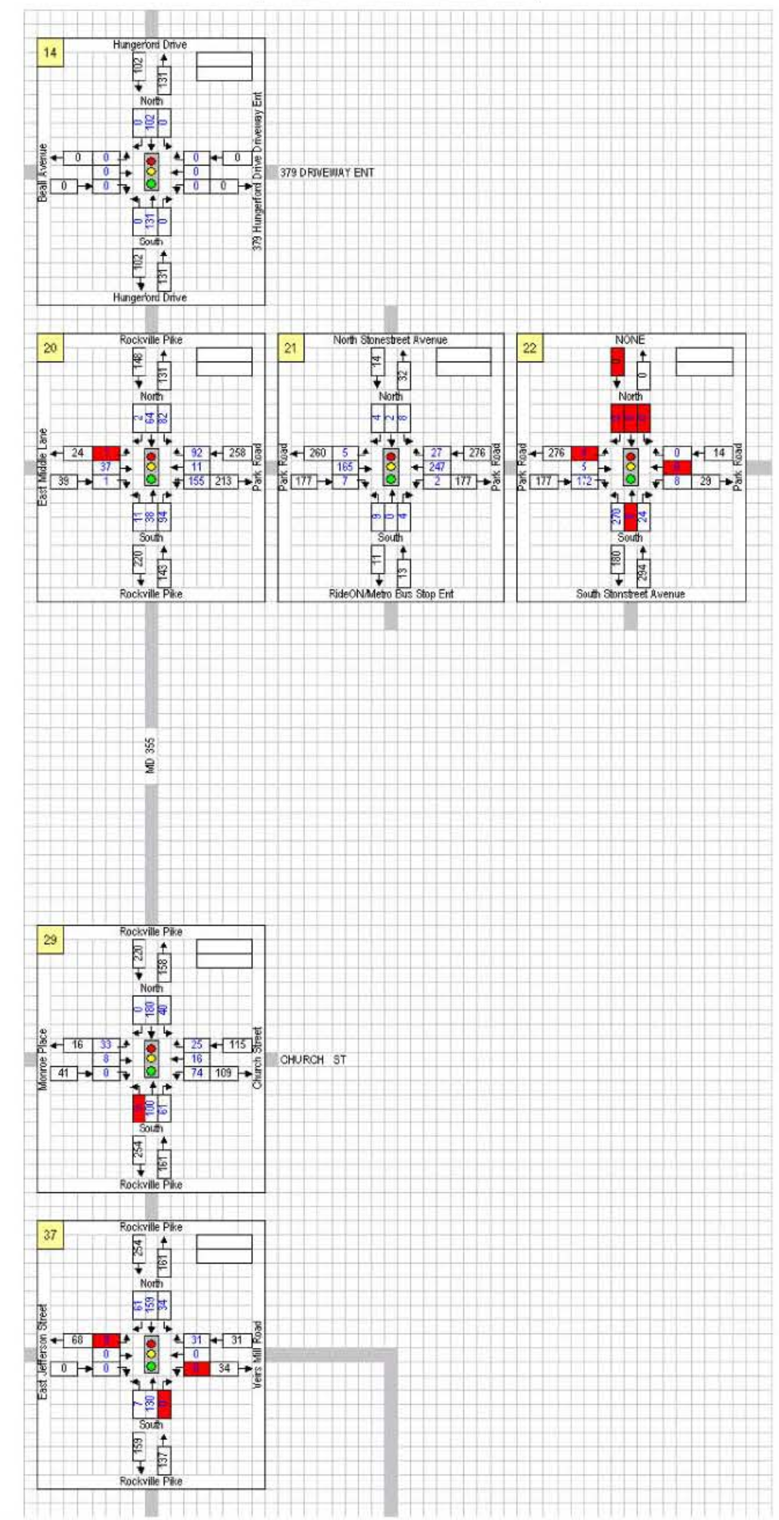
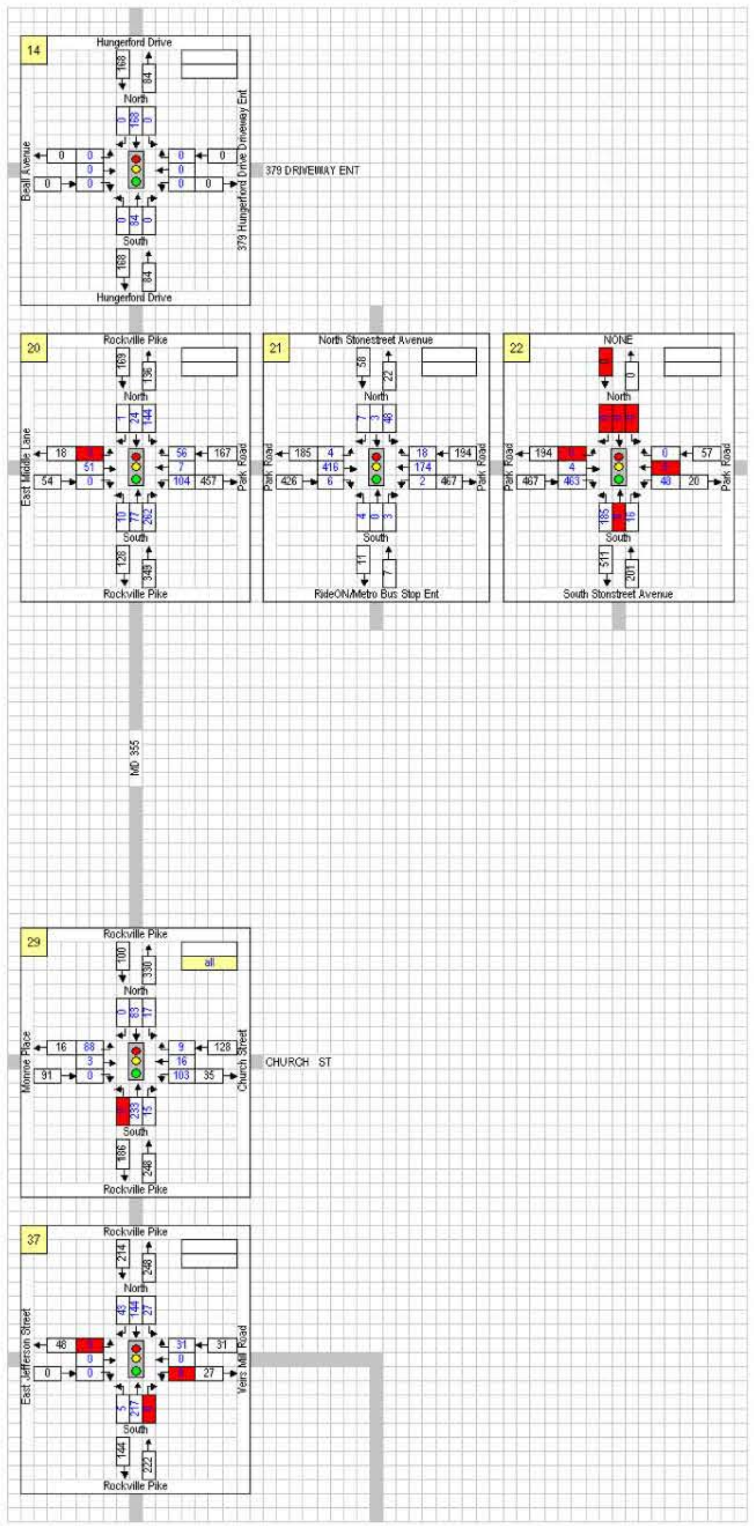


Figure 4-1B. 2010 Traffic Volumes for Optional Program #2
Source: City of Rockville

AM Peak Hour



PM Peak Hour

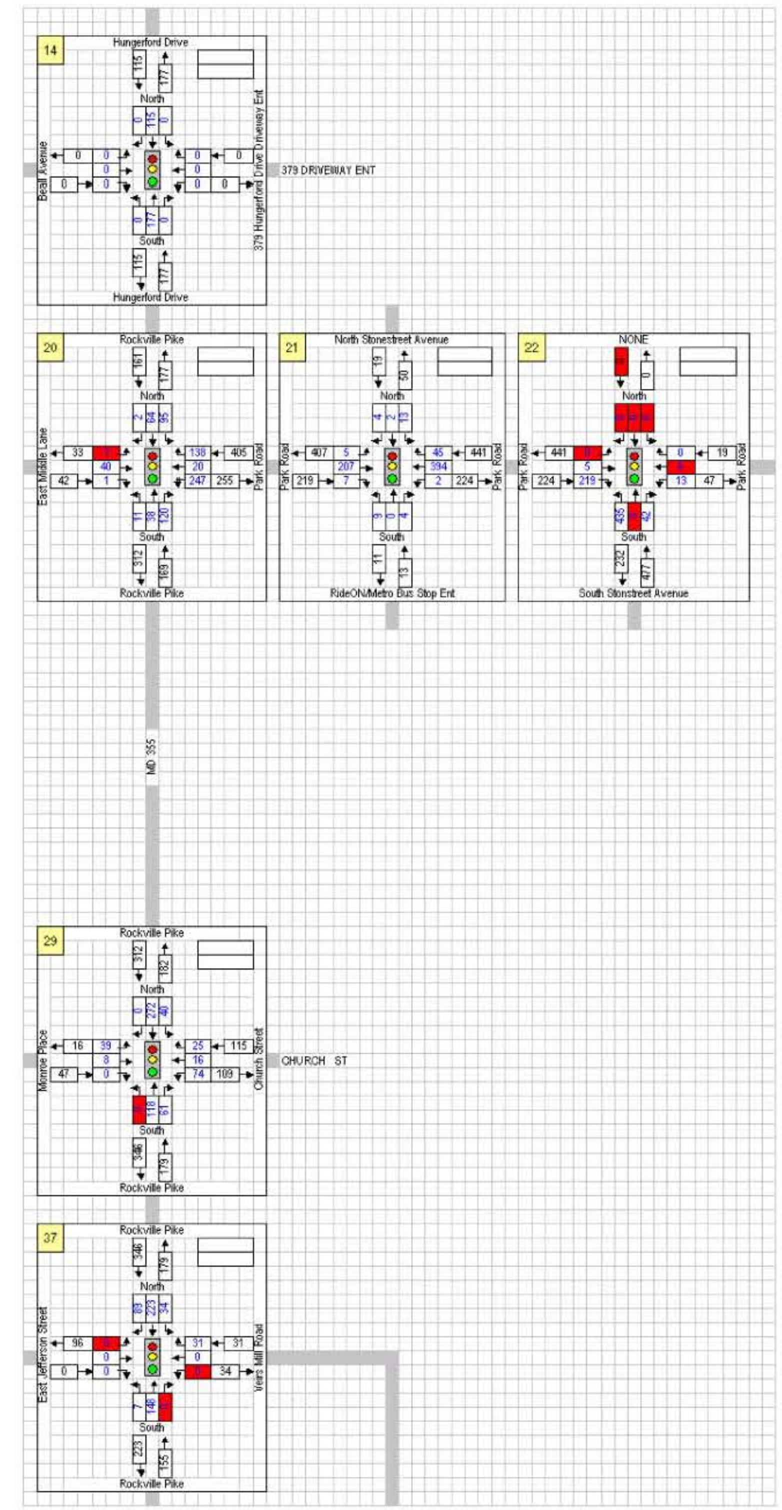


Figure 5-1A. Critical Lane Volume Analysis Results for Optional Program #1

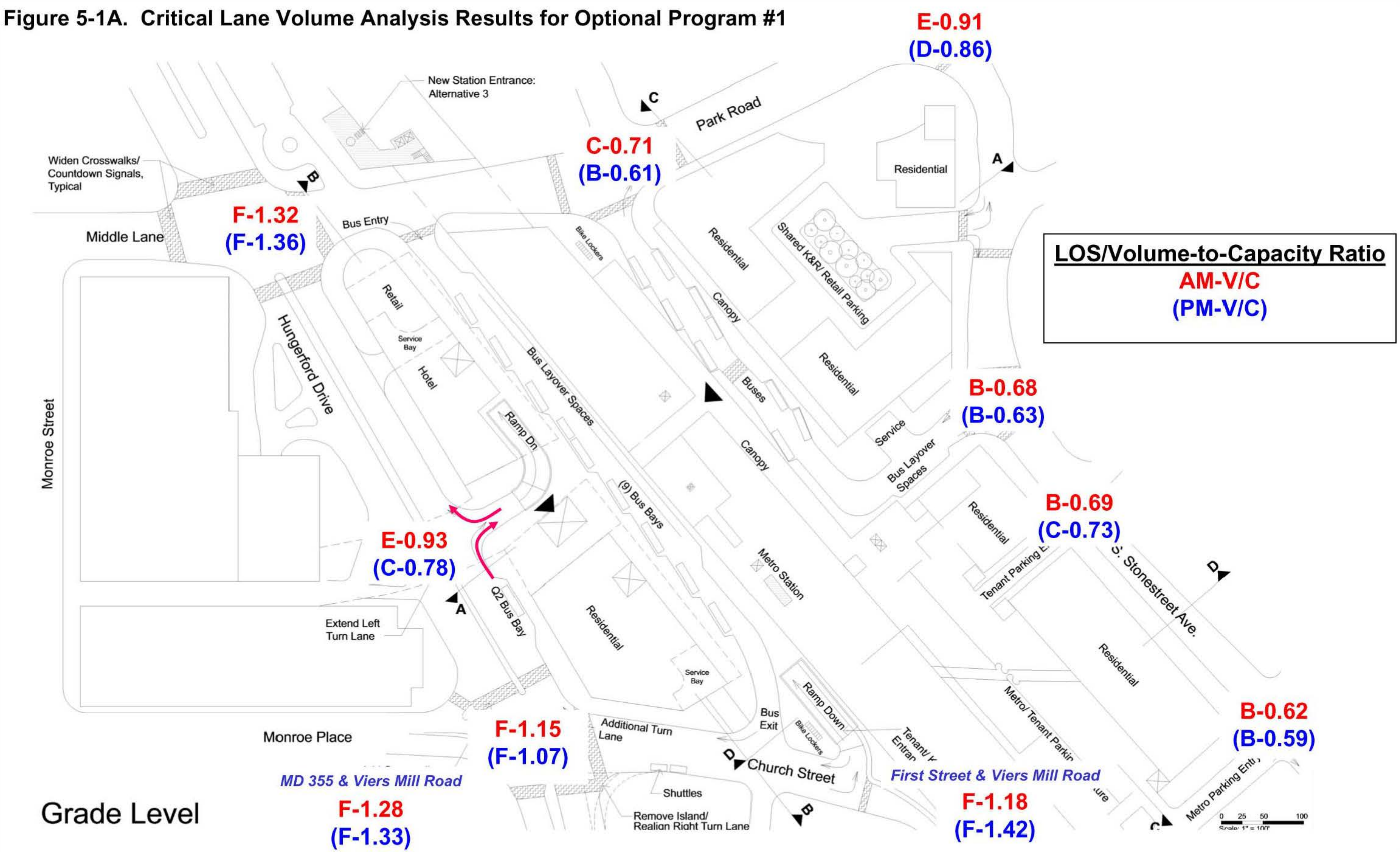
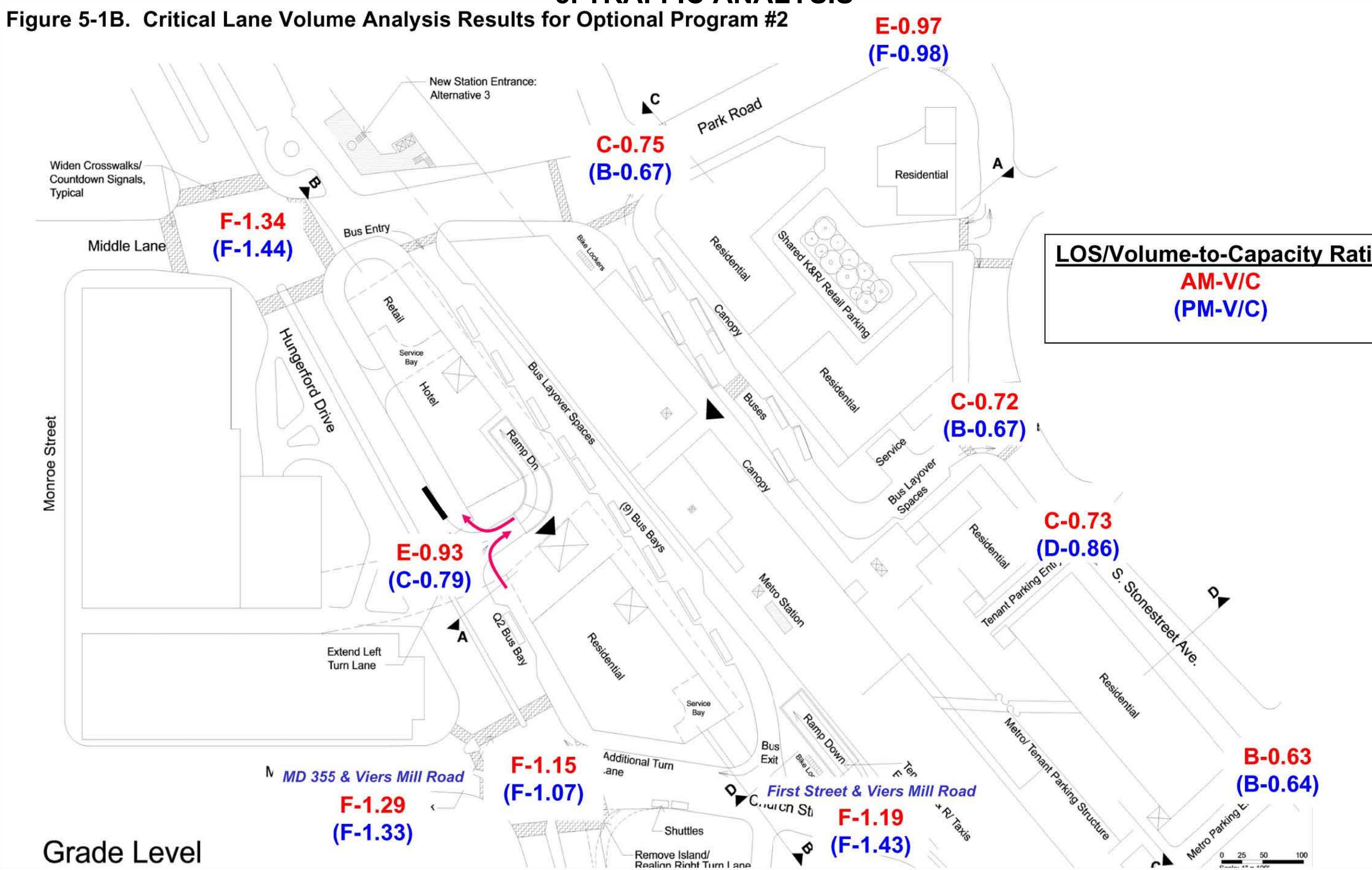


Figure 5-1B. Critical Lane Volume Analysis Results for Optional Program #2



6. Summary of Findings

The following is a summary of findings of the analysis.

Optional Development Program #1

The intersections of MD 28-MD355 and MD 355-East Middle Lane would operate at LOS F during the morning and evening peak periods, as volumes at these intersections would exceed the intersection capacity of 1,550 vehicles per hour. The intersection of MD 355 with mid-block entrance to the hotel development on the west side of the Metrorail station would operate at 93 percent capacity during the morning peak hour and 78 percent capacity during the evening peak hour. The traffic traveling on MD 355 during the peak periods would not restrict right-turn movements from the hotel exit, and therefore not contribute to excessive queuing at the hotel exit.

The intersection of MD 355-Church Street-Monroe Place would operate at LOS F for both morning and evening peak hours. This is because of the increase in traffic volumes entering and exiting the mixed-use development via Church Street as a result of the limited access to the development from the mid-block entrance. The addition of a queue-jumper lane and a dedicated signal for buses at the west side of the station would be a benefit to traffic operations. According to a preliminary simulation analysis, queues of 245 feet or less form on the westbound Church Street approach but do not block the exit of the buses as the dedicated signal provides necessary gaps in traffic for buses to exit the facility.

On the east side of development, the intersections would operate at LOS C or better, with capacities of 73 percent or less. The exception, however, is the intersection of South Stonestreet Avenue with Park Road. This intersection would operate at LOS E for the morning peak hour and LOS D for the evening peak hour. The limited intersection operation and resulting congestion at the South Stonestreet Avenue-Park Road intersection could impact the circulation on South Stonestreet Avenue particularly at the two exits at the structured parking.

Table 6-1 shows the 2010 traffic operations results for the Optional Development Program #1.

Table 6-1. Traffic Operations Results – Optional Development Program #1
Source: Parsons Brinckerhoff

Intersection	AM/PM	V/C Ratio	LOS
East Middle Lane & MD 355	AM	1.32	F
	PM	1.36	F
Park Road & North Stonestreet Avenue	AM	0.72	C
	PM	0.62	B
Park Road & South Stonestreet Avenue	AM	0.91	E
	PM	0.86	D
MD 355 & Mid-Block Hotel Entrance	AM	0.93	E
	PM	0.79	C
MD 355 & Church Street & Monroe Place	AM	1.15	F
	PM	1.07	F
MD 355 & West Jefferson & MD 28	AM	1.28	F
	PM	1.33	F
MD 28 & First Street (MD 585)	AM	1.18	F
	PM	1.42	F
South Stonestreet Ave & Metro Bus Entrance	AM	0.72	C
	PM	0.67	B
South Stonestreet Ave & Metro Parking Entrance #1	AM	0.73	C
	PM	0.86	D
South Stonestreet Ave & Metro Parking Entrance #2	AM	0.63	B
	PM	0.64	B

Optional Development Program #2

The intersections of MD 28-MD 355 and MD 355-East Middle Lane would operate at LOS F during the morning and evening peak periods, as in Development Program #1. The intersection of MD 355 with mid-block entrance to the hotel development on the west side of the Metrorail station would function similarly to the Development Program #1 operations. The intersection of MD 355-Church Street-Monroe Place would operate at LOS F for both morning and evening peak hours. The results of the queue jumper lane are similar to the results from Development Program #1

On the east side of the development, the intersections would operate at LOS D or better, with capacities of 86 percent or less. The intersection of South Stonestreet Avenue with Park Road operates at LOS E in both the morning and evening peak hours

Table 6-2 shows a comparison of the 2010 traffic operations results for the Optional Development Program #2.

Table 6-2. Traffic Operations Results – Optional Development Program #1
Source: Parsons Brinckerhoff

Intersection	AM/PM	V/C Ratio	LOS
East Middle Lane & MD 355	AM	1.34	F
	PM	1.44	F
Park Road & North Stonestreet Avenue	AM	0.75	C
	PM	0.67	B
Park Road & South Stonestreet Avenue	AM	0.97	E
	PM	0.98	E
MD 355 & Mid-Block Hotel Entrance	AM	0.93	E
	PM	0.79	C
MD 355 & Church Street & Monroe Place	AM	1.15	F
	PM	1.07	F
MD 355 & West Jefferson & MD 28	AM	1.29	F
	PM	1.33	F
MD 28 & First Street (MD 585)	AM	1.19	F
	PM	1.43	F
South Stonestreet Ave & Metro Bus Entrance	AM	0.72	C
	PM	0.67	B
South Stonestreet Ave & Metro Parking Entrance #1	AM	0.73	C
	PM	0.86	D
South Stonestreet Ave & Metro Parking Entrance #2	AM	0.63	B
	PM	0.64	B

Comparison of Traffic Conditions

Table 6-3 shows a comparison of the future traffic conditions with the existing traffic conditions. Intersections levels of service operations would deteriorate at key intersections adjacent to the Rockville Metrorail station. Only three intersections operate at LOS E or F during existing conditions, as compared to five intersections operating at LOS E or F in the future. Thus, traffic operations would deteriorate in the future when compared to existing conditions.

Table 6-3. Comparison of Existing and Future Intersection Analyses

Intersection	AM/PM	Existing		2010 w/ Optional Development #1		2010 w/ Optional Development #2	
		V/C Ratio	LOS	V/C Ratio	LOS	V/C Ratio	LOS
East Middle Lane & MD 355	AM	0.96	E	1.32	F	1.34	F
	PM	0.88	D	1.36	F	1.44	F
Park Road & N. Stonestreet	AM	0.50	A	0.72	C	0.75	C
	PM	0.39	A	0.62	B	0.67	B
Park Road & S. Stonestreet	AM	0.59	A	0.91	E	0.97	E
	PM	0.53	A	0.86	D	0.98	E
MD 355 & Church St & Monroe Place	AM	0.76	C	1.15	F	1.15	F
	PM	0.68	B	1.07	F	1.07	F
MD 355 & W. Jefferson & MD 28	AM	0.99	E	1.28	F	1.29	F
	PM	0.98	E	1.33	F	1.33	F
MD 28 & First St (MD 585)	AM	0.96	E	1.18	F	1.19	F
	PM	1.11	F	1.42	F	1.43	F

Table 6-4 shows a comparison of the future traffic conditions with the Rockville Town Center traffic operations for year 2006. In 2006, the intersections of MD355-East Middle Lane, MD 355-MD 28, and MD 28-First Street would operate at LOS F, with volumes exceeding intersection capacity ranging from six to 29 percent over capacity. These three intersections would operate at failing levels of service despite roadway improvements recommended by the City of Rockville for the Town Center development. The addition of traffic due to the Joint Development at the Rockville Metrorail station would reduce capacity by as much as 37 percent at intersections that would operate at LOS F in 2006. Intersections that would operate with adequate capacity in 2006, such as Park Road and South Stonestreet, would operate with reduced capacities in 2010.

Table 6-4. Comparison of Town Center and Future Intersection Analyses
Source: City of Rockville, MD. Town Center Transportation Analysis. May 2003.

Intersection	AM/PM	2006 w/ Town Center Development		2010 w/ Optional Development #1		2010 w/ Optional Development #2	
		V/C Ratio	LOS	V/C Ratio	LOS	V/C Ratio	LOS
East Middle Lane & MD 355	AM	1.13	F	1.32	F	1.34	F
	PM	1.09	F	1.36	F	1.44	F
Park Road & N. Stonestreet	AM	0.59	A	0.72	C	0.75	C
	PM	0.43	A	0.62	B	0.67	B
Park Road & S. Stonestreet	AM	0.78	C	0.91	E	0.97	E
	PM	0.61	B	0.86	D	0.98	E
MD 355 & Church St & Monroe Place	AM	0.88	D	1.15	F	1.15	F
	PM	0.81	D	1.07	F	1.07	F
MD 355 & W. Jefferson & MD 28	AM	1.18	F	1.28	F	1.29	F
	PM	1.22	F	1.33	F	1.33	F
MD 28 & First St (MD 585)	AM	1.06	F	1.18	F	1.19	F
	PM	1.29	F	1.42	F	1.43	F

Mitigation strategies are needed to accommodate the increased vehicular traffic to the joint development site. Recommended strategies outlined in the City of Rockville's Town Center Transportation Analysis should be the basis for any proposed mitigation plan. One of main goals for mitigating traffic in the town center includes substituting intersection traffic improvements with multimodal improvements if the impacted intersection resides close to the Metrorail station or provides a critical pedestrian link. Other recommended mitigation strategies from the Town Center Analysis include:

1. On MD 28, from I-270 to MD 189, use the center turn lane as a second eastbound lane from 7 – 9 AM. Complement this configuration with turning restrictions and pedestrian enhancements.
    a. Remove the eastbound to southbound right turn lane from MD 28 to Great Falls Road to enhance pedestrian safety / access
    b. Restrict left turn movements from Great Falls Road to Williams to eliminate cut-thru traffic
    c. Complete enhancements at I-270 / MD 28 / Nelson Street.

2. In conjunction with mitigation #1, implement a reversible lane configuration on Maryland Avenue to provide a second westbound lane from the Town Center to I-270 during PM peak hours. This would add PM capacity and divert trips from MD 28.
3. Add traffic signal at Maryland Avenue and Middle Lane.
4. Increase pedestrian and bicycle access along MD 355.
5. Complete MD SHA Town Center Intersection Study.
6. Raise average intersection safety ratings from "adequate" to "good" by adding pedestrian signals, crosswalks, right turn on red restrictions and any other warranted safety measures that should be built into the system
7. Add sidewalk links to ensure sidewalk continuity for pedestrian access to activity centers and transit-oriented areas.
8. Implement a TDM program.

Any operational enhancements and roadway improvements needed to mitigate traffic as a result of the WMATA Joint Development should harmonize with the City of Rockville's Master Plan, and the mitigation strategies outlined in the Rockville Town Center Transportation Analysis.

7. References

City of Rockville, MD. Town Center Transportation Analysis: FRIT Redevelopment – Final Draft. May 15, 2003.

City of Rockville, MD. Comprehensive Transportation Review Methodology. May 2004

City of Rockville, MD. East Rockville Neighborhood Plan.

City of Rockville, MD. Comprehensive Master Plan.

Maryland National Capital Park and Planning Commission, Montgomery County Department of Park and Planning. Local Area Transportation Review Guidelines. July 2004.

Institute of Transportation Engineers. Trip Generation Manual, 6th Edition. 1999.

6. ORDER OF MAGNITUDE COST ESTIMATE

CONCEPTUAL ORDER OF MANGNITUDE COST ESTIMATE

<u>Station entrance improvements</u>

Alternative 1: Mezzanine Extension	$22,000,000
Alternative 2: New Entrance at Pedestrian Promenade	$25,000,000
Alternative 3: New Entrance at Park Rd./Platform Extension	$28,000,000
Option for New Elevator to MARC Platform	$1,500,000

7. NEXT STEPS

The Rockville Station Access Improvement Study has been prepared to provide WMATA, MDOT, the City of Rockville, and all other jurisdictional stakeholders with documentation for the feasibility of Joint Development on the station site and the feasibility for expanding station capacity with a new station entrance. If the City of Rockville decides to move forward with the Joint Development process, then WMATA will include the Rockville station into the next Joint Development Solicitation. If MDOT decides to move forward with implementing the study's recommendation for expanding station capacity with new station entrances, then WMATA will begin work with all the jurisdictional stakeholders in the conceptual engineering and environmental assessment process.

Any plans for Joint Development or station expansion is subject to further review by WMATA, MDOT, the City of Rockville, and the citizens of the Rockville community through the process of public hearing and environmental assessment.

M
metro

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

ROCKVILLE STATION ACCESS IMPROVEMENT STUDY

Appendix
August 2005

Washington Metropolitan Area Transit Authority
Department of Planning and Information Technology
Office of Business Planning & Project Development

A-1. Appendix A – Trip Generation Results

Rockville Station Access Study
Trip Generation Results
Revised Development Program - Optional Method #1
Revised 5/6/2005

West Side

Transit Program

- New station entry north of Park Road - elevators only
- 9 Bus Bays (1 articulated bay)
- 7 layover spaces
- 123 existing Park & Ride spaces north of Park Road to remain
- 16 Kiss & Ride spaces (in parking garage)
- 4 Taxi stands (in parking garage)

Parking	# Spaces	
Hotel Parking	300	
Residential	700	
Retail	0	*(assume transit related retail)*
Total	1,000	

Joint Development

Land Use	ITE Description	Unit	# Units	ITE Code*	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Hotel (north)	**Hotel**	SF	240,000	**310**	2,140	135	74	61	159	92	67
		Rooms	260								
		Stories	9								
			*Mixed Use Trip Reductions*****	*10%*	*214*	*14*	*7*	*6*	*16*	*9*	*7*
			*Modal Split Trip Reductions ****	*35%/24%*	*77*	*43*	*37*	*25*	*34*	*48*	*25*
				Total Trips Generated - Hotel	**1,849**	**79**	**30**	**30**	**108**	**35**	**35**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code***	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Retail (north)	**Shopping Center**	SF	25,000	**820/MNPPC**							
			Pass-by Trip Reduction (*retail only*)	*35%*	***Assume transit-related retail; no vehicle trips generated***						
			*Mixed Use Trip Reductions*****	*10%*							
			*Modal Split Trip Reductions ****	*15%*							
				Total Trips Generated - Retail	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code****	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Residential (north)	**High-Rise Residential**	Unit	128	**232/MNPPC**	535	54	11	43	61	40	21
	Condo/Townhouses	SF	150,000								
			*Mixed Use Trip Reductions*****	*10%*	54	5	1	4	6	4	2
			*Modal Split Trip Reductions ****	*25%*	120	12	2	10	14	9	5
				Total Trips Generated - Residential	**361**	**37**	**7**	**29**	**41**	**27**	**14**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code****	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Residential (south)	**High-Rise Residential**	Unit	340	**232/MNPPC**	1421	139	28	111	161	106	55
	Condo/Townhouses	SF	380,000								
			*Mixed Use Trip Reductions*****	*10%*	142	14	3	11	16	11	5
			*Modal Split Trip Reductions ****	*25%*	320	31	6	25	36	24	12
				Total Trips Generated - Residential	**959**	**94**	**19**	**75**	**109**	**72**	**37**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code***	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Retail (south)	**Shopping Center**	SF	25,000	**820/MNPPC**							
			Pass-by Trip Reduction (*retail only*)	*35%*	***Assume transit-related retail; no vehicle trips generated***						
			*Mixed Use Trip Reductions*****	*10%*							
			*Modal Split Trip Reductions ****	*15%*							
				Total Trips Generated - Retail	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code***	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Commuter Parking - *existing*	**Park and Ride Lot w/ Bus Service**	Spaces	123	**90**	554	92	74	18	77	17	60
				Total Trips Generated - Metro Parking	**554**	**92**	**74**	**18**	**77**	**17**	**60**
				Total Trips Generated - West Side	**3,723**	**302**	**130**	**153**	**336**	**151**	**146**

Notes:
**Daily volumes determined from ITE Trip Generation source; am and pm peak-hour trips determined from M-NPPC manual*
* Pass-by percentage for shopping center taken from ITE Trip Generation
**** Taken from email from Sandra Marks, City of Rockville, dated 2/16/2005. Retail (15%/15%), Residential (25%/25%), Office (50%/35%).*
The numbers are consistent with M-NPPC Local Area Transportation Review Guidelines
***** Taken from City of Rockville Comprehensive Transportation Review Methodology, May 2004, pg. 15, trip reductions for transit-oriented area*

Rockville Station Access Study
Trip Generation Results
Revised Development Program - Optional Method #1
Revised 5/6/2005

East Side

Transit Program

- 8 Bus Bays (including 2 BRT bus bays)
- 2 layover spaces
- Kiss & Ride/taxi in plaza area

Parking	# Spaces
Joint Development	460
Metro	524
Total	984

Joint Development

Land Use	ITE Description	Unit	# Units	ITE Code**	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Retail (ground level)*	**Shopping Center**	SF	50,000	**820/MNPPC**	2,146	100	52	48	402	209	193
			Pass-by Trip Reduction (*retail only*)	*35%*	-	-	-	-	141	73	67
			*Mixed Use Trip Reductions*****	*10%*	215	10	5	5	26	14	13
			*Modal Split Trip Reductions ****	*15%*	290	14	7	7	35	18	17
				Total Trips Generated - Retail	**1,642**	**77**	**40**	**37**	**200**	**104**	**96**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code****	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Residential (North)	**High-Rise Residential**	Unit	160	**232/MNPPC**	669	67	13	54	76	50	26
	Condo/Townhouses	SF	180,000								
			*Mixed Use Trip Reductions*****	*10%*	67	7	1	5	8	5	3
			*Modal Split Trip Reductions ****	*25%*	150	15	3	12	17	11	6
				Total Trips Generated - Residential	**451**	**45**	**9**	**36**	**51**	**34**	**17**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code****	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Residential (South)	**Low-Rise Residential**	Unit	60	**231/MNPPC**	N/A	26	4	22	29	19	10
	Condo/Townhouses	SF	70,000								
			*Mixed Use Trip Reductions*****	*10%*	-	3	0	2	3	2	1
			*Modal Split Trip Reductions ****	*25%*	-	6	1	5	6	4	2
				Total Trips Generated - Residential		**18**	**3**	**15**	**19**	**13**	**6**
Land Use	**ITE Description**	**Unit**	**# Units**	**ITE Code****	**Daily**	**AM Peak**	**AM In**	**AM Out**	**PM Peak**	**PM In**	**PM Out**
Metro parking - *existing*	**Park and Ride Lot w/ Bus Service**	Spaces	524	**90**	2,358	393	314	79	330	73	257
				Total Trips Generated - Metro Parking	**2,358**	**393**	**314**	**79**	**330**	**73**	**257**
				Total Trips Generated - East Side	**4,451**	**533**	**366**	**166**	**601**	**223**	**377**

Notes:
Daily volumes determined from ITE Trip Generation source; am and pm peak-hour trips determined from M-NPPC manual
* Pass-by percentage for shopping center taken from ITE Trip Generation
**** Taken from email from Sandra Marks, City of Rockville, dated 2/16/2005. Retail (15%/15%), Residential (25%/25%), Office (50%/35%).*
The numbers are consistent with M-NPPC Local Area Transportation Review Guidelines
***** Taken from City of Rockville Comprehensive Transportation Review Methodology, May 2004, pg. 15, trip reductions for transit-oriented area*

Rockville Station Access Study
Trip Generation Results
Revised Development Program - Optional Method #2
Revised 5/6/2005

West Side

Transit Program

- New station entry north of Park Road - elevators only
- 9 Bus Bays (1 articulated bay)
- 7 layover spaces
- 123 existing Park & Ride spaces north of Park Road to remain
- 16 Kiss & Ride spaces (in parking garage)
- 4 Taxi stands (in parking garage)

Parking	# Spaces	
Hotel Parking	300	
Residential	700	
Retail	0	*(assume transit related retail)*
Total	1,000	

Joint Development

Land Use	ITE Description	Unit	# Units	ITE Code*	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Hotel (north)	**Hotel**	SF	240,000	**310**	2,140	135	74	61	159	92	67
		Rooms	260								
		Stories	9								
	*Mixed Use Trip Reductions*****			*10%*	*214*	*14*	*7*	*6*	*16*	*9*	*7*
	*Modal Split Trip Reductions ****			*35%/24%*	*77*	*43*	*37*	*25*	*34*	*48*	*25*
	Total Trips Generated - Hotel				**1,849**	**79**	**30**	**30**	**108**	**35**	**35**

Land Use	ITE Description	Unit	# Units	ITE Code*	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Retail (north)	**Shopping Center**	SF	25,000	**820/MNPPC**							
	Pass-by Trip Reduction (*retail only*)			*35%*	***Assume transit-related retail; no vehicle trips generated***						
	*Mixed Use Trip Reductions*****			*10%*							
	*Modal Split Trip Reductions ****			*15%*							
	Total Trips Generated - Retail				**0**	**0**	**0**	**0**	**0**	**0**	**0**

Land Use	ITE Description	Unit	# Units	ITE Code**	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Residential (north)	**High-Rise Residential**	Unit	128	**232/MNPPC**	535	54	11	43	61	40	21
	Condo/Townhouses	SF	150,000								
	*Mixed Use Trip Reductions*****			*10%*	54	5	1	4	6	4	2
	*Modal Split Trip Reductions ****			*25%*	120	12	2	10	14	9	5
	Total Trips Generated - Residential				**361**	**37**	**7**	**29**	**41**	**27**	**14**

Land Use	ITE Description	Unit	# Units	ITE Code**	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Residential (south)	**High-Rise Residential**	Unit	340	**232/MNPPC**	1421	139	28	111	161	106	55
	Condo/Townhouses	SF	380,000								
	*Mixed Use Trip Reductions*****			*10%*	142	14	3	11	16	11	5
	*Modal Split Trip Reductions ****			*25%*	320	31	6	25	36	24	12
	Total Trips Generated - Residential				**959**	**94**	**19**	**75**	**109**	**72**	**37**

Land Use	ITE Description	Unit	# Units	ITE Code*	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Retail (south)	**Shopping Center**	SF	25,000	**820/MNPPC**							
	Pass-by Trip Reduction (*retail only*)			*35%*	***Assume transit-related retail; no vehicle trips generated***						
	*Mixed Use Trip Reductions*****			*10%*							
	*Modal Split Trip Reductions ****			*15%*							
	Total Trips Generated - Retail				**0**	**0**	**0**	**0**	**0**	**0**	**0**

Land Use	ITE Description	Unit	# Units	ITE Code*	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Commuter Parking - *existing*	**Park and Ride Lot w/ Bus Service**	Spaces	123	**90**	554	92	74	18	77	17	60
	Total Trips Generated - Metro Parking				**554**	**92**	**74**	**18**	**77**	**17**	**60**
	Total Trips Generated - West Side				**3,723**	**302**	**130**	**153**	**336**	**151**	**146**

Notes:
**Daily volumes determined from ITE Trip Generation source; am and pm peak-hour trips determined from M-NPPC manual*
* Pass-by percentage for shopping center taken from ITE Trip Generation
**** Taken from email from Sandra Marks, City of Rockville, dated 2/16/2005. Retail (15%/15%), Residential (25%/25%), Office (50%/35%).*
The numbers are consistent with M-NPPC Local Area Transportation Review Guidelines
***** Taken from City of Rockville Comprehensive Transportation Review Methodology, May 2004, pg. 15, trip reductions for transit-oriented area*

Rockville Station Access Study
Trip Generation Results
Revised Development Program - Optional Method #2
Revised 5/6/2005

East Side

Transit Program

- 8 Bus Bays (including 2 BRT bus bays)
- 2 layover spaces
- Kiss & Ride/taxi in plaza area

Parking	# Spaces
Joint Development	460
Metro	1,024
Total	1,484

Joint Development

Land Use	ITE Description	Unit	# Units	ITE Code**	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Retail (ground level)*	**Shopping Center**	SF	50,000	**820/MNPPC**	2,146	100	52	48	402	209	193
	Pass-by Trip Reduction (*retail only*)			*35%*	-	-	-	-	141	73	67
	*Mixed Use Trip Reductions*****			*10%*	215	10	5	5	26	14	13
	*Modal Split Trip Reductions ****			*15%*	290	14	7	7	35	18	17
	Total Trips Generated - Retail				**1,642**	**77**	**40**	**37**	**200**	**104**	**96**

Land Use	ITE Description	Unit	# Units	ITE Code**	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Residential (North)	**High-Rise Residential**	Unit	160	**232/MNPPC**	669	67	13	54	76	50	26
	Condo/Townhouses	SF	180,000								
	*Mixed Use Trip Reductions*****			*10%*	67	7	1	5	8	5	3
	*Modal Split Trip Reductions ****			*25%*	150	15	3	12	17	11	6
	Total Trips Generated - Residential				**451**	**45**	**9**	**36**	**51**	**34**	**17**

Land Use	ITE Description	Unit	# Units	ITE Code**	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Residential (South)	**Low-Rise Residential**	Unit	60	**231/MNPPC**	N/A	26	4	22	29	19	10
	Condo/Townhouses	SF	70,000								
	*Mixed Use Trip Reductions*****			*10%*	-	3	0	2	3	2	1
	*Modal Split Trip Reductions ****			*25%*	-	6	1	5	6	4	2
	Total Trips Generated - Residential					**18**	**3**	**15**	**19**	**13**	**6**

Land Use	ITE Description	Unit	# Units	ITE Code**	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
Metro parking - *existing*	**Park and Ride Lot w/ Bus Service**	Spaces	1024	**90**	4,608	768	614	154	645	142	503
	Total Trips Generated - Metro Parking				**4,608**	**768**	**614**	**154**	**645**	**142**	**503**
	Total Trips Generated - East Side				**6,701**	**908**	**666**	**241**	**916**	**293**	**623**

Notes:
Daily volumes determined from ITE Trip Generation source; am and pm peak-hour trips determined from M-NPPC manual
* Pass-by percentage for shopping center taken from ITE Trip Generation
**** Taken from email from Sandra Marks, City of Rockville, dated 2/16/2005. Retail (15%/15%), Residential (25%/25%), Office (50%/35%).*
The numbers are consistent with M-NPPC Local Area Transportation Review Guidelines
***** Taken from City of Rockville Comprehensive Transportation Review Methodology, May 2004, pg. 15, trip reductions for transit-oriented area*

A-2. Appendix B – Trip Distribution and Traffic Assignment Results

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #1
Revised 5/6/2005

Trip Assignment for Origin By Super District

Trip Distribution to Super District #4 Rockville/North Bethesda	Hotel Development	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	3.5%					100%					100%
Silver Spring/Takoma Park	2.2%					100%					100%
Potomac/Darnestown/Travilah	8.0%			50%		50%					100%
Rockville/North Bethesda	12.8%			25%	25%	25%	25%				100%
Kensington/Wheaton	7.2%				100%						100%
White Oak/Fairland/Cloverly	4.1%				50%	50%					100%
Gaithersburg/Shady Grove	14.4%						100%				100%
Aspen Hill/Olney	8.5%				100%						100%
Germantown/Clarksburg	6.5%			50%			50%				100%
Rural: West of I270	0.9%			75%			25%				100%
Rural: East of I270	4.2%				25%		75%				100%
Washington, DC	3.6%					100%					100%
Prince George's County	8.8%				50%	50%					100%
Virginia	7.8%			50%		50%					100%
Frederick County	4.6%			50%			50%				100%
Howard County	2.9%				50%		50%				100%
TOTALS	**100.0%**										

Trip Assignment for Development Case

Trip Distribution to Super District #4 Rockville/North Bethesda	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	0.0%	0.0%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%	3.5%
Silver Spring/Takoma Park	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	2.2%
Potomac/Darnestown/Travilah	0.0%	0.0%	4.0%	0.0%	4.0%	0.0%	0.0%	0.0%	0.0%	8.0%
Rockville/North Bethesda	0.0%	0.0%	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%	0.0%	12.8%
Kensington/Wheaton	0.0%	0.0%	0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	7.2%
White Oak/Fairland/Cloverly	0.0%	0.0%	0.0%	2.1%	2.1%	0.0%	0.0%	0.0%	0.0%	4.1%
Gaithersburg/Shady Grove	0.0%	0.0%	0.0%	0.0%	0.0%	14.4%	0.0%	0.0%	0.0%	14.4%
Aspen Hill/Olney	0.0%	0.0%	0.0%	8.5%	0.0%	0.0%	0.0%	0.0%	0.0%	8.5%
Germantown/Clarksburg	0.0%	0.0%	3.3%	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	6.5%
Rural: West of I270	0.0%	0.0%	0.7%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.9%
Rural: East of I270	0.0%	0.0%	0.0%	1.1%	0.0%	3.2%	0.0%	0.0%	0.0%	4.2%
Washington, DC	0.0%	0.0%	0.0%	0.0%	3.6%	0.0%	0.0%	0.0%	0.0%	3.6%
Prince George's County	0.0%	0.0%	0.0%	4.4%	4.4%	0.0%	0.0%	0.0%	0.0%	8.8%
Virginia	0.0%	0.0%	3.9%	0.0%	3.9%	0.0%	0.0%	0.0%	0.0%	7.8%
Frederick County	0.0%	0.0%	2.3%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	4.6%
Howard County	0.0%	0.0%	0.0%	1.5%	0.0%	1.5%	0.0%	0.0%	0.0%	2.9%
TOTALS	**0.0%**	**0.0%**	**17.3%**	**27.9%**	**26.9%**	**28.0%**	**0.0%**	**0.0%**	**0.0%**	**100.0%**

Traffic Assignment for Office - Hotel		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
		0.0%	**0.0%**	**17.3%**	**27.9%**	**26.9%**	**28.0%**	**0.0%**	**0.0%**	**0.0%**
AM IN	30	0	0	5	8	8	8	0	0	0
AM OUT	30	0	0	5	8	8	8	0	0	0
PM IN	35	0	0	6	10	9	10	0	0	0
PM OUT	35	0	0	6	10	9	10	0	0	0

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #1
Revised 5/6/2005

Trip Assignment for Origin By Super District

Trip Distribution to Super District #4 Rockville/North Bethesda	Retail Development	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	3.5%					100%					100%
Silver Spring/Takoma Park	2.2%					100%					100%
Potomac/Darnestown/Travilah	8.0%			50%		50%					100%
Rockville/North Bethesda	21.8%	5%		5%	10%	25%	25%	10%	10.0%	10.0%	100%
Kensington/Wheaton	7.2%				100%						100%
White Oak/Fairland/Cloverly	4.1%				50%	50%					100%
Gaithersburg/Shady Grove	19.4%						100%				100%
Aspen Hill/Olney	8.5%				100%						100%
Germantown/Clarksburg	6.5%			50%			50%				100%
Rural: West of I270	0.2%			75%			25%				100%
Rural: East of I270	1.2%				25%		75%				100%
Washington, DC	1.8%					100%					100%
Prince George's County	4.4%				50%	50%					100%
Virginia	3.7%			50%		50%					100%
Frederick County	4.6%			50%			50%				100%
Howard County	2.9%				50%		50%				100%
TOTALS	**100.0%**										

Trip Assignment for Development Case

Trip Distribution to Super District #4 Rockville/North Bethesda	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	0.0%	0.0%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%	3.5%
Silver Spring/Takoma Park	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	2.2%
Potomac/Darnestown/Travilah	0.0%	0.0%	4.0%	0.0%	4.0%	0.0%	0.0%	0.0%	0.0%	8.0%
Rockville/North Bethesda	1.1%	0.0%	1.1%	2.2%	5.5%	5.5%	2.2%	2.2%	2.2%	21.8%
Kensington/Wheaton	0.0%	0.0%	0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	7.2%
White Oak/Fairland/Cloverly	0.0%	0.0%	0.0%	2.1%	2.1%	0.0%	0.0%	0.0%	0.0%	4.1%
Gaithersburg/Shady Grove	0.0%	0.0%	0.0%	0.0%	0.0%	19.4%	0.0%	0.0%	0.0%	19.4%
Aspen Hill/Olney	0.0%	0.0%	0.0%	8.5%	0.0%	0.0%	0.0%	0.0%	0.0%	8.5%
Germantown/Clarksburg	0.0%	0.0%	3.3%	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	6.5%
Rural: West of I270	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.2%
Rural: East of I270	0.0%	0.0%	0.0%	0.3%	0.0%	0.9%	0.0%	0.0%	0.0%	1.2%
Washington, DC	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	1.8%
Prince George's County	0.0%	0.0%	0.0%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	4.4%
Virginia	0.0%	0.0%	1.9%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	3.7%
Frederick County	0.0%	0.0%	2.3%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	4.6%
Howard County	0.0%	0.0%	0.0%	1.5%	0.0%	1.5%	0.0%	0.0%	0.0%	2.9%
TOTALS	**1.1%**	**0.0%**	**12.6%**	**23.9%**	**23.1%**	**32.8%**	**2.2%**	**2.2%**	**2.2%**	**100.0%**

Traffic Assignment for Retail - East		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
		1.1%	**0.0%**	**12.6%**	**23.9%**	**23.1%**	**32.8%**	**2.2%**	**2.2%**	**2.2%**
AM IN	40	0	0	5	10	9	13	1	1	1
AM OUT	37	0	0	5	9	8	12	1	1	1
PM IN	104	1	0	13	25	24	34	2	2	2
PM OUT	96	1	0	12	23	22	31	2	2	2

ROCKVILLE STATION ACCESS IMPROVEMENT STUDY

TRAFFIC ANALYSIS

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #1
Revised 5/6/2005

Trip Distribution to Super District #4 Rockville/North Bethesda	Residential Development	Trip Assignment for Origin By Super District										Trip Assignment for Development Case									
		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	15.6%					100%					100%	0.0%	0.0%	0.0%	0.0%	15.6%	0.0%	0.0%	0.0%	0.0%	15.6%
Silver Spring/Takoma Park	2.4%					100%					100%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%	0.0%	0.0%	2.4%
Potomac/Darnestown/Travilah	3.3%			50%		50%					100%	0.0%	0.0%	1.7%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	3.3%
Rockville/North Bethesda	31.0%	5%		5%	10%	25%	25%	10%	10.0%	10.0%	100%	1.6%	0.0%	1.6%	3.1%	7.8%	7.8%	3.1%	3.1%	3.1%	31.0%
Kensington/Wheaton	2.6%				100%						100%	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%
White Oak/Fairland/Cloverly	0.7%				50%	50%					100%	0.0%	0.0%	0.0%	0.4%	0.4%	0.0%	0.0%	0.0%	0.0%	0.7%
Gaithersburg/Shady Grove	10.6%						100%				100%	0.0%	0.0%	0.0%	0.0%	0.0%	10.6%	0.0%	0.0%	0.0%	10.6%
Aspen Hill/Olney	1.7%				100%						100%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%
Germantown/Clarksburg	1.0%			50%			50%				100%	0.0%	0.0%	0.5%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	1.0%
Rural: West of I270	0.0%			75%			25%				100%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rural: East of I270	0.2%				25%		75%				100%	0.0%	0.0%	0.0%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%
Washington, DC	13.9%					100%					100%	0.0%	0.0%	0.0%	0.0%	13.9%	0.0%	0.0%	0.0%	0.0%	13.9%
Prince George's County	6.1%				50%	50%					100%	0.0%	0.0%	0.0%	3.1%	3.1%	0.0%	0.0%	0.0%	0.0%	6.1%
Virginia	9.7%			50%		50%					100%	0.0%	0.0%	4.9%	0.0%	4.9%	0.0%	0.0%	0.0%	0.0%	9.7%
Frederick County	0.5%			50%			50%				100%	0.0%	0.0%	0.3%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.5%
Howard County	0.7%				50%		50%				100%	0.0%	0.0%	0.0%	0.4%	0.0%	0.4%	0.0%	0.0%	0.0%	0.7%
TOTALS	**100.0%**											**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**	**100.0%**

Traffic Assignment for Residential - West		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	North	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	7	0	0	1	1	4	1	0	0	0
AM OUT	29	0	0	3	3	15	6	1	1	1
PM IN	27	0	0	2	3	14	5	1	1	1
PM OUT	14	0	0	1	2	7	3	0	0	0

Traffic Assignment for Residential - West		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	South	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	19	0	0	2	2	9	4	1	1	1
AM OUT	75	1	0	7	8	37	15	2	2	2
PM IN	72	1	0	6	8	35	14	2	2	2
PM OUT	37	1	0	3	4	18	7	1	1	1

Traffic Assignment for Residential - East		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	North	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	9	0	0	1	1	4	2	0	0	0
AM OUT	36	1	0	3	4	18	7	1	1	1
PM IN	34	1	0	3	4	17	7	1	1	1
PM OUT	17	0	0	2	2	9	3	1	1	1

Traffic Assignment for Residential - East		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	South	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	3	0	0	0	0	2	1	0	0	0
AM OUT	15	0	0	1	2	7	3	0	0	0
PM IN	13	0	0	1	1	6	3	0	0	0
PM OUT	6	0	0	1	1	3	1	0	0	0

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #1
Revised 5/6/2005

Trip Assignment for Origin By Super District

Trip Distribution to Super District #4 Rockville/North Bethesda	Metro Parking	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase						100%					100%
Silver Spring/Takoma Park						100%					100%
Potomac/Darnestown/Travilah	15.0%			50%		50%					100%
Rockville/North Bethesda	75.0%	5%		5%	10%	25%	25%	10%	10.0%	10.0%	100%
Kensington/Wheaton					100%						100%
White Oak/Fairland/Cloverly					50%	50%					100%
Gaithersburg/Shady Grove							100%				100%
Aspen Hill/Olney	10.0%				100%						100%
Germantown/Clarksburg				50%			50%				100%
Rural: West of I270				75%			25%				100%
Rural: East of I270					25%		75%				100%
Washington, DC						100%					100%
Prince George's County					50%	50%					100%
Virginia				50%		50%					100%
Frederick County				50%			50%				100%
Howard County					50%		50%				100%
TOTALS	100.0%										

Trip Assignment for Development Case

Trip Distribution to Super District #4 Rockville/North Bethesda	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Silver Spring/Takoma Park	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Potomac/Darnestown/Travilah	0.0%	0.0%	7.5%	0.0%	7.5%	0.0%	0.0%	0.0%	0.0%	15.0%
Rockville/North Bethesda	3.8%	0.0%	3.8%	7.5%	18.8%	18.8%	7.5%	7.5%	7.5%	75.0%
Kensington/Wheaton	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
White Oak/Fairland/Cloverly	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Gaithersburg/Shady Grove	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Aspen Hill/Olney	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%
Germantown/Clarksburg	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rural: West of I270	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rural: East of I270	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Washington, DC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prince George's County	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Virginia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Frederick County	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Howard County	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTALS	3.8%	0.0%	11.3%	17.5%	26.3%	18.8%	7.5%	7.5%	7.5%	100.0%

Traffic Assignment for Metro Parking - West		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	Existing	**3.8%**	**0.0%**	**11.3%**	**17.5%**	**26.3%**	**18.8%**	**7.5%**	**7.5%**	**7.5%**
AM IN	74	3	0	8	13	19	14	6	6	6
AM OUT	18	1	0	2	3	5	3	1	1	1
PM IN	17	1	0	2	3	4	3	1	1	1
PM OUT	60	2	0	7	11	16	11	5	5	5

Traffic Assignment for Metro Parking - East		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	Existing	**3.8%**	**0.0%**	**11.3%**	**17.5%**	**26.3%**	**18.8%**	**7.5%**	**7.5%**	**7.5%**
AM IN	314	12	0	35	55	83	59	24	24	24
AM OUT	79	3	0	9	14	21	15	6	6	6
PM IN	73	3	0	8	13	19	14	5	5	5
PM OUT	257	10	0	29	45	68	48	19	19	19

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #2
Revised 5/6/2005

Trip Assignment for Origin By Super District

Trip Distribution to Super District #4 Rockville/North Bethesda	Hotel Development	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	3.5%					100%					100%
Silver Spring/Takoma Park	2.2%					100%					100%
Potomac/Darnestown/Travilah	8.0%			50%		50%					100%
Rockville/North Bethesda	12.8%			25%	25%	25%	25%				100%
Kensington/Wheaton	7.2%				100%						100%
White Oak/Fairland/Cloverly	4.1%				50%	50%					100%
Gaithersburg/Shady Grove	14.4%						100%				100%
Aspen Hill/Olney	8.5%				100%						100%
Germantown/Clarksburg	6.5%			50%			50%				100%
Rural: West of I270	0.9%			75%			25%				100%
Rural: East of I270	4.2%				25%		75%				100%
Washington, DC	3.6%					100%					100%
Prince George's County	8.8%				50%	50%					100%
Virginia	7.8%			50%		50%					100%
Frederick County	4.6%			50%			50%				100%
Howard County	2.9%				50%		50%				100%
TOTALS	**100.0%**										

Trip Assignment for Development Case

Trip Distribution to Super District #4 Rockville/North Bethesda	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	0.0%	0.0%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%	3.5%
Silver Spring/Takoma Park	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	2.2%
Potomac/Darnestown/Travilah	0.0%	0.0%	4.0%	0.0%	4.0%	0.0%	0.0%	0.0%	0.0%	8.0%
Rockville/North Bethesda	0.0%	0.0%	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%	0.0%	12.8%
Kensington/Wheaton	0.0%	0.0%	0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	7.2%
White Oak/Fairland/Cloverly	0.0%	0.0%	0.0%	2.1%	2.1%	0.0%	0.0%	0.0%	0.0%	4.1%
Gaithersburg/Shady Grove	0.0%	0.0%	0.0%	0.0%	0.0%	14.4%	0.0%	0.0%	0.0%	14.4%
Aspen Hill/Olney	0.0%	0.0%	0.0%	8.5%	0.0%	0.0%	0.0%	0.0%	0.0%	8.5%
Germantown/Clarksburg	0.0%	0.0%	3.3%	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	6.5%
Rural: West of I270	0.0%	0.0%	0.7%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.9%
Rural: East of I270	0.0%	0.0%	0.0%	1.1%	0.0%	3.2%	0.0%	0.0%	0.0%	4.2%
Washington, DC	0.0%	0.0%	0.0%	0.0%	3.6%	0.0%	0.0%	0.0%	0.0%	3.6%
Prince George's County	0.0%	0.0%	0.0%	4.4%	4.4%	0.0%	0.0%	0.0%	0.0%	8.8%
Virginia	0.0%	0.0%	3.9%	0.0%	3.9%	0.0%	0.0%	0.0%	0.0%	7.8%
Frederick County	0.0%	0.0%	2.3%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	4.6%
Howard County	0.0%	0.0%	0.0%	1.5%	0.0%	1.5%	0.0%	0.0%	0.0%	2.9%
TOTALS	**0.0%**	**0.0%**	**17.3%**	**27.9%**	**26.9%**	**28.0%**	**0.0%**	**0.0%**	**0.0%**	**100.0%**

Traffic Assignment for Office - Hotel		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
		0.0%	**0.0%**	**17.3%**	**27.9%**	**26.9%**	**28.0%**	**0.0%**	**0.0%**	**0.0%**
AM IN	30	0	0	5	8	8	8	0	0	0
AM OUT	30	0	0	5	8	8	8	0	0	0
PM IN	35	0	0	6	10	9	10	0	0	0
PM OUT	35	0	0	6	10	9	10	0	0	0

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #2
Revised 5/6/2005

Trip Assignment for Origin By Super District

Trip Distribution to Super District #4 Rockville/North Bethesda	Retail Development	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	3.5%					100%					100%
Silver Spring/Takoma Park	2.2%					100%					100%
Potomac/Darnestown/Travilah	8.0%			50%		50%					100%
Rockville/North Bethesda	21.8%	5%		5%	10%	25%	25%	10%	10.0%	10.0%	100%
Kensington/Wheaton	7.2%				100%						100%
White Oak/Fairland/Cloverly	4.1%				50%	50%					100%
Gaithersburg/Shady Grove	19.4%						100%				100%
Aspen Hill/Olney	8.5%				100%						100%
Germantown/Clarksburg	6.5%			50%			50%				100%
Rural: West of I270	0.2%			75%			25%				100%
Rural: East of I270	1.2%				25%		75%				100%
Washington, DC	1.8%					100%					100%
Prince George's County	4.4%				50%	50%					100%
Virginia	3.7%			50%		50%					100%
Frederick County	4.6%			50%			50%				100%
Howard County	2.9%				50%		50%				100%
TOTALS	**100.0%**										

Trip Assignment for Development Case

Trip Distribution to Super District #4 Rockville/North Bethesda	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	0.0%	0.0%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%	3.5%
Silver Spring/Takoma Park	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	2.2%
Potomac/Darnestown/Travilah	0.0%	0.0%	4.0%	0.0%	4.0%	0.0%	0.0%	0.0%	0.0%	8.0%
Rockville/North Bethesda	1.1%	0.0%	1.1%	2.2%	5.5%	5.5%	2.2%	2.2%	2.2%	21.8%
Kensington/Wheaton	0.0%	0.0%	0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	7.2%
White Oak/Fairland/Cloverly	0.0%	0.0%	0.0%	2.1%	2.1%	0.0%	0.0%	0.0%	0.0%	4.1%
Gaithersburg/Shady Grove	0.0%	0.0%	0.0%	0.0%	0.0%	19.4%	0.0%	0.0%	0.0%	19.4%
Aspen Hill/Olney	0.0%	0.0%	0.0%	8.5%	0.0%	0.0%	0.0%	0.0%	0.0%	8.5%
Germantown/Clarksburg	0.0%	0.0%	3.3%	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	6.5%
Rural: West of I270	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.2%
Rural: East of I270	0.0%	0.0%	0.0%	0.3%	0.0%	0.9%	0.0%	0.0%	0.0%	1.2%
Washington, DC	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	1.8%
Prince George's County	0.0%	0.0%	0.0%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	4.4%
Virginia	0.0%	0.0%	1.9%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	3.7%
Frederick County	0.0%	0.0%	2.3%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	4.6%
Howard County	0.0%	0.0%	0.0%	1.5%	0.0%	1.5%	0.0%	0.0%	0.0%	2.9%
TOTALS	**1.1%**	**0.0%**	**12.6%**	**23.9%**	**23.1%**	**32.8%**	**2.2%**	**2.2%**	**2.2%**	**100.0%**

Traffic Assignment for Retail - East		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
		1.1%	**0.0%**	**12.6%**	**23.9%**	**23.1%**	**32.8%**	**2.2%**	**2.2%**	**2.2%**
AM IN	40	0	0	5	10	9	13	1	1	1
AM OUT	37	0	0	5	9	8	12	1	1	1
PM IN	104	1	0	13	25	24	34	2	2	2
PM OUT	96	1	0	12	23	22	31	2	2	2

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #2
Revised 5/6/2005

Trip Assignment for Origin By Super District

Trip Distribution to Super District #4 Rockville/North Bethesda	Residential Development	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	15.6%					100%					100%
Silver Spring/Takoma Park	2.4%					100%					100%
Potomac/Darnestown/Travilah	3.3%			50%		50%					100%
Rockville/North Bethesda	31.0%	5%		5%	10%	25%	25%	10%	10.0%	10.0%	100%
Kensington/Wheaton	2.6%				100%						100%
White Oak/Fairland/Cloverly	0.7%				50%	50%					100%
Gaithersburg/Shady Grove	10.6%						100%				100%
Aspen Hill/Olney	1.7%				100%						100%
Germantown/Clarksburg	1.0%			50%			50%				100%
Rural: West of I270	0.0%			75%			25%				100%
Rural: East of I270	0.2%				25%		75%				100%
Washington, DC	13.9%					100%					100%
Prince George's County	6.1%				50%	50%					100%
Virginia	9.7%			50%		50%					100%
Frederick County	0.5%			50%			50%				100%
Howard County	0.7%				50%		50%				100%
TOTALS	**100.0%**										

Trip Assignment for Development Case

Trip Distribution to Super District #4 Rockville/North Bethesda	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	0.0%	0.0%	0.0%	0.0%	15.6%	0.0%	0.0%	0.0%	0.0%	15.6%
Silver Spring/Takoma Park	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%	0.0%	0.0%	2.4%
Potomac/Darnestown/Travilah	0.0%	0.0%	1.7%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	3.3%
Rockville/North Bethesda	1.6%	0.0%	1.6%	3.1%	7.8%	7.8%	3.1%	3.1%	3.1%	31.0%
Kensington/Wheaton	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%
White Oak/Fairland/Cloverly	0.0%	0.0%	0.0%	0.4%	0.4%	0.0%	0.0%	0.0%	0.0%	0.7%
Gaithersburg/Shady Grove	0.0%	0.0%	0.0%	0.0%	0.0%	10.6%	0.0%	0.0%	0.0%	10.6%
Aspen Hill/Olney	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%
Germantown/Clarksburg	0.0%	0.0%	0.5%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	1.0%
Rural: West of I270	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rural: East of I270	0.0%	0.0%	0.0%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%
Washington, DC	0.0%	0.0%	0.0%	0.0%	13.9%	0.0%	0.0%	0.0%	0.0%	13.9%
Prince George's County	0.0%	0.0%	0.0%	3.1%	3.1%	0.0%	0.0%	0.0%	0.0%	6.1%
Virginia	0.0%	0.0%	4.9%	0.0%	4.9%	0.0%	0.0%	0.0%	0.0%	9.7%
Frederick County	0.0%	0.0%	0.3%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.5%
Howard County	0.0%	0.0%	0.0%	0.4%	0.0%	0.4%	0.0%	0.0%	0.0%	0.7%
TOTALS	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**	**100.0%**

Traffic Assignment for Residential - West		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	North	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	7	0	0	1	1	4	1	0	0	0
AM OUT	29	0	0	3	3	15	6	1	1	1
PM IN	27	0	0	2	3	14	5	1	1	1
PM OUT	14	0	0	1	2	7	3	0	0	0

Traffic Assignment for Residential - West		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	South	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	19	0	0	2	2	9	4	1	1	1
AM OUT	75	1	0	7	8	37	15	2	2	2
PM IN	72	1	0	6	8	35	14	2	2	2
PM OUT	37	1	0	3	4	18	7	1	1	1

Traffic Assignment for Residential - East		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	North	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	9	0	0	1	1	4	2	0	0	0
AM OUT	36	1	0	3	4	18	7	1	1	1
PM IN	34	1	0	3	4	17	7	1	1	1
PM OUT	17	0	0	2	2	9	3	1	1	1

Traffic Assignment for Residential - East		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	South	**1.6%**	**0.0%**	**8.8%**	**11.2%**	**49.6%**	**19.6%**	**3.1%**	**3.1%**	**3.1%**
AM IN	3	0	0	0	0	2	1	0	0	0
AM OUT	15	0	0	1	2	7	3	0	0	0
PM IN	13	0	0	1	1	6	3	0	0	0
PM OUT	6	0	0	1	1	3	1	0	0	0

TRAFFIC ANALYSIS

Rockville Station Access Study
Trip Distribution Results
Revised Development Program - Optional Method #2
Revised 5/6/2005

Trip Assignment for Origin By Super District

Trip Distribution to Super District #4 Rockville/North Bethesda	Metro Parking	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase						100%					100%
Silver Spring/Takoma Park						100%					100%
Potomac/Darnestown/Travilah	15.0%			50%		50%					100%
Rockville/North Bethesda	75.0%	5%		5%	10%	25%	25%	10%	10.0%	10.0%	100%
Kensington/Wheaton					100%						100%
White Oak/Fairland/Cloverly					50%	50%					100%
Gaithersburg/Shady Grove							100%				100%
Aspen Hill/Olney	10.0%				100%						100%
Germantown/Clarksburg				50%			50%				100%
Rural: West of I270				75%			25%				100%
Rural: East of I270					25%		75%				100%
Washington, DC						100%					100%
Prince George's County					50%	50%					100%
Virginia				50%		50%					100%
Frederick County				50%			50%				100%
Howard County					50%		50%				100%
TOTALS	**100.0%**										

Trip Assignment for Development Case

Trip Distribution to Super District #4 Rockville/North Bethesda	E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave	TOTAL
Bethesda/Chevy Chase	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Silver Spring/Takoma Park	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Potomac/Darnestown/Travilah	0.0%	0.0%	7.5%	0.0%	7.5%	0.0%	0.0%	0.0%	0.0%	15.0%
Rockville/North Bethesda	3.8%	0.0%	3.8%	7.5%	18.8%	18.8%	7.5%	7.5%	7.5%	75.0%
Kensington/Wheaton	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
White Oak/Fairland/Cloverly	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Gaithersburg/Shady Grove	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Aspen Hill/Olney	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%
Germantown/Clarksburg	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rural: West of I270	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rural: East of I270	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Washington, DC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prince George's County	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Virginia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Frederick County	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Howard County	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTALS	**3.8%**	**0.0%**	**11.3%**	**17.5%**	**26.3%**	**18.8%**	**7.5%**	**7.5%**	**7.5%**	**100.0%**

Traffic Assignment for Metro Parking - West

		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	Existing	**3.8%**	**0.0%**	**11.3%**	**17.5%**	**26.3%**	**18.8%**	**7.5%**	**7.5%**	**7.5%**
AM IN	74	3	0	8	13	19	14	6	6	6
AM OUT	18	1	0	2	3	5	3	1	1	1
PM IN	17	1	0	2	3	4	3	1	1	1
PM OUT	60	2	0	7	11	16	11	5	5	5

Traffic Assignment for Metro Parking - East

		E. Middle Ln	Monroe Street	Jefferson St (Rt 28)	Viers Mill Rd (Rt 28)	Rockville Pike - fr south (Rt 355)	Hungerford Drive - fr north (Rt 355)	Park Lane	N. Stonestreet Ave	S. Stonestreet Ave
	Existing + New	**3.8%**	**0.0%**	**11.3%**	**17.5%**	**26.3%**	**18.8%**	**7.5%**	**7.5%**	**7.5%**
AM IN	614	23	0	69	108	161	115	46	46	46
AM OUT	154	6	0	17	27	40	29	12	12	12
PM IN	142	5	0	16	25	37	27	11	11	11
PM OUT	503	19	0	57	88	132	94	38	38	38

TRAFFIC ANALYSIS

Bus Volume per Peak Hour and Bus Bays Requirements

		Existing (2004)			Forecasted (20 yrs) not pulse				Forecasted (year 2010) not pulse			
AM		bus volume	bays	buses / bay	growth in bus volume	bus volume	bays	buses / bay	growth in bus volume per year	bus volume	bays	buses / bay
	East side	28	4	7	30%	36	5	8	1.6667%	31	10	3
	West side	48	6	8	30%	62	8	8	1.6667%	53	10	5
	Total	**76**	**10**	**15**		**98**	**13**	**16**		**84**	**20**	**8**

		Existing (2004)			Forecasted (20 yrs) not pulse				Forecasted (year 2010) not pulse			
PM		bus volume	bays	buses / bay	growth in bus volume	bus volume	bays	buses / bay	growth in bus volume per year	bus volume	bays	buses / bay
	East side	53	4	13	30%	69	9	8	1.6667%	58	10	6
	West side	55	6	9	30%	72	9	8	1.6667%	61	10	6
	Total	**108**	**10**	**22**		**141**	**18**	**16**		**119**	**20**	**12**

Bus Volume at Rockville Metro: East

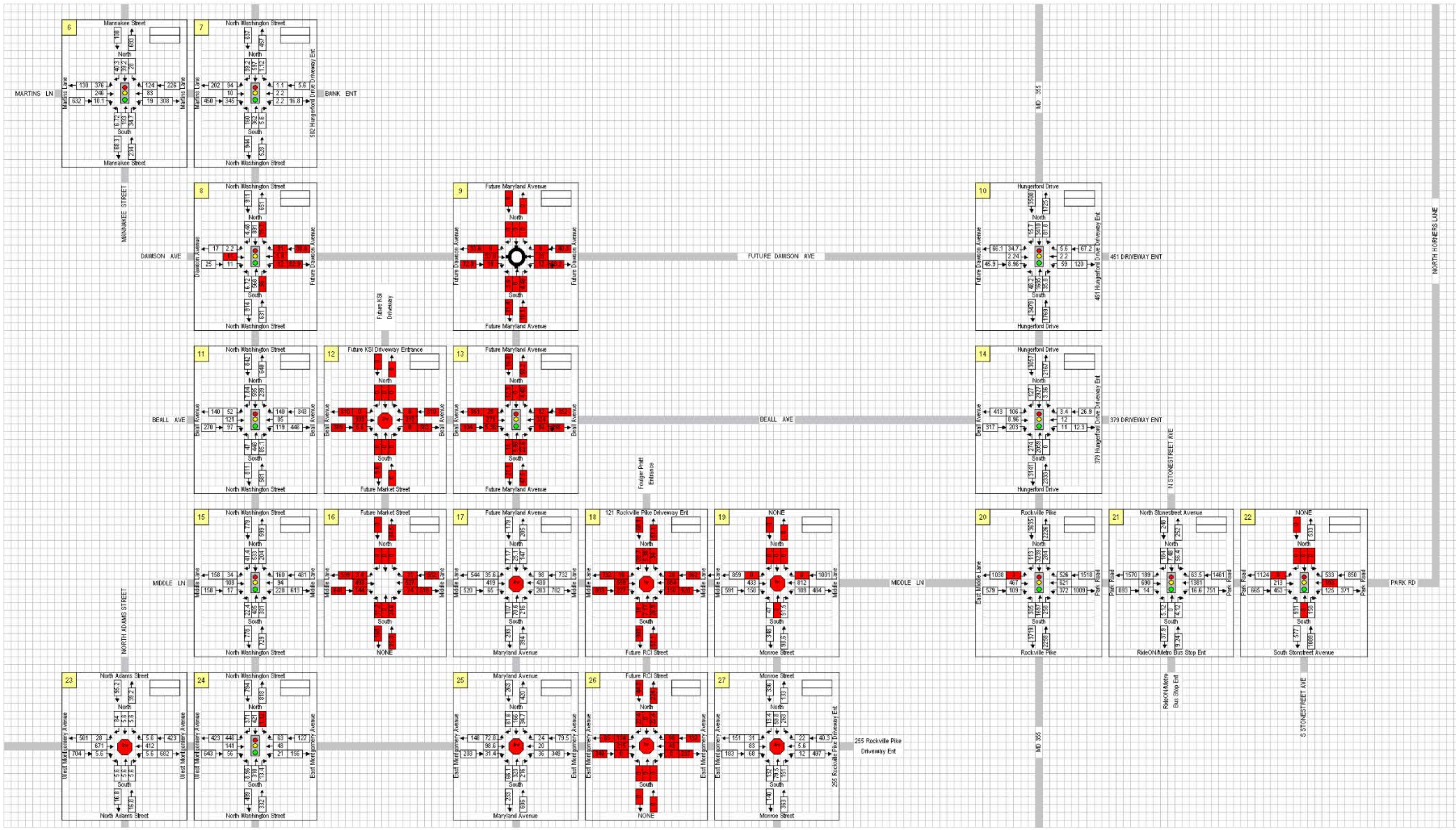
		Existing		2010		2010	
Route	**Direction**	**AM Peak Hour 7-8 AM**	**PM Peak Hour 4:30-5:30 PM**	**AM Peak Hour 7-8 AM**	**AM round**	**PM Peak Hour 4:30-5:30 PM**	**PM round**
45	From Twinbrook	2	3	2.2	2	3.3	3
45	To Twinbrook	3	3	3.3	4	3.3	4
48	From Rockville	2	2	2.2	2	2.2	2
48	To Rockville	2	2	2.2	2	2.2	2
49	From Rockville	2	2	2.2	2	2.2	2
49	To Rockville	4	3	4.4	5	3.3	3
52	From Rockville	1	2	1.1	1	2.2	2
52	To Rockville	2	1	2.2	2	1.1	1
55	From Rockville	2	5	2.2	2	5.5	6
55	To Rockville	2	3	2.2	2	3.3	3
59	From Rockville	3	4	3.3	4	4.4	5
59	To Rockville	3	2	3.3	3	2.2	2
	Total East Side	**28**	**32**	**30.8**	**31**	**35.2**	**35**

Bus Volume at Rockville Metro: West

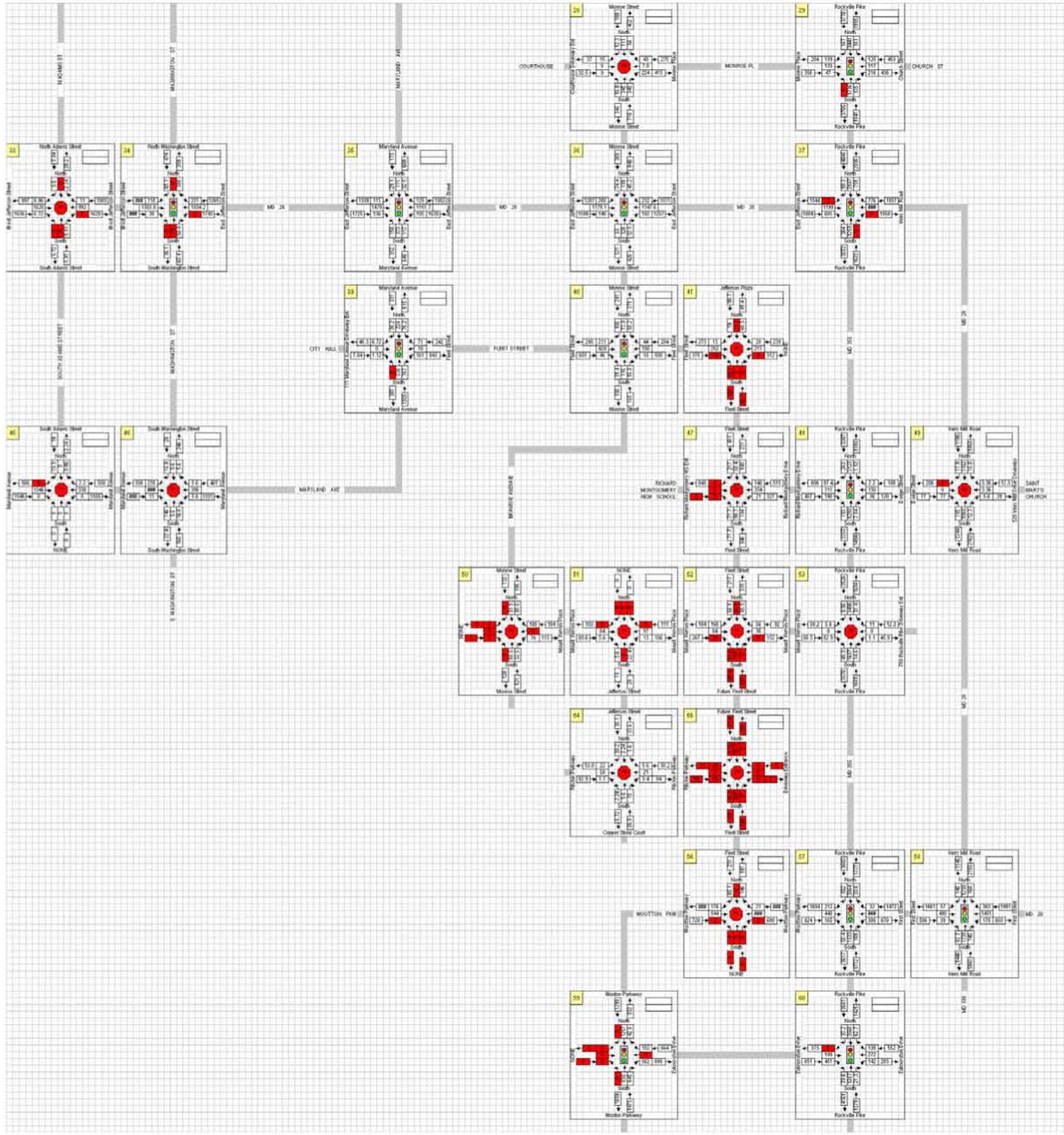
		Existing		2010		2010	
Route	**Direction**	**AM Peak Hour 7-8 AM**	**PM Peak Hour 4:30-5:30 PM**	**AM Peak Hour 7-8 AM**	**AM round**	**PM Peak Hour 4:30-5:30 PM**	**PM round**
44	From Rockville	2	2	2.2	2	2.2	2
44	To Rockville	2	2	2.2	2	2.2	2
46	From Shady Grove	4	5	4.4	5	5.5	7
46	To Shady Grove	3	5	3.3	4	5.5	6
47	From Rockville	2	2	2.2	2	2.2	2
47	To Rockville	3	2	3.3	3	2.2	2
54	From Rockville	3	4	3.3	3	4.4	4
54	To Rockville	3	2	3.3	3	2.2	2
56	From Rockville	4	3	4.4	5	3.3	3
56	To Rockville	3	2	3.3	3	2.2	2
63	From Rockville	2	2	2.2	2	2.2	2
63	To Rockville	2	2	2.2	2	2.2	2
81	From Rockville	2	3	2.2	2	3.3	3
81	To Rockville	2	2	2.2	2	2.2	2
Q2	From Silver Spring	6	6	6.6	7	6.6	7
Q2	To Silver Spring	4	5	4.4	5	5.5	7
T2	From Rockville	4	3	4.4	4	3.3	3
T2	To Rockville	2	3	2.2	2	3.3	3
	Total East Side	**53**	**55**	**58.3**	**58**	**60.5**	**61**

A-3. Appendix C – 2010 Traffic Volumes

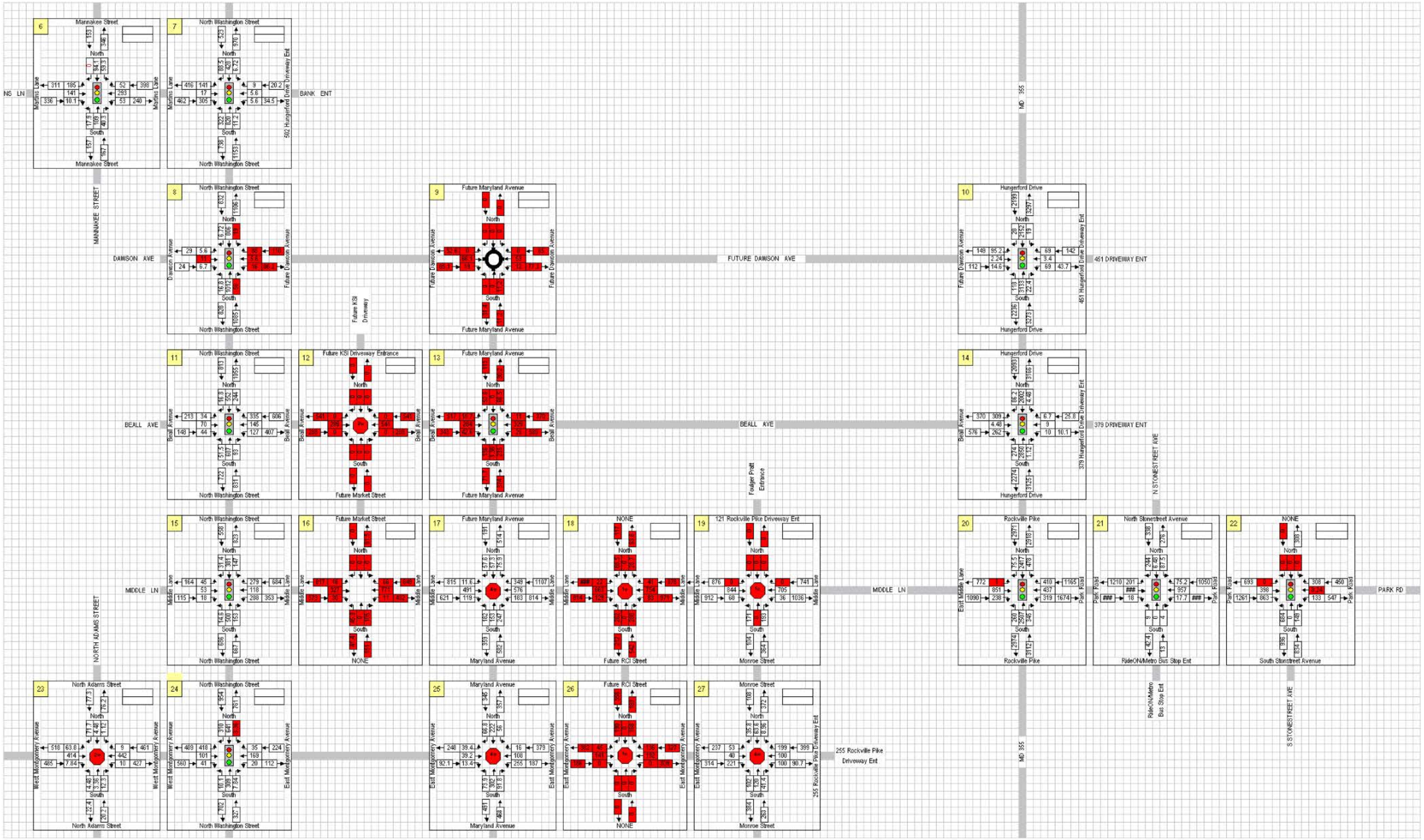
Year 2010 with Optional Development Program #1 – Morning Peak Hour



TRAFFIC ANALYSIS

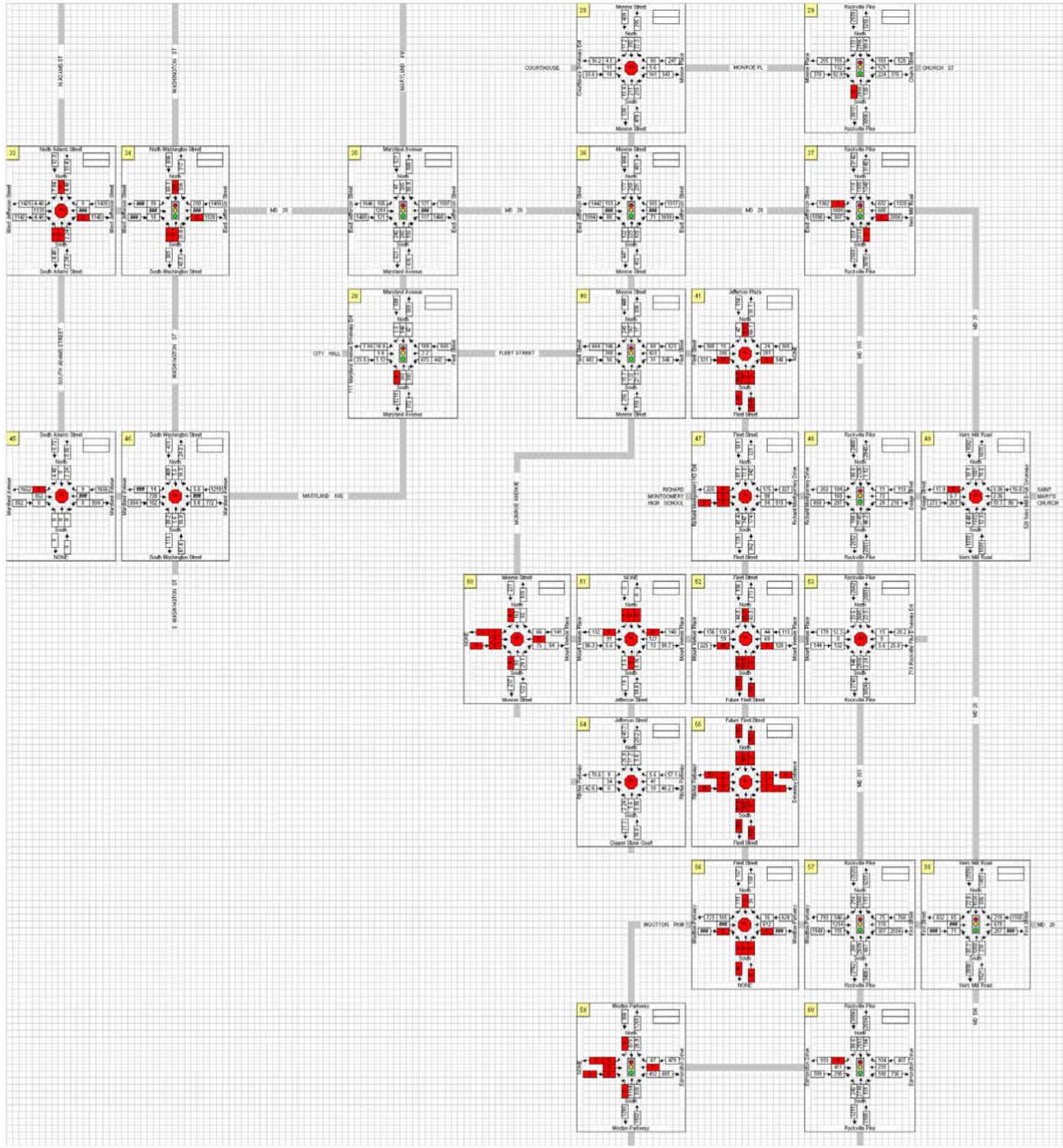


Year 2010 with Optional Development Program #1 – Evening Peak Hour

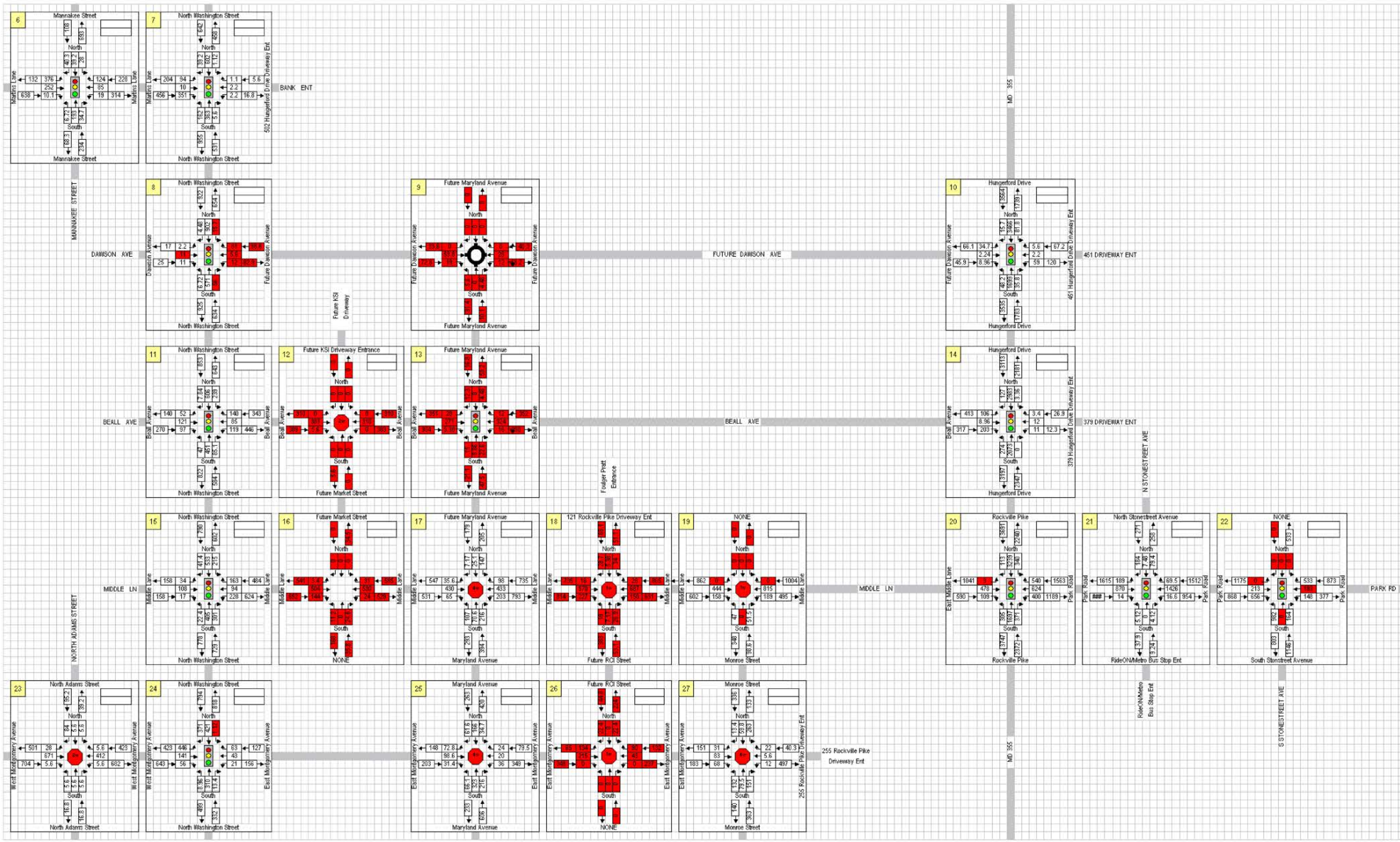


ROCKVILLE STATION ACCESS IMPROVEMENT STUDY

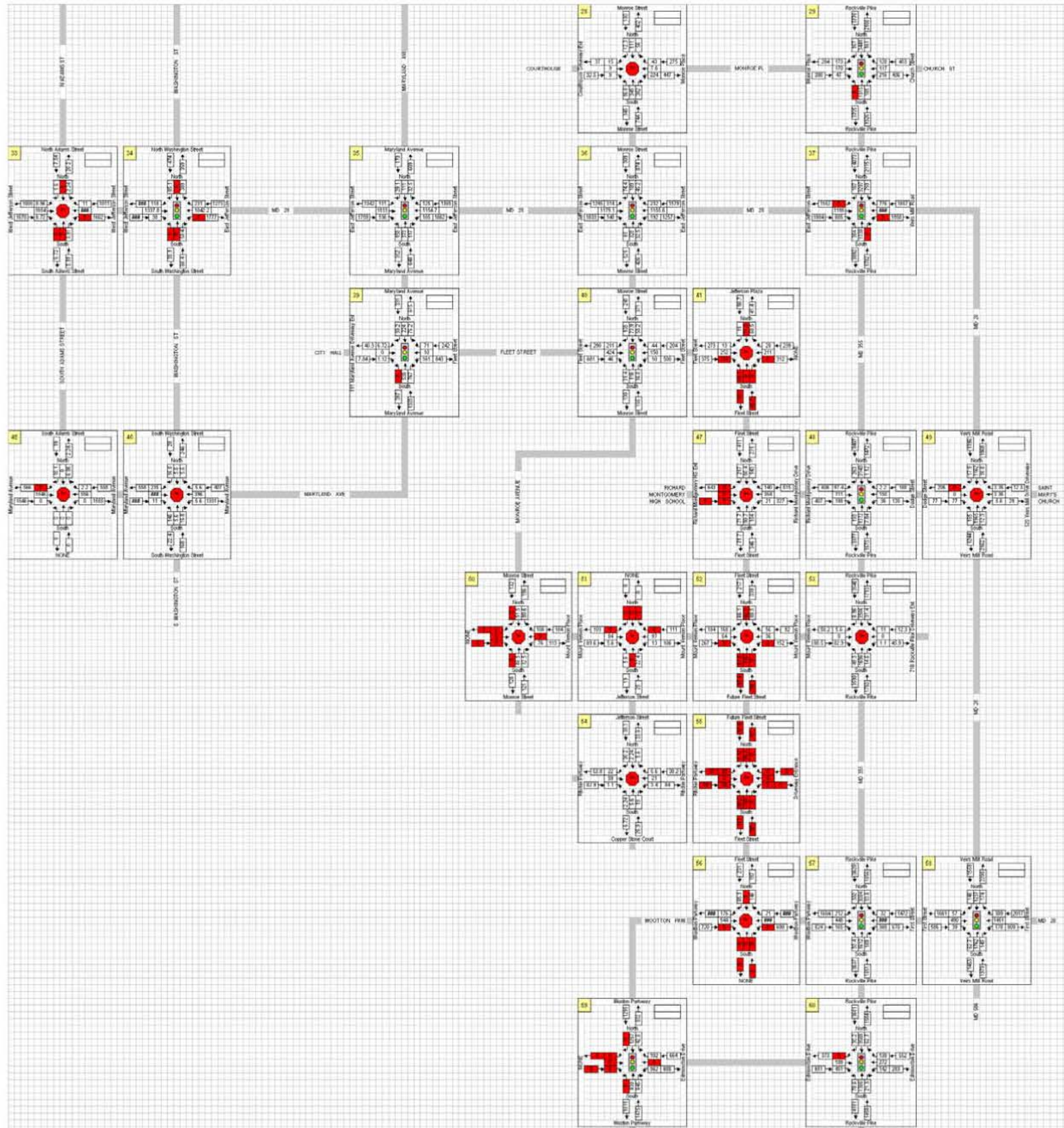
TRAFFIC ANALYSIS



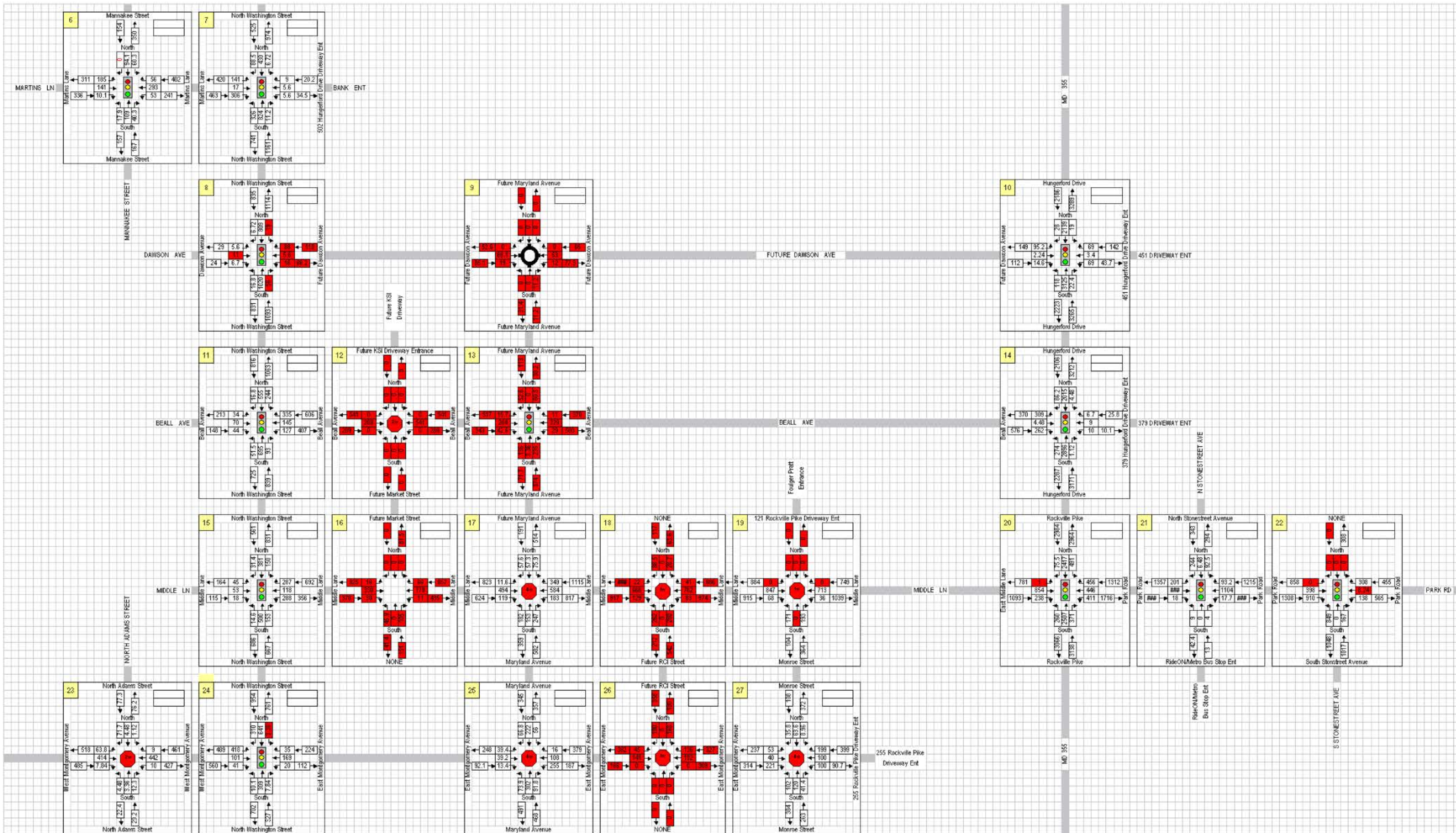
Year 2010 with Optional Development Program #2 – Morning Peak Hour



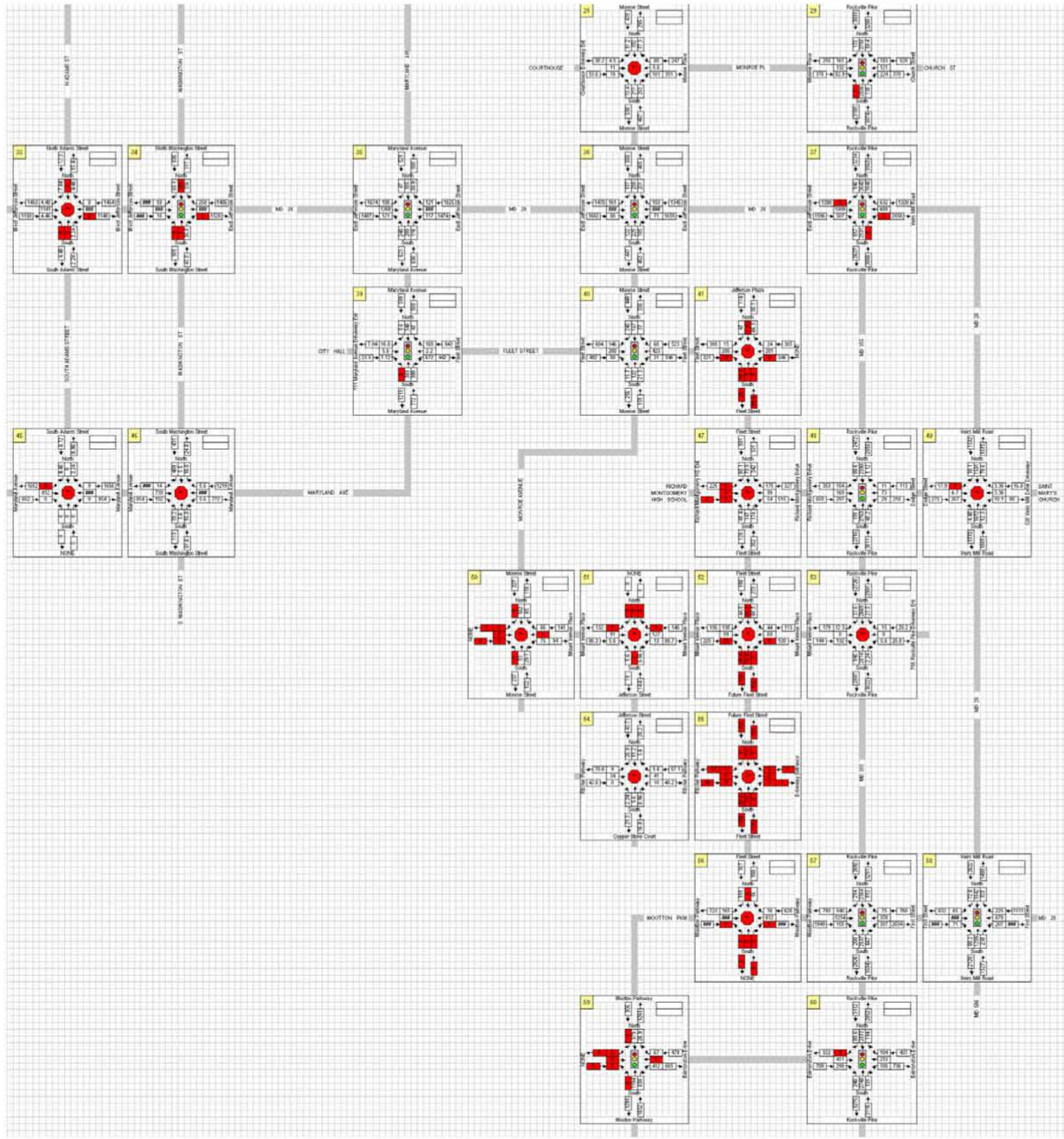
TRAFFIC ANALYSIS



Year 2010 with Optional Development Program #2 – Evening Peak Hour



TRAFFIC ANALYSIS



A-4. Appendix D – Critical Lane Volume Analysis Results

Year 2010 with Optional Development Program #1

Morning Peak Hour

INTERSECTION	CLV SYNCHRO NUMBER	FR SOUTH CLV	FR NORTH CLV	FR WEST CLV	FR EAST CLV	AM CLV TOTAL	AM V/C RATIO	AM LOS
Manakee St. & MD 355	1	507	1879	0	95	1973	1.19	F
Frederick Ave & MD 355	2	737	1469	78	41	1548	0.93	E
N. Horners Ln & Southlawn Ln	3	465	234	436	492	957	0.59	A
N. Washington & MD 355	4	720	1476	158	56	1689	1.08	F
N. Horners Ln & Lincoln Av	5	401	599	77	104	703	0.43	A
Martins Ln & Manakee St	6	283	95	281	621	904	0.60	B
N. Washington & Martins Ln	7	305	544	166	159	710	0.50	A
Dawson Ave & N. Washington	8	367	497	46	110	606	0.37	A
Maryland Av & Dawson (Fut.)	9	11	6	93	48	103	0.06	A
Dawson Ave & MD 355	10	709	1286	162	158	1448	0.87	D
Beall Ave & N. Washington	11	543	678	373	152	1051	0.70	C
Beall Av & Market St (Fut.)	12	0	0	204	163	204	0.12	A
Maryland Av & Beall (Fut.)	13	41	44	207	260	303	0.18	A
Beall Ave & MD 355	14	745	1401	226	153	1627	0.98	E
W. Middle Ln & N. Washington	15	596	337	420	138	1016	0.67	B
Market St & Middle Ln (Fut.)	16	25	12	433	351	458	0.28	A
Maryland Av & Middle Ln	17	178	179	809	633	1166	0.72	C
Middle Ln & RCI St (Fut.)	18	119	119	1047	753	1166	0.72	C
Middle Ln & Monroe St	19	103	52	784	675	887	0.55	A
E. Middle Ln & MD 355	20	874	1389	664	374	2053	1.32	F
Park Rd & N. Stonestreet	21	102	106	396	966	1072	0.71	C
Park Rd & S. Stonestreet	22	0	1025	213	137	1375	0.91	E
N. Adams St & W. Montgomery Av	23	29	108	769	510	876	0.54	A
W. Montgomery & N. Washington	24	191	460	231	629	1089	0.66	B
Maryland Av & E. Montgomery Av	25	732	420	304	218	1036	0.64	B
RCI St & E. Montgomery (Fut.)	26	25	47	430	347	477	0.29	A
Monroe St & E. Montgomery Av	27	863	706	221	98	1084	0.67	B
Monroe St & Monroe Pl & COB	28	596	375	400	433	1028	0.64	B
MD 355 & Church St & Monroe Pl	29	803	1299	498	242	1797	1.15	F
Manakee St & MD 28	30	0	93	1109	1308	1401	0.87	D
W. Montgomery Av & Laird St	31	80	112	1291	2610	2722	1.60	F
W. Jefferson & Great Falls Rd	32	417	267	917	1487	1904	1.26	F
N. Adams St & W. Jefferson St	33	9	0	882	580	891	0.55	A
Jefferson St & N. Washington	34	557	506	1077	1252	1808	1.09	F
Jefferson St & Maryland Ave	35	542	346	963	792	1505	0.94	E
Jefferson St & Monroe St	36	357	302	903	1032	1389	0.86	D
MD 355 & W. Jefferson & Viers Mill	37	909	1366	630	567	1995	1.28	F
Rose Pedal Wy & Great Falls Rd	38	22	31	394	598	629	0.39	A
Maryland Av & Fleet St	39	622	255	8	171	801	0.53	A
Fleet St & Monroe St	40	189	217	449	452	669	0.44	A
Jefferson Plaza & Fleet St	41	67	167	201	260	427	0.26	A
Falls Road & Maryland Av	42	161	228	688	819	1047	0.67	B
Monument St & Maryland Av	43	207	213	720	726	939	0.58	A
Maryland Av & W. Argyle St	44	220	229	817	588	1045	0.69	B
S. Adams St & Maryland Av	45	10	20	812	558	831	0.51	A
S. Washington St & Maryland Av	46	264	264	1035	1023	1299	0.81	D
Fleet St & Richard Montgomery Dr	47	277	361	23	517	878	0.54	A
MD 355 & Richard Montgomery Dr	48	475	1433	168	279	1712	1.03	F
MD 355 & Dodge St	49	739	915	86	16	1001	0.62	B
Monroe St & Mt Vernon Pl	50	250	181	84	191	441	0.27	A
Mt Vernon Pl & E. Jefferson St	51	29	6	111	119	148	0.09	A
Fleet St & Mt Vernon Pl	52	361	260	367	361	729	0.45	A
MD 355 & Mt Vernon Pl	53	637	1337	94	22	1431	0.89	D
E. Jefferson St & Ritchie Pk	54	37	45	102	68	147	0.09	A
Fleet St & Ritchie Pk (fut.)	55	207	39	87	32	294	0.18	A
Fleet St & Wootton Pk	56	160	0	286	1040	1200	0.75	C
MD 355 & First St & Wootton Pk	57	589	1159	235	569	1963	1.26	F
Viers Mill Rd & First St	58	1012	792	473	824	1836	1.18	F
Wootton Pk & W. Edmonston Dr	59	482	660	337	0	997	0.66	B
MD 355 & W. Edmonston Dr	60	532	1373	530	410	1903	1.22	F

Project:	23044U - Rockville Metro Stration Acess Study					
Time Period:	2010 Optional Program #1 - AM					
Location:	MD 355 and Hotel Entrance					
Direction of Travel	Link Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	0	0	1.00	0	0	0
SB Lefts	0	0	1.00	0	0	0
NB Through & Rights	1995	3	0.37	738.15	0	738
SB Through	3770	3	0.37	1394.9	0	1,395
WB Total	40	1	1.00	40	0	40
EB Lefts	0	0	1.00	0	0	0
EB Through	0	0	1.00	0	0	0
					Critical Lane Volume	**1,435**
					Capacity	**1,550**
					% of Capacity	**92.6%**
					LOS	**E**
Location:	South Stonestreet and Metro Parking Entrance #1					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	11	1	1.10	12.1	0	12
SB Lefts	0	0	1.10	0	0	0
NB Through	958	1	1.00	958	0	958
SB Through	299	1	1.00	299	12.1	311
NB Rights	0	0	1.00	0	0	0
SB Rights	278	1	1.00	278	0	278
EB Lefts	131	1	1.10	144.1	0	144
EB Rights	10	1	1.00	10	0	10
					Critical Lane Volume	**1,102**
					Capacity	**1,600**
					% of Capacity	**68.9%**
					LOS	**B**
Location:	South Stonestreet and Metro Parking Entrance #2					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	80	1	1.10	88	0	88
SB Lefts	0	0	1.10	0	0	0
NB Through	969	1	1.00	969	0	969
SB Through	309	1	1.00	309	88	397
NB Rights	0	0	1.00	0	0	0
SB Rights	0	1	1.00	0	0	0
EB Lefts	0	1	1.10	0	0	0
EB Right	27	1	1.00	27	0	27
					Critical Lane Volume	**996**
					Capacity	**1,600**
					% of Capacity	**62.3%**
					LOS	**B**
Location:	South Stonestreet and Bus Entrance/Exit					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	9	1	1.10	9.9	0	10
SB Lefts	0	0	1.10	0	0	0
NB Through	1083	1	1.00	1083	0	1,083
SB Through	577	1	1.00	577	9.9	587
NB Rights	0	0	1.00	0	0	0
SB Rights	0	1	1.00	0	0	0
EB Lefts	6	1	1.10	6.6	0	7
EB Rights	5	1	1.00	5	0	5
					Critical Lane Volume	**1,090**
					Capacity	**1,600**
					% of Capacity	**68.1%**
					LOS	**B**

Evening Peak Hour

INTERSECTION	CLV SYNCHRO NUMBER	FR SOUTH CLV	FR NORTH CLV	FR WEST CLV	FR EAST CLV	PM CLV TOTAL	PM V/C RATIO	PM LOS
Manakee St. & MD 355	1	1300	1214	0	264	1563	0.94	E
Frederick Ave & MD 355	2	1423	1042	208	124	1631	0.98	E
N. Horners Ln & Southlawn Ln	3	655	355	274	329	985	0.61	B
N. Washington & MD 355	4	1372	986	421	155	1948	1.39	F
N. Horners Ln & Lincoln Av	5	652	549	79	119	771	0.48	A
Martins Ln & Manakee St	6	272	218	219	549	822	0.54	A
N. Washington & Martins Ln	7	683	704	256	254	960	0.68	B
Dawson Ave & N. Washington	8	627	494	52	128	755	0.47	A
Maryland Av & Dawson (Fut.)	9	11	0	105	72	116	0.07	A
Dawson Ave & MD 355	10	1157	914	280	336	1493	0.90	E
Beall Ave & N. Washington	11	678	651	279	198	956	0.63	B
Beall Av & Market St (Fut.)	12	0	0	152	284	284	0.17	A
Maryland Av & Beall (Fut.)	13	317	366	265	256	631	0.39	A
Beall Ave & MD 355	14	1031	1054	280	418	1471	0.91	E
W. Middle Ln & N. Washington	15	504	240	445	189	949	0.63	B
Market St & Middle Ln (Fut.)	16	105	51	248	517	622	0.38	A
Maryland Av & Middle Ln	17	335	191	1076	916	1602	1.00	F
Middle Ln & RCI St (Fut.)	18	745	554	794	681	1539	0.96	E
Middle Ln & Monroe St	19	381	188	622	848	1229	0.76	C
E. Middle Ln & MD 355	20	1313	1053	799	233	2113	1.36	F
Park Rd & N. Stonestreet	21	158	161	656	763	924	0.61	B
Park Rd & S. Stonestreet	22	0	753	398	147	1297	0.86	D
N. Adams St & W. Montgomery Av	23	25	85	606	635	720	0.45	A
W. Montgomery & N. Washington	24	196	690	174	695	1385	0.83	D
Maryland Av & E. Montgomery Av	25	652	547	524	595	1247	0.77	C
RCI St & E. Montgomery (Fut.)	26	185	375	253	439	814	0.50	A
Monroe St & E. Montgomery Av	27	339	277	505	543	881	0.55	A
Monroe St & Monroe Pl & COB	28	437	588	294	351	939	0.58	A
MD 355 & Church St & Monroe Pl	29	1160	1022	507	312	1666	1.07	F
Manakee St & MD 28	30	0	0	1541	1232	1541	0.96	E
W. Montgomery Av & Laird St	31	36	107	1451	1696	1803	1.09	F
W. Jefferson & Great Falls Rd	32	301	353	776	1616	1969	1.31	F
N. Adams St & W. Jefferson St	33	8	1	597	756	764	0.47	A
Jefferson St & N. Washington	34	473	729	797	987	1716	1.03	F
Jefferson St & Maryland Ave	35	538	815	854	895	1711	1.06	F
Jefferson St & Monroe St	36	837	814	834	822	1671	1.04	F
MD 355 & W. Jefferson & Viers Mill	37	1534	1046	530	361	2063	1.33	F
Rose Pedal Wy & Great Falls Rd	38	36	37	363	554	591	0.36	A
Maryland Av & Fleet St	39	434	552	24	674	1250	0.89	D
Fleet St & Monroe St	40	155	265	451	663	929	0.61	B
Jefferson Plaza & Fleet St	41	73	216	180	341	557	0.34	A
Falls Road & Maryland Av	42	31	52	499	1328	1380	0.89	D
Monument St & Maryland Av	43	6	12	933	1013	1025	0.64	B
Maryland Av & W. Argyle St	44	183	180	868	892	1076	0.71	C
S. Adams St & Maryland Av	45	2	7	852	870	876	0.54	A
S. Washington St & Maryland Av	46	147	539	945	1318	1857	1.16	F
Fleet St & Richard Montgomery Dr	47	693	213	59	332	1026	0.64	B
MD 355 & Richard Montgomery Dr	48	1012	1088	216	323	1411	0.85	D
MD 355 & Dodge St	49	791	801	289	23	1090	0.68	B
Monroe St & Mt Vernon Pl	50	226	266	83	149	415	0.25	A
Mt Vernon Pl & E. Jefferson St	51	15	6	118	148	163	0.10	A
Fleet St & Mt Vernon Pl	52	237	196	308	334	570	0.35	A
MD 355 & Mt Vernon Pl	53	1067	1183	161	43	1344	0.83	D
E. Jefferson St & Ritchie Pk	54	27	51	64	78	128	0.08	A
Fleet St & Ritchie Pk (fut.)	55	196	187	49	12	246	0.15	A
Fleet St & Wootton Pk	56	62	0	828	593	890	0.55	A
MD 355 & First St & Wootton Pk	57	1067	1049	659	274	1999	1.28	F
Viers Mill Rd & First St	58	1043	1082	1125	428	2207	1.42	F
Wootton Pk & W. Edmonston Dr	59	656	461	247	0	904	0.60	B
MD 355 & W. Edmonston Dr	60	1196	1305	521	337	1826	1.17	F

Project: 23044U - Rockville Metro Stration Acess Study
Time Period: 2010 Optional Program #1 - PM

Location: MD 355 and Hotel Entrance

Direction of Travel	Link Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	0	0	1.00	0	0	0
SB Lefts	0	0	1.00	0	0	0
NB Through & Rights	3256	3	0.37	1204.72	0	1,205
SB Through	2939	3	0.37	1087.43	0	1,087
WB Total	10	1	1.00	10	0	10
EB Lefts	0	0	1.00	0	0	0
EB Through	0	0	1.00	0	0	0
					Critical Lane Volume	**1,215**
					Capacity	**1,550**
					% of Capacity	**78.4%**
					LOS	**C**

Location: South Stonestreet and Metro Parking Entrance #1

Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	28	1	1.10	30.8	0	31
SB Lefts	0	0	1.10	0	0	0
NB Through	550	1	1.00	550	0	550
SB Through	826	1	1.00	826	30.8	857
NB Rights	0	0	1.00	0	0	0
SB Rights	170	1	1.00	170	0	170
EB Lefts	284	1	1.10	312.4	0	312
EB Rights	25	1	1.00	25	0	25
					Critical Lane Volume	**1,169**
					Capacity	**1,600**
					% of Capacity	**73.1%**
					LOS	**C**

Location: South Stonestreet and Metro Parking Entrance #2

Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	26	1	1.10	28.6	0	29
SB Lefts	0	0	1.10	0	0	0
NB Through	578	1	1.00	578	0	578
SB Through	851	1	1.00	851	28.6	880
NB Rights	0	0	1.00	0	0	0
SB Rights	0	0	1.00	0	0	0
EB Lefts	0	0	1.10	0	0	0
EB Right	68	1	1.00	68	0	68
					Critical Lane Volume	**948**
					Capacity	**1,600**
					% of Capacity	**59.2%**
					LOS	**A**

Location: South Stonestreet and Bus Entrance/Exit

Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	7	1	1.10	7.7	0	8
SB Lefts	0	0	1.10	0	0	0
NB Through	827	1	1.00	827	0	827
SB Through	996	1	1.00	996	7.7	1,004
NB Rights	0	0	1.00	0	0	0
SB Rights	0	1	1.00	0	0	0
EB Lefts	7	1	1.10	7.7	0	8
EB Rights	4	1	1.00	4	0	4
					Critical Lane Volume	**1,011**
					Capacity	**1,600**
					% of Capacity	**63.2%**
					LOS	**B**

Year 2010 with Optional Development Program #2

Morning Peak Hour

INTERSECTION	CLV SYNCHRO NUMBER	FR SOUTH CLV	FR NORTH CLV	FR WEST CLV	FR EAST CLV	AM CLV TOTAL	AM V/C RATIO	AM LOS
Manakee St. & MD 355	1	513	1901	0	95	1995	1.20	F
Frederick Ave & MD 355	2	743	1491	78	41	1570	0.95	E
N. Horners Ln & Southlawn Ln	3	465	234	436	492	957	0.59	A
N. Washington & MD 355	4	725	1497	158	56	1712	1.10	F
N. Horners Ln & Lincoln Av	5	401	599	77	104	703	0.43	A
Martins Ln & Manakee St	6	283	95	287	623	906	0.60	B
N. Washington & Martins Ln	7	307	549	166	159	715	0.51	A
Dawson Ave & N. Washington	8	368	503	46	110	612	0.38	A
Maryland Av & Dawson (Fut.)	9	11	6	93	48	103	0.06	A
Dawson Ave & MD 355	10	714	1307	162	158	1468	0.88	D
Beall Ave & N. Washington	11	545	689	373	152	1062	0.70	C
Beall Av & Market St (Fut.)	12	0	0	204	163	204	0.12	A
Maryland Av & Beall (Fut.)	13	41	44	207	260	303	0.18	A
Beall Ave & MD 355	14	750	1421	226	153	1647	0.99	E
W. Middle Ln & N. Washington	15	608	337	420	138	1028	0.68	B
Market St & Middle Ln (Fut.)	16	25	12	439	353	464	0.28	A
Maryland Av & Middle Ln	17	178	179	815	635	1172	0.73	C
Middle Ln & RCI St (Fut.)	18	119	119	1053	755	1172	0.73	C
Middle Ln & Monroe St	19	103	52	1073	825	1177	0.73	C
E. Middle Ln & MD 355	20	948	1389	700	354	2090	1.34	F
Park Rd & N. Stonestreet	21	139	143	491	993	1135	0.75	C
Park Rd & S. Stonestreet	22	0	1081	213	162	1456	0.97	E
N. Adams St & W. Montgomery Av	23	29	108	769	510	876	0.54	A
W. Montgomery & N. Washington	24	191	460	231	629	1089	0.66	B
Maryland Av & E. Montgomery Av	25	732	420	304	218	1036	0.64	B
RCI St & E. Montgomery (Fut.)	26	25	47	430	347	477	0.29	A
Monroe St & E. Montgomery Av	27	863	706	221	98	1084	0.67	B
Monroe St & Monroe Pl & COB	28	596	375	400	433	1028	0.64	B
MD 355 & Church St & Monroe Pl	29	831	1299	498	286	1797	1.15	F
Manakee St & MD 28	30	0	93	1127	1316	1409	0.88	D
W. Montgomery Av & Laird St	31	80	112	1291	2618	2730	1.60	F
W. Jefferson & Great Falls Rd	32	417	267	935	1495	1912	1.27	F
N. Adams St & W. Jefferson St	33	9	0	900	584	909	0.56	A
Jefferson St & N. Washington	34	557	506	1094	1256	1812	1.09	F
Jefferson St & Maryland Ave	35	542	346	981	794	1523	0.95	E
Jefferson St & Monroe St	36	357	302	903	1074	1431	0.89	D
MD 355 & W. Jefferson & Viers Mill	37	937	1373	630	567	2003	1.29	F
Rose Pedal Wy & Great Falls Rd	38	22	31	394	598	629	0.39	A
Maryland Av & Fleet St	39	622	255	8	171	801	0.53	A
Fleet St & Monroe St	40	189	217	449	452	669	0.44	A
Jefferson Plaza & Fleet St	41	67	167	201	260	427	0.26	A
Falls Road & Maryland Av	42	161	228	688	819	1047	0.67	B
Monument St & Maryland Av	43	207	213	720	726	939	0.58	A
Maryland Av & W. Argyle St	44	220	229	817	588	1045	0.69	B
S. Adams St & Maryland Av	45	10	20	812	558	831	0.51	A
S. Washington St & Maryland Av	46	264	264	1035	1023	1299	0.81	D
Fleet St & Richard Montgomery Dr	47	277	361	23	517	878	0.54	A
MD 355 & Richard Montgomery Dr	48	503	1440	168	279	1719	1.04	F
MD 355 & Dodge St	49	739	915	86	16	1001	0.62	B
Monroe St & Mt Vernon Pl	50	250	181	84	191	441	0.27	A
Mt Vernon Pl & E. Jefferson St	51	29	6	111	119	148	0.09	A
Fleet St & Mt Vernon Pl	52	361	260	367	361	729	0.45	A
MD 355 & Mt Vernon Pl	53	666	1344	94	22	1438	0.89	D
E. Jefferson St & Ritchie Pk	54	37	45	102	68	147	0.09	A
Fleet St & Ritchie Pk (fut.)	55	207	39	87	32	294	0.18	A
Fleet St & Wootton Pk	56	160	0	286	1040	1200	0.75	C
MD 355 & First St & Wootton Pk	57	617	1166	235	569	1970	1.27	F
Viers Mill Rd & First St	58	1029	796	473	824	1854	1.19	F
Wootton Pk & W. Edmonston Dr	59	482	660	337	0	997	0.66	B
MD 355 & W. Edmonston Dr	60	561	1380	530	410	1910	1.23	F

Project:	23044U - Rockville Metro Stration Acess Study					
Time Period:	2010 Optional Program #2 - AM					
Location:	MD 355 and Hotel Entrance					
Direction of Travel	Link Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	0	0	1.00	0	0	0
SB Lefts	0	0	1.00	0	0	0
NB Through & Rights	2108	3	0.37	779.96	0	780
SB Through	3770	3	0.37	1394.9	0	1,395
WB Total	40	1	1.00	40	0	40
EB Lefts	0	0	1.00	0	0	0
EB Through	0	0	1.00	0	0	0
					Critical Lane Volume	**1,435**
					Capacity	**1,550**
					% of Capacity	**92.6%**
					LOS	**E**
Location:	South Stonestreet and Metro Parking Entrance #1					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	11	1	1.10	12.1	0	12
SB Lefts	0	0	1.10	0	0	0
NB Through	958	1	1.00	958	0	958
SB Through	299	1	1.00	299	12.1	311
NB Rights	0	0	1.00	0	0	0
SB Rights	504	1	1.00	504	0	504
EB Lefts	188	1	1.10	206.8	0	207
EB Rights	10	1	1.00	10	0	10
					Critical Lane Volume	**1,165**
					Capacity	**1,600**
					% of Capacity	**72.8%**
					LOS	**C**
Location:	South Stonestreet and Metro Parking Entrance #2					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	156	1	1.10	171.6	0	172
SB Lefts	0	0	1.10	0	0	0
NB Through	969	1	1.00	969	0	969
SB Through	309	1	1.00	309	171.6	481
NB Rights	0	0	1.00	0	0	0
SB Rights	0	0	1.00	0	0	0
EB Lefts	0	0	1.10	0	0	0
EB Right	46	1	1.00	46	0	46
					Critical Lane Volume	**1,015**
					Capacity	**1,600**
					% of Capacity	**63.4%**
					LOS	**B**
Location:	South Stonestreet and Bus Entrance/Exit					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	9	1	1.10	9.9	0	10
SB Lefts	0	0	1.10	0	0	0
NB Through	1140	1	1.00	1140	0	1,140
SB Through	803	1	1.00	803	9.9	813
NB Rights	0	0	1.00	0	0	0
SB Rights	0	1	1.00	0	0	0
EB Lefts	6	1	1.10	6.6	0	7
EB Rights	5	1	1.00	5	0	5
					Critical Lane Volume	**1,147**
					Capacity	**1,600**
					% of Capacity	**71.7%**
					LOS	**C**

Evening Peak Hour

INTERSECTION	CLV SYNCHRO NUMBER	FR SOUTH CLV	FR NORTH CLV	FR WEST CLV	FR EAST CLV	PM CLV TOTAL	PM V/C RATIO	PM LOS
Manakee St. & MD 355	1	1297	1211	0	264	1560	0.94	E
Frederick Ave & MD 355	2	1420	1039	208	124	1628	0.98	E
N. Horners Ln & Southlawn Ln	3	652	355	272	327	980	0.61	B
N. Washington & MD 355	4	1369	984	421	155	1946	1.38	F
N. Horners Ln & Lincoln Av	5	649	547	79	119	768	0.47	A
Martins Ln & Manakee St	6	274	219	219	553	827	0.55	A
N. Washington & Martins Ln	7	688	710	256	254	966	0.69	B
Dawson Ave & N. Washington	8	631	495	52	128	759	0.47	A
Maryland Av & Dawson (Fut.)	9	11	0	105	72	116	0.07	A
Dawson Ave & MD 355	10	1154	910	280	336	1490	0.90	E
Beall Ave & N. Washington	11	682	654	279	198	960	0.64	B
Beall Av & Market St (Fut.)	12	0	0	152	284	284	0.17	A
Maryland Av & Beall (Fut.)	13	317	366	265	256	631	0.39	A
Beall Ave & MD 355	14	1048	1058	280	418	1476	0.92	E
W. Middle Ln & N. Washington	15	507	240	445	194	952	0.63	B
Market St & Middle Ln (Fut.)	16	105	51	250	521	627	0.39	A
Maryland Av & Middle Ln	17	335	191	1077	920	1603	1.00	F
Middle Ln & RCI St (Fut.)	18	745	554	796	685	1541	0.96	E
Middle Ln & Monroe St	19	381	188	624	856	1237	0.77	C
E. Middle Ln & MD 355	20	1331	1053	902	238	2233	1.44	F
Park Rd & N. Stonestreet	21	166	169	678	850	1019	0.67	B
Park Rd & S. Stonestreet	22	0	934	398	152	1484	0.98	E
N. Adams St & W. Montgomery Av	23	25	85	606	635	720	0.45	A
W. Montgomery & N. Washington	24	196	690	174	695	1385	0.83	D
Maryland Av & E. Montgomery Av	25	652	547	524	595	1247	0.77	C
RCI St & E. Montgomery (Fut.)	26	185	375	253	439	814	0.50	A
Monroe St & E. Montgomery Av	27	339	277	505	543	881	0.55	A
Monroe St & Monroe Pl & COB	28	437	588	294	351	939	0.58	A
MD 355 & Church St & Monroe Pl	29	1166	1055	507	321	1673	1.07	F
Manakee St & MD 28	30	0	0	1549	1247	1549	0.96	E
W. Montgomery Av & Laird St	31	36	107	1459	1724	1831	1.10	F
W. Jefferson & Great Falls Rd	32	301	353	781	1644	1997	1.33	F
N. Adams St & W. Jefferson St	33	8	1	602	770	779	0.48	A
Jefferson St & N. Washington	34	473	729	801	1002	1731	1.04	F
Jefferson St & Maryland Ave	35	538	815	858	910	1725	1.07	F
Jefferson St & Monroe St	36	837	814	834	846	1683	1.05	F
MD 355 & W. Jefferson & Viers Mill	37	1540	1069	530	361	2070	1.33	F
Rose Pedal Wy & Great Falls Rd	38	36	37	363	554	591	0.36	A
Maryland Av & Fleet St	39	434	552	24	674	1250	0.89	D
Fleet St & Monroe St	40	155	265	451	663	929	0.61	B
Jefferson Plaza & Fleet St	41	73	216	180	341	557	0.34	A
Falls Road & Maryland Av	42	31	52	499	1328	1380	0.89	D
Monument St & Maryland Av	43	6	12	933	1013	1025	0.64	B
Maryland Av & W. Argyle St	44	183	180	868	892	1076	0.71	C
S. Adams St & Maryland Av	45	2	7	852	870	876	0.54	A
S. Washington St & Maryland Av	46	147	539	945	1318	1857	1.16	F
Fleet St & Richard Montgomery Dr	47	693	213	59	332	1026	0.64	B
MD 355 & Richard Montgomery Dr	48	1019	1111	216	323	1434	0.86	D
MD 355 & Dodge St	49	791	801	289	23	1090	0.68	B
Monroe St & Mt Vernon Pl	50	226	266	83	149	415	0.25	A
Mt Vernon Pl & E. Jefferson St	51	15	6	118	148	163	0.10	A
Fleet St & Mt Vernon Pl	52	237	196	308	334	570	0.35	A
MD 355 & Mt Vernon Pl	53	1073	1206	161	43	1367	0.85	D
E. Jefferson St & Ritchie Pk	54	27	51	64	78	128	0.08	A
Fleet St & Ritchie Pk (fut.)	55	196	187	49	12	246	0.15	A
Fleet St & Wootton Pk	56	62	0	828	593	890	0.55	A
MD 355 & First St & Wootton Pk	57	1074	1072	659	274	2006	1.29	F
Viers Mill Rd & First St	58	1059	1094	1125	428	2218	1.43	F
Wootton Pk & W. Edmonston Dr	59	656	461	247	0	904	0.60	B
MD 355 & W. Edmonston Dr	60	1202	1328	521	337	1849	1.19	F

Project:	23044U - Rockville Metro Stration Acess Study					
Time Period:	2010 Optional Program #1 - PM					
Location:	MD 355 and Hotel Entrance					
Direction of Travel	Link Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	0	0	1.00	0	0	0
SB Lefts	0	0	1.00	0	0	0
NB Through & Rights	3280	3	0.37	1213.6	0	1,214
SB Through	3031	3	0.37	1121.47	0	1,121
WB Total	10	1	1.00	10	0	10
EB Lefts	0	0	1.00	0	0	0
EB Through	0	0	1.00	0	0	0
					Critical Lane Volume	**1,224**
					Capacity	**1,550**
					% of Capacity	**78.9%**
					LOS	**C**
Location:	South Stonestreet and Metro Parking Entrance #1					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	28	1	1.10	30.8	0	31
SB Lefts	0	0	1.10	0	0	0
NB Through	640	1	1.00	640	0	640
SB Through	826	1	1.00	826	30.8	857
NB Rights	0	0	1.00	0	0	0
SB Rights	222	1	1.00	222	0	222
EB Lefts	467	1	1.10	513.7	0	514
EB Rights	25	1	1.00	25	0	25
					Critical Lane Volume	**1,371**
					Capacity	**1,600**
					% of Capacity	**85.7%**
					LOS	**D**
Location:	South Stonestreet and Metro Parking Entrance #2					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	43	1	1.10	47.3	0	47
SB Lefts	0	0	1.10	0	0	0
NB Through	668	1	1.00	668	0	668
SB Through	851	1	1.00	851	47.3	898
NB Rights	0	0	1.00	0	0	0
SB Rights	0	0	1.00	0	0	0
EB Lefts	0	0	1.10	0	0	0
EB Right	129	1	1.00	129	0	129
					Critical Lane Volume	**1,027**
					Capacity	**1,600**
					% of Capacity	**64.2%**
					LOS	**B**
Location:	South Stonestreet and Bus Entrance/Exit					
Direction of Travel	Volume	Number of lanes	Lane use factor	Approach Volume	Opposing Lefts	Lane Volume
NB Lefts	7	1	1.10	7.7	0	8
SB Lefts	0	0	1.10	0	0	0
NB Through	1009	1	1.00	1009	0	1,009
SB Through	1048	1	1.00	1048	7.7	1,056
NB Rights	0	0	1.00	0	0	0
SB Rights	0	1	1.00	0	0	0
EB Lefts	7	1	1.10	7.7	0	8
EB Rights	4	1	1.00	4	0	4
					Critical Lane Volume	**1,063**
					Capacity	**1,600**
					% of Capacity	**66.5%**
					LOS	**B**

A-5. Appendix E – Revised Development Programs

A preliminary development program was developed prior to the optional development programs in July 2004. The traffic impacts as a result of this preliminary program, revised in September 2004, were also analyzed and are the results are included in this appendix. **Tables A5-1** shows the components of the development program.

Table A5-1. Development Program –Preliminary Program (Revised)
Source: Lee and Associates, September 2004

West Side	East Side
Transit Program	
• 9 Bus Bays (1 articulated bay) on site • One bus pullout on Hungerford Drive • 7 layover spaces • 123 existing long term spaces north of Park Rd. to remain • 16 Kiss & Ride spaces (in parking garage) • 4 Taxi stands (in parking garage)	• 8 Bus bays (including 2 articulated BRT bus bays) • 2 layover spaces • Kiss & Ride/taxi in public plaza area
Joint Development	
• Site area approximately 138,000 s.f. • Hotel- 240,000 s.f. Approximately 260 rooms • 9 stories (7 room levels over two levels of retail and hotel functions). • Commercial 220,000 s.f. 9 stories (7 levels over two levels of retail and commercial space) • Retail- 25,000 s.f. At mezzanine (ground) and pedestrian promenade levels • TOTAL Development = 485,000 s.f. for an FAR of 3.6 (approx)	• Site area approximately 280,000 s.f. • Commercial 50,000 s.f. Assume ground floor retail and upper level residential. 3-6 stories above retail development • North End Residential 150-160 units or 180,000 s.f. • South End Residential 30-60 units or 70,000 s.f. • TOTAL Development= 300,000 s.f. for an FAR of 1.1 (Total of 180-220 units)
Parking	
• Hotel - 300 • Commercial - 730 • Retail - 0 (assume transit related retail) • TOTAL= 1030 spaces • Underground Parking- 412 spaces /level x 2.5 levels = 1030 spaces • Note: ½ of the top parking level is devoted to taxis and Kiss and Ride	• Metro- 1024 spaces (includes 524 existing additional 500 Metro spaces) • Joint Development- 460 spaces • TOTAL = 1484 spaces • 7 levels = 1484 spaces
Other	
• 8 pull out spaces on Hungerford Drive • Office/hotel drop off/K&R/taxi	

The methodology for calculation new trips by for the preliminary development was similar to the methodology for the optional development programs. For a conservative estimate, the maximum range listed in the preliminary development was used for trip generation purposes. For the north end residential units on the east side of the development, 160 units were used in calculations. For the south end residential units on the east side of the development, 60 units were used in calculations.

The CTR and LATR listed the development site as a *Transit Oriented Area*, and because of its designation a reduction could be made in amount of vehicles trips due to its proximity to a Metrorail station. Based on factors noted in the CTR and LATR, the amount of trip reduction for general office units during the morning peak hour is 50 percent of the vehicle trips. The amount of trip reduction for general office units during the evening peak hour ranges between 33 percent and 38 percent trip reduction, dependent upon the distance of the office building to the Metrorail station. The office trip generation results were reduced by these factors. Also, the vehicle trips for the joint development was further reduced because of its designation as a mixed-use development within a transit-oriented development. According to the CTR, the maximum trip reduction that could be applied is 10 percent. This percentage of trip reduction was used for office, retail, and residential trips at the development site. The Metrorail parking garage was considered as a Park-and-Ride location for the purposed of trip generation. The number of pass-by trips also reduced retail vehicle trips, which according to the ITE manual was 35 percent.

According to the calculations, daily trips of 10,900 vehicles would travel on roadways near the Rockville Metrorail station due to the joint development. Approximately 1,200 trips would occur during the morning peak hour, and 1,300 trips would occur during the evening peak hour. **Table A5-2** shows the trip generation by site orientation. **Figure A5-1** shows the new trip volumes generated from joint development. The detailed trip generation results are shown later in this section.

Table A5-2. Trip Generation Results for Revised Development Program
Source: Parsons Brinckerhoff, 2004

Joint Development	Daily	AM Peak	AM In	AM Out	PM Peak	PM In	PM Out
West Side	4,106	360	274	86	402	122	280
East Side	6,761	916	668	248	925	299	626
TOTALS	10,867	1,277	942	335	1,327	421	906

**Total Peak Generated Trips include pass-by and trip reductions.*

Trip Distribution and Traffic Assignment

Figure A5-2 shows development-generated volumes at each intersection in the study area as a result of the revised preliminary program.

Traffic Forecasts

The generated trips from the Rockville Station Joint Development were added to the background traffic volumes for the year of the development build out. The 2010 traffic volumes are shown in **Figure A5-3**.

Traffic Operations Analysis

A critical lane volume (CLV) analysis was performed to calculate the operational capacity at the intersections in the study area for year 2010. **Figure A5-4** shows the LOS results from the CLV analysis.

TRAFFIC ANALYSIS

According to the critical lane volume analysis, the intersections of MD 28-MD 355 and MD 355-Middle Lane would remain as the critical intersections, operating at LOS F for both development programs. The future traffic volumes would exceed intersection capacity. The intersection of MD 355-Church Street-Monroe Place would operate at LOS F for the morning and evening peak hours for the revised development program. This is because of the increase in traffic volumes entering and exiting the commercial development via Church Street.

On the east side of the development, intersections would operate at LOS C or better, with capacities of 70 percent or less. The exception is the intersection of South Stonestreet Avenue with Park Road. This intersection would operate at LOS F for both morning and evening peak hours. The limited capacity at this intersection would possibly impact the operations along South Stonestreet, particularly near the Metrorail parking garage.

Table A5-3 shows a comparison of the future traffic conditions with the existing traffic conditions. **Table A5-4** compares the future traffic conditions with the Rockville Town Center traffic operations. Mitigation strategies recommended for the optional development programs would also apply for the revised preliminary program.

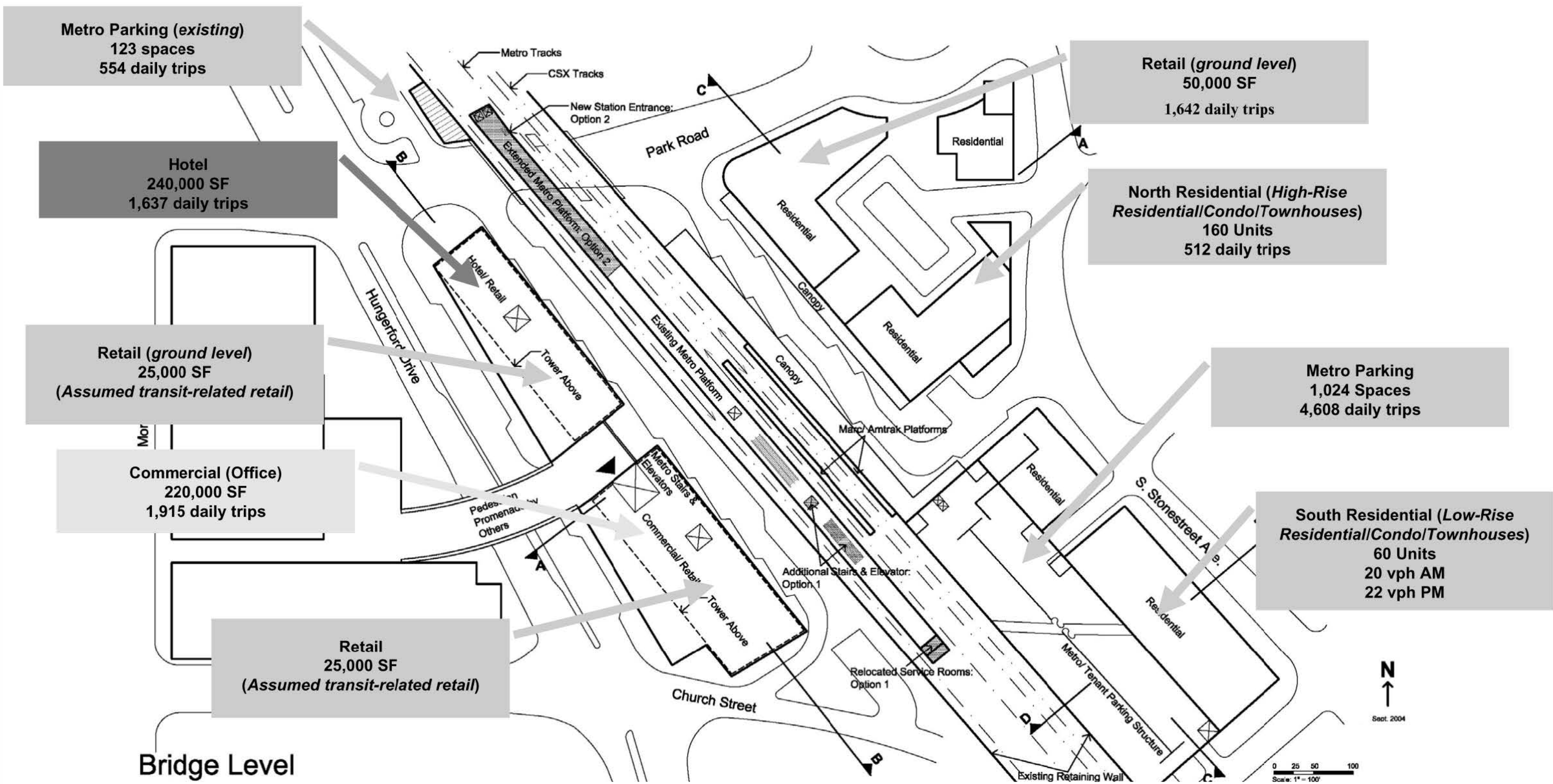
Table A5-3. Comparison of Existing and Future Intersection Analyses

Intersection	AM/PM	Existing		2010 w/ Revised Development	
		V/C Ratio	LOS	V/C Ratio	LOS
E. Middle Ln & MD 355	AM	0.96	E	1.38	F
	PM	0.88	D	1.50	F
Park Rd & N. Stonestreet	AM	0.50	A	0.79	C
	PM	0.39	A	0.68	B
Park Rd & S. Stonestreet	AM	0.59	A	1.05	F
	PM	0.53	A	1.01	F
MD 355 & Church St & Monroe Pl	AM	0.76	C	1.07	F
	PM	0.68	B	1.03	F
MD 355 & W. Jefferson & MD 28	AM	0.99	E	1.34	F
	PM	0.98	E	1.41	F
MD 28 & First St (MD 585)	AM	0.96	E	1.23	F
	PM	1.11	F	1.47	F

Table A5-4. Comparison of Town Center and Future Intersection Analyses
Source: City of Rockville, MD. Town Center Transportation Analysis. May 2003.

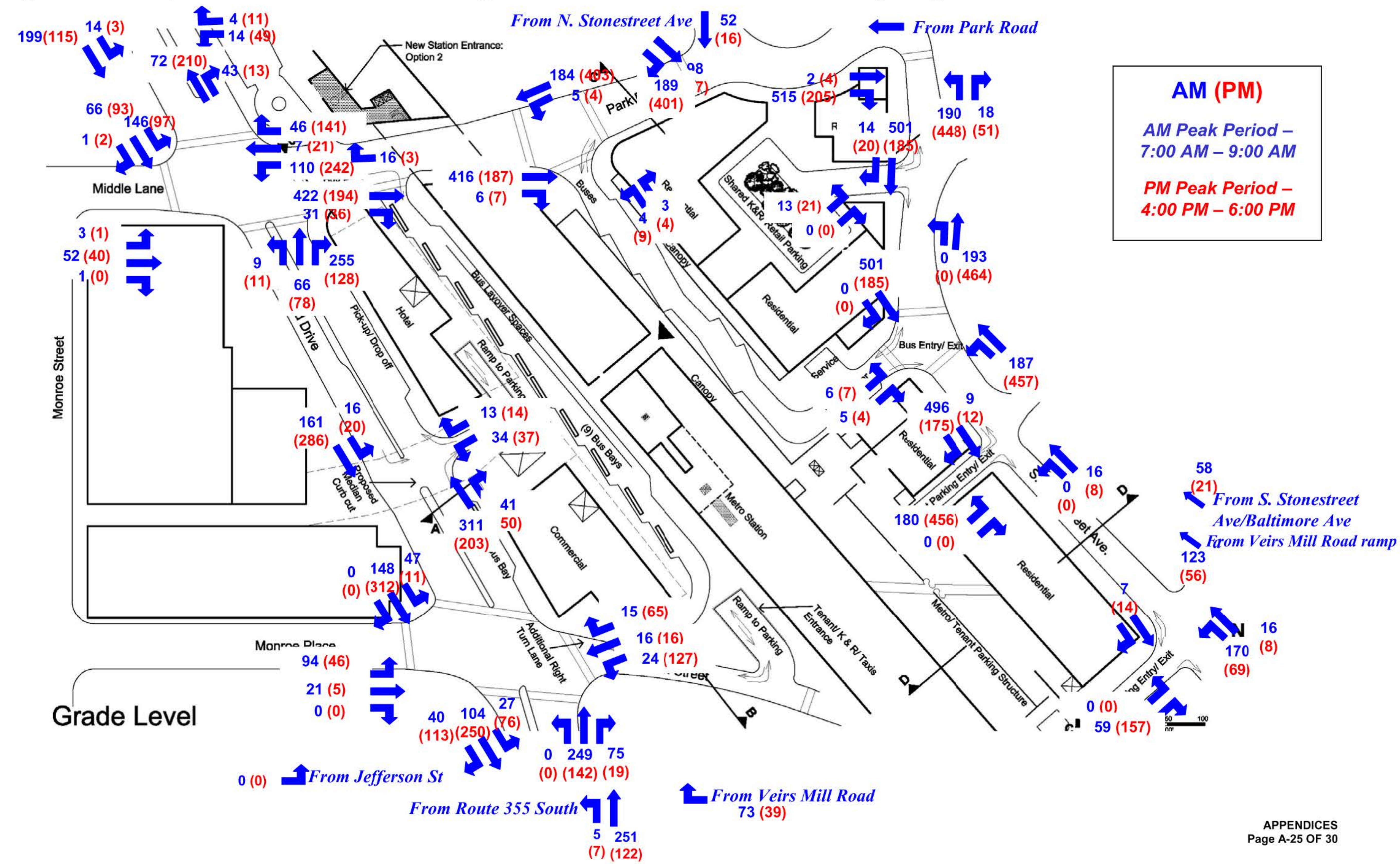
Intersection	AM/PM	2006 w/ Town Center Development		2010 w/ Revised Development	
		V/C Ratio	LOS	V/C Ratio	LOS
E. Middle Ln & MD 355	AM	1.13	F	1.38	F
	PM	1.09	F	1.50	F
Park Rd & N. Stonestreet	AM	0.59	A	0.79	C
	PM	0.43	A	0.68	B
Park Rd & S. Stonestreet	AM	0.78	C	1.05	F
	PM	0.61	B	1.01	F
MD 355 & Church St & Monroe Pl	AM	0.88	D	1.07	F
	PM	0.81	D	1.03	F
MD 355 & W. Jefferson & MD 28	AM	1.18	F	1.34	F
	PM	1.22	F	1.41	F
MD 28 & First St (MD 585)	AM	1.06	F	1.23	F
	PM	1.29	F	1.47	F

Figure A5-1. Trip Generation Results for Revised Preliminary Development Program



TRAFFIC ANALYSIS

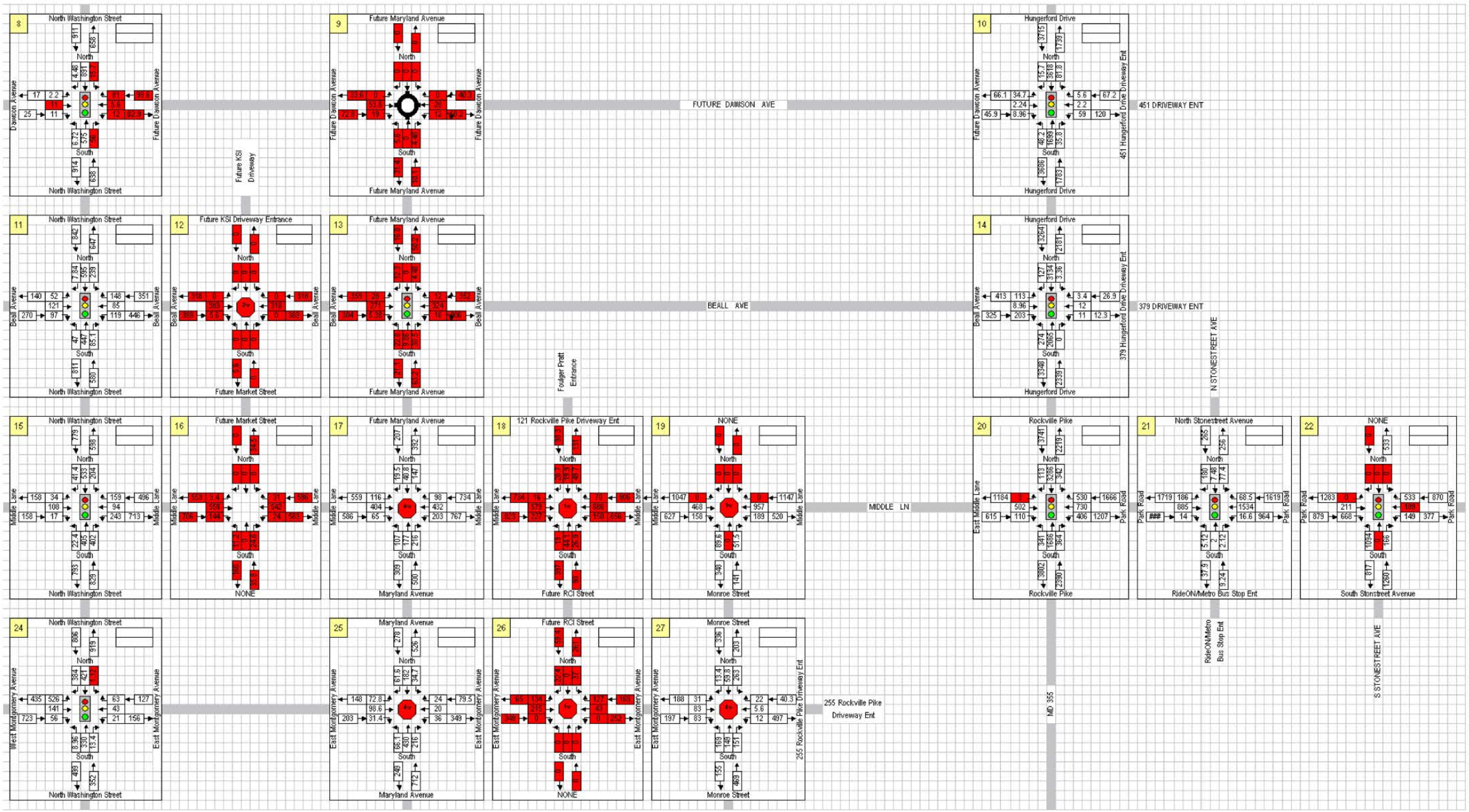
Figure A5-2. Trip Distribution and Traffic Assignment Results for Revised Preliminary Program



TRAFFIC ANALYSIS

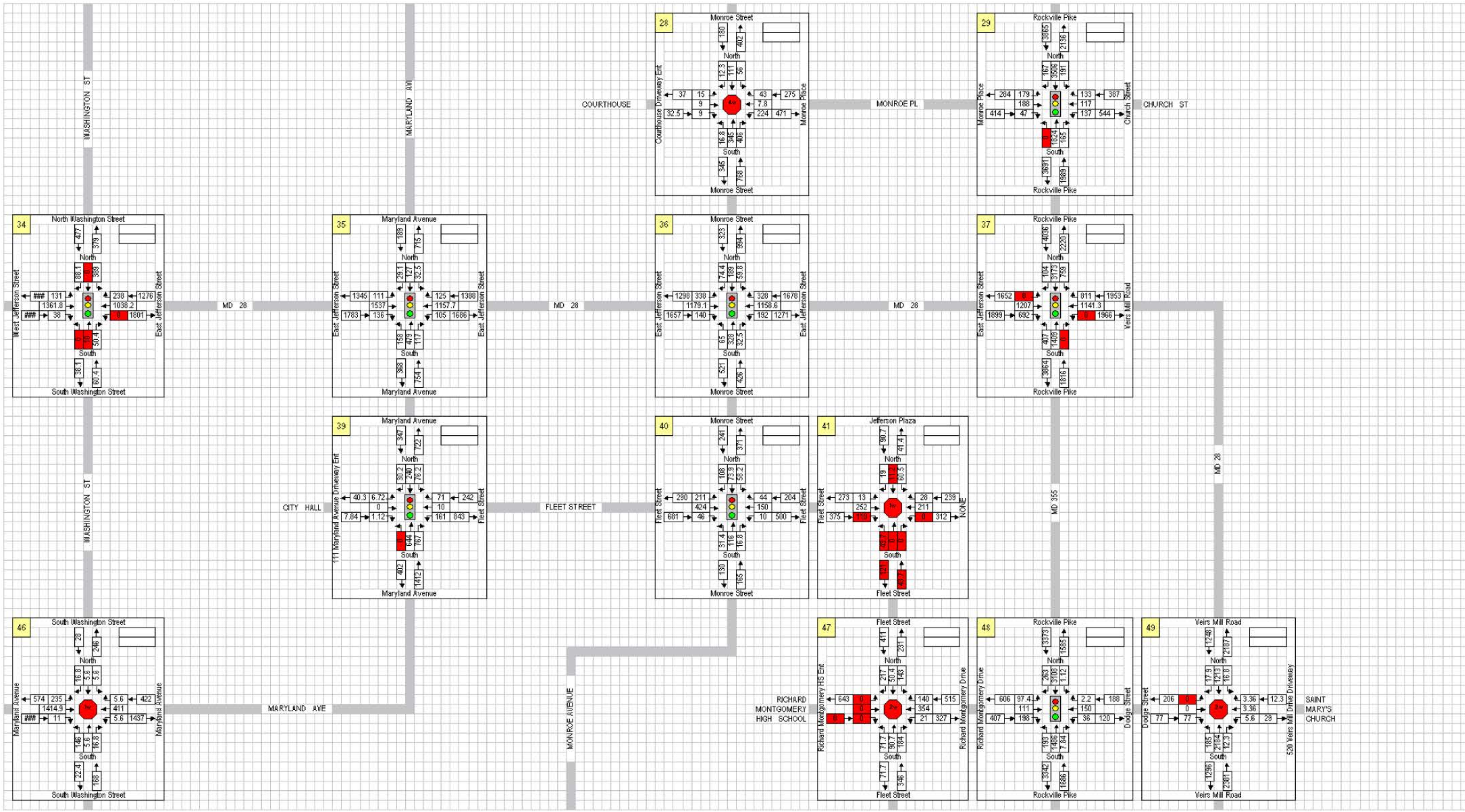
Figure A5-3. 2010 Traffic Volumes for Revised Preliminary Program

AM Peak Hour

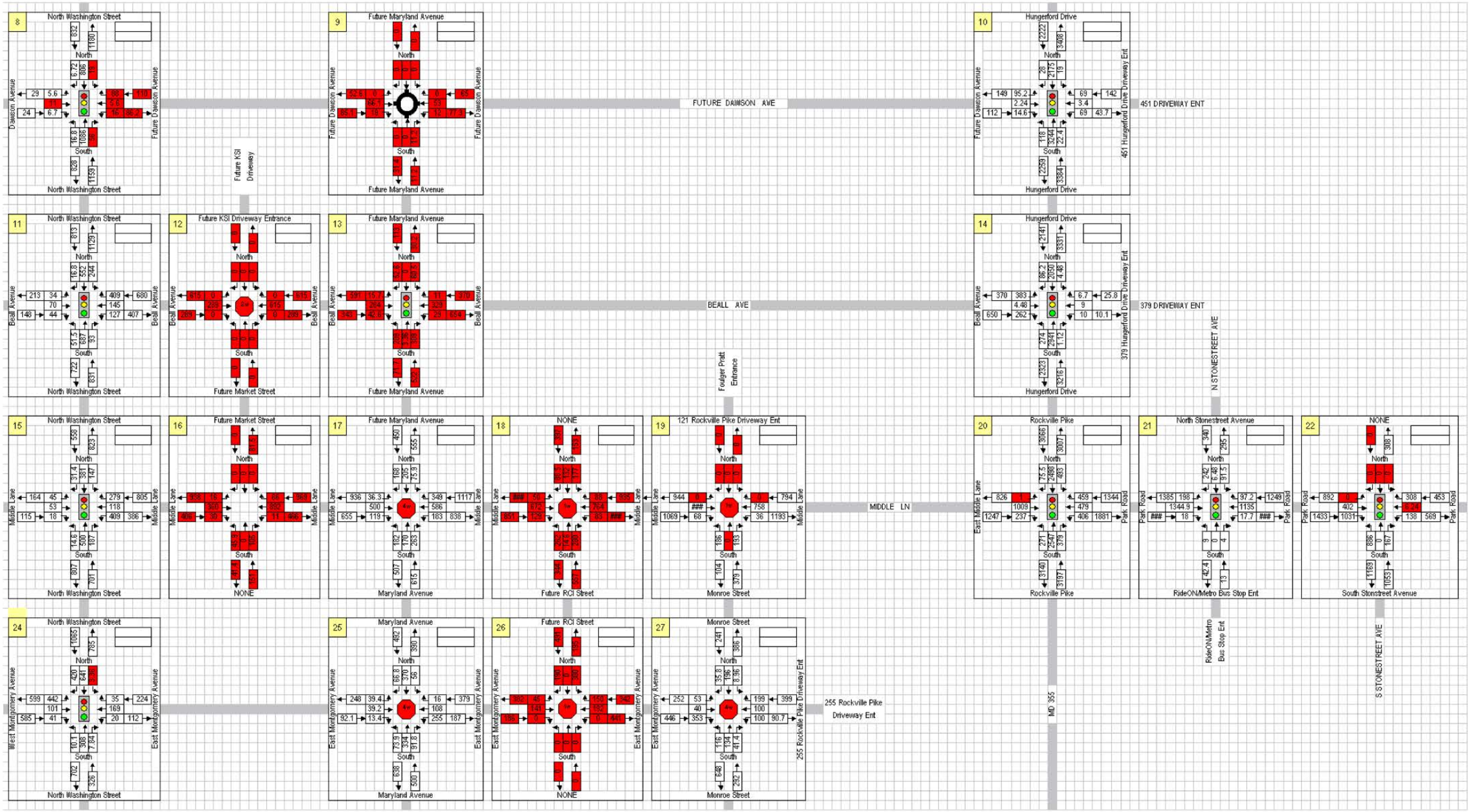


TRAFFIC ANALYSIS

AM Peak Hour

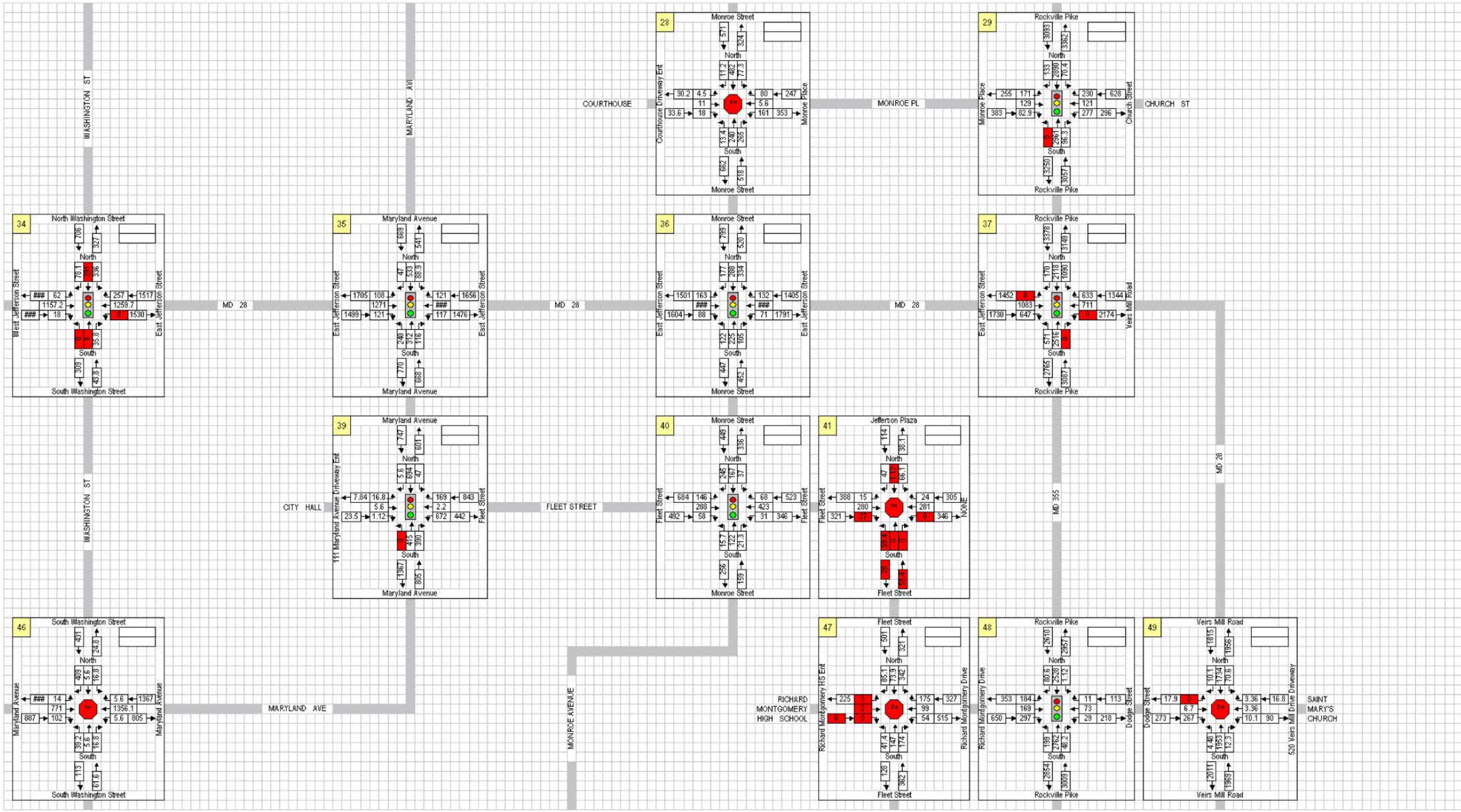


PM Peak Hour



FUTURE DAWSON AVE
451 DRIVEWAY ENT
Future KSI Driveway
BEALL AVE
379 DRIVEWAY ENT
Foulger Pratt Entrance
N STONESTREET AVE
MIDDLE LN
255 Rockville Pike Driveway Ent
RideON/Metro Bus Stop Ent
MD 355
S STONESTREET AVE

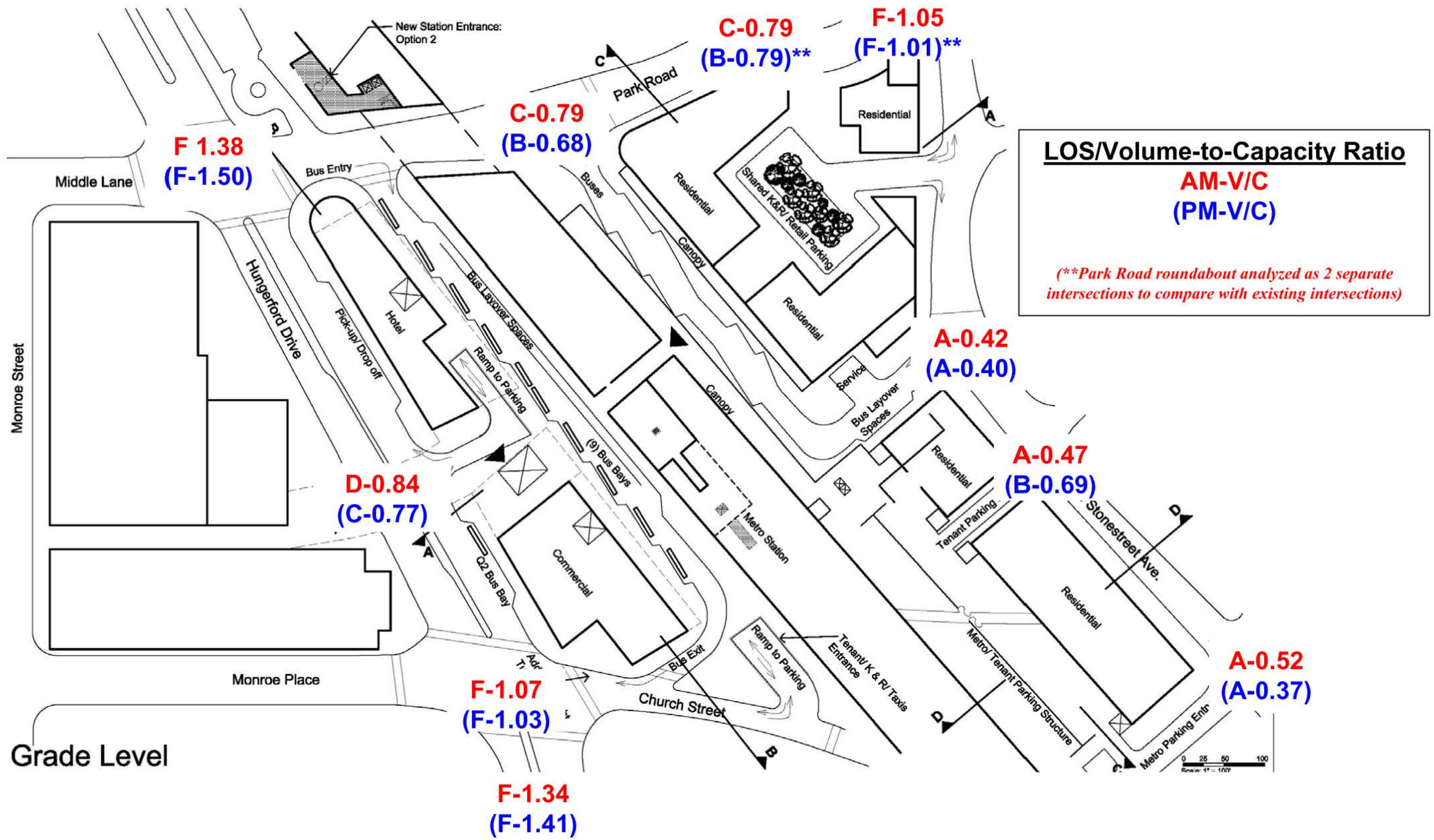
PM Peak Hour



WASHINGTON ST
MARYLAND AVE
COURTHOUSE
MONROE PL
CHURCH ST
MD 28
CITY HALL
FLEET STREET
MD 355
MARYLAND AVE
MONROE AVENUE
RICHARD MONTGOMERY HIGH SCHOOL
SAINT MARY'S CHURCH

TRAFFIC ANALYSIS

Figure A5-4. Critical Lane Volume Analysis Results for Revised Preliminary Program



MINNESOTA AVENUE METRORAIL STATION ACCESS IMPROVEMENT STUDY

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
DEPARTMENT OF PLANNING AND INFORMATION TECHNOLOGY
OFFICE OF BUSINESS PLANNING AND PROJECT DEVELOPMENT

FINAL REPORT
JANUARY 2006

Contents

Tables

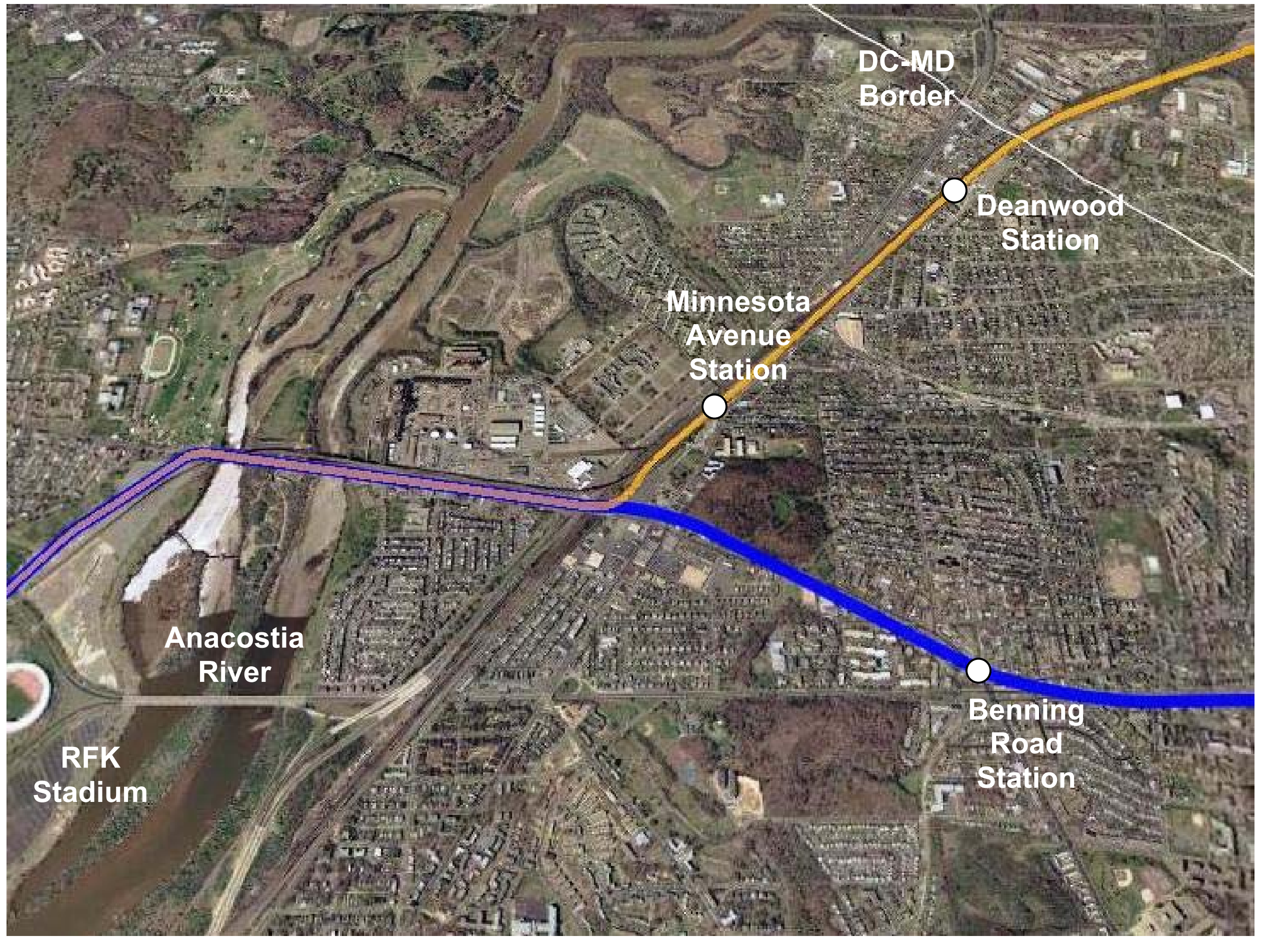
Figures

INTRODUCTION

Background

The Minnesota Avenue Metrorail station is located just east of the Anacostia River in Ward 7. The station was one of five stations that opened on November 20, 1978 when the Metrorail Orange Line was extended to New Carrollton. These included two stations in the District of Columbia, Minnesota Avenue, and Deanwood, and three stations in Prince George's County, Cheverly, Landover, and New Carrollton. The Minnesota Avenue station serves Orange Line trains on the Metrorail system operated by the Washington Metropolitan Area Transit Authority (WMATA). The station provides a vital link to local and regional destinations for residents in the station area. Figure 1 is an aerial photograph of the station area.

Figure 1: Aerial View of Minnesota Avenue Station and Anacostia River



Source: Google Earth

Steady growth in the region, particularly around Metrorail stations, has generated increased transit ridership, but has also led to more vehicle traffic in station areas. As a result, the different modes of access often come into conflict in station areas. WMATA and local jurisdictional planners have recognized that many existing Metrorail stations designed thirty years ago, such as the Minnesota Avenue station, need a new assessment to determine if existing site conditions for pedestrian access, bus operations, and vehicular traffic are adequate to meet existing capacity and future demand.

Study Purpose

Improving access to and from Metro is critical to meeting ridership goals and serving customer needs. Potential riders may also be lost if access constraints mean that the door-to-door journey involving Metro becomes more time consuming, unreliable or frustrating than an alternative means of travel, such as driving. Ultimately, the goal of improving station access is to attract additional customers by: enhancing the pedestrian experience with a safer and more attractive walking environment; maintaining a good level of service for transit access to the site, which includes buses and other transit vehicles; accommodating future access needs, which include vehicular traffic growth; and making transit use more convenient and attractive as a travel mode.

This study will provide the District Department of Transportation (DDOT) and the District Office of Planning (DCOP) with a baseline for their transportation and development projects in the Minnesota Avenue station area and identify WMATA operational needs before any District project goes forward. The purpose of the study is to provide conceptual planning and engineering solutions for multi-model site access improvements at the Minnesota Avenue Metrorail Station. More specifically, this study will:

- Identify access deficiencies and conflicts between modes of arrival at the station.
- Analyze traffic studies in the station area.
- Develop design alternatives demonstrating improvements for pedestrians, bicycles, and vehicular traffic accessing the station.
- Develop inter-modal traffic improvements and recommend improvements for traffic operational problems on adjacent streets and intersections.
- Accommodate future growth and maximize the convenience and level of service at the Metrorail station.

Planning Context

The study is being coordinated with other District transportation projects, plans, and developments in the station vicinity. Improving access to the Minnesota Avenue Metrorail Station is consistent with other District planning efforts and initiatives. The station is located within the Anacostia Waterfront Initiative (AWI) region. The Anacostia Waterfront Initiative envisions an energized waterfront that will unify diverse areas with one of the city's greatest natural assets, the Anacostia River. The Initiative seeks to revitalize neighborhoods, enhance and protect parks, improve water quality and increase access to waterfront destinations. Minnesota Avenue is also one of the streets designated for improvements in the first round of the District's *Great Streets* program.

Improving access to the Minnesota Avenue station's Metrorail and Metrobus services will also support the creation of a more inclusive city by helping individuals and families in the station area have better access to jobs, schools, or other destinations, and build better ties to the region. Improvements at the Minnesota Avenue Metrorail station can also:

- Target investment in the local community.
- Strengthen neighborhood identity by improving a vital transportation link and public space.
- Help transform the Minnesota Avenue and Kenilworth Avenue corridors by improving the streetscape and pedestrian environment in the station area.
- Guide growth by enhancing transit access to nearby planned developments.

Relationship to Other Transportation Studies

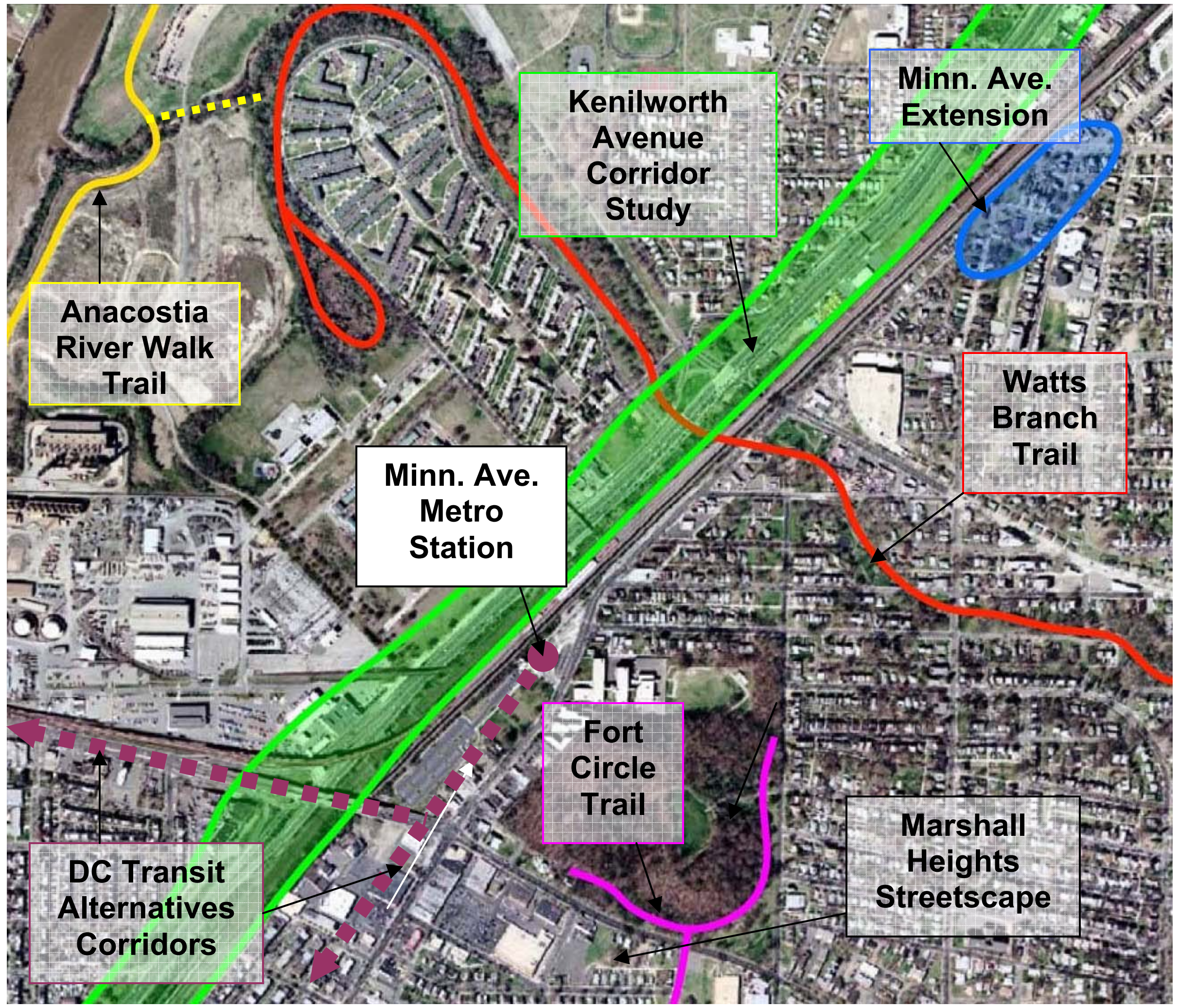
Several other transportation projects and master plans near the Minnesota Avenue Metrorail Station could affect station access. These other studies or projects include the DC Transit Alternatives Analysis (DCAA), Kenilworth Avenue Corridor Study (KACS), the Minnesota Avenue Extension, the Anacostia Riverwalk, the Marshall Heights Streetscape Project, and the Watts Branch Trail Rehabilitation. Figure 2 identifies the location of these other studies. Land use development projects in the station area, such as the Government Center project, are discussed later.

The DC Transit Alternatives Analysis identified three potential transit corridors with connections to the Minnesota Avenue Metrorail station. One of the corridors would create a new streetcar line on Minnesota Avenue from the Anacostia Metrorail station to the Minnesota Avenue Metrorail station. The introduction of new transit lines or modes, such as streetcars, will affect access to the station

The KACS is a major component of the Anacostia Waterfront Initiative (AWI). Design features of the existing roadway need to be improved, repaired, or redesigned to support the current and future needs of the area. Kenilworth Avenue is located adjacent to the Metrorail Orange line in the station vicinity. The study is proposing to rehabilitate the current pedestrian bridge over Kenilworth Avenue that connects to the station. The rehabilitation would improve the visibility and environment of the bridge by relocating the large sign on the side of the bridge, provide additional lighting, and cover the walkway with a canopy, among other things.

The Minnesota Avenue Extension would extend Minnesota Avenue to provide a connection of Minnesota Avenue between Sheriff Road and Meade Street. The proposed extension is located northeast of the Minnesota Avenue Metrorail station and would consist of the construction of a new four-lane roadway and associated intersection improvements, upgrading and installing traffic control measures, modifying or constructing drainage facilities, and adding pedestrian facilities. Providing the connection could improve bus, pedestrian, and vehicular access to the station.

FIGURE 2: OTHER TRANSPORTATION STUDIES



The Anacostia Riverwalk project consists of the creation of a multiuse trail and connecting points that travel along the east side of the Anacostia River from the Washington Navy Yard to Benning Road, and on the west side of the Anacostia River from the Anacostia Naval Station to the Bladensburg trail in Prince George's County, Maryland. A portion of the proposed trail would be located approximately one half mile northwest of the station near the Anacostia River.

The Marshall Heights Streetscape Project includes the improvement of commercial façades along Minnesota Avenue and Benning Road. Activities included repair and replacement of storefront windows and doors, installation of uniform signage, lighting, painting, and creation of a cohesive appearance.

The Watts Branch Trail was constructed in 1978 by the DC Department of Parks and Recreation (DPR). The Trail is 1.9 miles long and functions as a neighborhood circulation path. The Trail has suffered from illegal dumping and has gaps that require bicyclists to transition to the street traffic and/or sidewalk with no signage or pavement markings to indicate the continuation of the trail corridor. The rehabilitation effort will improve trail conditions and connectivity to the neighborhood and station.

EXISTING CONDITIONS

The study team conducted site assessments, analyzed traffic and collision data provided by DDOT, identified bus routes and pedestrian flows, reviewed ridership data for both Metrorail and Metrobus, and counted pedestrian traffic to help identify existing deficiencies and conflicts between modes of access at the station. The Washington Regional Network for Livable Communities (WRN) also provided information on existing access problems, including a pedestrian survey of local residents.

FIGURE 3: PEDESTRIANS CROSSING MINNESOTA AVENUE (*LACK OF CROSSWALKS CREATES UNSAFE PEDESTRIAN AND TRAFFIC CONDITIONS)*

Transit Ridership

Table 1 lists the existing modes of access for Metrorail boardings at the Minnesota Avenue Station for the AM peak, AM off peak, PM peak, PM off peak, and daily total. The most common mode of access to Metrorail is walking. Metrobus provides the second most boardings to Metrorail. The volume of bus boardings at the station is more than twice that of rail boardings and actually exceeds the number of rail boardings at Deanwood, Eisenhower Avenue, Cheverly, and Morgan Boulevard stations combined. The station has approximately 6,400 weekday bus boardings, the fourth largest volume of bus boardings in the Metro system behind 1) Silver Spring, 2) Pentagon, and 3) Anacostia. The X2 route has approximately 1,900 daily boardings at the station. The X2 has three of the top 20 highest transfer volume pairs with other routes at this station. There are also 3,088 bus boardings at the nearby Minn. Ave./Benning Rd. Intersection. The high volume of bus service and bus-to-bus transfers creates more potential pedestrian/vehicle conflicts.

TABLE 1: EXISTING MODES OF ACCESS TO METRORAIL

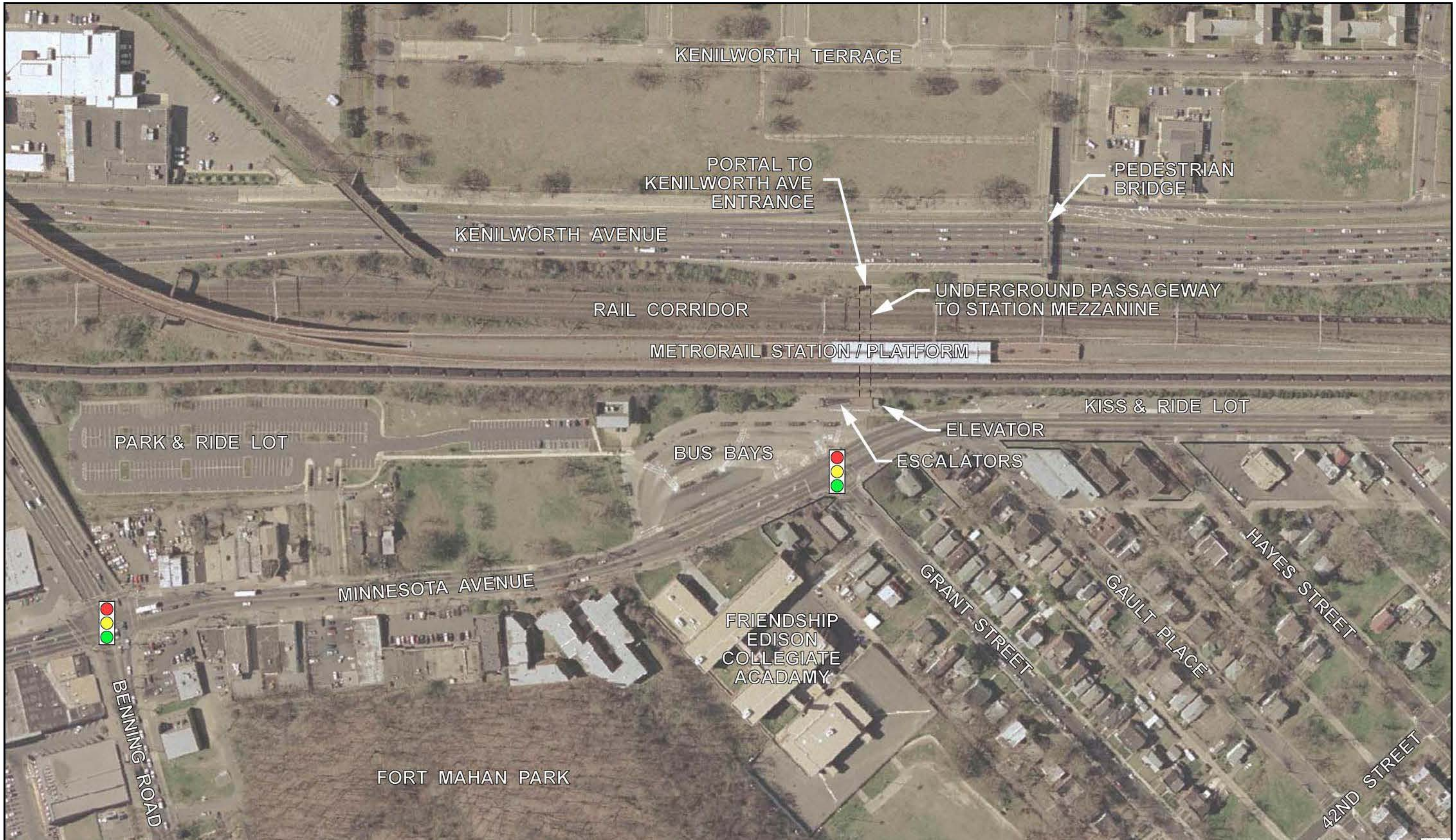
Mode of Access	AM Peak		AM Off Peak		PM Peak		PM Off Peak		Daily	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Walk or bicycle	378	25%	205	34%	321	50%	138	63%	1,042	35%
Bus	501	33%	217	36%	161	25%	55	25%	934	31%
Dropped off	88	6%	60	10%	96	15%	28	12.5%	272	9%
Drove and parked	527	35%	121	20%	64	10%	0	0%	712	24%
Total	**1,511**	**100%**	**604**	**100%**	**642**	**100%**	**220**	**100%**	**2,977**	**100%**

Source: 2002 Metrorail Passenger Survey, WMATA. Note: Percentages may not add up to 100% due to rounding.

Transportation Facilities

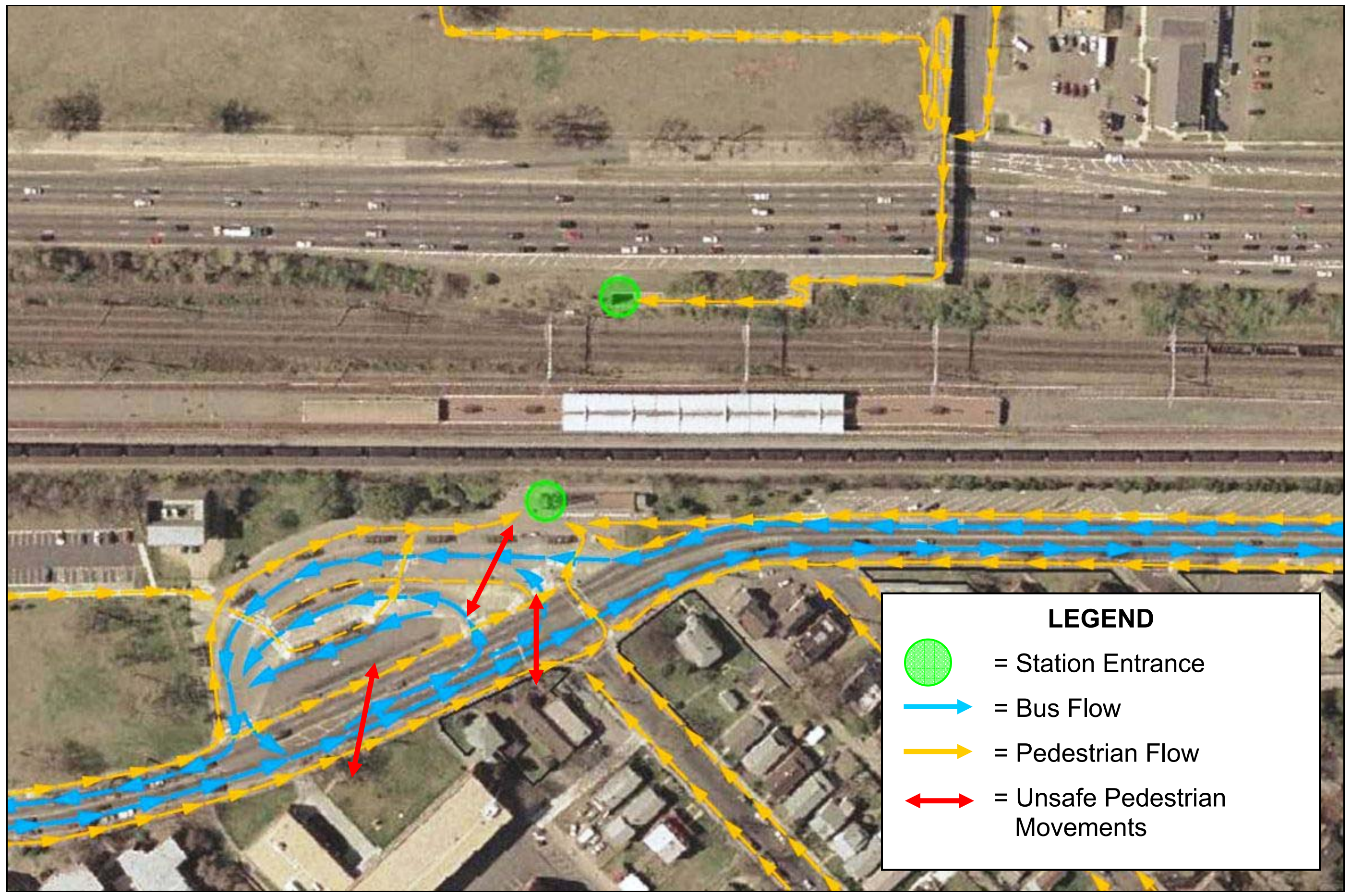
The Metrorail Orange Line runs between Kenilworth Avenue, a CSX rail corridor, and Minnesota Avenue in the station vicinity. Kenilworth Avenue is a six-lane major arterial providing a link between Interstate 395 (I-395), Interstate 295 (I-295), and the Baltimore-Washington Parkway. Access from Kenilworth Avenue is an indirect route via Nannie Helen-Burroughs Avenue and Minnesota Avenue. Minnesota Avenue is a four-lane arterial roadway, which provides bus and vehicle access to the station's site facilities. A pedestrian bridge across Kenilworth Avenue that connects to a tunnel below the CSX rail corridor is the only means of pedestrian access from the northwest side of station. The existing pedestrian bridge and tunnel open 24 hours a day. Figure 4 is a map of the station area and WMATA facilities. Existing bus and pedestrian routes, which includes sidewalks and marked crosswalks, to the station are illustrated in Figure 5.

FIGURE 4: MINNESOTA AVENUE STATION AREA AND FACILITIES



The Minnesota Avenue Station originally opened with six bus bays and eighteen Kiss & Ride stalls. The Kiss & Ride stalls were later converted to bus facilities to accommodate additional bus service. Kiss & Ride spaces are now located along a narrow strip of land northeast of the station entrance.

FIGURE 5: BUS AND PEDESTRIAN ROUTES

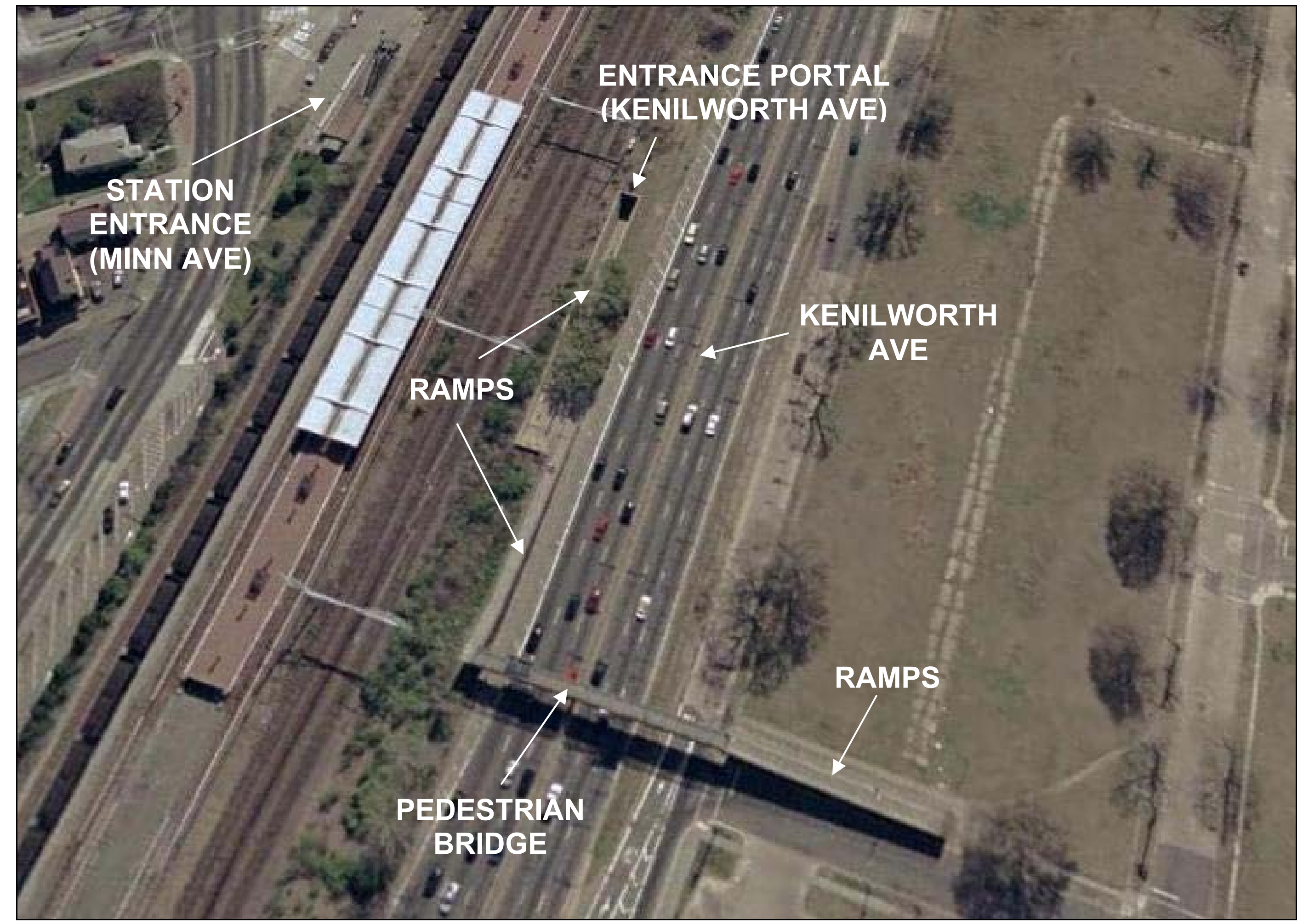


Pedestrian and Bicycle Access

Pedestrian and bicycle access is the largest source of Metrorail ridership at the Minnesota Avenue station. Current WMATA guidelines and standards for station facilities require priority access to all pedestrians in station site planning. Previous station planning efforts did not always provide priority access for pedestrians. At many existing stations, similar to the Minnesota Avenue station, pedestrians traveling on the station site must cross bus bays, parking lots, and vehicular lanes, to reach the station entrance.

Pedestrians can access the station from either direction along Minnesota Avenue or by using the pedestrian bridge over Kenilworth Avenue. The pedestrian bridge crosses over Kenilworth Avenue and ramps down to a passageway tunnel underneath the Metro and CSX rail corridor to the station mezzanine and to the bus facility located on Minnesota Avenue. Pedestrian counts taken within the station indicated that approximately half of the pedestrians used the tunnel to access Metrorail, with the other half continuing through to the bus facility or neighborhood.

FIGURE 6: AERIAL VIEW OF PEDESTRIAN BRIDGE

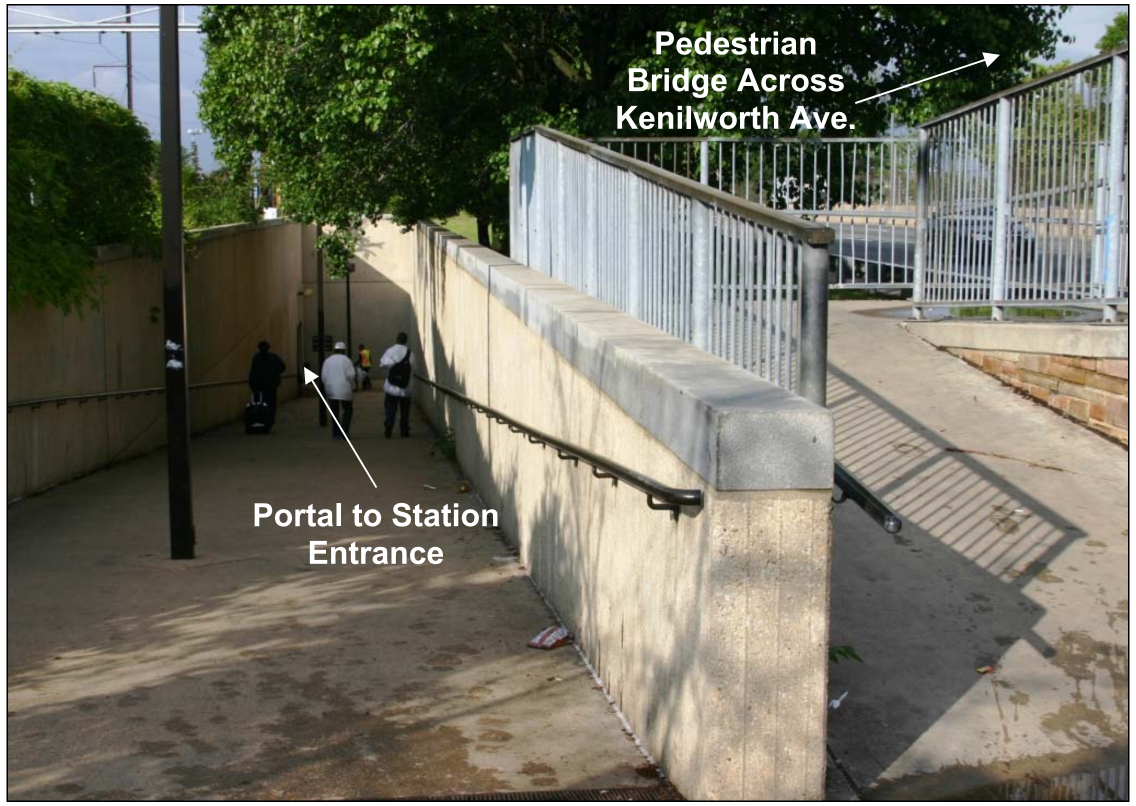


Source: Google Earth

The layout of the pedestrian bridge and ramps is indirect and extends the actual walking distance by approximately 250 feet, measured along the actual travel path. The indirect path and long ramps are especially problematic for persons with disabilities or mobility impairments. The layout of the ramps also creates several “blind corners” for potential hiding places. In the WRN pedestrian survey, many people indicated that they avoid using the bridge due to security concerns, particularly at night. The ramp leading down to the tunnel creates a “canyon” effect (Figures 6 and 7) and is not easily visible from other areas of the site. The existing bridge and ramps also have recurring maintenance problems including vandalism, snow removal, and standing water.

The Minnesota Avenue entrance consists of two escalators and one street elevator. The escalator way does not currently have a canopy to provide weather protection. The street elevator is located away from major pedestrian activity and existing evergreen vegetation surrounding the elevator impedes visibility, which may make the area feel less safe and secure for patrons.

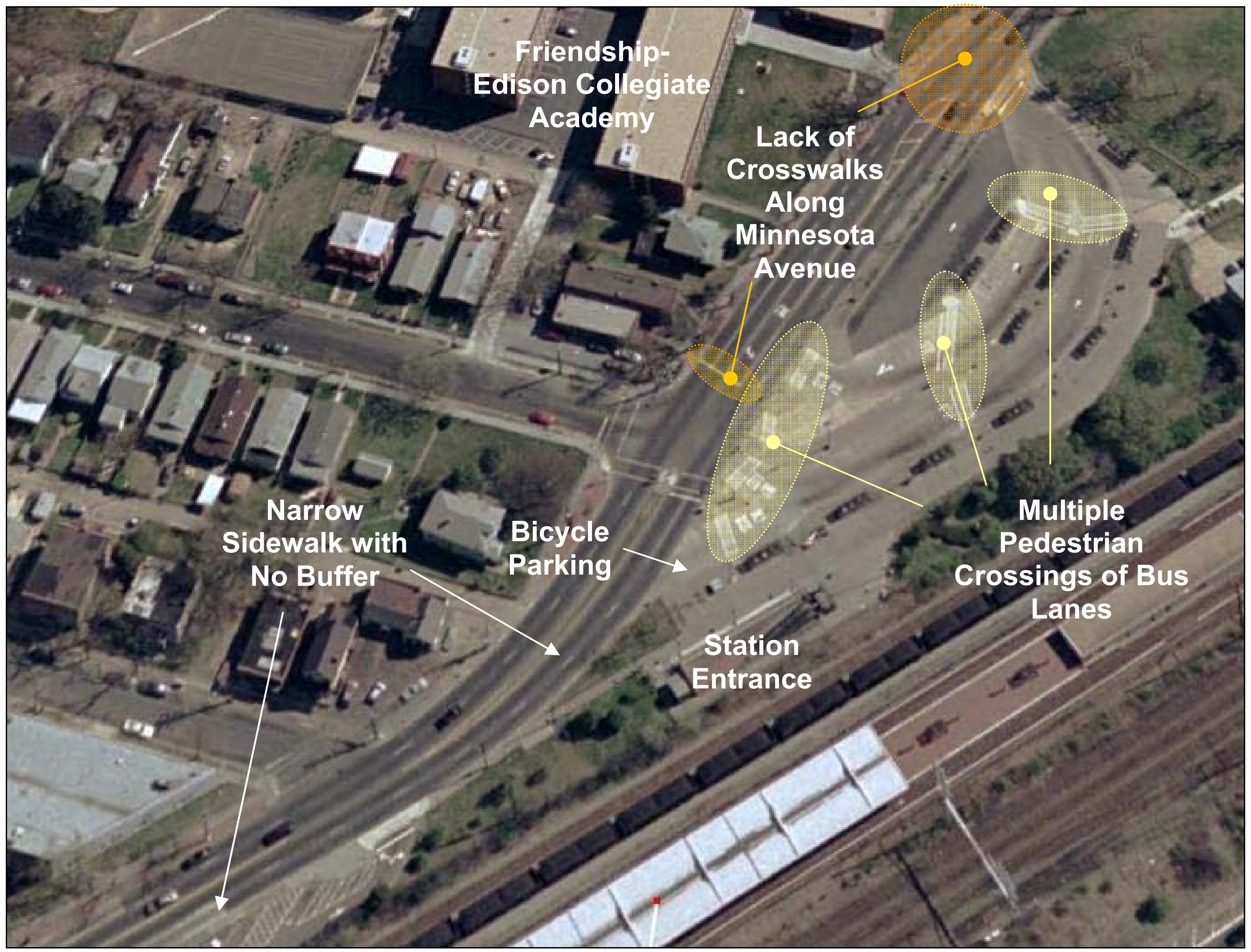
FIGURE 7: RAMPS FROM PEDESTRIAN BRIDGE TO TUNNEL



Pedestrian deficiencies on the Minnesota Avenue side of the station include a lack of crosswalks across Minnesota Avenue in the station area. The Minnesota Avenue/Grant Street intersection has crosswalks on each leg, except the south leg. Students from the Friendship-Edison Collegiate Academy, which is located on Minnesota Avenue across from the station, often cross bus lanes and Minnesota Avenue at unmarked locations because the existing crosswalks and pathways to the station are indirect.

The sidewalk on the station side along Minnesota Avenue is narrow with no landscaped buffer between pedestrians and the street. There are also four curb cuts along the sidewalk in front of the bus facility, however one curb cut is closed to vehicles. Exclusive bicycle lanes are not marked on any streets in the study area. Bicyclists can ride in the curb lane on these streets; however, bicycling on Minnesota Avenue or Benning Road is hazardous because of the high speed and volume of traffic. Bicycle racks and lockers at the station are not typically used. Only one of the four lockers is currently rented and no bicycles were parked in the bicycle rack during the site visits. This may be due to poor bicycle access to the site or concerns about vandalism and theft. Grant Street does provide access to the Watts Branch Trail, although not marked.

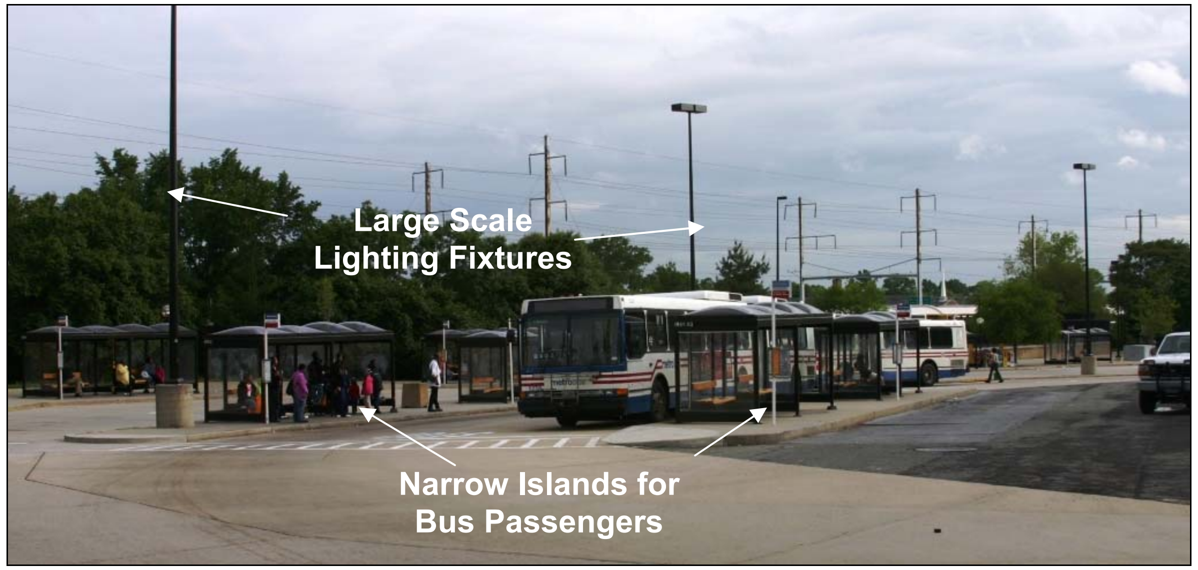
FIGURE 8: PEDESTRIAN ACCESS FROM MINNESOTA AVENUE



Source: Google Earth

In general, the station area lacks pedestrian amenities and landscaping, which creates a utilitarian and unwelcoming environment. There is no sense of arrival for station customers and the existing site layout does not provide a logical direction of pedestrian flow. The area lacks signage for pedestrians directing them from the station to the Kiss & Ride, bus bays, or to local points of interest. As illustrated in Figure 9, light fixtures in the bus facility vary in style and height, with many designed for larger parking areas rather than for pedestrian waiting areas. The bus facility also needs more seating both within bus shelters and near the station entrance. The sidewalk along the Kiss & Ride area is narrow with no buffer between the pedestrian pathway and Minnesota Avenue.

FIGURE 9: VIEW OF BUS FACILITY



Transit Access

Metrobus services provide the only current means of connecting transit service to the Minnesota Avenue station. Seven bus lines, consisting of 11 routes, access the station. Bus lines and routes with stops at the Minnesota Avenue Station are listed in Table 2. Four of the bus lines (Sheriff Road-River Terrace Line, Mayfair-Marshall Heights Line, Capitol Heights-Benning Heights Line, and Minnesota Ave-M Street Line) have northbound and southbound stops at the station.

TABLE 2: BUS LINES AND ROUTES WITH STOPS AT THE STATION

Bus Line and (Route)	Bus Stop Type (and Direction)at Minnesota Ave.
Minnesota Avenue-Anacostia Line (U2)	Start/Terminus(SB)
Sheriff Road-River Terrace Line (U4)	Start/Terminus (NB), Through (SB)
Mayfair-Marshall Heights Line (U5,6)	Start/Terminus (NB), Through (SB)
Capitol Hts-Benning Hts Line(U8)	Start//Terminus (NB), Through (SB)
Minnesota Ave-M Street Line (V7,8,9)	Through (NB), Through (SB)
Benning Road-Potomac Park Line (X1,3)	Start/Terminus (SB)
Benning Road-H Street Line (X2)	Start (SB)

Note: Southbound includes westbound routes and northbound includes eastbound routes.

The bus facility off Minnesota Avenue has eleven bays with ten bays currently in use. There are no on-street bus stops. There are two entrances to the bus facility, all located near the Minnesota Ave./Grant Street intersection and only one exit. Buses travel through the facility on one of three bus lanes and exit to Minnesota Avenue at one location at the southeast end of the site. Layover space is available for buses, but is not convenient, since they cannot re-circulate within the facility. The interior bus bay platforms are located on narrow islands in the center of the facility, which require pedestrians to cross bus lanes at several locations. The widths of these bus platforms do no meet current WMATA design guidelines.

Kiss- & Ride Access

The existing Kiss & Ride facility is located northeast of the station along a strip of land and provides 20 short-term parking spaces. The narrow site does not allow vehicles to re-circulate within the facility, nor does it provide good visibility to the station entrance from waiting vehicles. From site observations, passenger pick-up and drop-off activity was infrequent at the Kiss & Ride area, but was more common at other areas of the site. Cars often wait along Minnesota Avenue during the peak PM period, impeding traffic operations. Some vehicles entered the bus bay area to drop-off/ pick-up passengers, even though the area is designated as bus only. The existing Kiss & Ride parking spaces are predominately occupied by non-transit users with numerous expired meter violations noted.

FIGURE 10: KISS & RIDE FACILITY

Source: Google Earth

FIGURE 11: PASSENGER PICK-UP/DROP-OFFS ON MINNESOTA AVENUE

Park & Ride Access

The existing Park & Ride lot is located south of the station along the Minnesota Avenue corridor. The only access road to the Park & Ride lot is via an unsignalized intersection from Minnesota Avenue located between Benning Road and Grant Street. The lot contains 333 parking spaces. A new parking structure will be constructed in conjunction with the Government Centers development that will maintain approximately the same amount of parking for transit customers. The new parking structure will be constructed on the portion of the existing lot located closest to the station entrance, which will improve access for Metrorail passengers who drive and park at the station. The access road for the Government Center site will provide access to the structure in a configuration similar to the existing access.

GROWTH FORECASTS AND FUTURE PROJECTS

Ridership Projections

Future Metrorail trips for each mode of access were identified by applying the forecasted mode-by-mode growth rates from the Dulles Rapid Transit Project study to the mode share data in the 2002 WMATA Passenger Survey, as presented in Table 1. The results are shown in Table 3. Ridership and mode share forecast will likely be revised after WMATA completes the Station Inventory and Ridership Forecasts program later this fiscal year. According to the current forecast, walking trips and bus trips provide the largest sources of Metrorail ridership. Planned developments, such as the Government Center and Parkside could significantly increase the number of walking trips to and from the station. These developments are discussed in the next section.

TABLE 3: 2025 FORECAST MODES OF ACCESS AT MINNESOTA AVENUE STATION

Mode of Access	AM Peak		AM Off Peak		PM Peak		PM Off Peak		Daily	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Walk or bicycle	605	25%	306	34%	450	50%	182	63%	1,582	35%
Bus	847	35%	324	36%	225	25%	73	25%	1,401	31%
Dropped off	145	6%	90	10%	135	15%	35	12%	452	10%
Drove and parked	822	34%	180	20%	90	10%	-	0%	1,085	24%
Total	**2,420**	**100%**	**900**	**100%**	**900**	**100%**	**290**	**100%**	**4,520**	**100%**

Source: 2002 Metrorail Passenger Survey, Dulles Study projections

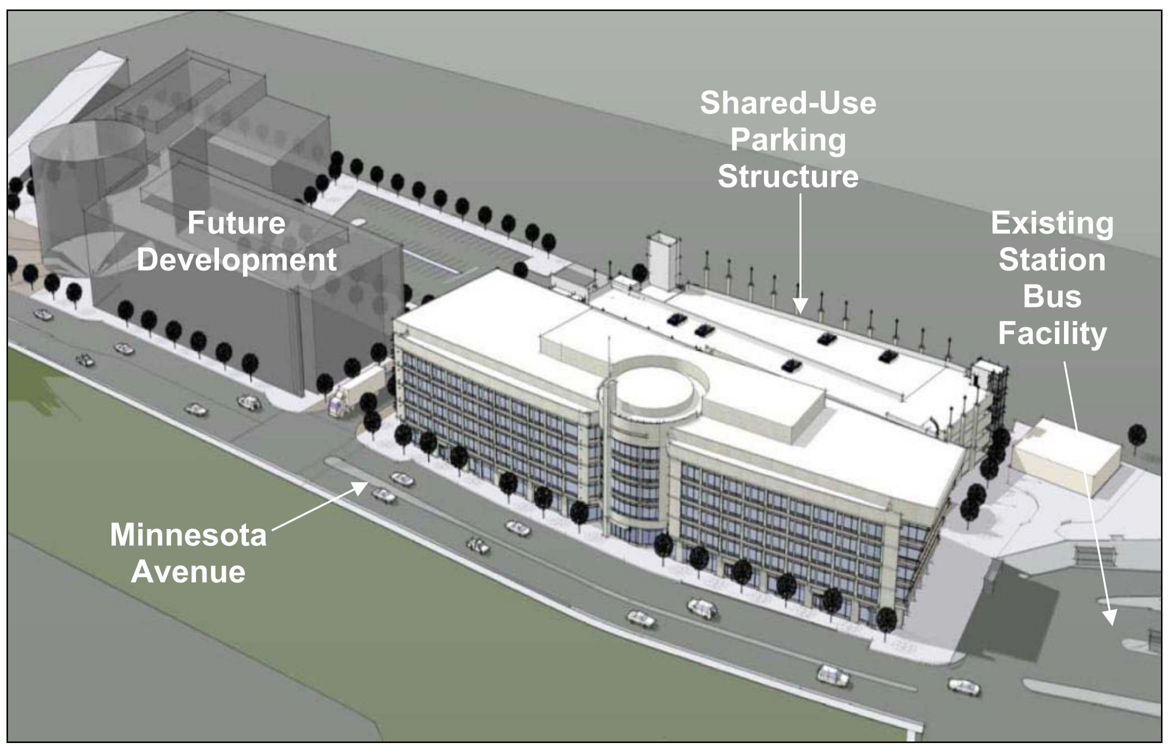
Station Area Development

Two large development projects are located in the station area. The Minnesota Avenue–Benning Road Government Centers (Government Center) and Parkside are illustrated in Figure 7. The combined area of the two development sites constitutes a significant portion of the land within the immediate station area. These two developments will significantly increase the development intensity and add create more mixed land uses within the station area.

FIGURE 12: STATION AREA DEVELOPMENT LOCATIONS

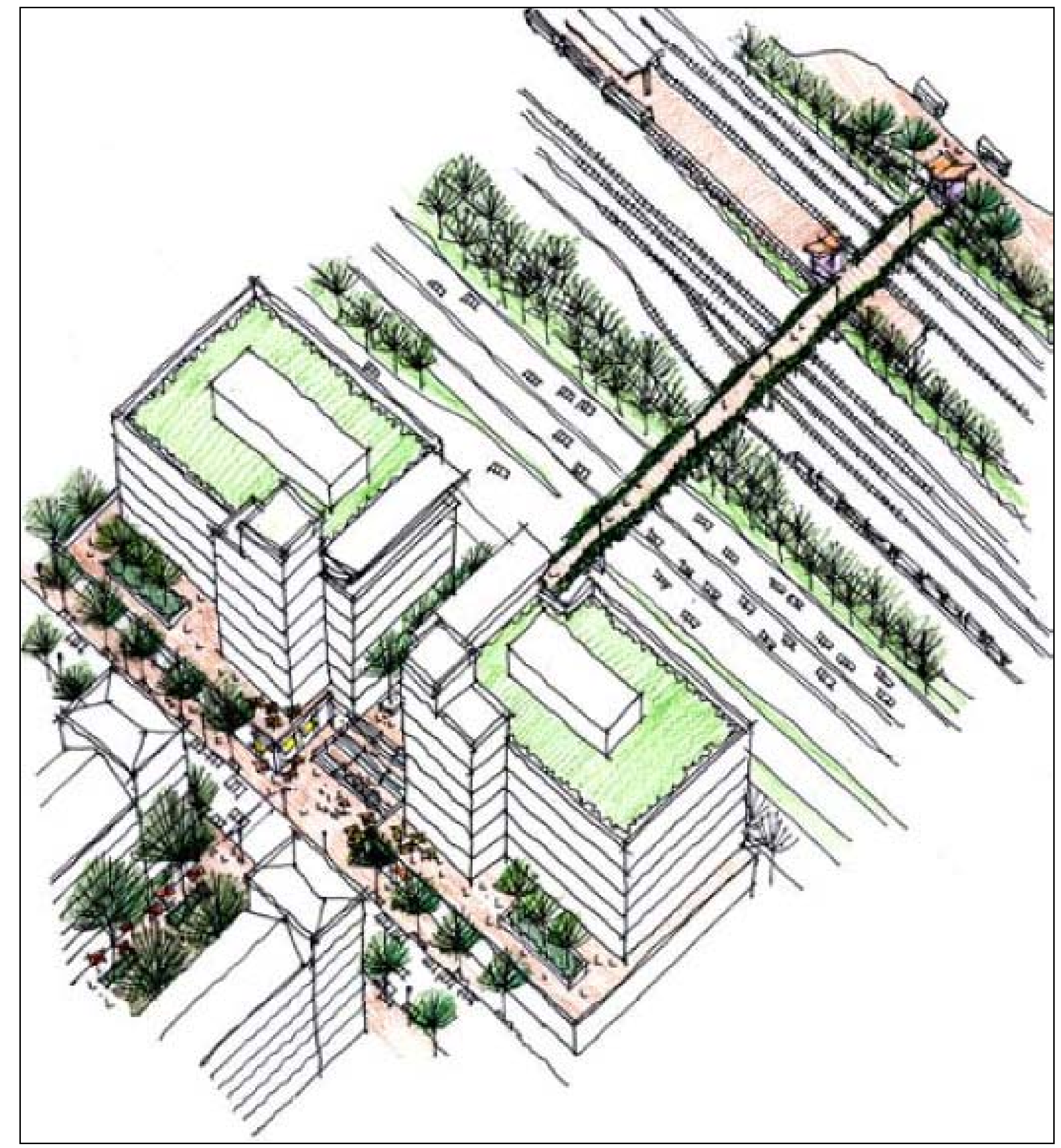
Minnesota Avenue - Benning Road Government Center. The Government Center buildings are being built to help revitalize downtown Ward 7 by relocating the District Department of Employment Services and the Department of Health Services to the area. The project site is located adjacent to the station on the northwest corner of Minnesota Avenue and Benning Road. The project will include office space, ground floor retail, and a four-story parking structure, which will include Metro parking. The existing Park & Ride lot is located on the development site. The first office building constructed will be a five-story facility with small retail establishments on the ground floor and meeting space available for community use. The other office building located closer to Benning Road will be four or five stories. The master plan also recommends adding a center turn lane on Minnesota Avenue for northbound vehicular traffic entering the site, a left-turn lane on Minnesota Avenue for southbound traffic turning east onto Benning Road, and a parking lane on the west side of the Minnesota Avenue. The new parking structure with shared office and transit use will replace the existing Park & Ride lot with construction scheduled to begin in October 2005. Both office buildings are scheduled for completion in late 2006 or early 2007.

FIGURE 13: GOVERNMENT CENTER BUILDINGS



Parkside. The Parkside area is located northwest of Kenilworth Avenue and includes several developed and undeveloped parcels, which are part of the planned Parkside development. A draft master plan of the development was prepared for use in a recent public workshop, which was attended by the community, DDOT, WMATA, and other jurisdictional and federal agencies. The current draft master plan for the site proposes adding approximately 1,500 - 2,000 residential units, 250,000 SF of office and 30,000 SF of retail uses. A key element of the development plan related to station access, involves replacing the existing pedestrian bridge across the Kenilworth Avenue with a new bridge that connects the development directly to the west station entrance, the bus facility, and the Central Northeast neighborhood along Minnesota Avenue, including the new Government Center development. The proposed bridge (see Figure 14) would be aligned with the central axis of the Parkside development. The new crossing would span the entire Kenilworth Avenue and rail corridors landing in the bus facility area and would need to be high enough to provide adequate clearance over the CSX tracks. The bridge would connect with Parkside in an area surrounded by active uses, such as retail shops, before stepping down to Kenilworth Terrace.

FIGURE 14: PARKSIDE PEDESTRIAN BRIDGE CONCEPT



Source: Draft Master Plan for Parkside (Prepared by Urban Design Associates)

ALTERNATIVES

Design Principles

Before design alternatives for station site improvements were developed, design principles or general design goals for pedestrian and bicycle facilities, transit facilities, and other passenger amenities were established in discussions with DDOT, DCOP, WRN, Parkside Developers, and WMATA. Design principles are discussed next.

Pedestrian and Bicycle Facilities

Good pedestrian access to the station entrance is essential in station site and access planning since all transit customers that are not walking to the station will ultimately become pedestrians when transferring between modes. For pedestrian pathways connecting to a station site, providing a safe and convenient walking environment with clear, un-fragmented, and integrated pedestrian paths to the station will encourage more customers to walk. The following design principles were recommended for pedestrian and bicycle facility improvements:

- Provide wide sidewalks, street trees, benches, wayfinding signage, and safe pedestrian crossings along Minnesota Avenue and across bus access points;
- Accommodate pedestrian desire-lines and provide the most direct path possible, while minimizing pedestrian crossings of bus lanes;
- Add pedestrian count-down signals and marked crosswalks to improve Minnesota Avenue crossings;
- Replace or renovate the existing pedestrian bridge across Kenilworth Avenue with a wider crossing, designed using passive and active security elements.;
- Provide wayfinding and signage to bicycle paths and trails (Anacostia Riverwalk and Watts Branch via Grant Street) and other points of interest in the station vicinity;
- Consider relocating bicycle parking within view of a station manager to provide better security, including locating bicycle racks inside the station passageway, but outside of the mezzanine.

Transit Facilities.

Transit facilities should be designed to accommodate bus access and capacity demand during the PM peak hour period–the PM peak hour period is used for planning transit facilities when transit headways are more frequent and passenger boardings are greater than during non-peak times. Vehicle dwell times and passenger queuing lines are also longer during PM periods with the greatest number of passenger boardings, when fare collection is required. The Minnesota Avenue station is a terminal station for a majority of the bus routes serving the station, thus longer dwell times are experienced when buses layover to wait for its scheduled time of boarding or departure. However, some of the through running southbound bus stops could be relocated to curbside on Minnesota Avenue. Providing on-street stops for any of the southbound through bus routes would improve bus service operations, while reducing off-street bus bay demand.

The following design principles were developed for the bus and streetcar facilities.

- Provide a more efficient layout of the off-street bus facility that has internal circulation potential, an adequate number of bus bays and layover space;
- Maintain the existing number of bus bays that are currently in use
- Provide curbside bus stops without pull-offs on Minnesota Ave.;
- Provide connections to platform for streetcar service along Minnesota Avenue and provide options for streetcar vehicle storage, since the planned routes would terminate at the station.
- Provide enhanced customer amenities at both bus and streetcar facilities including continuous platform shelters, adequate seating, windscreens, trash receptacles, and signage.

Kiss & Ride and Park & Ride Facilities

The narrow shape of the existing Kiss & Ride limits the available options for redesigning this facility. Improvement options for the Kiss & Ride facility should improve pedestrian access along Minnesota Avenue. Options for the Park & Ride facility were not considered, since a new parking structure has already been designed for Government Center development, which replaces the existing WMATA parking.

Other Design Principles

Other design principles included:

- Create a sense of arrival at the station.
- Reduce the amount of paved area and create more public space and opportunities for public art.
- Improve safety and security of transit patrons.
- Improve the appearance of the station site and generally maximize the convenience and level of service at the station.

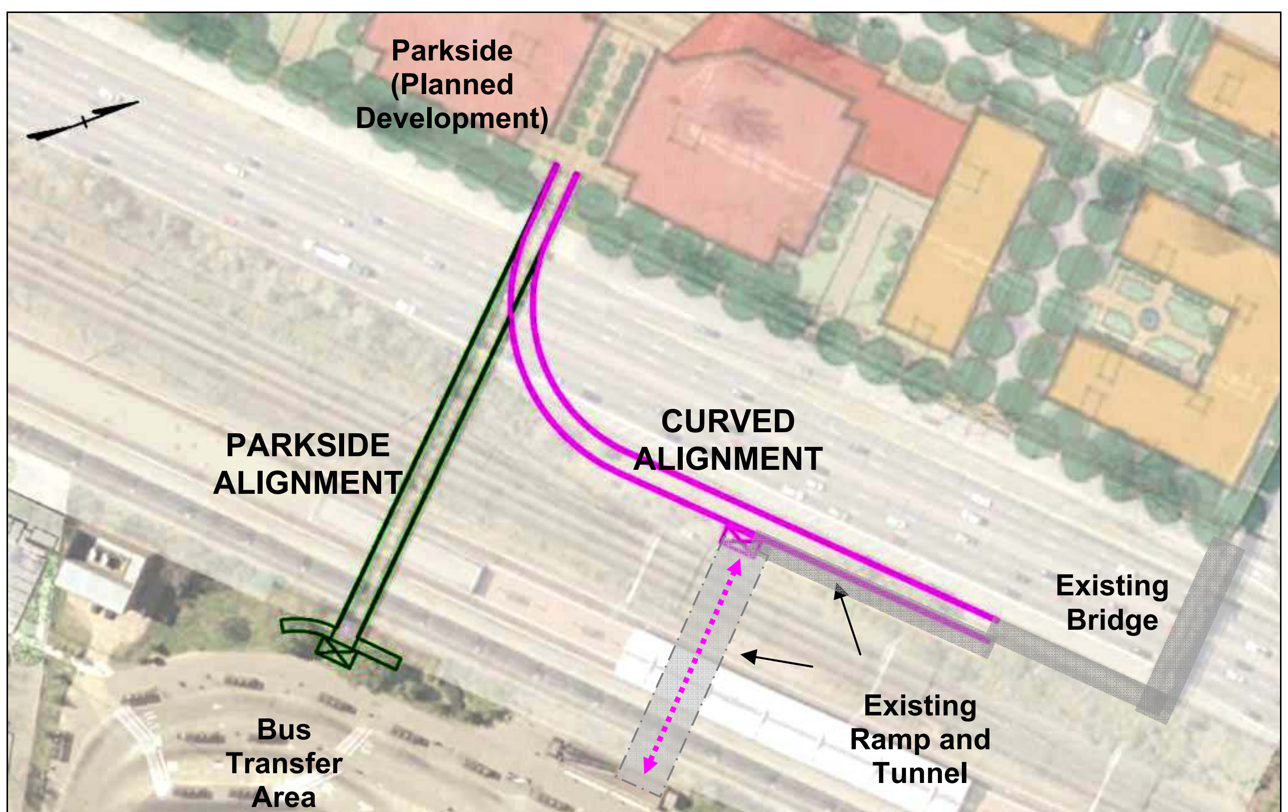
Improvement Alternatives

The improvement alternatives were developed as sketch/planning-level concepts with interchangeable elements. For instance, alternatives for the bus facility can be combined with any of the pedestrian crossing options. The improvement alternatives include two options for a new pedestrian bridge across Kenilworth Avenue, two options for the layout of the bus facility, two options for the Kiss & Ride facility, as well as recommendations for station amenities. Order of magnitude cost estimates for the alternatives are included in Table 10 at the end of the report.

<u>Pedestrian Bridge Options</u>

Two pedestrian bridge options were developed that would improve access from the Minnesota Avenue Station entrance to the north side of Kenilworth Avenue, the Parkside development, and the Anacostia Riverwalk Trail. The bridge alternatives are illustrated in Figure 15. Both alternatives connect to the same location between two office buildings into the commercial center of the Parkside development. According to the Parkside Developers, the viability of the development is contingent on a direct connection to the Metrorail station. Both bridge options should have a continuous walkway canopy due to the difficulty with snow removal operations above an operating railway and a major thoroughfare.

FIGURE 15: PEDESTRIAN BRIDGE OPTIONS



The first option, the Curved Pedestrian Bridge, would be a 15' wide covered bridge that would connect to the existing portal on the north side of the station. The structure would be curvilinear in plan, similar to the pedestrian bridge currently in use at the New Carrolton Metro station (Figure 16). This option would include two new elevators located near the passageway entrance and a ramp connecting to the existing ramp. The location of the bridge landing adjacent to and directly above the existing tunnel entrance would provide better visibility within the site than the existing bridge does.

The second option is based on the bridge design proposed in the Master Plan for the Parkside development that would consist of a 15' wide pedestrian bridge. It would be aligned with the central axis of the Parkside development for direct access to the east side of the station. The bridge would cross over Kenilworth Avenue and the rail corridors before terminating above the bus facility. Two elevators and stairways leading towards the station entrance and towards the Government Centers development would be provided. This option would improve the pedestrian connection between the Parkside development and the area along Minnesota Avenue, including the Government Center site and the bus facility. The crossing would be located entirely above grade, which would increase visibility and avoid some of the security issues associated with the use of the existing bridge, ramp, and passageway. In the long-term, this option could provide opportunities for a new station entrance connecting the bridge directly to the station platform.

FIGURE 16: CURVED PEDESTRIAN BRIDGE DESIGN AT NEW CARROLTON STATION

Bus Facility

One of the primary issues in station site planning is the need to create improvements that are consistent with WMATA Standards and Guidelines, while fitting the layout of the facility into a relatively small and irregularly shaped site. Two alternatives were developed for the bus facility. A two-way bus loop design with a center island is used for both alternatives because it was the most efficient layout that will accommodate nine bays and layover spaces within the limited area. The center island layout is the preferred design to accommodate the high number of bus-to-bus transfers. However, in order to accommodate a two-way loop design on a small site, the bus lane widths provided are operable but narrower than WMATA guidelines suggest but would still be operable. The alternatives would maintain the existing number of bus stops, provide off-street circulation for buses, and improve the pedestrian environment. The creation of additional pedestrian space near the station entrance would provide opportunities for public use and the potential for relocating bicycle parking to a more visible area outside of the main pedestrian flows. In addition, both alternatives provide a connection for a streetcar platform on Minnesota Avenue.

Alternative 1 is the single-entrance alternative and is illustrated in Figures 17-19. This alternative would provide a full two-way loop for buses with 9 off-street bus bays for passenger boarding/alighting with storage for 2 buses. For all bus bays to be accessible from the layover spaces, buses would have to park in both directions, requiring a lane crossover for buses traveling in a clockwise direction. The single entrance alternative would reduce curb cuts along Minnesota Avenue, which creates conflict with pedestrian traffic, and provide a much larger pedestrian area in front of the station entrance. This alternative would also allow the existing bus turning lane to be converted into a full-length median and pedestrian refuge island. One on-street bus stop would be located on Minnesota Avenue for southbound through routes. Options for streetcar facilities on Minnesota Avenue are illustrated in Figures 18 and 19.

Alternative 2 is the two-entrance layout and is illustrated in Figures 20-22. This alternative would provide a full one-way loop with partial two-way circulation, allowing most buses the option to re-circulate within the facility. All buses could re-circulate on street if necessary. The plan has 9 bus bays for passenger boarding/alighting with storage for 2 buses and one on-street bus stop. This alternative would also provide a much larger pedestrian area in front of the station entrance than currently exits. Options for the streetcar facilities on Minnesota Avenue are illustrated in Figures 21 and 22.

A solid wall could be constructed under either alternative, located between the bus facility and the CSX tracks to provide a visual buffer that would replace the existing chain link fence and any landscaping displaced by the improvements. The wall should be high enough to dampen track noise, but should be not be high enough to block visibility from the Metrorail platform. A wire mesh fence can be mounted to the top of the solid low wall for visibility.

Kiss & Ride Options

The narrow width of the existing Kiss & Ride area limits the available options for redesigning this facility. The first option for the Kiss & Ride facility would maintain the existing configuration with the addition of a pick-up/drop-off lane along Minnesota Ave. and improve the site lines between parked vehicles and the station entrance by altering existing landscaping. Figures 17-22 illustrate the added pick-up/drop-off lane near the station entrance for this option.

The second option could also add a pick-up/drop-off lane on Minnesota Avenue while maintaining a portion of the existing Kiss & Ride. This option would provide a convenient turnaround area for vehicles accessing the pick-up/drop-off lane, but would convert the northern section of the existing Kiss & Ride area from angled off-street parking to parallel parking along Minnesota Avenue with a wider sidewalk and improved streetscaping. This second alternative is illustrated with options for a streetcar service in Figures 23 and 24. The northern portion of the Kiss & Ride lot could be used for an off-street streetcar turnback track. The narrow shape of the Kiss & Ride facility limits its potential for other uses, but would be ideal for this use.

Recommended Station Amenities

All site amenities should be designed appropriately to match the context of the site. Improvements should include:

- Wayfinding signage should be located throughout the station and should direct customers to other places or routes near the station, such as the Government Center, local schools, Watts Branch Trail, Parkside Development, etc...;
- Create an informational and a wayfinding signage system that clearly directs and informs the pedestrians as to the Minnesota Station location, parking structure, and the different bus pick-up locations. Kiosks and real-time information on transit service and the availability of transfers should be provided;
- Relocate some bicycle parking inside the station to enhance security;
- Add an additional street elevator and platform elevator to maintain ADA accessibility when one of the elevator units is out-of-service for repairs or routine maintenance as shown on Figure 25;
- Provide canopies over the bus platform in the bus facility. Current WMATA guidelines and standards for bus facilities now require canopies over bus platforms to create parity with the amenities provided to Metrorail customers;
- Provide shelters with windscreen protection for bus customers at each stop;

(CONTINUED ON PAGE 12)

FIGURE 17: BUS FACILITY ALTERNATIVE 1

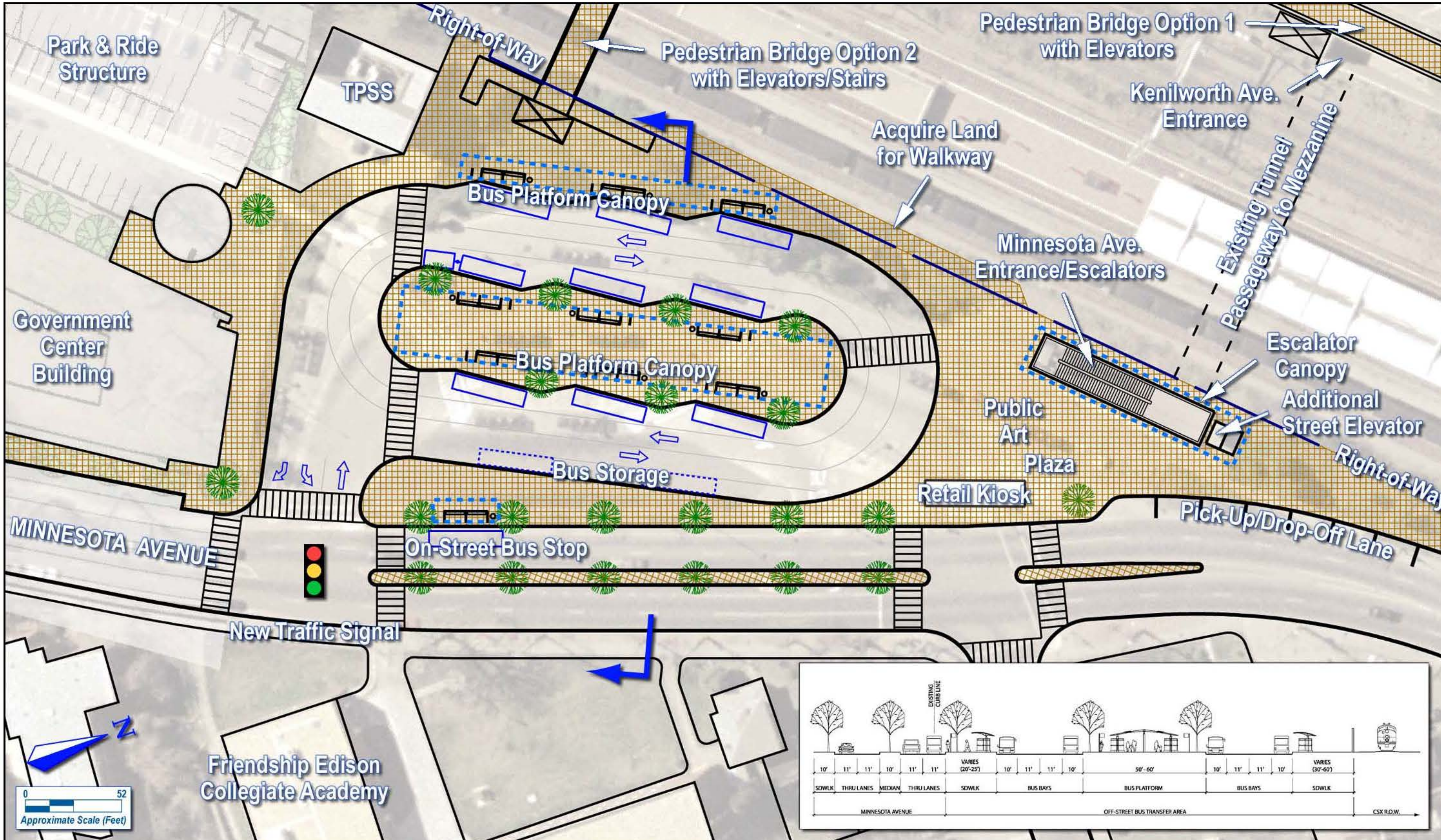


FIGURE 18: BUS TRANSFER FACILITY ALTERNATIVE 1 (WITH TRANSIT VEHICLES IN CURBSIDE LANES ON MINNESOTA AVENUE)

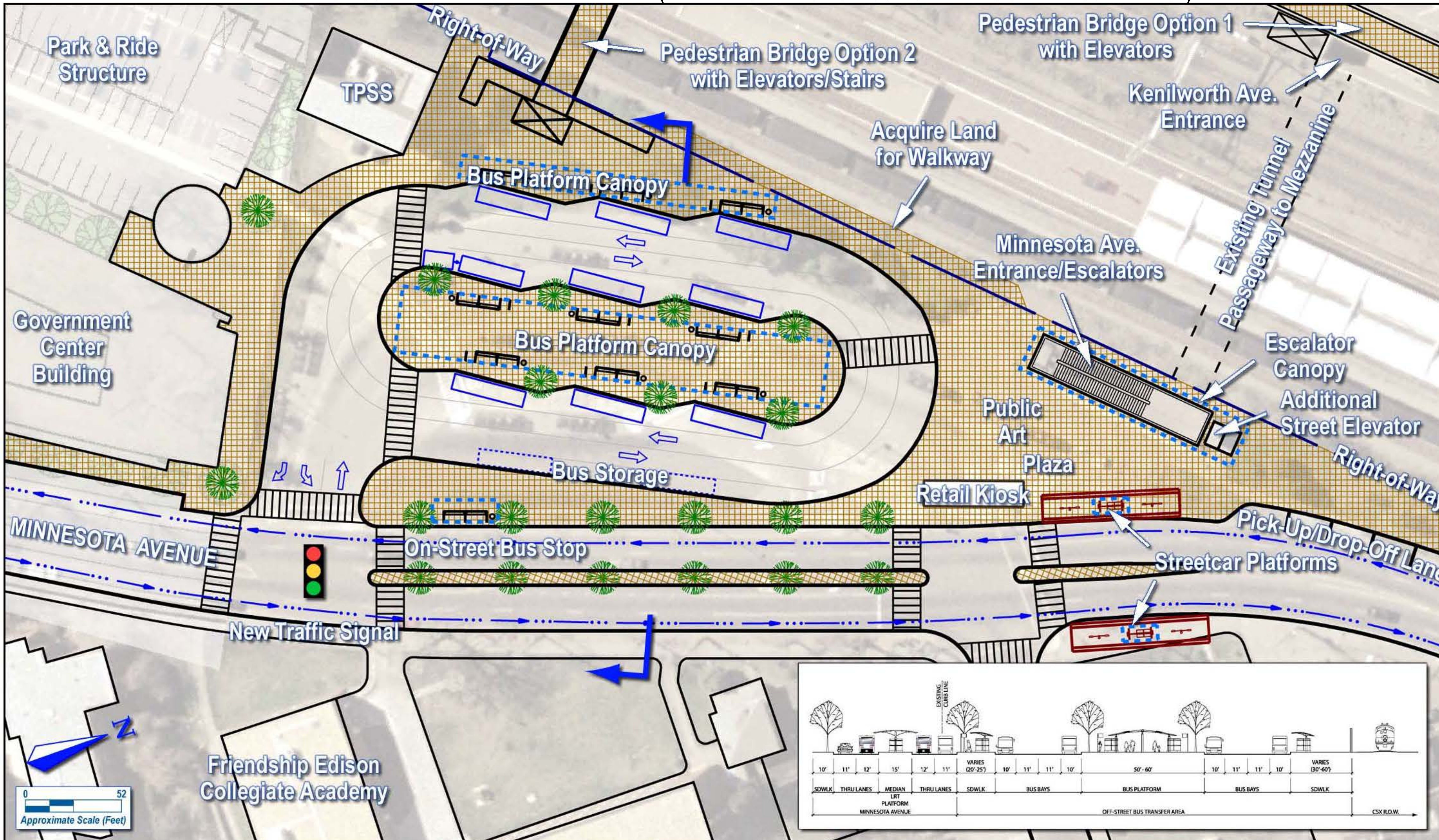


FIGURE 19: BUS TRANSFER FACILITY ALTERNATIVE 1 (WITH TRANSIT VEHICLES IN CENTER LANES ON MINNESOTA AVENUE)

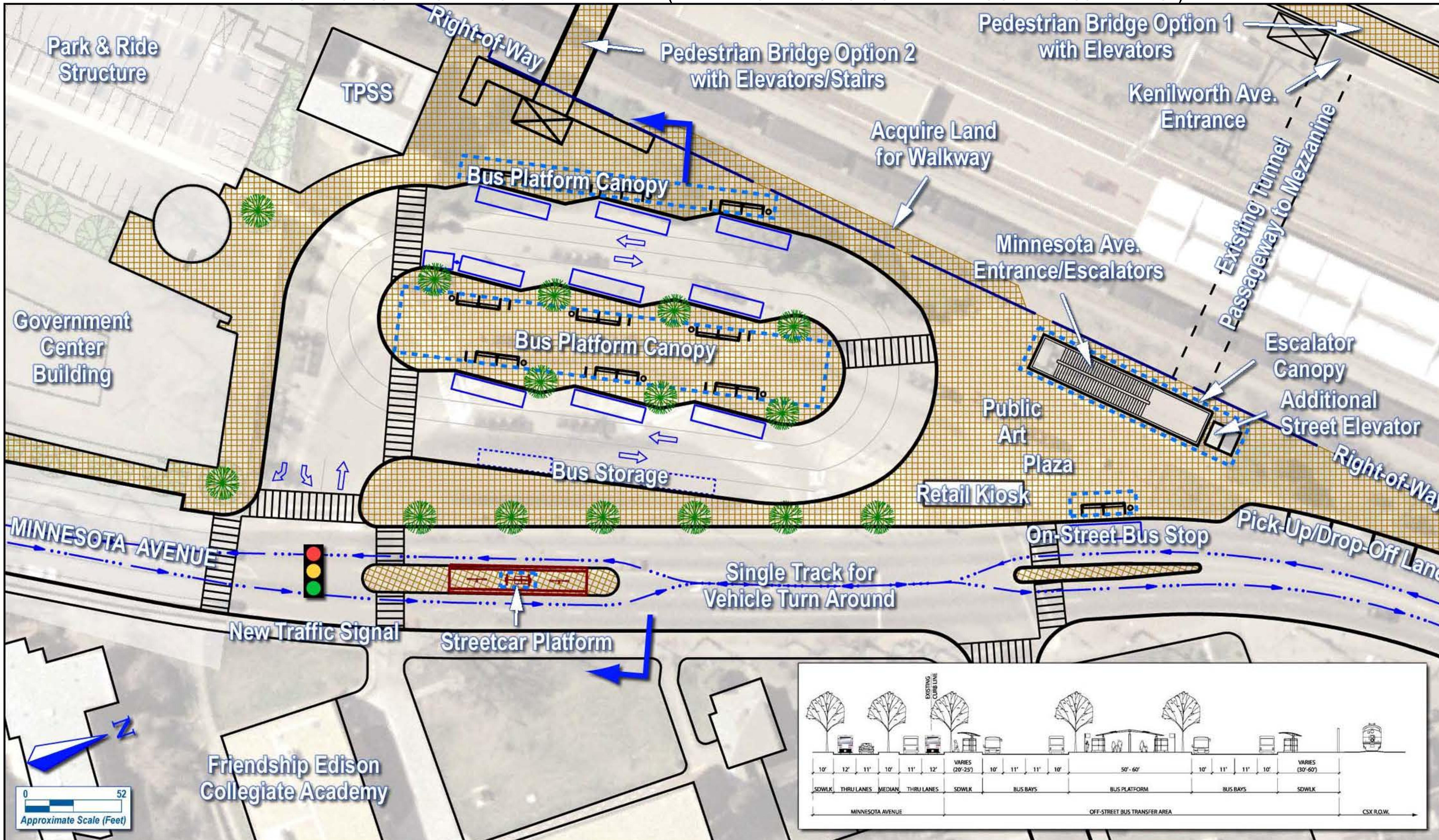


FIGURE 20: BUS TRANSFER FACILITY ALTERNATIVE 2

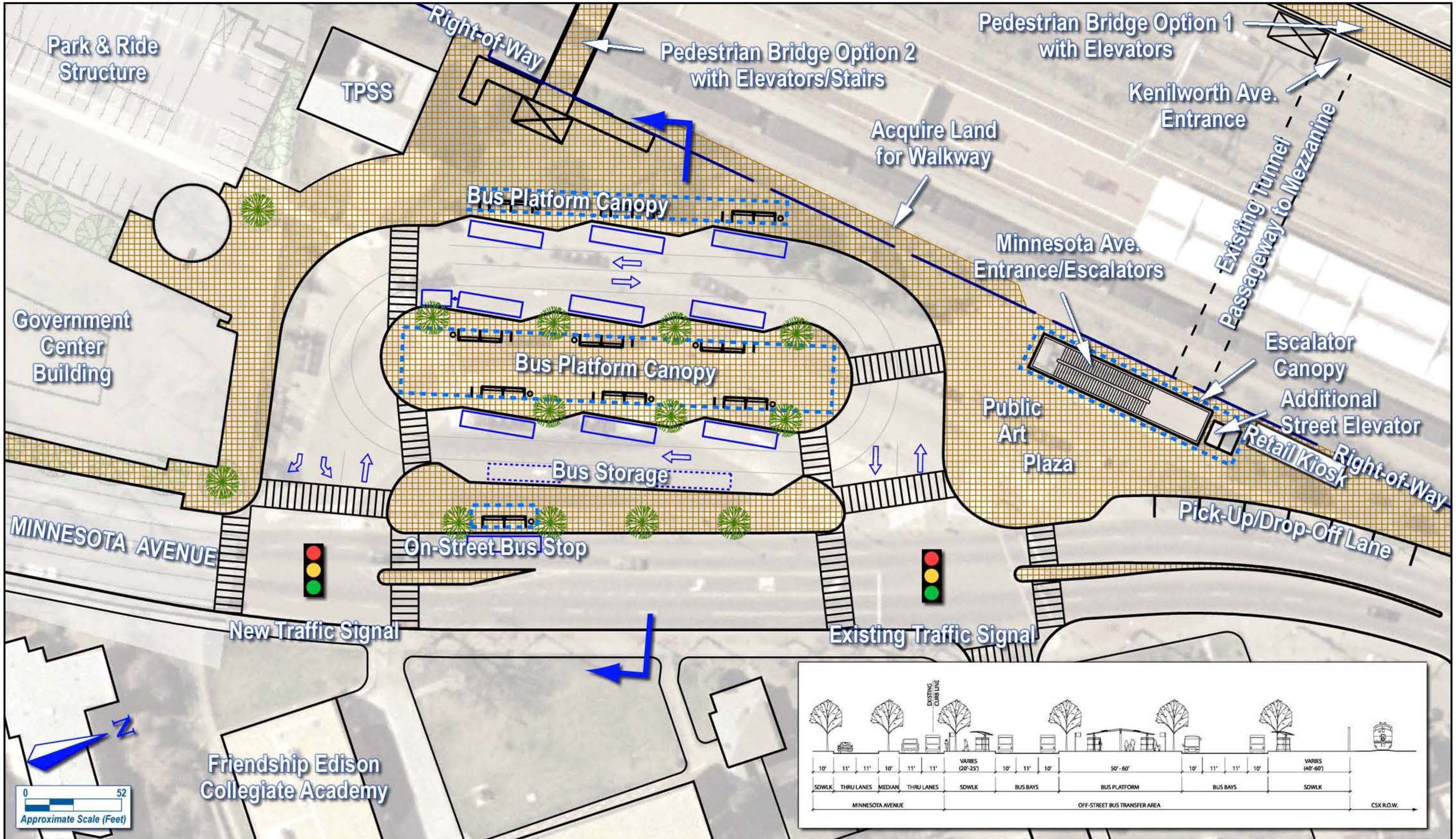


FIGURE 21: BUS TRANSFER FACILITY ALTERNATIVE 2 (WITH TRANSIT VEHICLES IN CURBSIDE LANES ON MINNESOTA AVENUE)

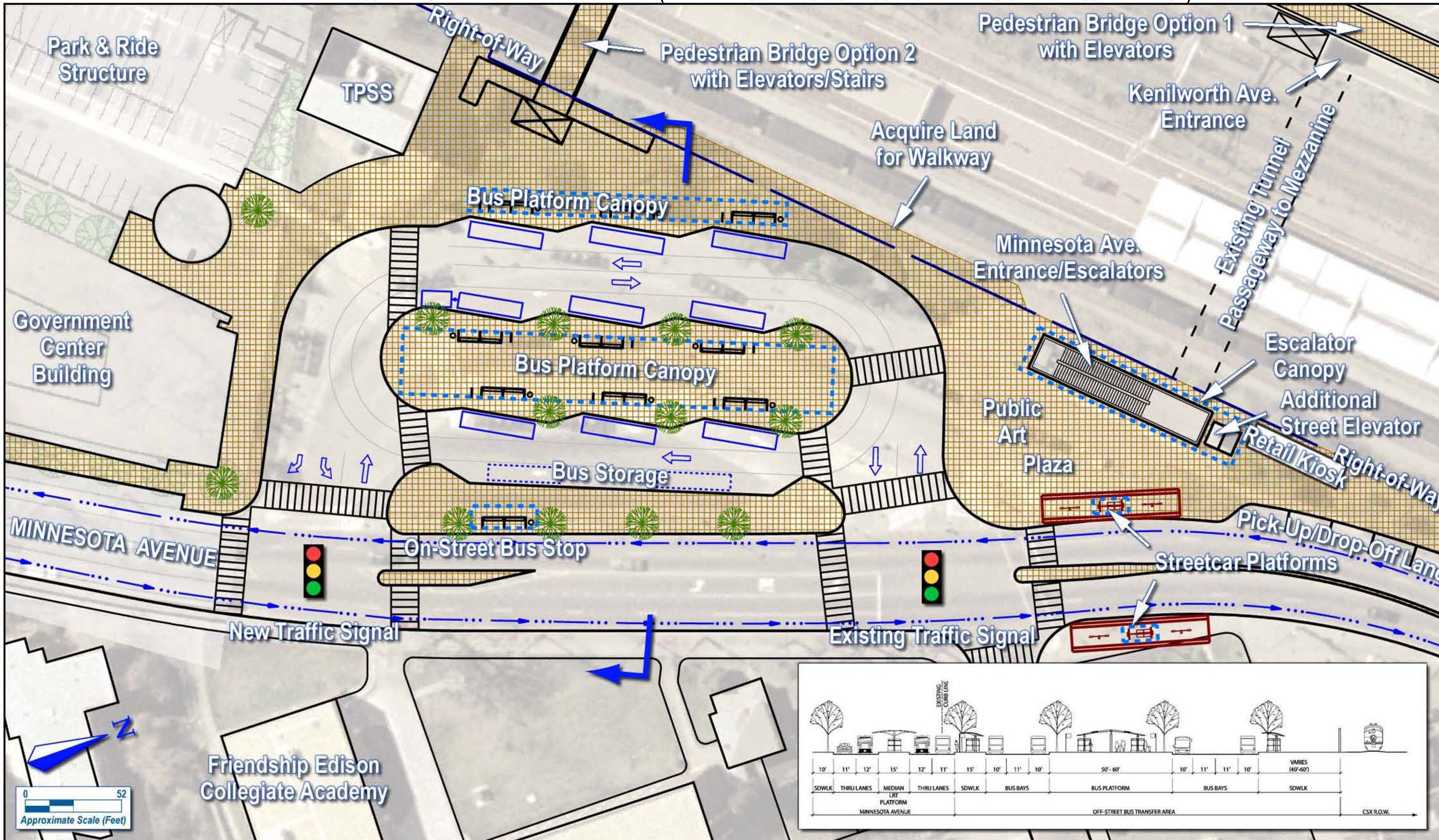


FIGURE 22: BUS TRANSFER FACILITY ALTERNATIVE 2 (WITH TRANSIT VEHICLES IN CENTER LANES ON MINNESOTA AVENUE)

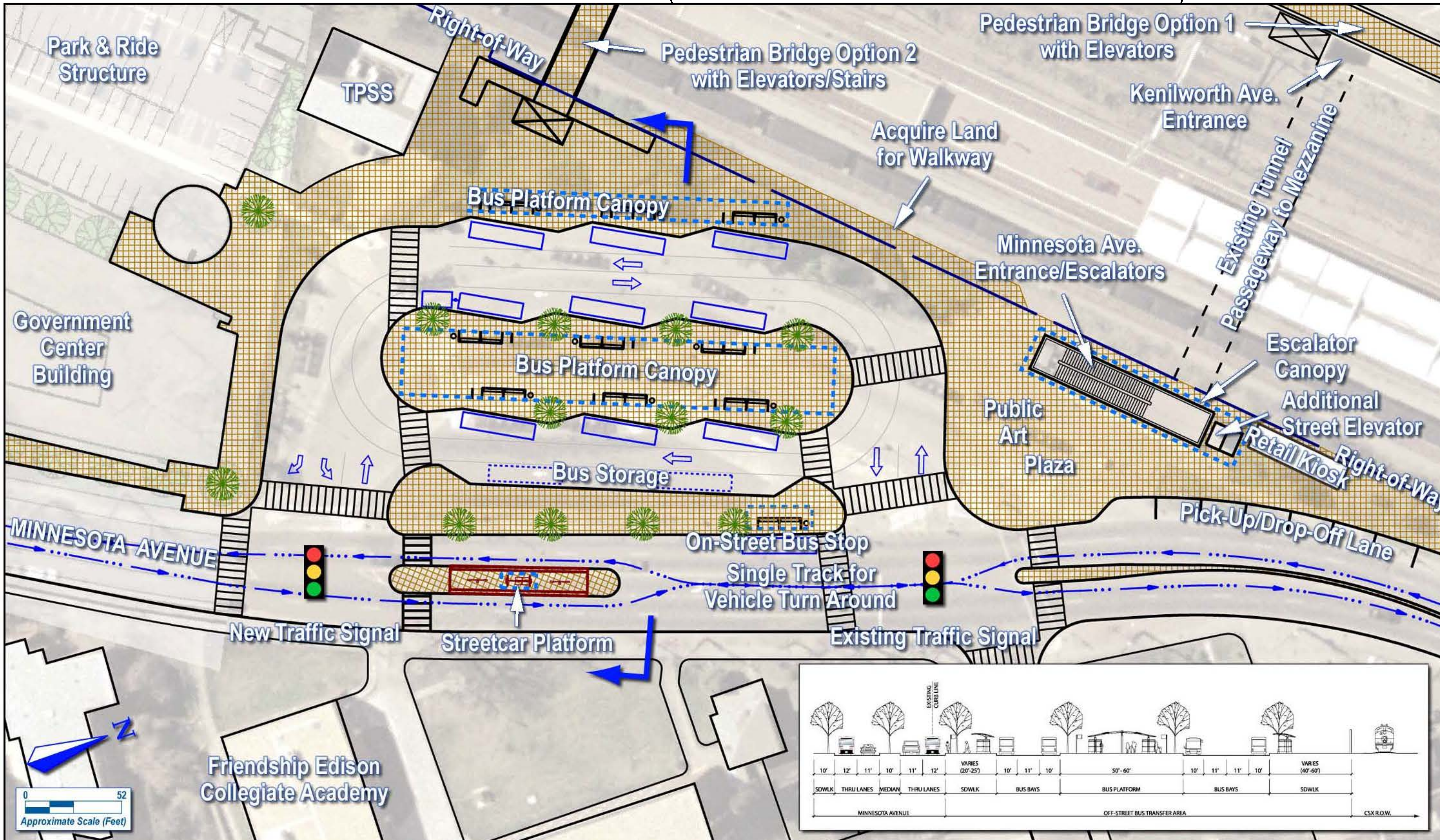


FIGURE 23: KISS & RIDE WITH VEHICLE STORAGE (WITH TRANSIT VEHICLES IN CURB SIDE LANES ON MINNESOTA AVENUE)

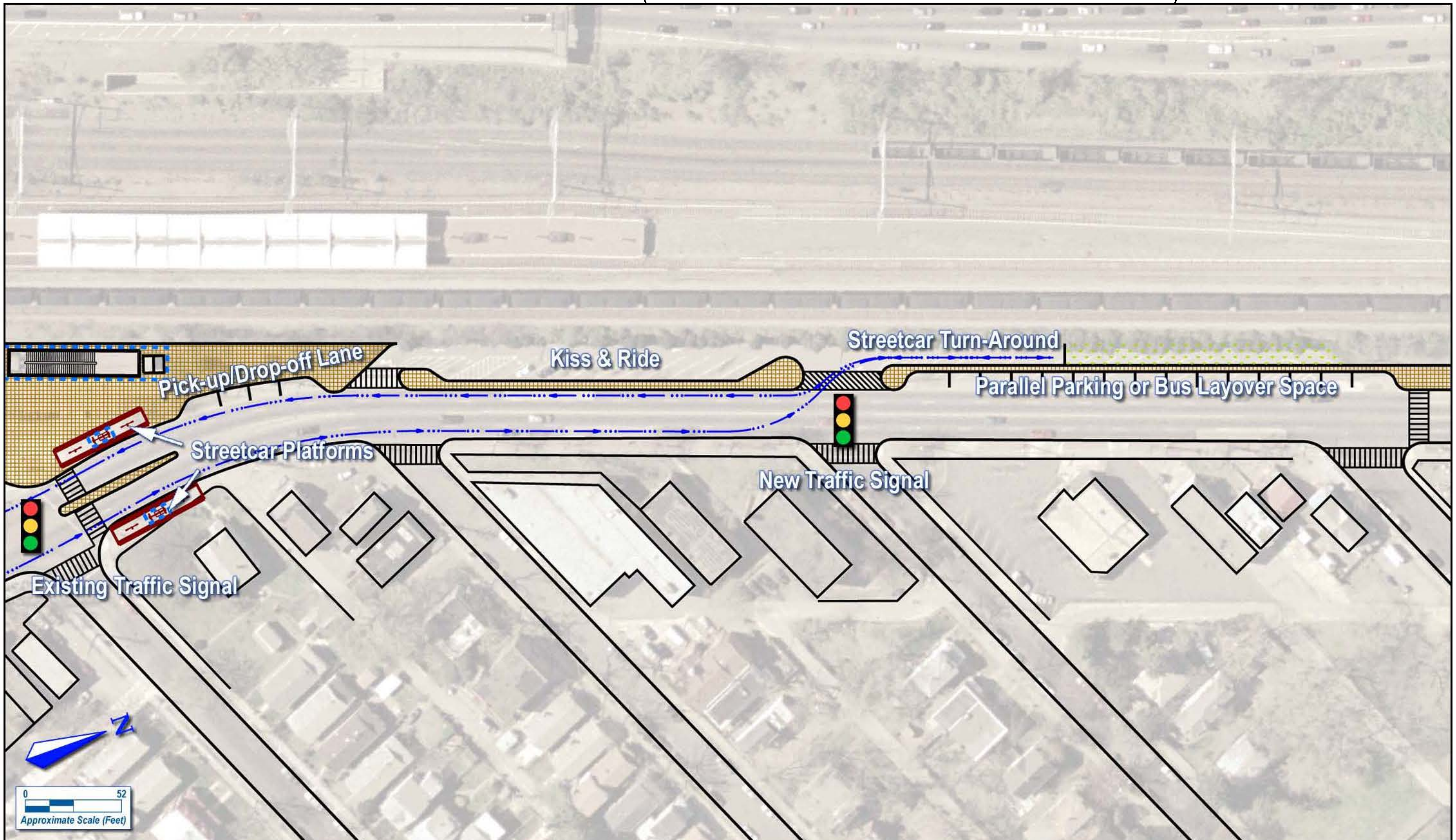
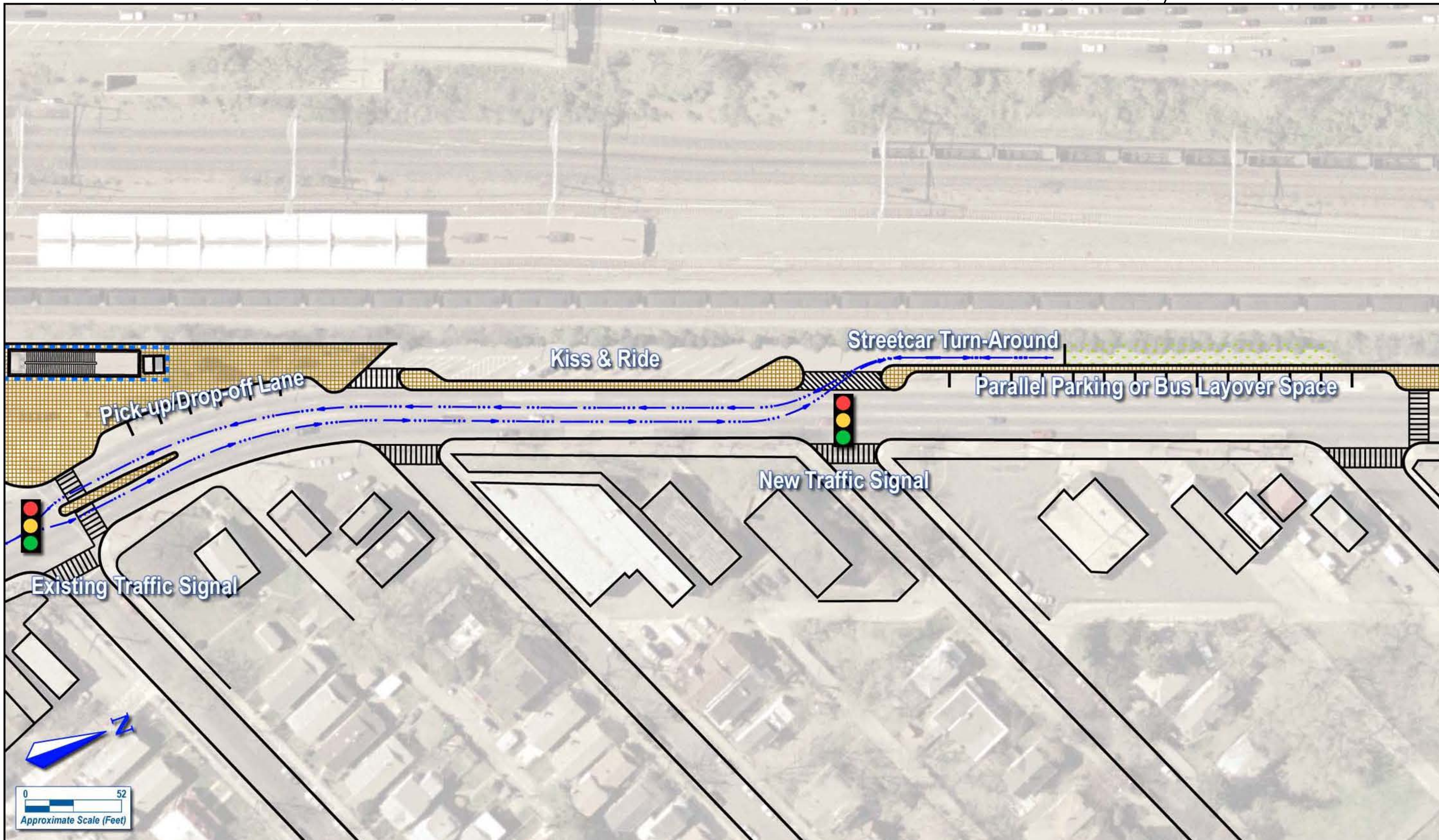


FIGURE 24: KISS & RIDE WITH VEHICLE STORAGE (WITH TRANSIT VEHICLES IN CENTER LANES ON MINNESOTA AVENUE)



(CONTINUED FROM PAGE 12)

- Provide the new WMATA signature glass canopy over the escalator entrance to improve safety (both street elevators were recently rehabilitated and service reliability has increased) and provide weather protection to the station customers and the escalator system.
- Provide kiosk(s) at the public plaza for convenience retail through the proposed WMATA Retail Pilot Program.

Art in Transit Program

Improvements to the station would open opportunities to support art in the public plaza. WMATA's Art in Transit Program is available to plan, develop, and manage an art program for the Minnesota Station Access Improvement Project.

Alternatives Analysis

The pros and cons for each pedestrian bridge option are presented in Table 4 and 5. The Parkside option provides direct access and a link between the proposed development and the Minnesota Avenue Station entrance, the Government Center, and the local community. The curved pedestrian bridge option improves security at the Kenilworth Ave. entrance by adding glazed elevators adjacent to the passageway portal, and reinforcing visual sight lines. The curved option avoids crossing above the CSX and Metrorail tracks.

TABLE 4: PARKSIDE PEDESTRIAN BRIDGE – PROS AND CONS

Pros	Cons
• Provides direct connection between both sides of Metrorail station with improved connectivity to the Government Center site and bus bays. • Provides excellent visibility and enhances safety. • Creates a sense of arrival on both sides of bridge and enhances scenic vistas. • Provides good connection from east station side to the proposed Anacostia River Walk. • Elevators would improve ADA-accessibility. • Eliminates non-Metrorail pedestrian thru-traffic from station escalators and tunnel.	• Travel distance from the west side of Kenilworth Avenue to the station mezzanine is longer for some walking trips. • New bridge landing on the east end is located in an area with limited space, adjacent to the bus facility. • Requires permission and coordination with the CSX Corporation for air-rights above tracks.

TABLE 5: CURVED PEDESTRIAN BRIDGE OPTION – PROS AND CONS

Pros	Cons
• Eliminates blind corners through curved design. • Realignment of pedestrian bridge would locate a portion of the structure adjacent to the tunnel, which would improve visibility within the west station entrance portal. • Elevators would improve ADA-accessibility. • Does not require permission and coordination with the CSX Corporation for air-rights above tracks	• Requires use of existing passageway tunnel, which poses safety concerns, particularly during non-operating hours. • Access to bus bays or Government Centers from west side of Kenilworth Avenue is less direct.

The pros and cons for the two alternatives for the bus transfer facility are presented in Tables 6 and 7. The single entrance option consolidates vehicle access to one point, which reduces curb cuts and allows for the construction of a full-length median on Minnesota Avenue, which would significantly improve pedestrian safety and access. This alternative would require additional right-of-way along Minnesota Avenue to allow a new a left-turn lane into the facility, which could affect planning for the Government Center development.

TABLE 6: BUS FACILITY ALTERNATIVE 1 – PROS AND CONS

Pros	Cons
• Creates large pedestrian space near entrance. • Provides wider sidewalk area along station side of Minnesota Avenue than currently exists. • Reduces curb cuts along Minnesota Ave. • Eliminates pedestrian crossing of bus lanes between the station entrance and Minn Ave. • Provides a median refuge island with marked crosswalks at three locations across Minnesota Ave. • Elimination of bus entrance at Grant Street, allows for an extended median that creates a boulevard type design. • Full 2-way bus loop provides off-street circulation. • Potential for bus storage area to be partially converted to an additional bus stop if needed. • Less turning conflicts on Minn Ave. (without 4-way intersections). Removes one leg from the Grant Street intersection; which should improve traffic operations at the signal.	• Requires a second traffic signal at bus entrance/exit. • Average bus trips to the station would be a few seconds longer than the two-entrance alternative because there is only one entrance. • Needs northbound left-turn lane for buses at new traffic signal and potential expansion of existing right-of-way, which may affect Government Centers planning and the street alignment. • Consolidated bus entrance/exit and full two-way loop results in more potential bus operations conflicts within the bus facility, particularly near the entrance/exit point. • Requires approval from WMATA Bus Transportation (BTRA) to store buses that are facing in opposite directions in one lane. • Design is a "tight-fit" on the site, resulting in bus travel lanes that are less than WMATA Guidelines suggest.

The second alternative provides two vehicular entrances for buses along Minnesota Avenue, which allows for better bus access/egress to the facility with less conflicts between bus movements, and provides redundancy for bus service operations. This alternative would also provide significant access improvements for pedestrians with less curb cuts along the station area of Minnesota Avenue.

TABLE 7: BUS FACILITY ALTERNATIVE 2 – PROS AND CONS

Pros	Cons
• Creates large pedestrian area in front of station entrance, which may be used as a public space. • Provides wider sidewalk area along station side of Minnesota Avenue than currently exists. • Reduces curb cuts along station side of Minnesota Avenue to two access points for buses. • Improves pedestrian access to the Friendship Edison Collegiate Academy. • Provides a partial median refuge island (less than single-entrance alternative) with marked crosswalks at four locations across Minnesota Avenue. • Creates more of a boulevard type design consistent with the District's Great Streets program. • Additional entrance/exit to bus bays provides more flexibility for bus routing. • Bus loop allows most buses to re-circulate off-street. • Could have signal pre-emption for buses. • Second traffic signal would improve access across Minnesota for Pedestrians.	• Requires a second traffic signal, which would only be activated for buses and pedestrians. • More pedestrian crossings at bus lanes and fewer direct pedestrian links than in single-entrance alternative. • Some bus bays are accessible only from one of the two entrance points. • Buses in storage space have access to only the center island bus bays only. • Design is a "tight-fit" on the site, resulting in bus travel lanes that are less than WMATA Guidelines suggest.

Both curbside and center-lane transit improvements on Minnesota Avenue would also work with the alternatives developed for the bus transfer facility and Kiss & Ride. The pros and cons each scenario are listed in Tables 8 and 9.

TABLE 8: CURBSIDE STREETCAR – PROS AND CONS

Pros	Cons
• Streecar vehicle services the platform when stopped outside the traffic stream, reducing traffic impacts. • Streetcar-to-Metrorail transfers do not require any roadway crossings for outbound boardings. • Streetcar-to-bus transfers require minimum roadway crossings. • Allows Buses to uses northbound left turn lane into bus transfer facility (Alternative 2).	• Northbound transition at Grant Street impacts traffic more than center lane option. • Streetcar platform and track reduce available sidewalk space. • Transit operations may reduce opportunities for on-street bus bays or curbside drop-off/pick-up lanes.

TABLE 9: CENTER LANE STREETCAR – PROS AND CONS

Pros	Cons
• More flexibility for transit operations because trains can service both sides of the platform. • More intuitive transition from Northbound Minnesota Ave to exclusive space (from left lane or left-turn lane).	• Median platform is less desirable as a passenger waiting area. • Platforms on the near-side of traffic signals complicate signal pre-emption and increase traffic impacts. • Passengers must cross vehicle lanes to transfer to Metrorail or bus. • Vehicle Turn Around eliminates northbound bus turning lane into bus transfer area (Alternative 2).

STATION CAPACITY AND ENHANCEMENTS

Existing Conditions

The Minnesota Avenue station has two entrances at each end of a passageway leading to the underground mezzanine. The Minnesota Avenue entrance has 2 escalators and 1 elevator from the mezzanine level to the street level. The Kennilworth Avenue exit has a single ramp to the pedestrian bridge. There are 2 escalators from the mezzanine to the station platform. The elevator to the station platform has it's own entrance on the opposite side of the passageway from the mezzanine. The main mezzanine has five faregates. There is only 1 faregate to the separate platform elevator vestibule and lacks any fare vending equipment.

Mezzanine Capacity and Revenue Control

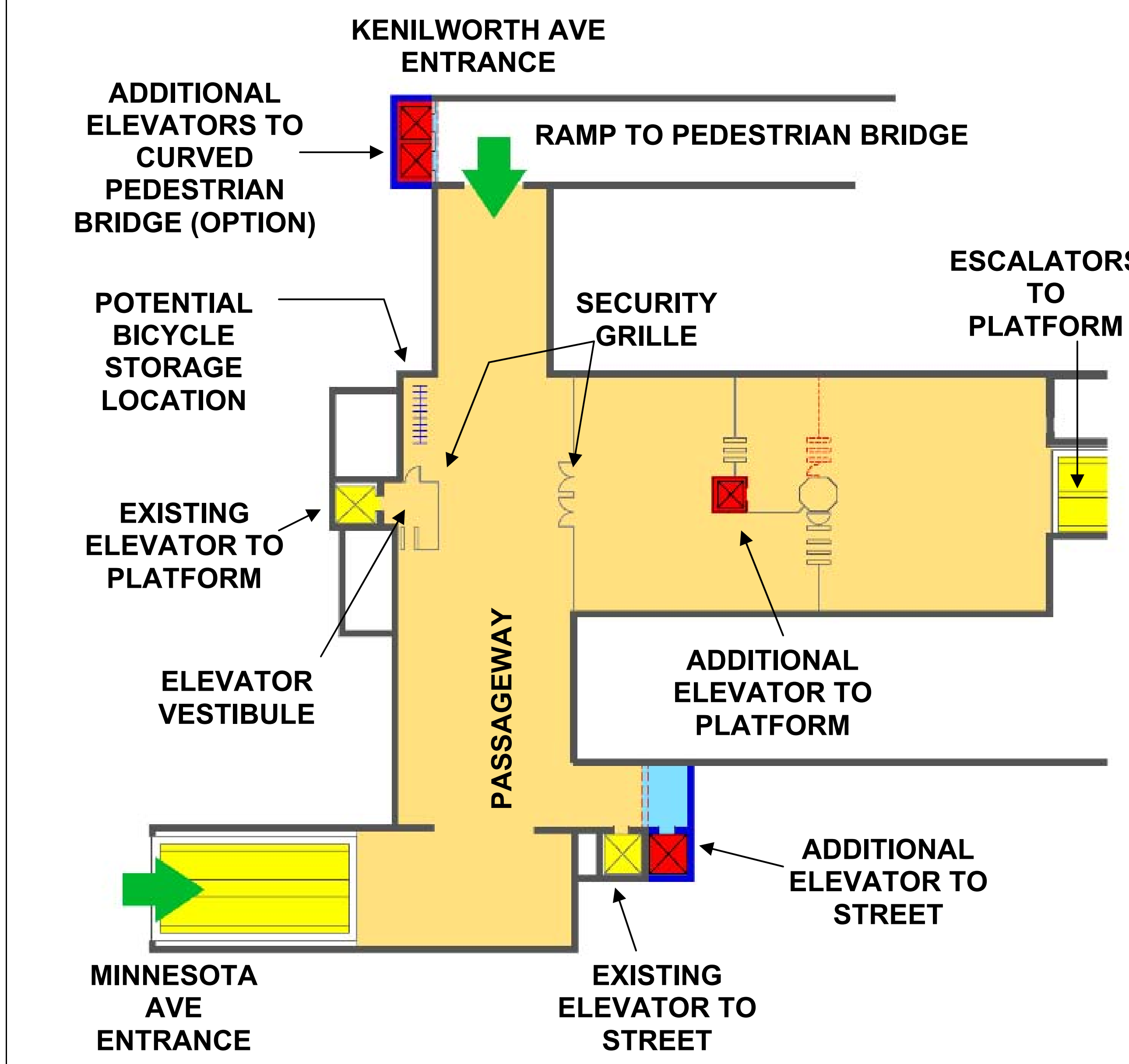
The size of the station mezzanine and the number of faregates at the kiosk should be adequate to handle the projected increase in ridership for the foreseeable future. Each faregate has capacity for 30 entries per minute, or 900 entries per 30 minutes. The faregate at the platform elevator vestibule constrains travel flow when customers must share a single faregate while traveling in both directions. Without fare vending equipment at the elevator entrance, the customer must travel to the fare vending equipment in the mezzanine first before accessing the platform elevator. Customers exiting the elevator vestibule who need to add fare to their farecards must call for the station manager for assistance. On a recent site visit, the station manager reported that fare evasion at the elevator entrance was a chronic problem due to the remote location and the inability for the station manager to control access.

Vertical Circulation Capacity and Expansion

Both sets of escalators should have adequate vertical circulation capacity to meet future ridership demand, given that each escalator can handle 3,000 people in a 30-minute period. However, elevator service is inadequate and should be expanded, which is the case at other Metrorail stations. Customers using wheelchairs that rely on elevator service cannot access the station when either the single street elevator or the platform elevator is out of service. When either elevator is out of service at a Metrorail station for extended rehabilitation, customers using wheelchairs must use the elevators at the nearest station, and then transfer to their destination station using expensive Metrobus shuttle service. For short-term elevator service disruptions, a bus must be dispatched on demand. During any elevator outages, customers using strollers, wheeled luggage, and seniors with balance problems are forced to use the escalators. WMATA policy prohibits strollers and wheeled luggage on escalators for safety reasons.

Current WMATA design criteria for the planning of new or expanded Metrorail station facilities require redundant elevator service between all levels of a station. When a minimum of two elevators is provided between each level in a station, access for station customers using a wheelchair can be provided even if one of the elevators is shut down for repairs or maintenance. Maintenance on one elevator could then be performed during revenue hours whenever necessary without restricting wheelchair access. Figure 25 illustrates how additional elevators can be incorporated at both station entrances and the mezzanine. Locating an additional elevator to the platform in the main mezzanine area and reconfiguring the faregates and pedestrian barriers would allow the station manager to better monitor the faregate use. The existing elevator entrance could then be closed whenever the station management is unable to control faregate transactions at this location.

FIGURE 25: DIAGRAM OF MEZZANINE (WITH ADDITIONAL ELEVATIONS)



NEXT STEPS

The Minnesota Avenue Station Access Improvement Study has been prepared to provide the District of Columbia with documentation for the feasibility of the proposed alternatives for station site and access improvements. If the District decides to move forward with the planning process for implementing any of the improvements presented in this study, then WMATA will begin working with the District in the conceptual engineering and environmental assessment process.

The conceptual engineering process would be subject to further review by WMATA, the District, and the citizens of the Minnesota Avenue Station area community through the process of public hearing and environmental assessment. WMATA would also coordinate the design for any site improvements with other District transportation and development projects adjacent to the station.

TABLE 10: ORDER OF MAGNITUDE COST ESTIMATES

Item No.	Element	Construction Cost	Contingency (30%)	WMATA Soft Costs	Sub-Total
1	Bus Facilities - Alternate 1	$ 3,490,260	$ 1,047,078	$ 1,588,068	$ 6,125,406
2	Bus Facilities - Alternate 2	$ 3,481,995	$ 1,044,599	$ 1,584,308	$ 6,110,901
3	Kiss&Ride Facilities - Alternate 1	$ 974,120	$ 292,236	$ 443,225	$ 1,709,581
4	Kiss&Ride Facilities - Alternate 2	$ 974,120	$ 292,236	$ 443,225	$ 1,709,581
5	Parkside Pedestrian Bridge	$ 3,603,875	$ 1,081,163	$ 1,639,763	$ 6,324,801
6	Curved Alignment Bridge	$ 3,661,765	$ 1,098,530	$ 1,666,103	$ 6,426,398
7	Street Elevator	$ 1,370,045	$ 411,014	$ 623,370	$ 2,404,429
8	Platform Elevator	$ 1,004,450	$ 301,335	$ 457,025	$ 1,762,810
	Total (Alternate 1): Items 1, 3, 5, 7, and 8	$ 10,442,750	$ 3,132,825	$ 4,751,451	$ 18,327,026
	Total (Alternate 2): Items 2, 4, 6, 7, and 8	$ 5,430,235	$ 1,629,071	$ 2,470,757	$ 9,530,062
	Total (Alternate 1/No Bridge): Items 1, 3, 7, and 8	$ 6,838,875	$ 2,051,663	$ 3,111,688	$ 12,002,226
	Total (Alternate 2/No Bridge): Items 2, 4, 7, and 8	$ 6,830,610	$ 2,049,183	$ 3,107,928	$ 11,987,721

[1,2] Bus Facility costs include Site Demolition, Paving, Curbs, Shelters, Canopies, Trees, Lighting, Traffic Signal(s), Utility Relocation
[3,4] Kiss & Ride Facility costs include Site Demolition, Paving, Curbs, Canopies, Trees, Lighting , Traffic Signal, Utility Relocation
[5,6] Pedestrian Bridge costs include Piers, Steel Structure, Canopy, Enclosures, Finishes, Lighting, Stairs or Ramp, and Elevators
[7,8] Elevator costs include Demolition, Excavation, Structure, and Finishes
*WMATA Soft Costs (35%): Design+Engineering (10%), Design Management (10%), Construction Support (10%), and Insurance/Bond (5%).
*Costs do not include Retail Kiosks, Escalator Canopy, Streetcar Systems, or Land Acquisition.
*The Order of Magnitude cost baseline date is January 2006 and does not include escalation costs.

M
metro

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

STADIUM-ARMORY STATION AREA PLANNING STUDY

Final Report
January 2006

Washington Metropolitan Area Transit Authority
Department of Planning and Information Technology
Office of Business Planning & Project Development

metro

STADIUM-ARMORY STATION AREA PLANNING STUDY

CONTENTS

1. INTRODUCTION

Over the past five years, the District of Columbia has experienced a renaissance characterized by increased real estate values and a concerted effort by Mayor Anthony Williams, the Anacostia Waterfront Corporation (AWC), the District of Columbia Office of Planning (DCOP), and the District Department of Transportation (DDOT) to develop strategic land use and transportation plans that enhance existing public spaces, increase opportunities for cultural and recreational activity centers, and introduce mixed-use retail in older commercial corridors. The Stadium-Armory station area is one of the Metrorail station sites that will be impacted by many of the major infrastructure investments scheduled to be made by the District of Columbia in the next 10 years.

One program of strategic importance developing during this study period is the Anacostia Waterfront Initiative (AWI), with a study area that includes the Stadium-Armory Metrorail Station, among others. The AWI seeks to revitalize neighborhoods, enhance and protect parks, improve water quality and increase access to waterfront destinations. Other potential projects that could impact the station area include: the Hill East Waterfront Master Plan which envisions a mixed-use development with residential, commercial, medical center, government, and retail uses on the 67-acre area of public land known as Reservation 13; the Anacostia Riverwalk Trail; the Saint Coletta School campus plan; and the Master Plan for the RFK stadium site being developed by the National Capital Planning Commission (NCPC).

Given these planned or potential projects, and other on-going transportation studies in the station vicinity, the District Office of Planning and WMATA determined that a station area study was warranted to evaluate existing pedestrian and vehicular access in and around the station, to identify opportunities for enhancing the overall transit experience, and to coordinate plans for station improvements with other transportation and master plans.

The primary objective of this study is to provide the District with a report to use as a blueprint for their future planning efforts on transportation and development projects in the station area and to identify WMATA operational needs and site planning goals before any District projects or other area projects go forward. The Stadium-Armory Station Area Planning Study provides conceptual planning and design analysis for proposed site improvements designed to enhance pedestrian and bicycle access, maximize the convenience of using transit, and generally enhance the overall appearance of the station site area.

2. EXISTING CONDITIONS

Location

The Stadium-Armory Station is a transfer station located in SE Washington on the Orange and Blue Lines. The station is located between the Potomac Avenue Station and Minnesota Avenue Station on the Orange Line and the Benning Road Station on the Blue Line. The planning area generally encompasses the DC Jail site to the south, Constitution Avenue NE to the north, RFK Stadium, DC Armory and the Anacostia River to the east and 17th Street, SE to the west. Most of the area is near or within a quarter-mile radius of both station entrances as shown on Figure 1.

The planning area contains a mixture of land uses, centered on 19th Street SE (one-way northbound). To the west and north are typical Capitol Hill residential neighborhoods composed of two-three story attached row houses, apartment buildings, Eastern High School and small retail shops. The street grid is interrupted by two diagonal streets, Potomac Avenue and Massachusetts Avenue. To the south is the Congressional Cemetery and the DC Jail site. The area east of 19th Street is the site of the Hill East Waterfront Master Plan for the 67-acre area of land known as Reservation 13 (currently the site of vacated DC General Hospital). The parcel on the east side of 19th Street, between the north and south station entrances, is the site of the new St. Coletta's school campus. The DC Armory, RFK Stadium and their associated surface parking lots are between 19th St., SE and the Anacostia River.

Station Facilities

The Stadium-Armory Metrorail station is a center platform, underground station with two entrances, the Stadium & Armory (north) entrance and the DC General (south) entrance, both on the east side of 19th Street, SE. The entrances contain escalators with one street elevator located at the south entrance. New escalator canopies have been installed at both entrances. WMATA owns approximately three-quarters of an acre surrounding the north entrance at the corner of 19th Street and Independence Avenue.

There are no Park & Ride or Kiss & Ride facilities at the Stadium-Armory Station; however approximately 1,800 Metrorail customers use other parking lots in the area to access the station each weekday. There are 9 bus bays located at the north entrance- six on 19th Street and three on a diagonal cut-through at the corner of 19th Street and Independence Avenue. In addition, there is a WMATA chiller plant located to the east of the north entrance with service access from Independence Avenue. There are no bicycle racks or lockers at either station entrance.

Figure 1: Stadium-Armory Station Area

SCALE:1"=750'

2. EXISTING CONDITIONS

Figure 2: Stadium-Armory Station Plan—Existing Conditions

SCALE: 1”=120’

2. EXISTING CONDITIONS

View 1: Stadium & Armory Station Entrance

View 2: DC Armory

View 3: WMATA Chiller Plant,
Diagonal Bus Bays

View 4: DC Armory West Parking Lot

View 5: DC General Station Entrance

View 6: Stadium & Armory Station Entrance,
Chiller Plant, and DC Armory

3. PLANNING CONTEXT

Given the District's strong real estate market, ambitious revitalization plans for streets and neighborhoods, and the District Office of Planning's commitment to Transit-Oriented Development, the Stadium-Armory station area will likely experience major development growth in the next ten years. A primary goal of this study is to evaluate on-going District transportation and development studies and to coordinate any Metrorail station site improvements recommended in this study with any future District projects. This section of the study addresses the potential future District projects that may impact the Stadium-Armory station area.

Planning Initiatives

Anacostia Waterfront Initiative

The Anacostia Waterfront Initiative (AWI) is a plan for 900 acres of land along the Anacostia waterfront and the Washington Channel, ninety percent of which is publicly owned. The plan's objective is to "increase public access to the water, build new parks, and create mixed-use and mixed-income waterfront neighborhoods without displacing current residents."

The plan is organized in seven "Target Areas." The Station-Armory Station is within the Hill East area. This area includes Reservation 13, the eastern edge of Capitol Hill, RFK Stadium, the DC Armory and Congressional Cemetery. The "planning principles" for this Target Area include:

- Promote Transit-Oriented Development by introducing new uses near Metrorail stations;
- Create an environment where pedestrians, cycling and automobile routes are complementary and unobtrusive, reducing the impact of traffic on adjacent streets;
- Create a new village square around the Metrorail station at C Street and 19th Street, SE that serves the unmet commercial needs of the neighborhood.

Hill East Waterfront Master Plan

A master plan for the 67-acre DC General Hospital site known as Reservation 13 has been prepared and adopted by the District. The plan, which conforms to the objectives of the AWI, envisions a mixed-use neighborhood with a traditional street and block pattern that will "promoteTransit-Oriented development and increase transit ridership." The area around the south station entrance has been designed as a public plaza where there is now only vacant land. The plan also provides for the construction of the St. Colletta School campus (under construction), between both station entrances on 19th Street. The plan also calls for 19th St., SE to be returned to two-way traffic and the installation of traffic calming devices for safe and pleasant pedestrian movement.

Other Studies

Anacostia Riverwalk Trail

A major component of the AWI Framework Plan is a comprehensive trail system, including bicycle and pedestrian trails along the Anacostia River. Among the first of the AWI improvements to be built is the Anacostia Riverwalk Trail, which will run along both sides of the river. On the west bank, the trail will provide continuous access to the river from 11th Street, SE to Benning Road and will include branches leading into the neighborhoods and near the Stadium-Armory Station. DDOT and the National Park Service have completed the planning study and environmental analysis of the Riverwalk. Construction has begun and will be completed in 2006.

Capitol Hill Transportation Study

DDOT is investigating transportation improvements across the Capitol Hill area. The study is a comprehensive analysis of traffic, transit, bicycle and pedestrian conditions to identify measures to improve safety and mobility and to reduce speed and congestion. The study is considering traffic-calming measures and the conversion of one-way streets to two-way operation. The eastern boundary of the study area is 19th Street, SE.

The study is especially important because its recommendations could change the ways in which the surrounding transportation system provides access to the Stadium-Armory Station. The Capitol Hill Transportation Study was just beginning when this Stadium-Armory Station Area Planning Study was prepared, so no recommendations for changes had yet been developed. Not having recommendations limits the transportation analysis in this study, as some future transportation system characteristics and conditions cannot be known.

Middle Anacostia River Crossings Transportation Study

DDOT's Middle Anacostia River Crossings Transportation Study focuses on improvements to the Pennsylvania Avenue and 11th Street river crossings and the connecting roadways, with the southern Stadium-Armory Station entrance included in the northern edge of the study area. Among the study's recommended near-term improvements is the installation of bicycle storage facilities at the station entrances. The study also recommends improvements to the RFK stadium access road from Barney Circle, beginning with a near-term rehabilitation and including eventual construction of the Reservation 13 Road in the same area; one purpose of the road is to improve access to the Stadium-Armory Station.

STADIUM-ARMORY STATION AREA PLANNING STUDY

3. PLANNING CONTEXT

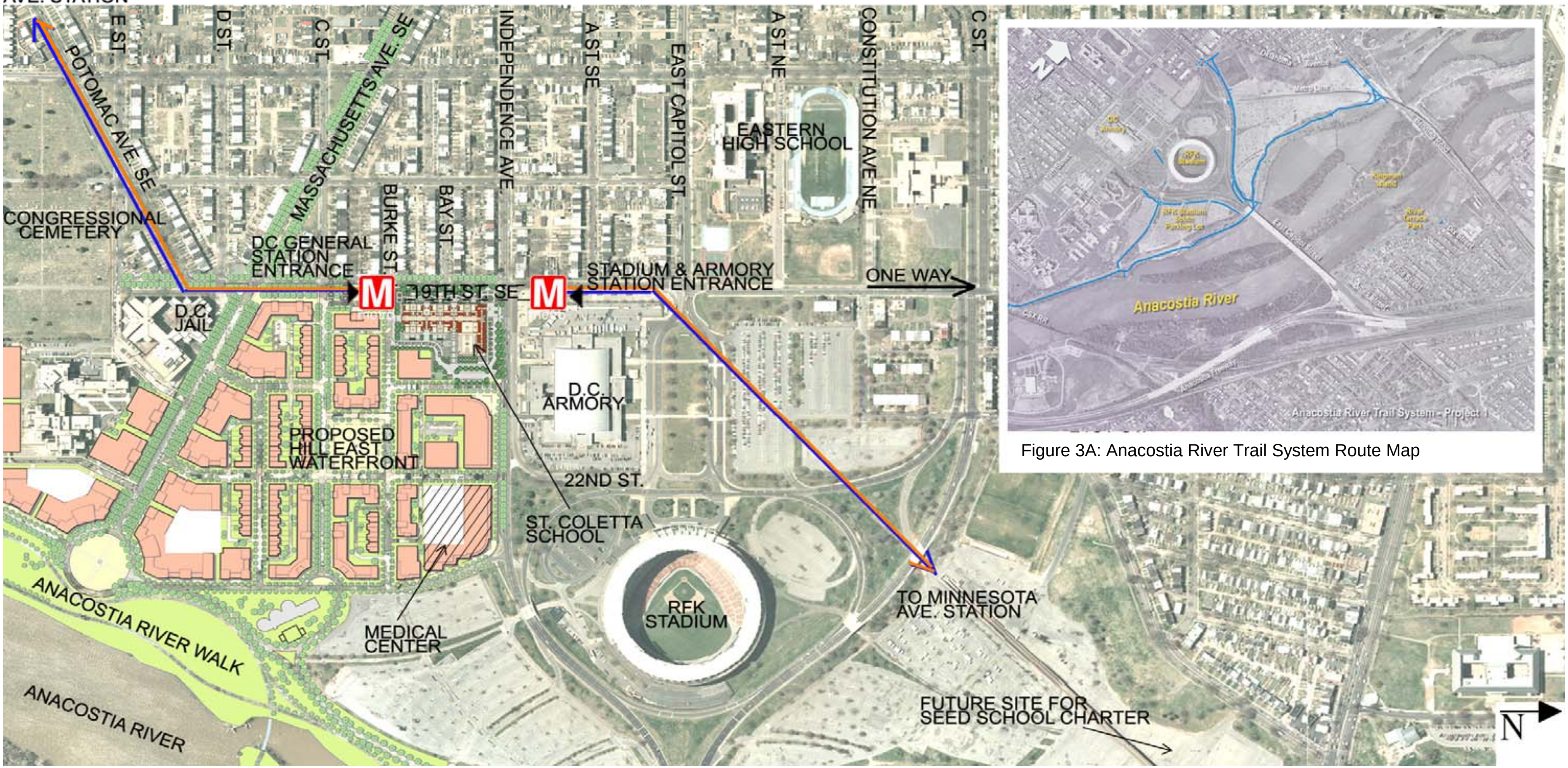


Figure 3A: Anacostia River Trail System Route Map

Figure 3: Stadium-Armory Station/Hill East Waterfront Master Plan

SCALE: 1"=450'

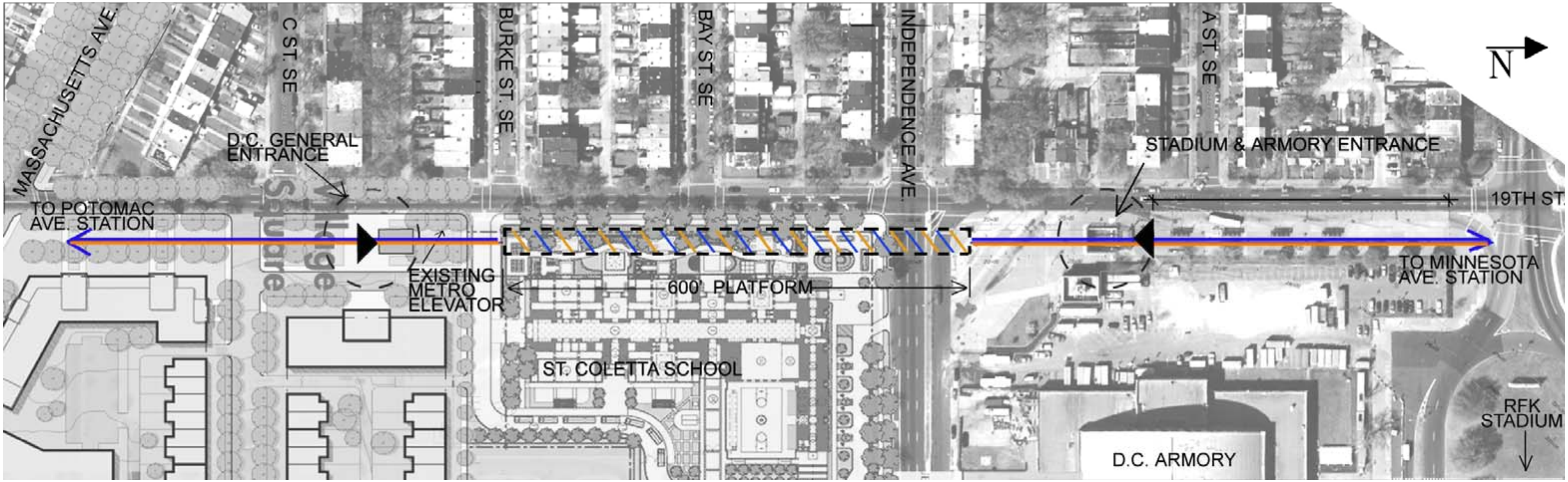


Figure 4: Enlarged Hill East Waterfront Master Plan

SCALE: 1"=120'

Planning Initiatives (continued)

District of Columbia Transit Alternatives Analysis (DCAA)

DDOT and WMATA completed a study of new transit alternatives, including streetcars, Rapid Bus, and Bus RapidTransit (BRT), to complement Metrorail and Metrobus services. The DCAA analyzed transit improvements to be made by 2030 in multiple corridors across the District. One corridor includes 19th Street, SE, passing the Stadium-Armory Metrorail station. The DCAA identified appropriate types of transit improvements in each corridor studied. Rapid Bus was recommended for the corridor that includes 19th Street, SE. Rapid Bus and BRT service is faster than conventional bus service because buses stop only at the busiest stops instead of every few blocks, and traffic signals may give buses priority over other traffic.

Rapid Bus systems have distinctive vehicles, and stops typically feature enhanced shelters with improved information for passengers like BRT, however Rapid Bus vehicles are smaller than BRT vehicles. Some corridors in the District will be considered for future conversion to premium transit service, either bus rapid transit or streetcars. The Stadium-Armory Station Area Planning Study recognized the potential need to accommodate premium transit on 19th Street, SE, so this report illustrates the addition of streetcars and stops at the Metrorail station. Design concepts developed for streetcars could easily be adapted to meet simpler facility requirements for Rapid Bus service. Rapid Bus service can also utilize the existing bus bays.

4. MASTER PLAN

The objectives of the Stadium-Armory Station Area Planning Study are to improve access to the station, enhance the appearance of the station and coordinate these improvements with other area planning initiatives including the Hill East Waterfront Master Plan, Anacostia Waterfront Initiative, and other District transportation and planning projects in the station vicinity. The Stadium-Armory Station Master Plan illustrates the addition of streetcars and stops on 19th Street, SE to provide for improved transit service. Rapid bus service, recommended for 19th Street, SE by the District of Columbia Transit Alternatives Analysis, would also fit within the master plan's design concepts. The Master Plan for this study proposes additional development on the DC Armory parking lot adjacent to the north station entrance.

This study proposes two alternatives with the only difference being the location of the streetcar stops. For this reason, both alternatives are described below, followed by options for the streetcar platform locations.

The master plan illustrates the following design elements for station site improvements:

- Clearly marked crosswalks at all intersections along 19th Street, SE between C Street and East Capitol Street with 10' minimum width.
- Street trees at 40' on center along 19th Street.
- Continuous bus shelter canopy at the north entrance, designed to complement the Metro escalator canopy.
- Addition of bicycle lanes to 19th Street connecting to the proposed Anacostia Riverwalk Trail.

- South Station Entrance: Station site improvements are proposed in this study to complement the Hill East Waterfront Master Plan which incorporates a new street and block layout around the Metro entrance. The entrance is situated within a 85'x300' parcel, surrounded on all sides by public streets:
  - ➢ Enhance the landscaping to soften the environment of the station entrance area and provide public art.
  - ➢ Add bike lockers and racks.
  - ➢ Provide canopy to shelter transit customers waiting to be picked up by automobile or shuttle.
- North Station Entrance
  - ➢ Maintain the existing five bus bays along 19th St., that are currently in use to serve existing and future demand, but add a continuous bus platform canopy to shelter customers. The unused sixth bay is currently part of the right turn lane.
  - ➢ Replace existing bus shelters with new glazed windscreen shelters to complement the architecture of the bus platform canopy and in accordance with the AWI standards.
  - ➢ The corner of 19th Street and Independence Avenue has been redesigned to eliminate the diagonal cut-through and associated bus bays. WMATA has determined that an excess capacity of bus bays exists at this corner and has no plans for future bus service expansion at the station. The area with three bus bays could be converted to another use. The part of the site above the station mezzanine structure is shown as a public plaza with seating, landscaping and a place for public art. Vehicular access to the chiller plant shall be from the public plaza to allow development on the remainder of WMATA property.
  - ➢ A pull-off lane is proposed on Independence Avenue for pick-up drop-off activity from private automobiles and shuttle buses with a canopy/shelter for waiting designed to match the continuous bus platform/canopy.
  - ➢ Covered bike racks and lockers are proposed to serve the future Anacostia Riverwalk Trail.
- ▪ An area for potential development is proposed at the north station entrance. A site of approximately 59,000 square feet (1.35 acres) could be earmarked for redevelopment just east of the station entrance and bus bays. The site is owned by WMATA and the U.S. Park Service and is currently underutilized as bus bays and a surface parking lot for the DC Armory. The only existing structure on the site is the WMATA chiller plant. The proposed plan shows a rectangular footprint for a 3 to 5 story building, of 166,000 square feet to 285,000 square feet. Although no development program is being proposed for this building, ground floor retail would be appropriate to serve the neighborhood and transit customers, and to contribute to the street life of the area.

The planning concepts presented above are common to the two alternatives presented in the Master Plan.

Alternative 1
This Alternative places the streetcar platforms on the east and west sides of 19th St. between Independence Ave. and A St., adjacent to the north Metro entrance. The short block widths and the alley curb cuts prevent locating a station platform south of Independence Avenue on 19th Street, therefore, both platforms are located north of Independence Avenue. Since 19th St. is a one way street in the northbound direction, further study will be needed to determine required right-of-way and traffic flow issues. Also, the northbound streetcar could interfere with bus operations.

Alternative 2
This Alternative places the streetcar platforms on the east and west sides of the block between C St. and Burke St., at the corner of C St. and 19th St., adjacent to the south station entrance. The conditions in Alternative 1 also apply to this location. Capacity improvements inside of the station are described in Section 6.

4. MASTER PLAN

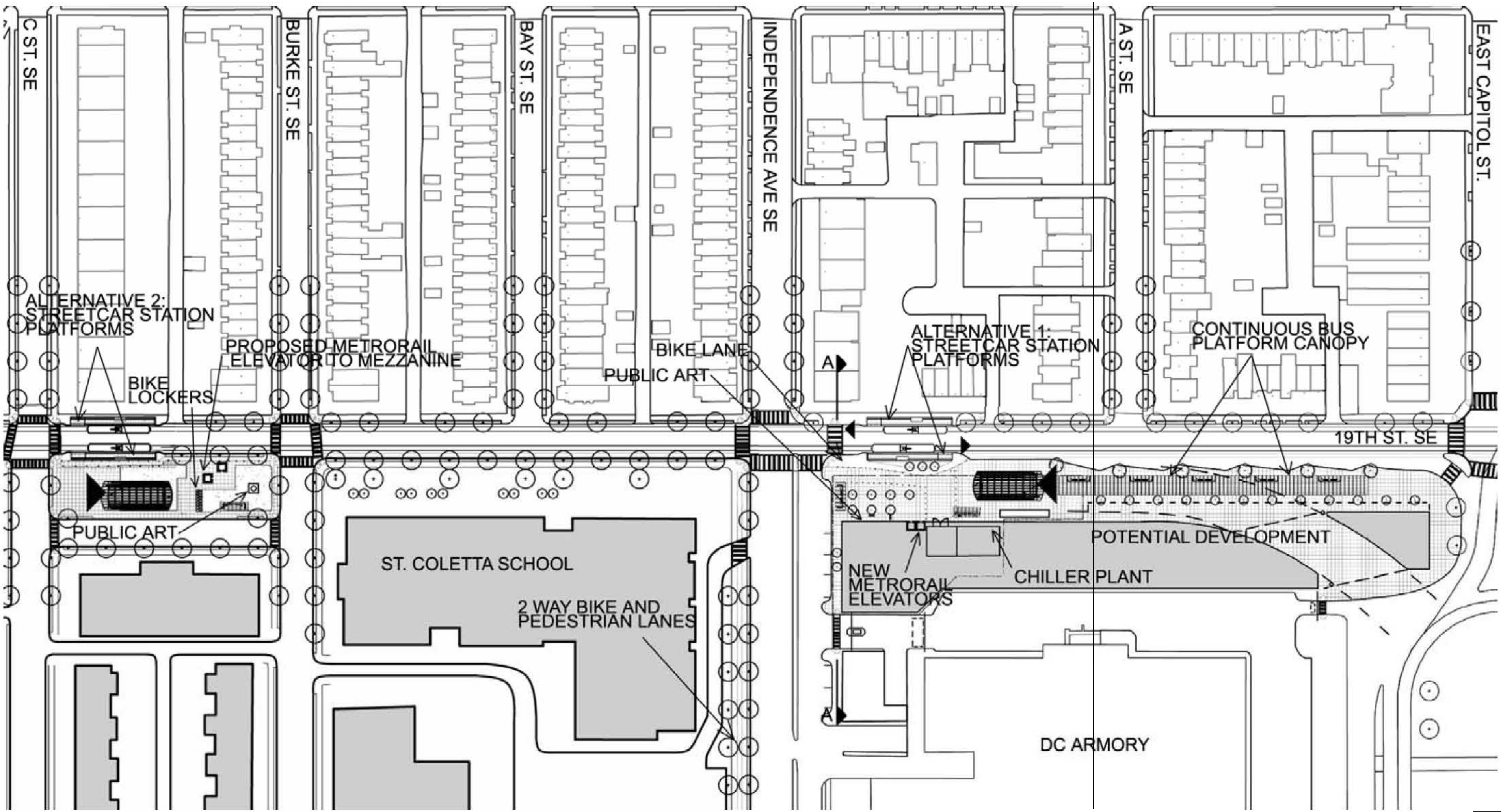


Figure 5: Site Plan **SCALE: 1”=120’**

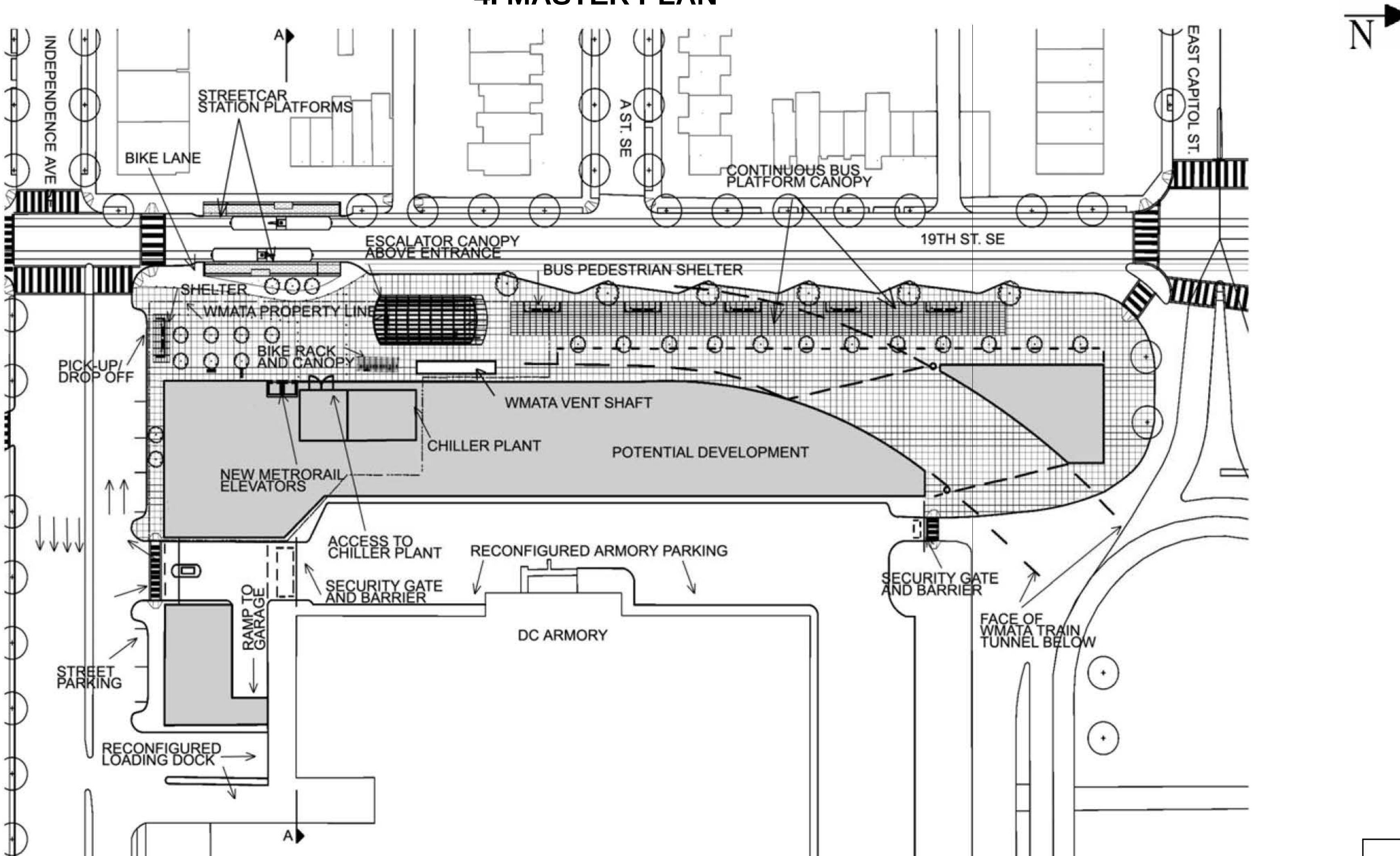


Figure 6: Enlarged Site Plan—North Entrance

SCALE: 1”=50’

4. MASTER PLAN

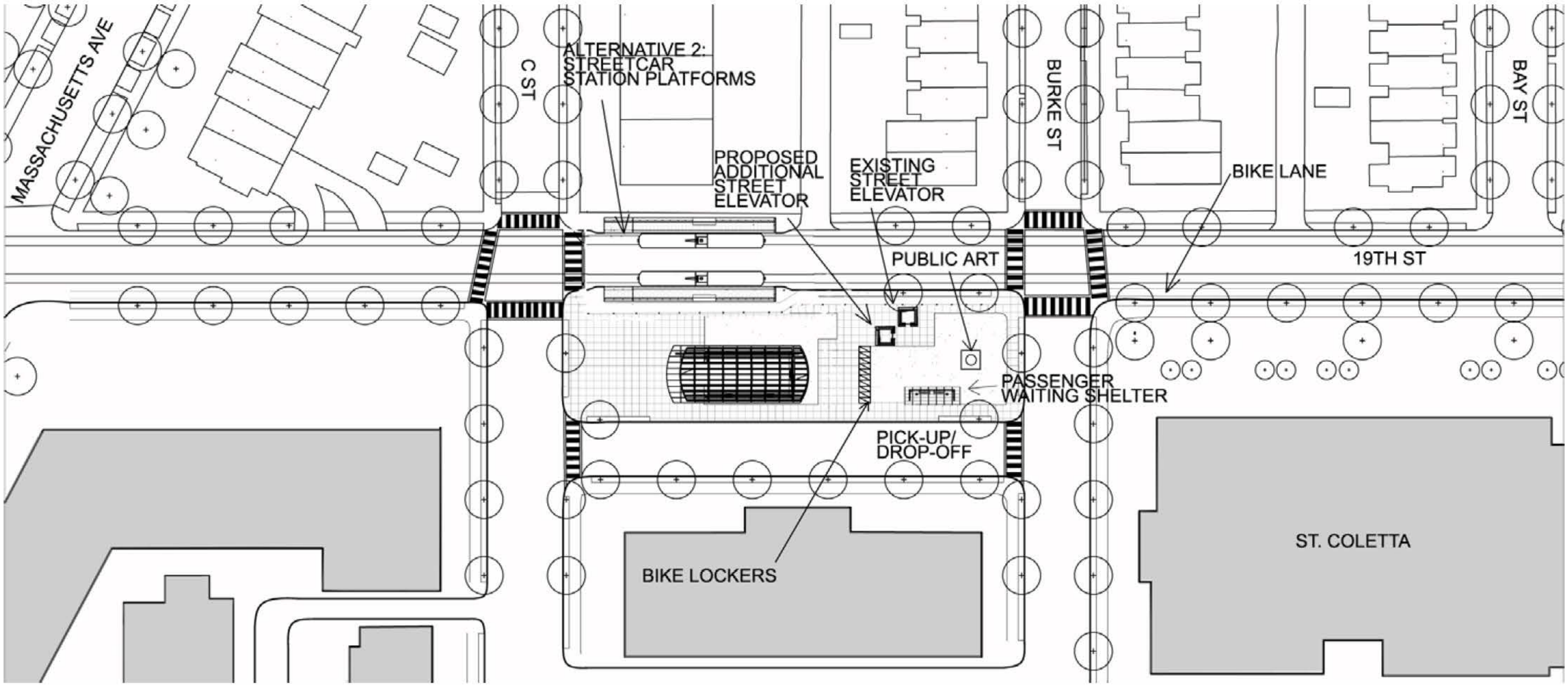
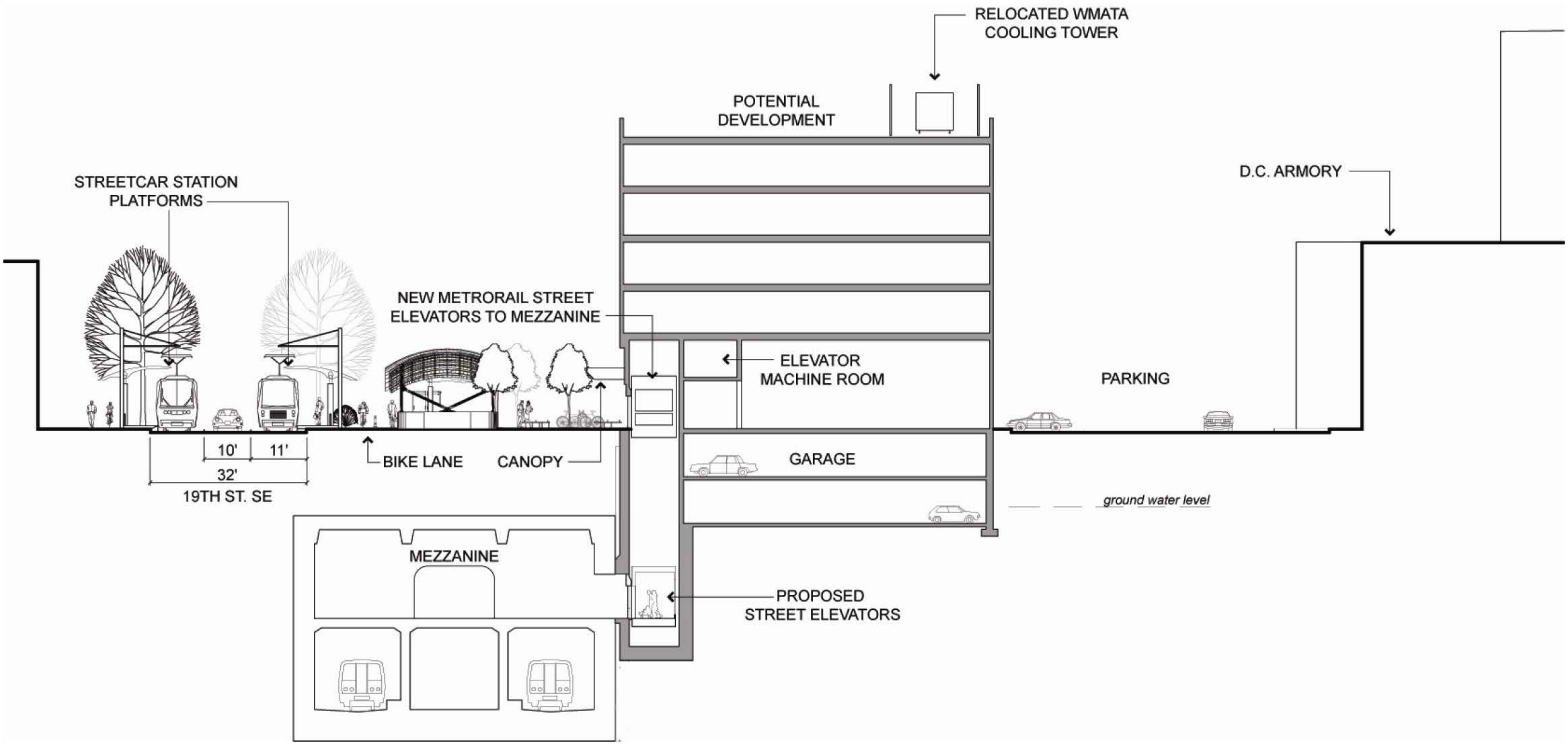


Figure 7: Enlarged Site Plan—South Entrance

SCALE: 1”=50’

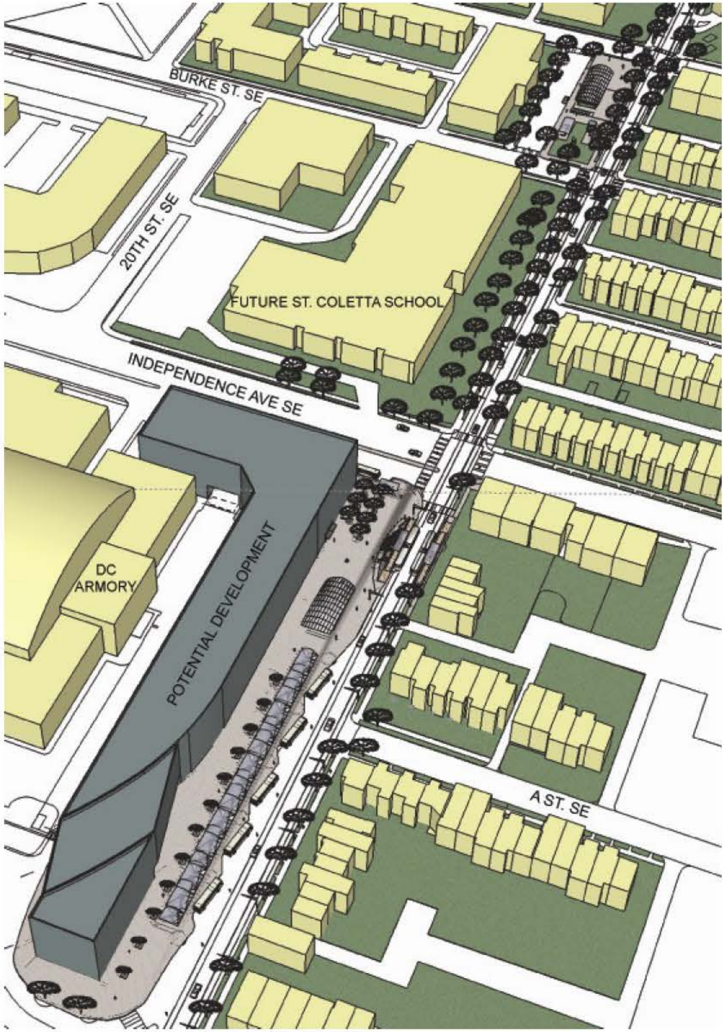


TYP. SECTION

SCALE: 1”=20’

Figure 8: Section—North Entrance

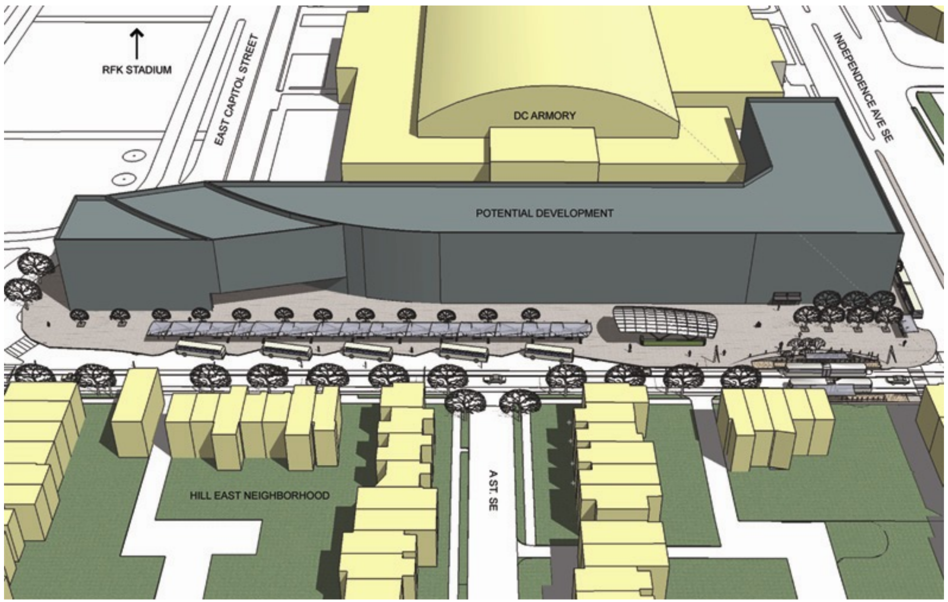
4. MASTER PLAN



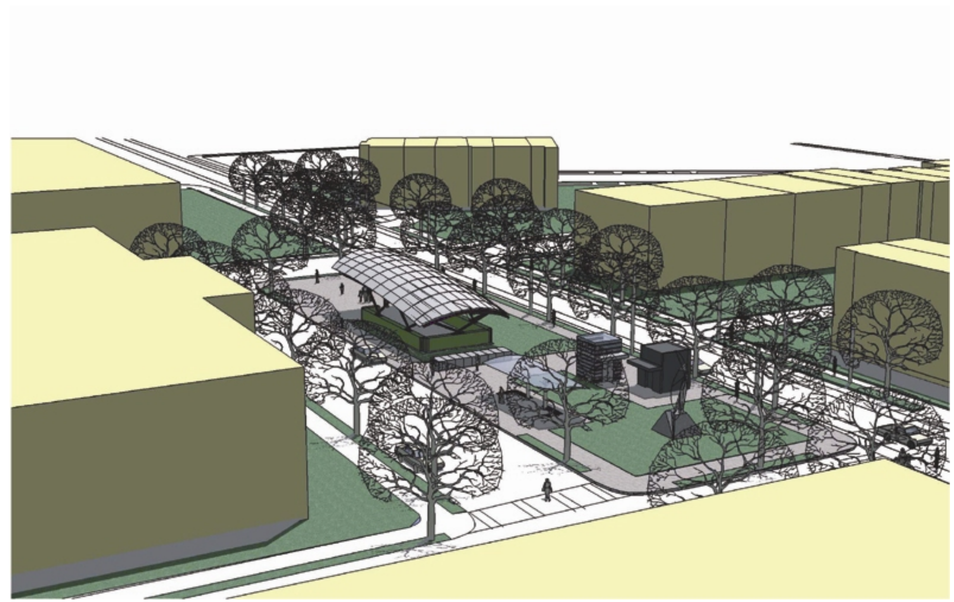
SOUTHBOUND 19TH ST.

NORTHBOUND 19TH ST.

Figure 9: Aerial Perspective



NORTH ENTRANCE



SOUTH ENTRANCE

Figure 10: Aerial Perspective

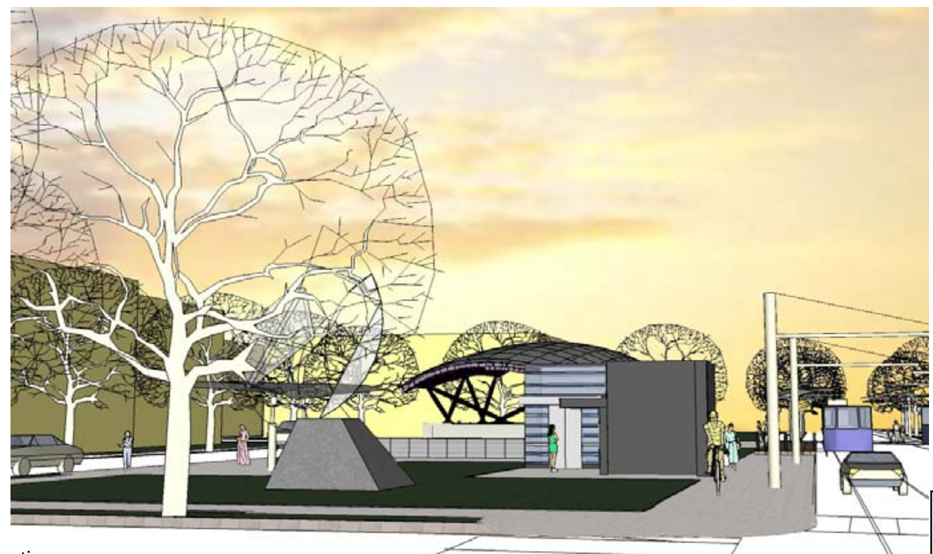


Figure 11: Perspectives

Motor Vehicles

Major arterials near the Stadium-Armory Metrorail station area are primary routes for commuters traveling between areas east of the Anacostia River and Washington's downtown core. These streets include East Capitol Street, C Street NE, and Independence Avenue SE. Near 19th Street, East Capitol Street carries approximately 14,000 vehicles per day (vpd). C Street NE carries 21,000 vpd, and Independence Avenue SE carries 14,000 vpd. Between 4,600 and 5,000 vpd use 19th Street SE/NE in the vicinity of the Stadium-Armory Metrorail station.[1]

There are three major intersections along 19th Street SE/NE that are close to the north entrance of the Metrorail station. All three are signalized. Traffic counts were performed recently at all three intersections:

- Independence Avenue SE and 19th Street SE, March 2004
- East Capitol Street and 19th Street SE/NE, June 2005
- C Street NE and 19th Street NE, March 2005

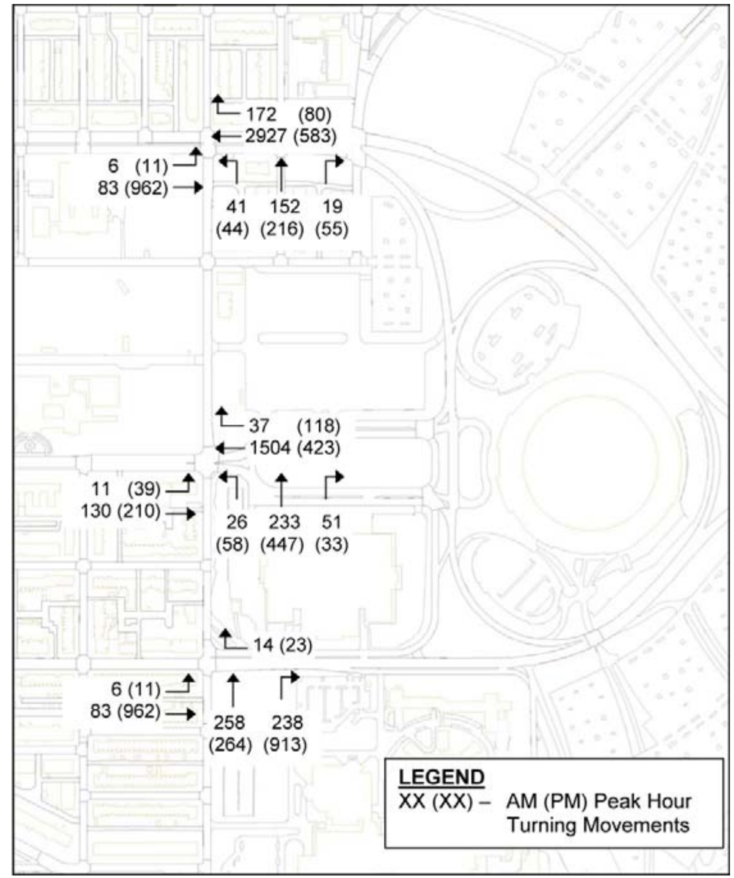
From the traffic count data, the morning peak period was determined to be from 7:00 a.m. to 9:00 a.m., and the evening peak period was determined to be from 4:30 p.m. to 6:30 p.m. The morning peak hour was calculated as 7:15 a.m. to 8:15 a.m., and the evening peak hour was calculated as 5:15 p.m. to 6:15 p.m. The highest approach volume in the morning peak hour was approximately 3,100 vehicles per hour (vph) westbound on C Street NE, and the highest approach volume in the evening peak hour was approximately 2,250 vph eastbound on Independence Avenue SE. Peak-hour volumes are in **Table 1** and **Figure 1**.

Table 1. Highest Peak-Hour Volumes
Source: Parsons Brinckerhoff, 2005

Link	Highest Peak-Hour Volume	
	AM	PM
NB 19th Street at Independence Avenue	496	1,178
EB Independence Avenue at 19th Street	461	2,258
NB 19th Street at East Capitol Street	310	538
EB East Capitol Street at 19th Street	141	249
WB East Capitol Street at 19th Street	1,541	541
NB 19th Street at C Street	212	315
EB C Street at 19th Street	89	973
WB C Street at 19th Street	3,099	663

[1] DDOT, 2002 Traffic Volumes

Figure 12. Existing Intersection Volumes



Highway Capacity Software[2] (HCS) was used to determine the intersection delays and the levels of service (LOS) for each of the three intersections. **Table 2** displays the results for existing conditions. All three intersections operate at LOS C or better in both the morning and evening peak hours, which is considered good traffic operations. Drivers experience delays on the average of 53 seconds per vehicle or less during peak hours.

Table 2. Existing Conditions Intersection Analyses
Source: Parsons Brinckerhoff, 2005

Intersection	Time Period	Fr South delay	Fr East delay	Fr West delay	Total delay	LOS[3]
19th and Independence	AM	10.6	23.4	25.3	17.4	B
	PM	53.1	8.2	13.4	22.6	C
19th and East Capitol	AM	27.8	15.6	7.7	16.9	B
	PM	29.8	8.5	8.1	17.1	B
19th and C	AM	35.1	11.0	4.9	12.3	B
	PM	31.4	7.4	8.7	11.9	B

Transit

The bus facilities along the east side of 19th Street SE at the north station entrance include nine bus bays, but only five are currently in use. Six bus bays are located along the 19th Street SE east curb and three bus bays are located just north of Independence Avenue SE.

Four Metrobus routes serve the station, as shown in **Figure 13**. The routes and the frequency of service for the morning and evening peak hours are listed in **Table 3**.

[2] Highway Capacity Software, version 4.1d. McTrans, University of Florida, 2003.
[3] The peak-hour level of service is a measure of the adequacy of the existing lanes and/or signalization at an intersection or roadway segment for the particular peak hour. Level of service is measured on a scale of A through F, with LOS A representing the best operating conditions with little or no delay and LOS F representing the worst with unacceptable delay. **LOS A** – less than 10.0 seconds of delay per vehicle; **LOS B** – between 10.0 and 20.0 seconds of delay per vehicle; **LOS C** – between 20.0 and 35.0 seconds of delay per vehicle**; LOS D** – between 35.0 and 55.0 seconds of delay per vehicle; **LOS E** – between 55.0 and 80.0 seconds of delay per vehicle; **LOS F** – greater than 80.0 seconds of delay per vehicle.

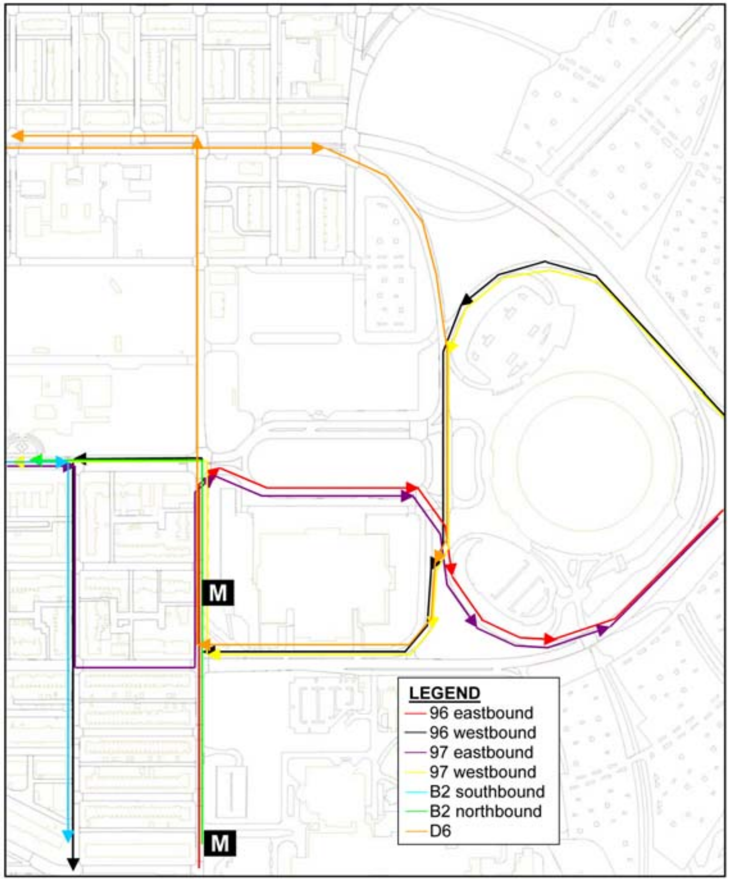
Table 3. Number of Weekday Bus Stops during Peak Periods at the Stadium Armory Metrorail Station
Source: WMATA

Route	Westbound AM	Eastbound AM	Westbound PM	Eastbound PM
96	7	7	6	6
97	11	7	8	8
D6	12	6	7	11
	Northbound AM	**Southbound AM**	**Northbound PM**	**Southbound PM**
B2[4]	18	-	13	-
Total	**68**		**59**	

[4] Bus route B2 (southbound) does not stop at the Stadium Armory Metrorail Station, but does stop close to the station along 18th Street SE/NE.

Currently, 68 buses stop at the Stadium-Armory station during the morning peak from 7:00 to 9:00 a.m., and 59 buses during the evening peak from 4:00 to 6:00 p.m. There are 16 buses that stop on 18th Street during both the morning and evening peak periods.

Figure 13. Existing Metrobus Routes at the Stadium-Armory Metrorail Station



Recent daily Metrobus boarding and alighting at the Stadium-Armory station for the four bus routes is summarized in **Table 4**.

Table 4. Metrobus Daily Ridership at Stadium-Armory Station
Source: WMATA, 2005

Route	Number of Passengers	
	Boardings	Alightings
96,97	285	332
B2	341	127
D6	370	212
Total	**996**	**671**

Pedestrian and Bicycle Access

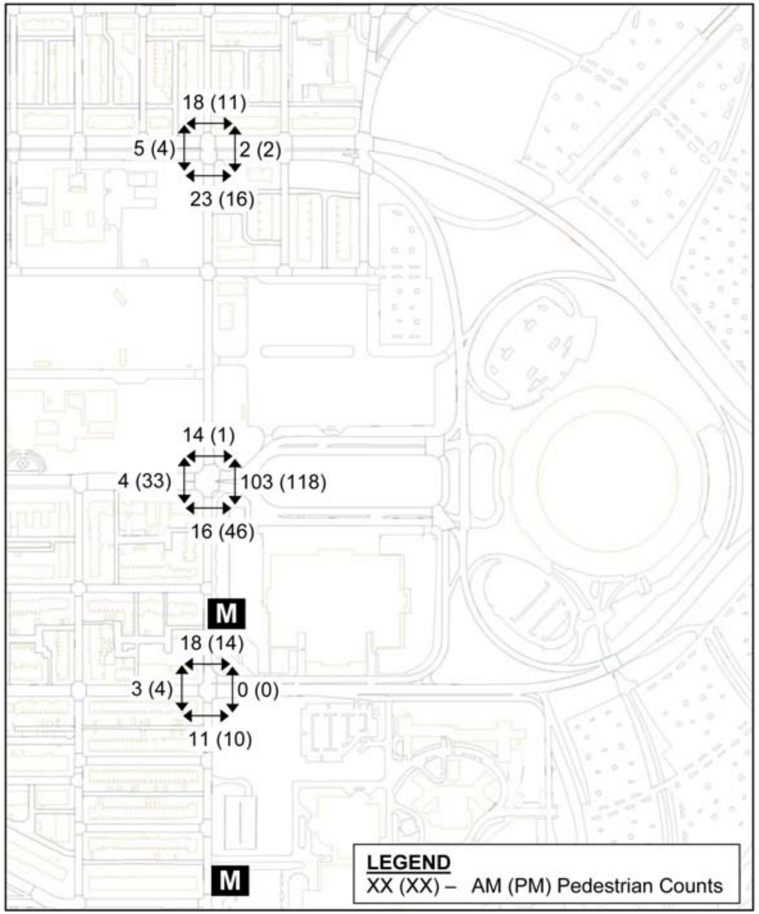
Several pedestrian and bicycle traffic generators are located near the north entrance of Stadium-Armory Metrorail station, including the DC Armory and Robert F. Kennedy Memorial Stadium to the east; RFK Stadium parking lot #3, which is used as a park-and-ride lot, to the north; and Eastern Senior High School and the residential community to the west.

The three signalized intersections along 19th Street SE/NE all have countdown pedestrian signal heads, which provide safety for pedestrians and cyclists crossing at these locations by indicating the time remaining for the crossing before the crossing time ends.

Pedestrian and bicycle movements were observed at the intersection of East Capitol Street and 19th Street SE/NE in June 2005. Pedestrians do not always cross at the designated crosswalks at this intersection but cross outside the crosswalk areas to shorten their walking distances. Many pedestrians cross east of the intersection along the RFK Stadium mall to access the park-and-ride lot, which is the largest generator of pedestrian traffic during the morning and evening peak hours. **Figure 14** presents the pedestrian volumes at the three signalized intersections along 19th Street SE/NE.

5. TRAFFIC ANALYSIS

Figure 14. Pedestrian Counts near the Stadium Armory Metrorail Station



Deficiencies

On June 16, 2005, a site visit to the area was conducted to evaluate the needs for improvements for all modes of travel at the Metrorail station. Existing deficiencies were noted during the site visit. These are summarized below:

Independence Avenue SE and 19th Street SE

- Median on the east side of the intersection is too narrow.
- Wheelchair ramps are not aligned on both sides of the intersection, resulting in a “zigzag” pattern.
- The condition of the concrete pavement at the pedestrian crosswalk on the east side of the intersection is poor.

East Capitol Street and 19th Street SE/NE [1]

- Wheelchair ramps are narrow and do not meet current ADA standards.
- Sidewalks are too narrow or do not exist at the end of the wheelchair ramps in the northeast quadrant.
- The pedestrian crosswalk cut-through in the median on the east leg of intersection is too narrow.
- The traffic island in the southeast quadrant needs to be repaired.
- Lack of lane markings on the east leg of the intersection creates a lane imbalance.

C Street NE and 19th Street NE

- No median pedestrian crosswalk cut-through exist in the median on the west leg of the intersection.
- Pedestrian crosswalk cut-through in the median on the east leg of the intersection does not meet current ADA standards.
- Wheelchair ramps on the south side of the intersection do not meet current ADA standards.
- The mailbox on the northwest quadrant impedes pedestrian flow, as it is located between the two wheelchair ramps.
- The curb condition on the northwest quadrant is poor.

Bus Facilities

- No dedicated area for automobile passenger drop-off or pick-up exists.
- Some portions of the sidewalk should be replaced as the condition is poor.
- The condition of the curbing along bus bays is poor, with damaged, broken concrete.
- No streetscape furniture (such as benches) exists for pedestrians, other than the benches located inside the bus shelters.
- The station area lacks wayfinding signage, bus route maps and station-area maps.
- The station does not have any bike storage facilities.

[1] Many of these deficiencies identified for the East Capitol and 19th Street intersection will be corrected with the planned reconstruction of East Capitol Street between 19th and 22nd Streets.

Recommendations for Improvement

Recommendations have been developed to improve access for all modes of travel to the Stadium-Armory Metrorail station. These recommendations would improve the deficiencies that currently exist at the Metrorail station. The improvements have been summarized by location:

Independence Avenue SE and 19th Street SE

- Widen the median on the east side of the intersection to improve pedestrian safety.
- Realign the wheelchair ramps on the east side of the intersection so that the path is straight from the southeast corner of the intersection to the northeast corner of the intersection and through the bus lanes.
- Replace concrete sidewalks in disrepair in accordance with the AWI Transportation Architecture Design Standards.
- Place wayfinding signs in the southeast quadrant to direct people towards the Anacostia Waterfront when the Riverwalk Trail project is completed and to other areas at the station

East Capitol Street and 19th Street SE/NE [1]

- Increase width of sidewalk in the northeast quadrant of the intersection to six feet.
- Install new ADA compliant wheelchair ramps in the northeast and northwest quadrants.
- Widen the median cut-through in east leg of the intersection to six feet.
- Repair the traffic island in southeast quadrant and relocate the wheelchair ramps and the traffic signal pole to avoid conflicts for pedestrians.
- Place signage in the southeast quadrant to direct people towards the Anacostia Waterfront when the Riverwalk Trail project is completed.

C Street NE and 19th Street NE

- Replace existing wheelchair ramps in the south quadrants of the intersection with ADA compliant ramps.
- Install ADA compliant wheelchair cut-through paths in the median on the east leg and widen the cut-through path on the west leg.
- Relocate the mailbox in the northwest quadrant to avoid conflicts for pedestrians and disabled persons.
- Replace the curbing in the northwest quadrant.

Bus Facilities

- Replace curbing and sidewalks in poor condition with new concrete.
- Add directional signs to include layout of bus facilities and directions to RFK Stadium, Reservation 13, and Anacostia Waterfront.
- Install bicycle storage facilities in a highly visible, well lit area.

All Locations

- In strategic locations throughout the station site at both entrances, provide wayfinding signage to direct pedestrians to the station entrances, bus facilities, pick-up/drop off areas, and bicycle storage facilities. Also, provide signage directing customers exiting the station to points of interest in the station vicinity: the Anacostia Riverwalk Trail, the Congressional Cemetery, DC Armory, Kingman Island Park, government and municipal facilities within the Hill East Waterfront Development among others.

Summary of Findings

The existing level of service (LOS) at the three intersections adjacent to the Stadium-Armory Metrorail Station is LOS C or better, which signifies good traffic operations. The intersections provide sufficient capacity for pedestrians; however they do need infrastructure improvements to improve mobility for pedestrians and disabled persons. These improvements include installing or replacing wheelchair ramps, and constructing median cut-through paths to meet current ADA standards. Minor improvements are needed at the bus bay area. Sections of the concrete sidewalk that are in poor condition should be replaced. A bicycle rack should be installed in a highly visible area to encourage people to use bicycles to reach the Metrorail station. Directional signage near the entrance to the Metrorail station should be installed to guide people to the various attractions around the station, including RFK stadium, DC Armory, and the Anacostia Waterfront.

[1] Recommendations for improvements to the E. Capitol Street and 19th Street intersection shall be forwarded to DDOT's Infrastructure Project Management Administration.

6. STATION CAPACITY AND ENHANCEMENTS

Existing Conditions:

The Stadium-Armory station has two mezzanines and entrances at each end of the station train room. The north entrance, known as the Stadium & Armory entrance, has three escalators from the platform to the mezzanine and three escalators and one stair from the mezzanine to the street. A bank of three escalators provides additional capacity for DC Armory and RFK Stadium events. The north entrance does not have elevator service. The south station entrance, known as the DC General entrance, has two escalators from the platform to the mezzanine and two escalators from the mezzanine to the street. There are thirteen faregates at the north mezzanine and six faregates at the south mezzanine. The station has only one elevator for each level of the station at the south entrance.

Ridership:

On a typical weekday, there are 3,015 customers entering the station with 740 entries at the south entrance and 2,275 entries at the north entrance. Excluding ridership from weekday Washington Nationals baseball games, ridership at the Stadium-Armory Station has remained virtually the same over the last five years. The 2002 WMATA Core Capacity study projected 4,980 daily boardings for the year 2025 at the Stadium-Armory station. Given the District's plans for the Hill East Waterfront development, ridership could exceed this projection within the next ten years, with the highest increase in entries at the south entrance. Ridership projections will be revised for all stations after WMATA completes the Station Inventory and Ridership Forecasts program later this fiscal year.

Mezzanine Capacity:

Without plans for a new, larger stadium on the RFK site, the thirteen existing faregates at the north mezzanine should provide sufficient capacity for the foreseeable future. The six existing faregates at the south mezzanine should provide adequate capacity to serve the projected increase in entries from the Hill East Waterfront Development and the future Medical Center, given that each faregate can handle up to 900 entries per half-hour. There is space available to add at least one additional faregate if it becomes necessary in the future.

Vertical Circulation Capacity:

Both station entrances should have adequate vertical circulation capacity to meet future ridership demand, given that each escalator can handle 3,000 people in a thirty-minute period. However, elevator service is inadequate and should be expanded, which is the case at other Metrorail stations. Customers using wheelchairs that rely on elevator service cannot access the station when either the single street elevator or the platform elevator is out of service. When either elevator is out of service at a Metrorail station for extended rehabilitation, customers using wheelchairs must use the elevators at the nearest station, then transfer to the destination station using expensive Metrobus shuttle service. For short-term elevator service disruptions, a bus must be dispatched on demand. During elevator outages, customers using strollers, wheeled luggage, and seniors with balance problems are forced to use escalators. WMATA policy prohibits strollers and wheeled luggage on escalators for safety reasons.

Current WMATA design criteria for the planning of new or expanded Metrorail station facilities require redundant elevator service between all levels of a station. When a minimum of two elevators is provided between each level in a station, access for station customers using a wheelchair can be provided even if one of the elevators is shut down for repairs or maintenance. Maintenance on one elevator could then be performed during revenue hours whenever necessary without restricting wheelchair access. Providing elevator redundancy at Stadium-Armory solves these access and safety issues for persons with disabilities and other customers. Figure 15 illustrates how additional elevators can be incorporated at both station entrances and mezzanines. The order of magnitude cost estimate for elevator improvements are described in Section 7.

Station Enhancements:

Enhanced signage inside the station should be provided to better direct customers to their desired station entrance and to station area destinations. During a recent site visit to the station, a station manager said he frequently has to redirect customers to the other entrance due to a lack of or unclear directions on signage, creating an unnecessary inconvenience for customers. Additional signage systems could be installed at the Stadium-Armory station similar to the signage provided as part of a successful pilot program at the Gallery Place-Chinatown station.

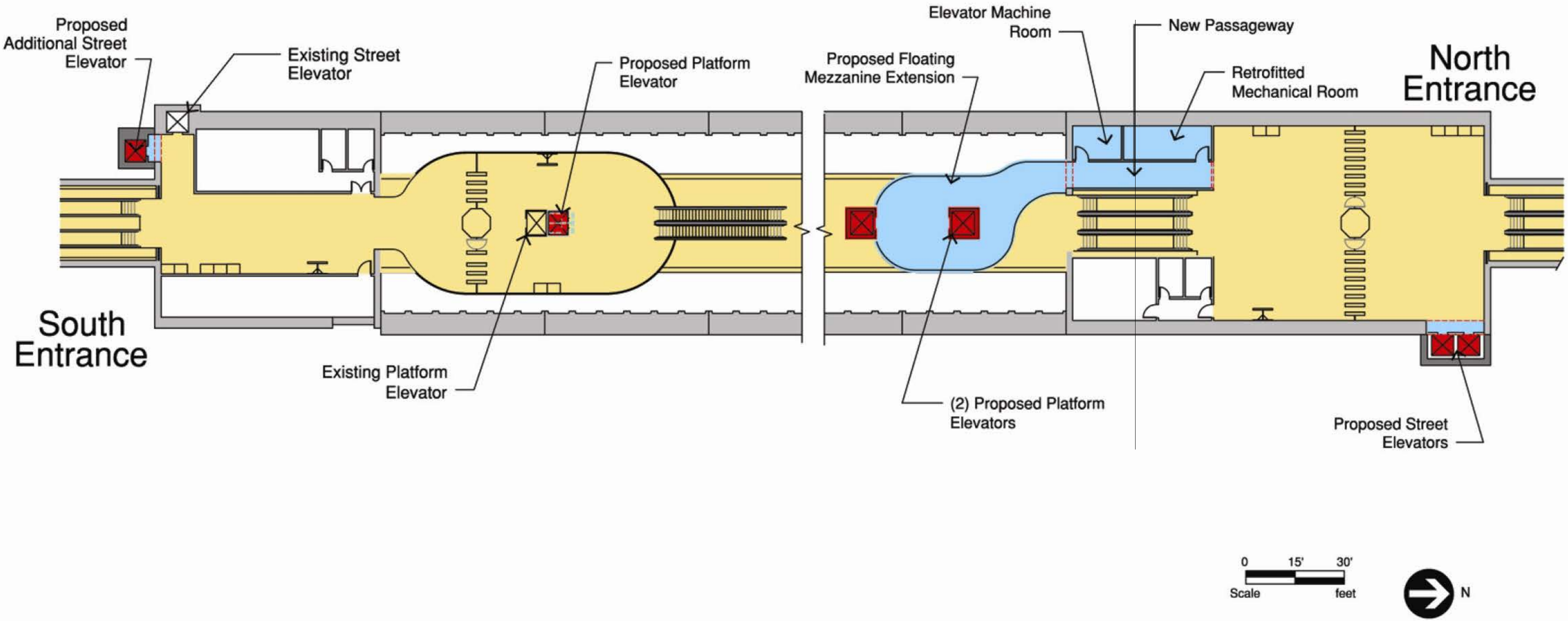


Figure 15: Proposed Station Capacity Improvements

7. ORDER OF MAGNITUDE

Table 5. Order of Magnitude Cost Estimate

Item No.	Element	Approx. Cost (FY06 $)
1	South Entrance/Mezzanine: Platform Elevator, Street Elevator	$2,703,700
2	North Mezzanine: Mezzanine Expansion, Platform Elevators, Mechanical Room Reconfiguration	$3,010,300
3	North Entrance: Street Elevators	$3,588,300
4	Site Work: Utilities Relocation, Sidewalks, Curbs, Furniture, Lighting, Traffic Controls	$2,060,300
5	Interior Station Signage Enhancements	$383,500
	Sub-Total	$11,748,100
6	Contingency (30%)	$3,524,430
7	Soft Costs: Design+Engineering (10%), Design Management (10%), Construction Support (10%), Insurance/Bond (5%)	$4,111,835
	Total Cost	**$19,384,365**

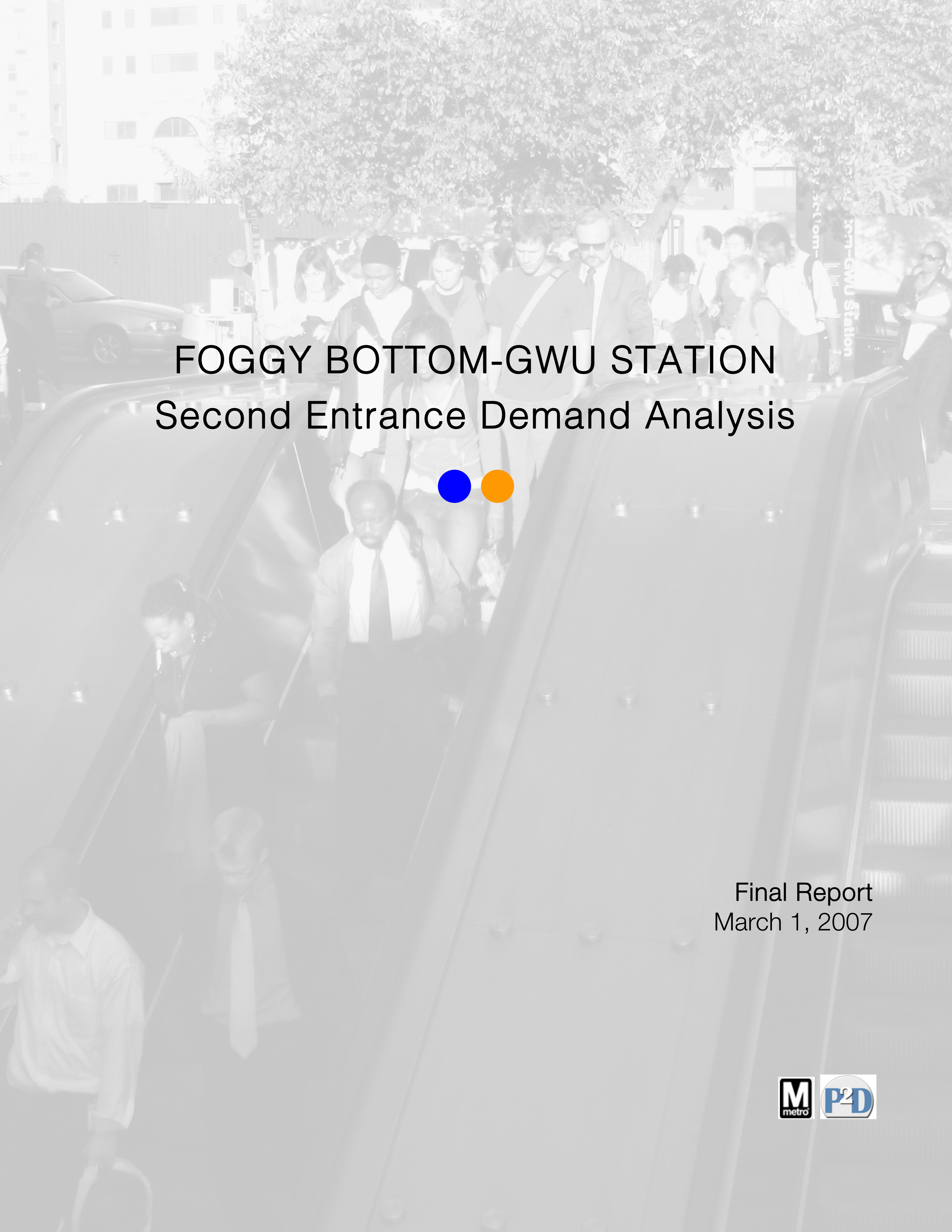
Cost does not include any potential land acquisition for development.

8. NEXT STEPS

The Stadium-Armory Station Area Planning Study has been prepared to provide the District of Columbia with documentation for the feasibility of the proposed alternatives for station site and access improvements. If the District decides to move forward with the planning process for implementing any improvements to the station, then WMATA will work with the District in the conceptual engineering and environmental assessment process.

The conceptual engineering process will be subject to further review by WMATA, AWC, the District, and the citizens of the Stadium-Armory Station area community through the process of public hearing and environmental assessment. WMATA would also coordinate the design for any site improvements with other District transportation and development projects adjacent to the station.

The development proposed at the north station entrance would require significant coordination between WMATA, the District, NCPC, DCSEC, and the U.S. Park Service. Potential development is proposed as part of the station master plan to present a potential means for funding portions of the station site improvements (by direct contribution from a developer, through TIFF funds from sale of WMATA property, or by the increase in tax revenue from the development) and for demonstrating how an important, but underutilized area adjacent to a station entrance can realize its highest and best use.



FOGGY BOTTOM-GWU STATION
Second Entrance Demand Analysis

Final Report
March 1, 2007

This page intentionally left blank

FOGGY BOTTOM-GWU STATION
Second Entrance Demand Analysis

Washington Metropolitan Area Transit Authority

Final Report

March 1, 2007

a joint venture of:
- Parsons Transportation Group Inc.
- Parsons Brinckerhoff Quade & Douglas, Inc.
- Delon Hampton & Associates, Chartered

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The Foggy Bottom-GWU station carried the eighth highest number of daily riders in the Metrorail system in 2006. Though the station efficiently handles passengers during typical peak hours, its emergency egress capabilities do not meet industry standards. In addition, ridership at the station is expected to increase approximately 15 percent by 2030. The addition of a second entrance to the Foggy Bottom-GWU Metrorail station would improve access to the station, the future efficiency of the station, and emergency evacuation time.

This study compared alternative entrance configurations by analyzing existing and future land uses, existing and projected future ridership, capacity constraints of the various station facilities, physical constraints of the site, and emergency egress performance.

Station Area Land Use and Ridership

Due to its central location in the District, the station area is home to more office than residential development. In addition, the majority of parcels within the station area are already developed. The DC Office of Planning, however, does anticipate an approximately 20 percent increase in station area households and two percent increase in employment by 2030.

The addition of a second station entrance at the intersection of 22nd and I Streets NW would not measurably increase the catchment area for walk-access passengers, which are the majority of Foggy Bottom-GWU riders. However, an entrance at this location would improve access for passengers located to the east of the station.

Forecasted ridership trends at the station are presented in the table below. Passenger volumes at the station are expected to increase by approximately 15 percent, which is similar to expected land use increases.

Table 1: Foggy Bottom-GWU Station Ridership Forecasts

	Time	2005	2010	2020	2030	% Change 2005-2030
Boardings Peak ½ Hour	5:00 PM - 5:30 PM	1,943	2,005	2,217	2,232	14.9
Boardings Peak Hour	5:00 PM - 6:00 PM	3,666	3,731	4,165	4,207	14.8
Alightings Peak ½ Hour	8:30 AM - 9:00 AM	2,133	2,173	2,413	2,445	14.6
Alightings Peak Hour	8:00 AM - 9:00 AM	4,220	4,249	4,700	4,751	12.6

Source: WMATA Station Access and Capacity Study data, 2006

Station Entrance Alternatives

The study explored the following alternatives:

1. Entrance at northwest corner of 22nd and I Streets NW
2. Entrance at southeast corner of 22nd and I Streets NW
3. Entrance locations near the corner of 24th and I Streets NW

A new entrance at the southeast corner of 22nd and I Streets NW is recommended. A new entrance at this location could be integrated into a future building, as the GWU Campus Plan proposes the redevelopment of this block.

The recommended entrance would include two escalators, a stair, and two elevators from the surface. These vertical access features would lead to a new mezzanine level outside the station tunnel, which would contain the faregate array for entry to the station. A short pedestrian tunnel would lead to two ADA-compliant elevators and a new stair leading down to the platform level.

An entrance at the northwest corner of 22nd and I Streets would provide needed additional station capacity, but it is not recommended. A new entrance here would require more-extensive construction because of the site topography, as well as a redesign of the buildings already planned for the site. An entrance west of the station is not recommended for several reasons. A new entrance to the west would not provide necessary added station capacity because all passengers would still have to move through the single internal mezzanine. In addition, each location for a new entrance west of the station would have at least one serious physical or construction drawback.

Implementation

Construction of a second entrance at the east end of the Foggy Bottom-GWU station would require architectural and structural modifications to the existing station as well as changes to the mechanical and electrical systems. All would be designed to comply with the applicable WMATA design criteria.

Order-of-magnitude costs were estimated for the construction of a second entrance at the east end of the Foggy Bottom-GWU Metrorail station. They total $21.2 million.

This study assumed that a second entrance to the Foggy Bottom-GWU station would be jointly developed by WMATA and The George Washington University (GWU). Because GWU is planning to redevelop the site recommended for a new entrance, developing the site concurrently would decrease construction time and costs and would provide for efficient use of infrastructure.

1 INTRODUCTION

The Foggy Bottom-GWU Metrorail station, located on the Metrorail Orange and Blue Lines, is the primary Metrorail station for residents and workers in the Foggy Bottom neighborhood and The George Washington University (GWU) campus in Washington, DC. The station has a single entrance, located at the northwest corner of 23rd and I Streets NW. In 2006, the station served the eighth highest number of daily riders in the Metrorail system; by 2030, the Washington Metropolitan Area Transit Authority (WMATA) expects ridership to grow by about 15 percent. According to the WMATA *Core Capacity Study*, the station is located in the Metrorail "core," making its capacity and access critical to expected system ridership growth.

The platform of the Foggy Bottom-GWU station runs under I Street NW from 22nd Street to between 23rd and 24th Streets NW. The existing station entrance is near the west end of the platform, just west of 23rd Street NW.

1.1 Purpose and Methods

Of the nine busiest Metrorail stations, Foggy Bottom-GWU is the only one with a single entrance. The creation of a second entrance would help improve station access to and from the surrounding area and increase the station's capacity to handle passengers during peak and emergency conditions. Therefore, the District of Columbia government requested that WMATA study the feasibility of adding a second entrance to the Foggy Bottom-GWU station.

The study compared alternative entrance configurations by analyzing existing and future land uses, existing and projected future ridership, capacity constraints of the various station facilities, and emergency egress performance. Based on this information, a new station entrance was conceptually designed and its costs were estimated.

Figure 1: Foggy Bottom-GWU and Surrounding Metrorail Stations
Source: WMATA, 2006

2 STATION CHARACTERISTICS TODAY

2.1 Station Area Land Use

The Foggy Bottom-GWU Metrorail station is located close to the Potomac River, the Downtown Business Improvement District (BID), the Golden Triangle BID, and the West End neighborhood. The GWU campus and the GW Hospital, which opened in 2002, surround the station. Due to its central location in the District, the station area is home to more office than residential development. In addition, the majority of parcels within the station area are already developed. Recent station-area developments include mixed-use residential and retail at the former Columbia Hospital for Women site and a specialty grocery store, both at 24th and L Streets NW.

The DC Office of Planning provided land use information at the traffic analysis zone (TAZ) level. The station area TAZs are shown in Figure 2 and summarized in Table 2. Figure 3 shows the station-area neighborhoods.

Table 2: 2005 Station Area Land Use

	Households		Employment	
	2005	% of Total	2005	% of Total
¼ Mile Radius	6,072	12	44,656	88
½ Mile Radius	9,128	6	144,026	94

Source: DC Office of Planning (based on MWCOG Round 7.1 household and employment forecasts)

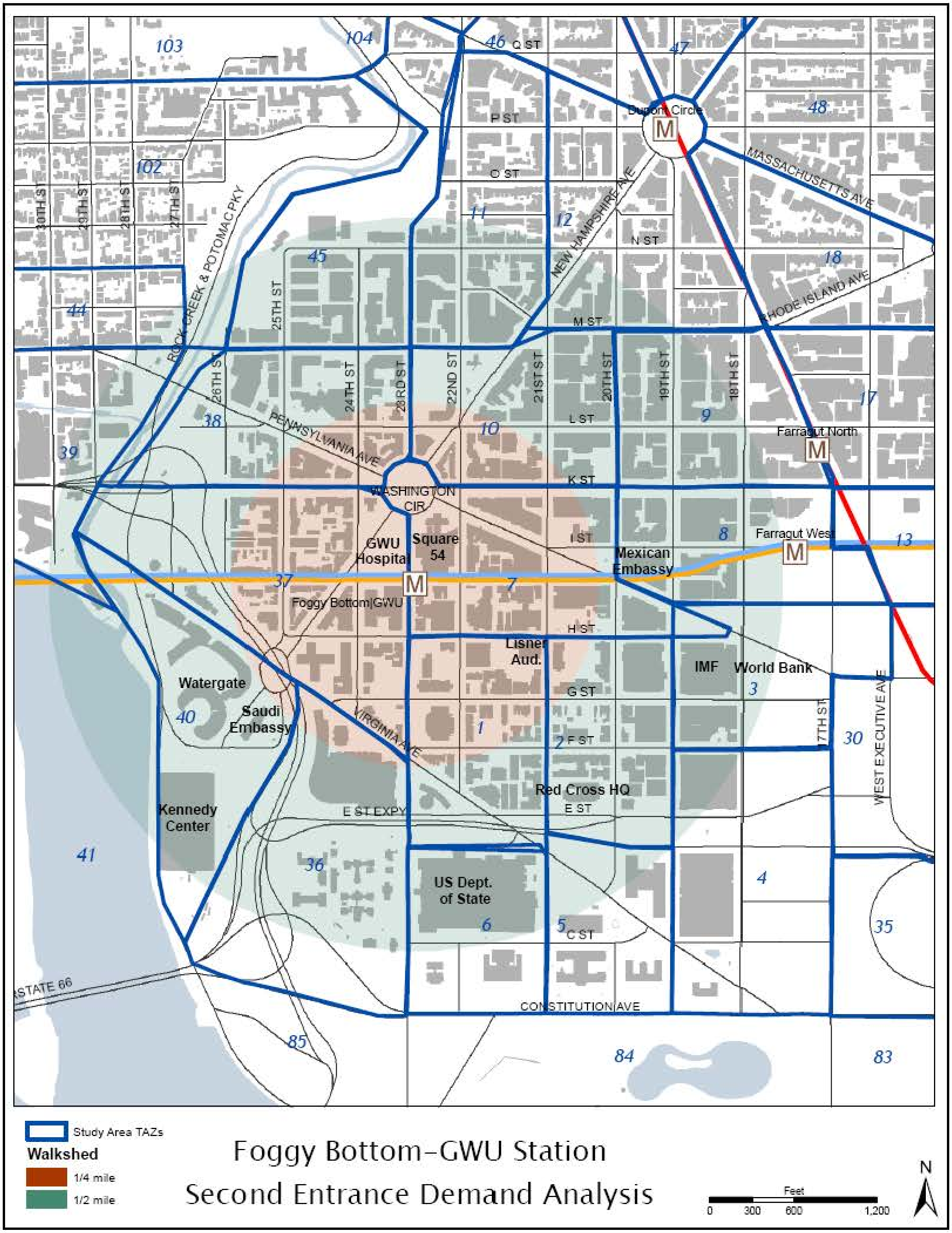


Figure 2: Station Area Walkshed and TAZs
Source: DC-OCTO-GIS, MWCOG, PB, 2006

Figure 3: Aerial View of the Foggy Bottom-GWU Area
Source: DC-OTCO-GIS, 1999

2.2 Existing Ridership

The Foggy Bottom-GWU station carried an average of 40,864 passengers per day in 2006, making it the eighth busiest Metrorail station. The existing ridership patterns at the Foggy Bottom-GWU station are shown in Figure 5. As expected from the predominance of jobs near the station, station exits, or alightings, are highest in the morning when riders are traveling to work and entries, or boardings, are highest in the evenings when riders are leaving work.

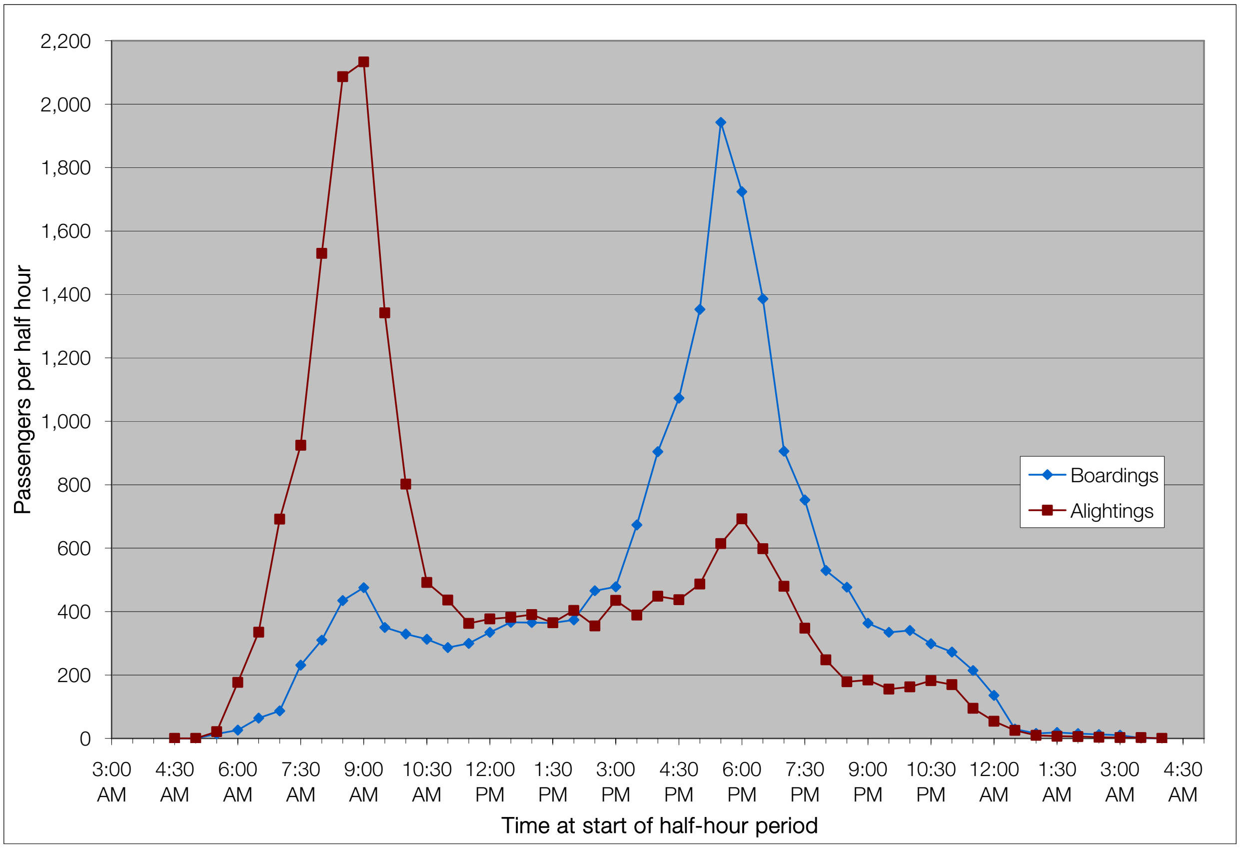


Figure 4: Existing Foggy Bottom-GWU Metrorail Station Boardings and Alightings
Source: WMATA Faregate data, May 2005

Figure 5: Riders entering the Foggy Bottom-GWU station during the evening peak hour
Source: PB, 2006

Ridership data collected from WMATA shows that the existing peak hours are 8:00-9:00 a.m. and 5:00-6:00 p.m.; similarly, peak half hours are 8:30-9:00 a.m. and 5:00-5:30 p.m.

Table 3: Average Weekday Boardings and Alightings, 2006

Time Period		Boardings	Alightings	Total
AM Peak Half Hour	8:30–9:00 AM	475	2,133	2,608
AM Peak Hour	8:00–9:00 AM	910	4,220	5,130
PM Peak Half Hour	5:00–5:30 PM	1,943	614	2,557
PM Peak Hour	5:00–6:00 PM	3,666	1,307	4,973

Source: WMATA Faregate data, May 2006

The majority of riders accessing the station arrive by walking (89 percent in the PM peak period), followed by bus, as shown in Table 4 and Figure 6. Because most riders already walk to the station, a new entrance located close to the existing entrance is not likely to attract a different balance of modes than exists today.

Table 4: Foggy Bottom Access Modes

Time Period	Total	Bicycle	Kiss 'n Ride	Drove & Parked	Metrobus	Other bus	Rode w/ someone, parked	Taxi	Walk
AM Peak	1,955	0	130	65	260	32	19	0	1,448
Percentage	-	0.00%	6.64%	3.32%	13.29%	1.66%	1.00%	0.00%	**74.09%**
Midday	4,112	13	107	134	107	134	0	40	3,576
Percentage	-	0.33%	2.61%	3.26%	2.61%	3.26%	0.00%	0.98%	**86.97%**
PM Peak	10,579	0	91	110	292	713	0		9,373
Percentage	-	0.00%	0.86%	1.04%	2.76%	6.74%	0.00%	0.00%	**88.60%**
Evening	4,872	0	34	51	102	392	0	17	4,276
Percentage	-	0.00%	0.70%	1.05%	2.10%	8.04%	0.00%	0.35%	**87.76%**

Source: WMATA 2002 Metrorail Passenger Survey

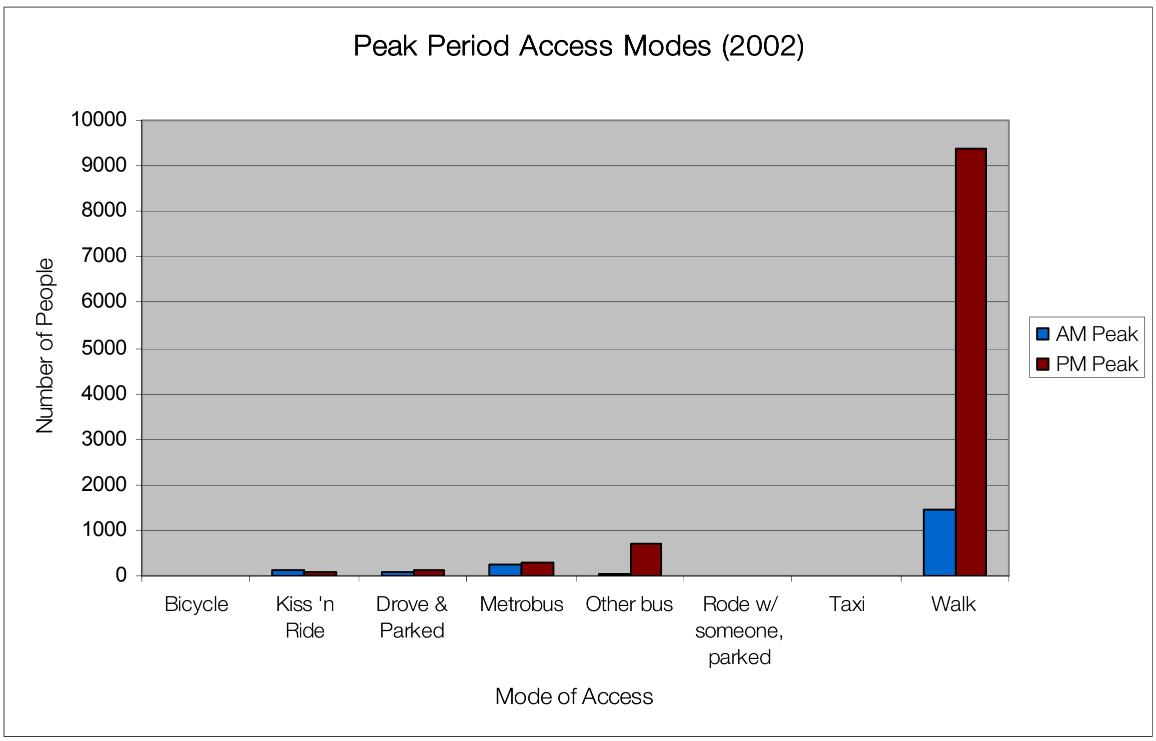


Figure 6: Foggy Bottom-GWU Station Peak Period Access Modes
Source: WMATA 2002 Metrorail Passenger Survey

2.2.1 Station Bus Service

As shown in Figure 7, Metrobus routes H1, L1, and N3 serve the Foggy Bottom-GWU station. Peak-period headways for these routes range from 15 to 30 minutes. Other Metrobus routes and the DC Circulator, with shorter headways, run within one block of the station. Bus access to the station is highest in the AM peak period.

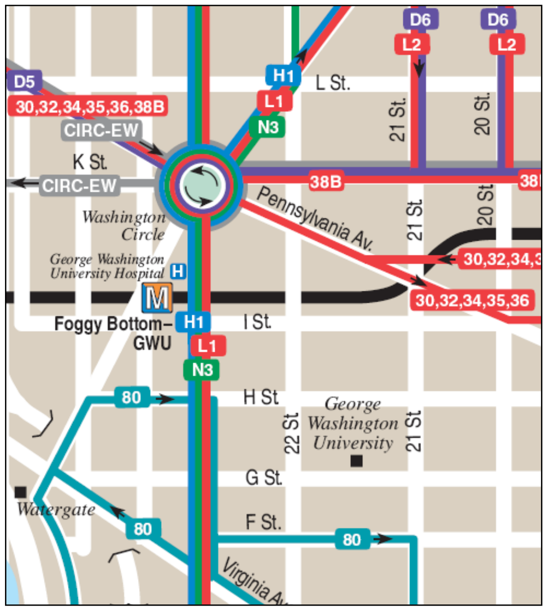


Figure 7: Bus Routes near Foggy Bottom-GWU
Source: WMATA, 2006

2.2.2 Pedestrian and Bicyclist Facilities

There are both pedestrian and bicyclist amenities at the Foggy Bottom-GWU Metrorail station. Based on a 2006 field survey performed by WMATA, 55 percent of the 20 bike lockers and 100 percent of the 10 bike racks at the station were utilized. There are no designated bike routes leading to the Foggy Bottom-GWU station, but the District Department of Transportation (DDOT) considers most station area roads as “fair” for bicycling. The absence of bicyclists accessing the station during the peak hours suggests a need for bicycle improvements to the station, such as additional bike racks.

In general, the roads leading to the station have wide sidewalks, crosswalks, pedestrian countdown signals, and wheelchair ramps.

Figure 8: Bike Racks at the Station

Figure 9: Pedestrians Approaching the Station

2.3 Existing Capacity

The Foggy Bottom-GWU station has adequate capacity for present ridership. Some elements, such as the escalators and farecard vending machines, are near capacity.

Table 5: Existing Infrastructure Capacity Summary

Infrastructure Element			Number of Elements Required	Number of Existing Elements
Vertical Circulation	Street to Mezzanine	Escalators	3	3
		Elevators	1	1
		Stairs	0	0
	Mezzanine to Platform	Escalators	3	3
		Elevators	1	1
		Stairs	0	0
Farecard Vendors			7	12
Faregate Aisles		Standard	5	15
		ADA	1	1
		Total	6	16

Source: PB, 2007

The mezzanine-to-platform escalator is near capacity during the PM peak period, as shown in Figure 10. Although boarding passengers are the dominant flow during this period, WMATA operates only one of the three escalators in this direction. This configuration maintains two escalators for alighting passengers to accommodate surges, such as when two trains arrive at the platform at the same time.

Figure 10: Mezzanine-to-Platform Flow in the Evening
Source: PB, 2006

Though the station efficiently handles average volumes of passengers, its emergency egress capabilities do not meet the standards set by the National Fire Protection Association (NFPA) *Standard for Fixed Guideway Transit and Passenger Rail Systems 2007* (NFPA 130), which call for clearing the platform in four minutes and evacuating the station in six minutes. The construction of the Foggy Bottom-GWU station predates this standard; therefore, WMATA is not required to meet these evacuation times, but uses them as design goals.

Table 6 shows that in the PM peak hour, the Foggy Bottom-GWU station's evacuation times are two to three times that of the aforementioned standards. This is largely because the platform-to-mezzanine escalators are located at the west end of the platform, requiring all passengers to exit the station at the same location.

Table 6: Existing Emergency Egress Results

	AM Peak	PM Peak
Time to Clear platform (min)	8.3	10.6
Evacuation Time (min)	14.7	19.6

Source: PB, 2007

A more detailed discussion of existing and future capacity is in Section 4.2 and 4.3 of this report.

3 FUTURE STATION CHARACTERISTICS

The future station configuration would include two entrances. Because the existing station entrance is near the west end of the platform, logical options for a second station entrance include 22nd Street NW and near the existing entrance. The analysis in this section takes into account the possibility of a second entrance at the intersection of 22nd and I Streets NW.

3.1 Projected Land Use

The DC Office of Planning, as part of the regional cooperative land-use forecasting process, expects minimal office and moderate residential growth in the station area. Table 7 shows the projected number of households and jobs within one-quarter and one-half mile of the station.

Table 7: Household and Employment Forecasts with Station Walkshed

	Households				Employment			
	2005	2010	2030	**% change, 2005 to 2030**	2005	2010	2030	**% change, 2005 to 2030**
¼ Mile Radius	6,072	6,690	7,197	**18.53**	44,656	45,076	45,636	**2.19**
½ Mile Radius	9,128	10,062	11,247	**23.21**	144,026	146,086	147,651	**2.52**

Source: DC Office of Planning (based on MWCOG Round 7.1 household and employment forecasts)

Figures 11 and 12 spatially show the future households and jobs. Most of the households will be to the west and north of the station, whereas most of the employment will be located to the east, north, and south of the station. These figures show the walkshed of a second entrance at the intersection of 22nd and I Streets NW, which is similar to the existing station entrance walkshed. The future ridership would not measurably increase as a result of a second entrance.

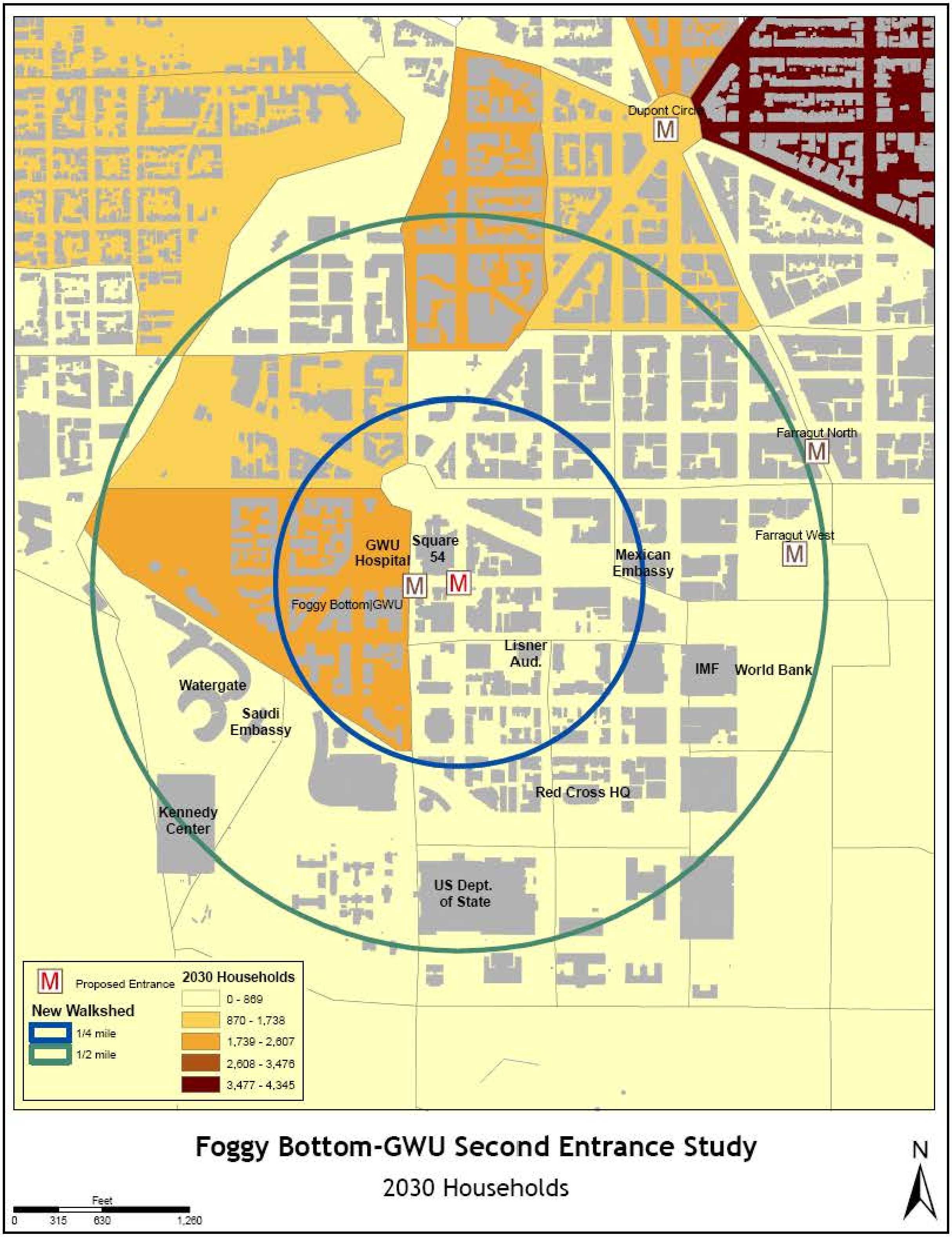


Figure 11: Distribution of Households in 2030
Source: DC-OCTO-GIS, PB, 2006

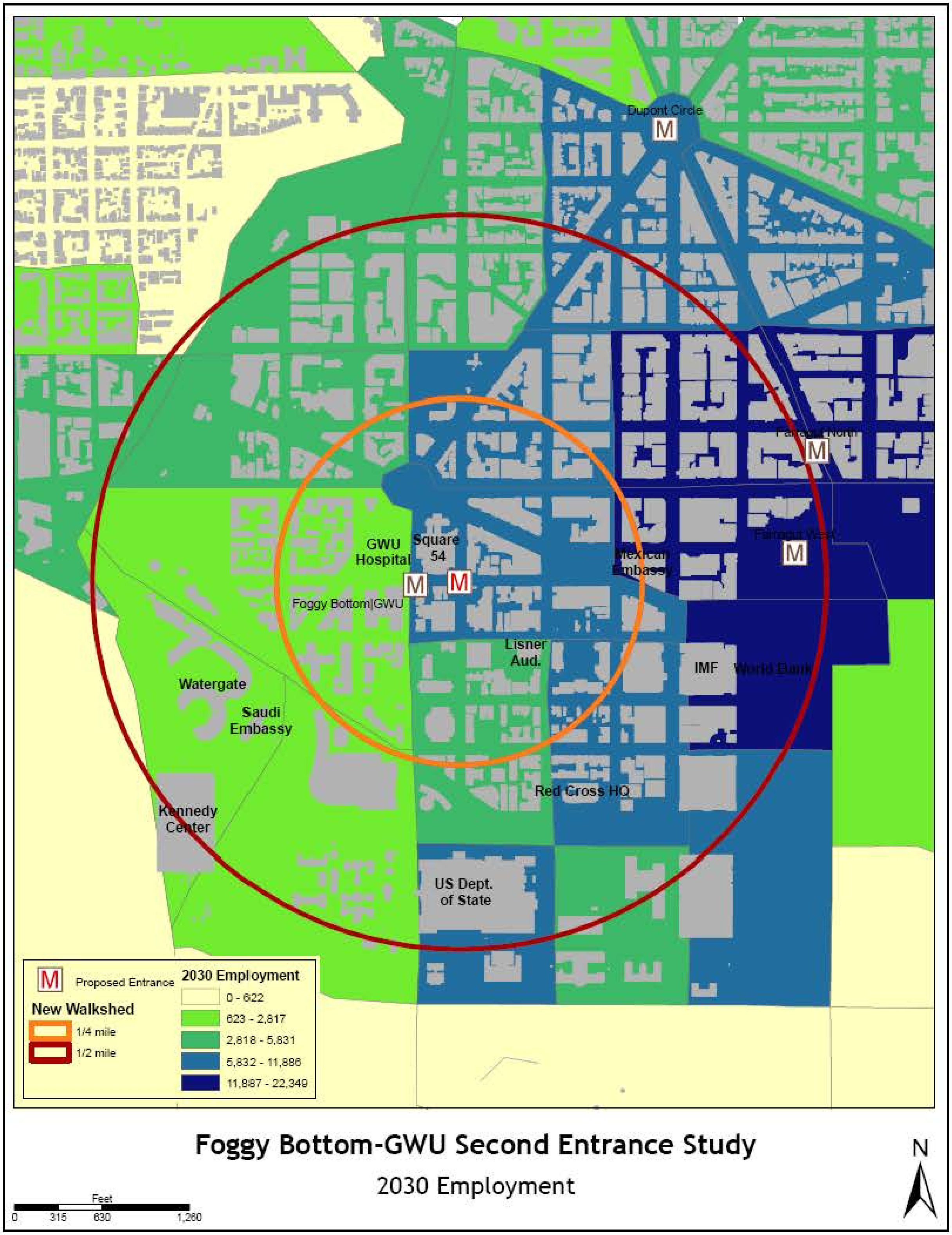


Figure 12: Distribution of Employment around Station in 2030

Source: DC-OCTO-GIS, PB, 2006

A station-area project presently in the development pipeline is Square 54, which is across 23rd Street from the existing station entrance. *The George Washington University Foggy Bottom Campus Plan* calls for academic/administrative/ medical uses along much of I Street. GWU envisions Square 54, shown as hatched area in Figure 13, as mixed-use development and a town center. The university and the DC Office of Planning worked together to submit a first-stage Planned Unit Development (PUD) application for Square 54 to the DC Zoning Commission in May 2006.

In addition, the Campus Plan designates I Street as a vibrant retail corridor, calling for the development of ground-floor retail uses along the street.

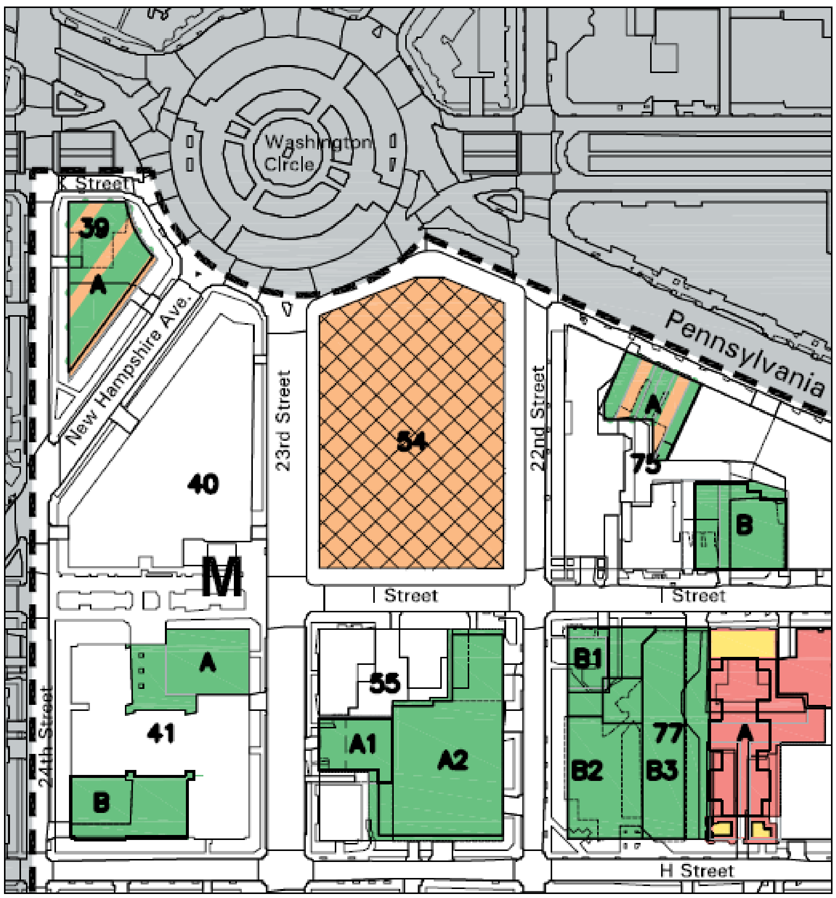


Figure 13: GWU Campus Plan Development Framework
Source: GWU, 2006

3.2 Forecasted Ridership

As part of the WMATA Station Access and Capacity Study, ridership in 2030 was forecasted at all 86 Metrorail stations using the MWCOG regional model as a base. By 2030, the Foggy Bottom-GWU station boardings and alightings are expected to increase by 12 to 15 percent, as shown in Table 8. This number is similar to the expected land use growth.

Table 8: Foggy Bottom-GWU Station Ridership

	Time	2005	2010	2020	2030	% Change 2005-2030
Boardings Peak ½ Hour	5:00 PM - 5:30 PM	1,943	2,005	2,217	2,232	14.9
Boardings Peak Hour	5:00 PM - 6:00 PM	3,666	3,731	4,165	4,207	14.8
Alightings Peak ½ Hour	8:30 AM - 9:00 AM	2,133	2,173	2,413	2,445	14.6
Alightings Peak Hour	8:00 AM - 9:00 AM	4,220	4,249	4,700	4,751	12.6

Source: WMATA Station Access and Capacity Study data, 2006

The analysis in this study assumed that boardings and alightings in the AM and PM peak hour and half hour would be divided between the existing and the proposed entrance based on the percent distribution of walk trips by the riders within each TAZ. Details of this process can be found in Appendix A. As shown in Table 9, the majority of future riders (65 percent) would use the proposed second entrance because of the concentration of jobs to the east of the station.

Table 9: 2030 Forecasted Ridership Distributed Between Existing and Proposed Entrances

		Boardings			*Alightings*		
Time Period		**Total**	Existing Entrance	New Entrance	**Total**	Existing Entrance	New Entrance
AM Peak Half Hour	8:30 AM - 9:00 AM	**538**	190	348	**2,445**	830	1,615
AM Peak Hour	8:00 AM - 9:00 AM	**1,045**	369	677	**4,751**	1,612	3,139
PM Peak Half Hour	5:00 PM - 5:30 PM	**2,232**	757	1,475	**714**	252	462
PM Peak Hour	5:00 PM - 6:00 PM	**4,207**	1,427	2,780	**1,515**	534	980

Source: WMATA Station Access and Capacity Study data, 2006

4 STATION ENTRANCE ALTERNATIVES

Based on the station configuration and the land use and ridership analysis, this study explored several alternatives for a new station entrance. The analysis established the required infrastructure within a new station entrance and allowed for a comparison between different entrance alternatives.

4.1 Initial Alternatives

The study explored the following alternatives:

1. Entrance at northwest corner of 22nd and I Streets NW
2. Entrance at southeast corner of 22nd and I Streets NW
3. Entrance locations near the corner of 24th and I Streets NW

Because of the platform configuration and the lack of station access at the east end of the platform, two sites adjacent to the east end of the station were identified as possible locations for the new entry. The first alternative was located at the northwest corner of the intersection of 22nd and I Streets NW on a plot designated as Square 54. The southeast corner of the intersection of 22nd and I Streets NW served as the second initial alternative. For both alternatives, an external-entry mezzanine was proposed in order to minimize construction interference with the operation of the station.

Representatives from GWU requested an analysis of adding entry capacity at the west end of the station through an unutilized pedestrian tunnel near the existing entry. The study developed and analyzed several such alternatives, which are shown in Appendix A.

4.2 Capacity Analysis of Alternatives

Infrastructure requirements at each entrance to the Foggy Bottom-GWU station were evaluated based on existing and predicted ridership levels and the requirements set by WMATA and the *Transit Capacity and Quality of Service Manual*. The capacity analyses of the vertical and horizontal elements of the station were performed for the following scenarios:

- **2006 Existing:** the existing station facilities were evaluated using the current (2006) ridership data.
- **2030 No Build:** the existing station facilities were evaluated using the projected 2030 ridership data.
- **2030 Build 1:** the facilities for a proposed east and the existing west entrances were evaluated using the 2030 ridership data.
- **2030 Build 2:** the facilities for a new west and the existing west entrances were evaluated using the 2030 ridership data.

The capacity analyses of the entrances were performed focusing on farecard vendors, faregate aisles, elevators, escalators, stairways, and the platform. All station elements were analyzed for the peak 15-minute passenger volume.

In 2030 Build 1, which includes an eastern entrance, an east mezzanine separate from the existing west mezzanine is required. As a result, the horizontal and vertical capacity analyses for the elements between the platform and the street for the east entrance would be separate from those of the existing conditions.

In 2030 Build 2, the new west entrance would connect to the existing mezzanine. Consequently, the capacity analyses of the elements between the mezzanine and the platform correspond to those of the 2030 No Build.

4.2.1 Analysis Assumptions

The design criteria used in the capacity analyses are presented in Table 10.

Table 10: Assumed Metrorail Station Capacity Criteria

Item		Units	*Source*
Peaking factor for alighting passengers	1.28		WMATA, Project scope
Escalator flow rate	90	p/min	WMATA, Station Access and Capacity Study
Stair-way flow rate per width	10	p/ft/min	Transit Capacity and Quality of Service Manual
Percent Passengers using farecard vendor	20	%	PB, Field measurements
Farecard vendor transactions per minute	2.5	p/min	WMATA, Bi-County Transitway/ Bethesda Station Access Demand Analysis
Faregate aisle flow rate	35	p/min	WMATA, Field measurements
Elevator Speed	75	ft/min	WMATA
Percent Passengers using Elevator	5	%	PB, Field measurements

Other general assumptions used throughout the analysis include:

- Design year: 2030
- Future Metrorail service at station: 2.5-minute headways
- Future Metrorail train consists: 8-car trains

Table 11: Summary of Existing Station Elements

Entrance	Regular Faregates	ADA Faregates	Exitfare	Fare Vendors	Platform Width (ft)	Platform Length (ft)	No. of Platform Elevators	No. of Mezzanine Elevators	No. of Platform Escalators	No. of Mezzanine Escalators	No. of Platform Stairs	No. of Mezzanine Stairs
Existing West	15	1	2	12	27	600	1	1	3	3	0	0

Source: WMATA Faregate Inventory, 2005; WMATA Elevator and Escalator Inventory, 2003

4.2.2 Analysis Results

Table 12 summarizes the station infrastructure requirements for the existing and future scenarios analyzed. This is based on the capacity criteria and WMATA standards previously cited.

Table 12: Infrastructure Requirements Summary

Infrastructure Element			Number of Elements Required					
			Existing	*2030 No Build*	*2030 Build 1*		*2030 Build 2*	
					West	*East*	*West*	*New West*
Vertical Circulation	Street to Mezzanine	Escalators	3	3	2	2	2	2
		Elevators	1	1	1	1	1	1
		Stairs				5’		5’
	Mezzanine to Platform	Escalators	3	**3**	2		**3**	
		Elevators	1	1	1	1	1	
		Stairs				10’		
Farecard Vendors			7	8	3	6	4	4
Faregate Aisles		Standard	4	5	3	4	3	
		ADA	1	1	1	1	1	
		Total	5	6	4	5	4	

Source: PB, 2007

# Indicates that the number of elements required is greater than the number of existing elements.

According to the capacity analysis, the 2030 No Build and the 2030 Build 2 alternatives would have inadequate capacity in 2030. Although the existing total number of mezzanine-to-platform escalators is equal to the required number in both scenarios, WMATA prefers to run two escalators up and one down to accommodate alighting passengers at this station; both the 2030 No Build and 2030 Build 2 scenarios would require two escalators going down and one going up.

The platform, shown in Figure 14, was found to have more than enough standing room capacity in all scenarios. The details of this analysis are in Appendix A.

Figure 14: Foggy Bottom-GWU Station platform during evening peak
Source: PB, 2006

4.3 NFPA 130 Emergency Egress Analysis

The egress capacity of the existing and future conditions of the station was analyzed based on the requirements set by the National Fire Protection Association (NFPA) *Standard for Fixed Guideway Transit and Passenger Rail Systems 2007* (NFPA 130).

For new transit facilities, the NFPA 130 requires the platform to be evacuated in four minutes and allow people to reach a point of safety in six minutes. As this study does not call for changes in the existing platform and station, WMATA is not required to meet NFPA 130 exiting times, but can use them as design goals. In addition, the NFPA 130 times can be used to compare the current and future ridership exiting times, and ensure the station exiting times for future ridership to not exceed the exiting times of the current ridership.

Table 13: Emergency Egress Analysis Results

NFPA 130 Measures	AM Peak			
	Existing	*No Build*	*Build 1*	*Build 2*
	2005	2030	2030	2030
Time to Clear platform (min)	**8.3**	**10.9**	**4.8**	**10.9**
Evacuation Time (min)	**14.7**	**20.2**	**10.7**	**14.9**
	PM Peak			
	Existing	*No Build*	*Build 1*	*Build 2*
	2005	2030	2030	2030
Time to Clear platform (min)	**10.6**	**13.6**	**6.0**	**13.6**
Evacuation Time (min)	**19.6**	**25.9**	**14.0**	**18.8**

Source: PB, 2007

As shown in Table 13, both the time to clear the platform and the time to evacuate the station is lowest in the Build 1 alternative. Although the addition of an eastern station entrance would not make the station compliant with NFPA 130 requirements, it would nearly meet the platform clearing standard in the AM peak and substantially improve emergency egress time during other periods.

NFPA 130 also sets requirements for station elements and their configuration. Section 5.5.6.3.2 allows escalators to account for more than one-half of egress capacity if a portion of the egress capacity at each station level is provided by stairs. This is the case with Build 2, in which a stairway would connect all station levels.

WMATA should address other emergency evacuation details, such as coordination with emergency responders, as this project progresses through the design stage.

4.4 Recommended Alternative

A new entrance at the southeast corner of 22nd and I Streets NW is recommended. A new entrance at this location could be integrated into a future building, as the GWU Campus Plan proposes the redevelopment of this block. The small townhouse that now occupies the location for a new entrance stair/escalator array is planned to be demolished.

Figure 15: Proposed New Entrance at 22nd and I Streets
Source: KGP Design Studio, 2007

The recommended entrance would provide access to the station from the east end for the first time. Two escalators, a stair, and two elevators from the surface would be located at the southeast corner of 22nd and I Streets NW. These vertical access features would lead to a new mezzanine level external to the station tunnel containing the faregate array for entry to the station. A short pedestrian tunnel would lead to two ADA-compliant elevators and a new stair leading down to the platform level from an added mezzanine at the end wall of the tunnel. The entrance at this end would allow workers from the nearby business district and students with classes at the eastern part of campus to more directly access their destinations without crossing high-traffic-volume intersections and separates this pedestrian traffic stream from patrons accessing the station from the residential district that abuts the west side of campus.

The two surface-to-mezzanine elevators would be WMATA standard elevators, while the two mezzanine-to-platform elevators would be smaller. These elevators meet ADA requirements but are small to fit within the existing structure of the east-end service rooms. Using these small elevators will require a variance from WMATA criteria. One standard elevator could be used instead.

An entrance at the northwest corner of 22nd and I Streets NW would provide needed additional station capacity, but it is not recommended. A new entrance here would require more-extensive construction because of the site topography. It would also require redesigning the buildings planned for the site.

An entrance west of the station is not recommended for several reasons. A new entrance to the west would not provide necessary added station capacity because all passengers would still have to move through the single internal mezzanine. In addition, each location for a new entrance west of the station would have at least one serious physical or construction drawback. Some locations would require acquisition and demolition of private residences within the Foggy Bottom historic district. Other locations would cause construction conflicts with existing university buildings. Still others would block entry into an existing university building. Locating an entrance on the only vacant parcel west of the station would require a long and expensive underground passageway.

Finally, the No Build option is not recommended for similar reasons; demand for its mezzanine-to-platform escalator would exceed available capacity, its elevators would be near capacity, and its emergency egress times are much worse than today.

5 IMPLEMENTATION

The addition of a second station entrance at the corner of 22nd and I Streets NW would require specific architectural, structural, mechanical, and electrical features. This study investigated these requirements and estimated the cost of the project.

5.1 Architectural Features

The following outlines the vertical connections to the surface, the new external mezzanine space, the passageway between the external mezzanine and the train room mezzanine, and the vertical connections from the mezzanine to the platform.

5.1.1 Vertical Connection between the Surface and the New External Mezzanine

The main vertical access to the underground fare area would be provided by a stair/escalator array on the southeast corner of 22nd and I Streets NW. The stair/escalator array would be oriented on an east-west axis with the upper landing facing east. The proposed array would be located where a brick townhouse that has been converted to educational use now sits; this structure has already been slated for removal in the GWU Master Plan. The array is arranged with two escalators and a stair. The stair should meet new WMATA standards with stainless steel, lighted balustrades. Two side-by-side WMATA standard elevators would be located to the south from the stair/escalator array enclosure. The entry to the elevators would be to the west, facing 22nd Street. The elevators would be aligned with the sidewalk edge, approximately 20 feet in from the curb. The array and elevators would traverse a vertical distance of approximately 27 feet to the mezzanine below.

The arrangement of the stair/escalator array and the elevators has the potential to fit into a future joint development commercial/office, classroom or dormitory building at GWU. The university plans to develop the entire parcel on which these new entry features would sit, Square 77. The stair/escalator array are placed and oriented in such a way so as to fit into a typical column bay structure that would allow a large building to sit over these elements, and the elevators are situated to fit into the first floor of such a building while remaining accessible from the street. This conceptual design anticipates the redevelopment of this parcel and thus does not propose a canopy system for the vertical entry elements.

5.1.2 New External Mezzanine

A new entry mezzanine would be constructed underground, at an elevation equal to the existing upper-level east service area. The new external mezzanine would be constructed as a cut-and-cover operation and, except with respect to the vertical entry elements discussed above, sit entirely under 22nd Street and the sidewalks to the east and west of 22nd Street, south of the I Street intersection. The size and layout of the mezzanine are specifically constrained so as not to interfere with the foundations of existing buildings and future development.

The main part of the mezzanine contains approximately 4,900 square feet of open area. The array of faregates, farecard vendors, add-fare vendors, and the station attendant kiosk would sit within the main space. The external mezzanine would also contain a limited number of service rooms associated with operation of the mezzanine and an area of rescue assistance

(AORA) for emergency protection. The connection to the tunnel would be through the south wall of the mechanical equipment room in the upper-level east service area of the existing station. The service rooms in the new external mezzanine would sit on the south side of this wall.

Figure 16: Proposed Mezzanine
Source: KGP Design Studio, 2007

The stair/escalator array and elevators would enter through the east wall of the mezzanine, with the faregates and attendant kiosk directly ahead. The farecard and add-fare vendors would line the south wall of the mezzanine. The entrance to the train room passage is located in the northwest corner of the space. The service rooms would line the north wall of the mezzanine to the east of the opening leading to the station and make use of the entire length of the existing tunnel wall. The service room area would contain an AORA, a men's and a women's restroom, a cleaners' room with ejector pit, a fire-equipment closet, new air-conditioning equipment room, electrical room, and an elevator machine room. The elevator machine and AC equipment rooms are located on an upper level. These rooms are all necessary to service the new mezzanine area and do not currently exist within the existing station at this end. The elevator room is meant to service both the new elevators to the surface and to the platform.

5.1.3 New Passageway to Station

The new passageway reflects the typical Metrorail station entrance passage design with curved concrete base and bronze railings and would connect the new external mezzanine to a new mezzanine to be constructed within the train room. This passageway would penetrate the existing tunnel wall enclosing the east service area and pass through space currently comprising the upper-level mechanical equipment room. The remaining space within the service area after the addition of the passageway and new elevators would serve as the reduced mechanical equipment room and a relocated communications room.

The passageway would end in a vestibule for the two new ADA-compliant elevators between the mezzanine and platform. These elevators would be built outside the station vault within the confines of the existing service-room area. The end wall of the train room would be opened to allow entry from the passageway onto a new mezzanine to be built at the east end of the vaulted tunnel space. The new internal mezzanine would be smaller than a typical station mezzanine, projecting only approximately 29 feet into the train room. The internal mezzanine would end in a 10-foot-wide stair leading to the platform below.

5.1.4 Vertical Connections from the Mezzanine to the Platform

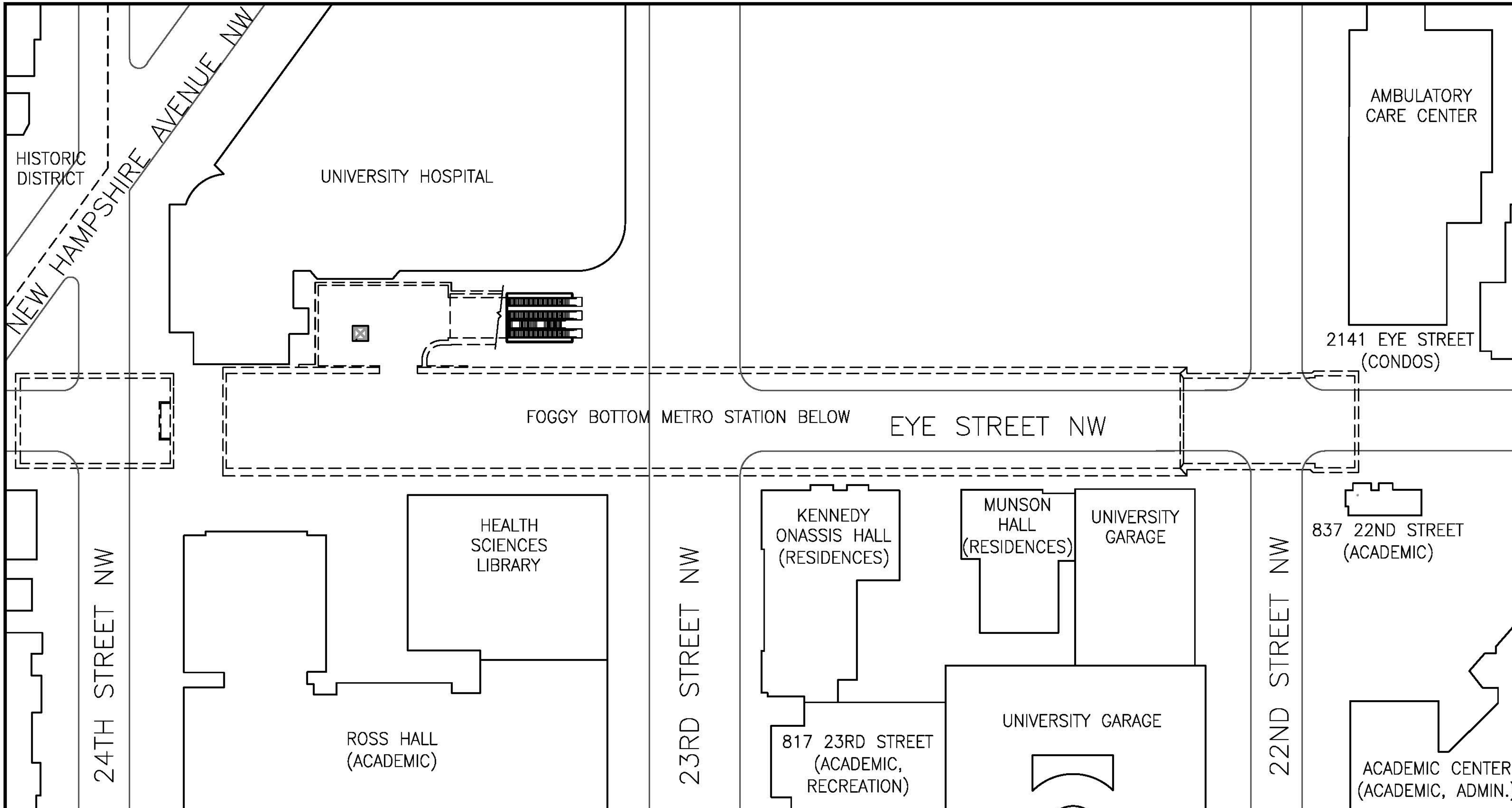
Because there is no current entrance at the east end of the station and all of the new work within the station would occur either within the service-room area or in the first 75 feet of the platform (an area utilized only for eight-car trains), construction of these station improvements should have little effect on the ongoing operations of the station. On the platform, the elevators and elevator vestibule would be carved out from the former communication area of the train control room. Sidewalls would be left in place to shield patrons from the track area and separate the vestibule from the service catwalks.

Figure 17: Proposed Mezzanine-to-Platform Stairway
Source: KGP Design Studio, 2007

The internal mezzanine should be of standard WMATA construction, with details to match the existing mezzanine toward the west end of the station. The new stair would be centered on the mezzanine and extend from the mezzanine end. The stair should conform to WMATA standard, with bronze-and-glass handrails. The location of the new stair would require the removal of one pylon and at least one bench. A second bench that would sit approximately underneath the upper landing of the stairs would not require removal but may be removed for aesthetic reasons.

The following pages illustrate the existing site plan, the proposed architectural features, and the existing utilities at the site.

This page intentionally left blank



1 STREET LEVEL SITE PLAN

Scale: 1" = 60'-0"

30 0 30 60

CONTRACT NO.

DESIGNED W.GALLAGHER 30Aug06 DATE
DRAWN S.GARLAND 30Aug06 DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS		
DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D

SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

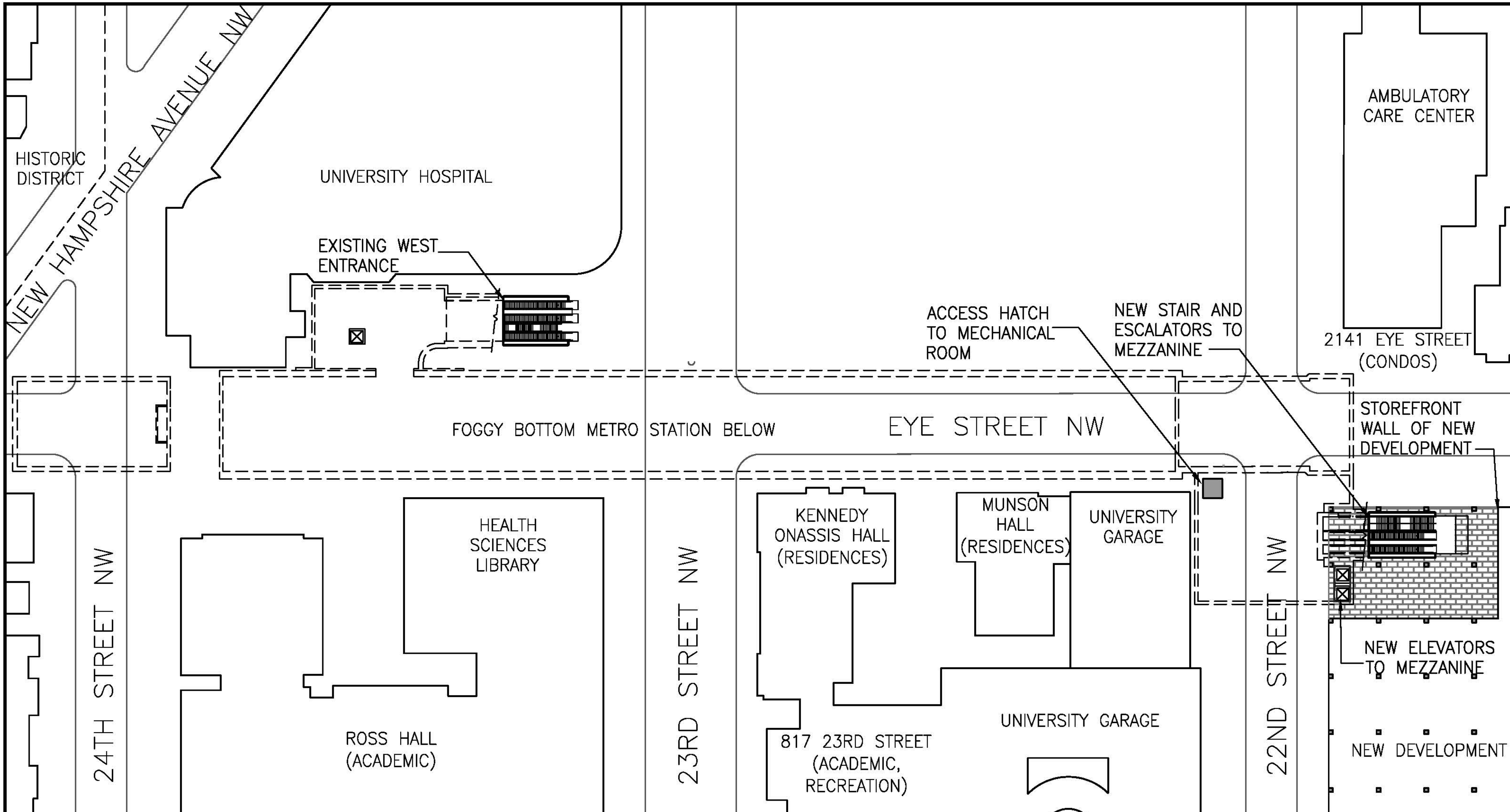
PROJECT MANAGER

FOGGY BOTTOM

SITE PLAN – EXISTING CONDITIONS

SCALE 1"=60'-0"

DRAWING NO. A-01



1 STREET LEVEL SITE PLAN

Scale: 1" = 60'–0"

30 0 30 60

CONTRACT NO.

DESIGNED	W.GALLAGHER	30Aug06 DATE
DRAWN	S.GARLAND	30Aug06 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS		
DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

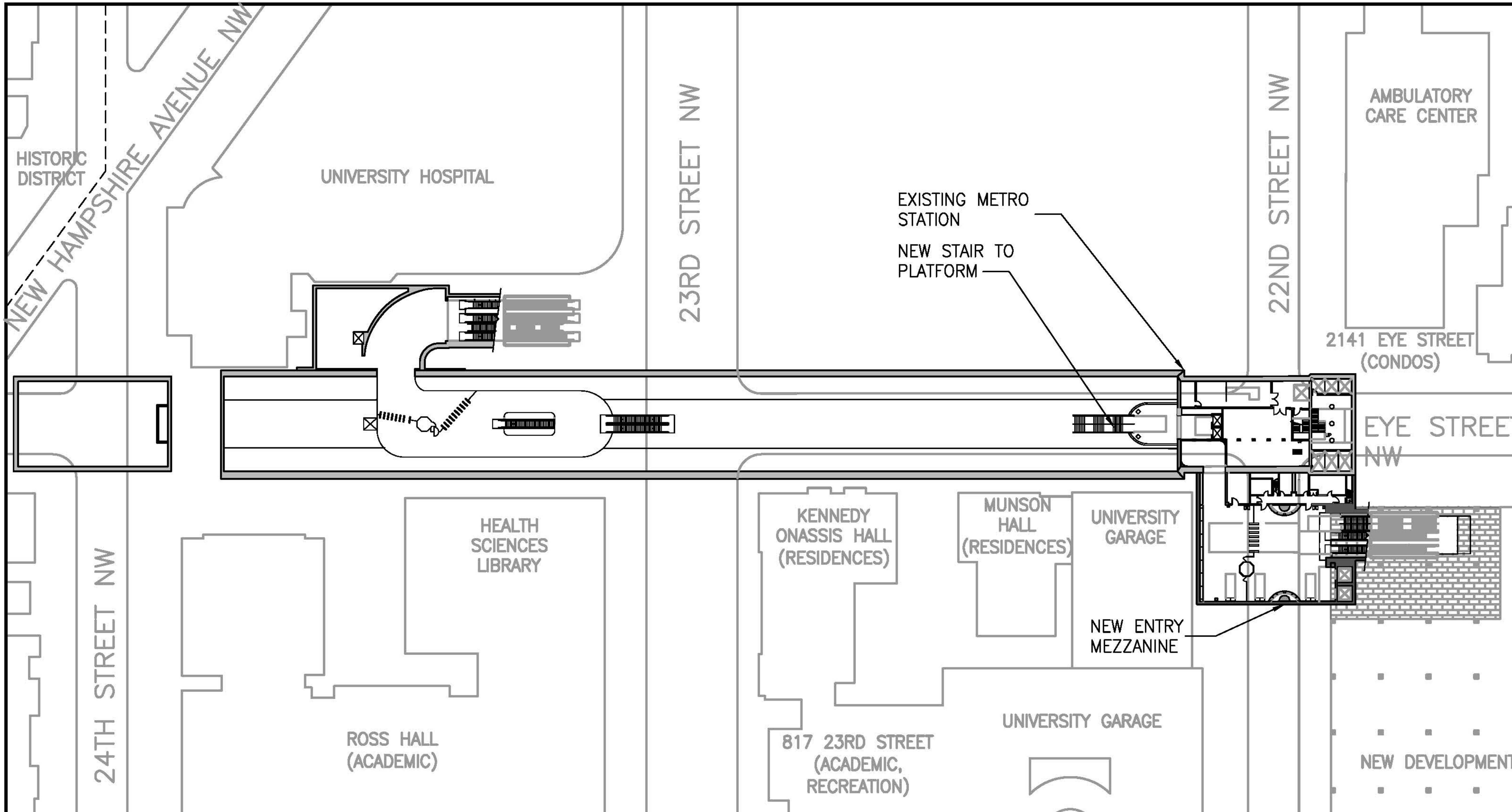
PROJECT MANAGER

FOGGY BOTTOM

SITE PLAN – POTENTIAL REDEVELOPMENT

SCALE 1"= 60-0"

DRAWING NO. A-02



1 MEZZANINE LEVEL STATION PLAN

Scale: 1" = 60'-0"

30 0 30 60

CONTRACT NO.

DESIGNED	W.GALLAGHER	30Aug06	DATE
DRAWN	S.GARLAND	30Aug06	DATE
CHECKED			DATE
APPROVED			DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

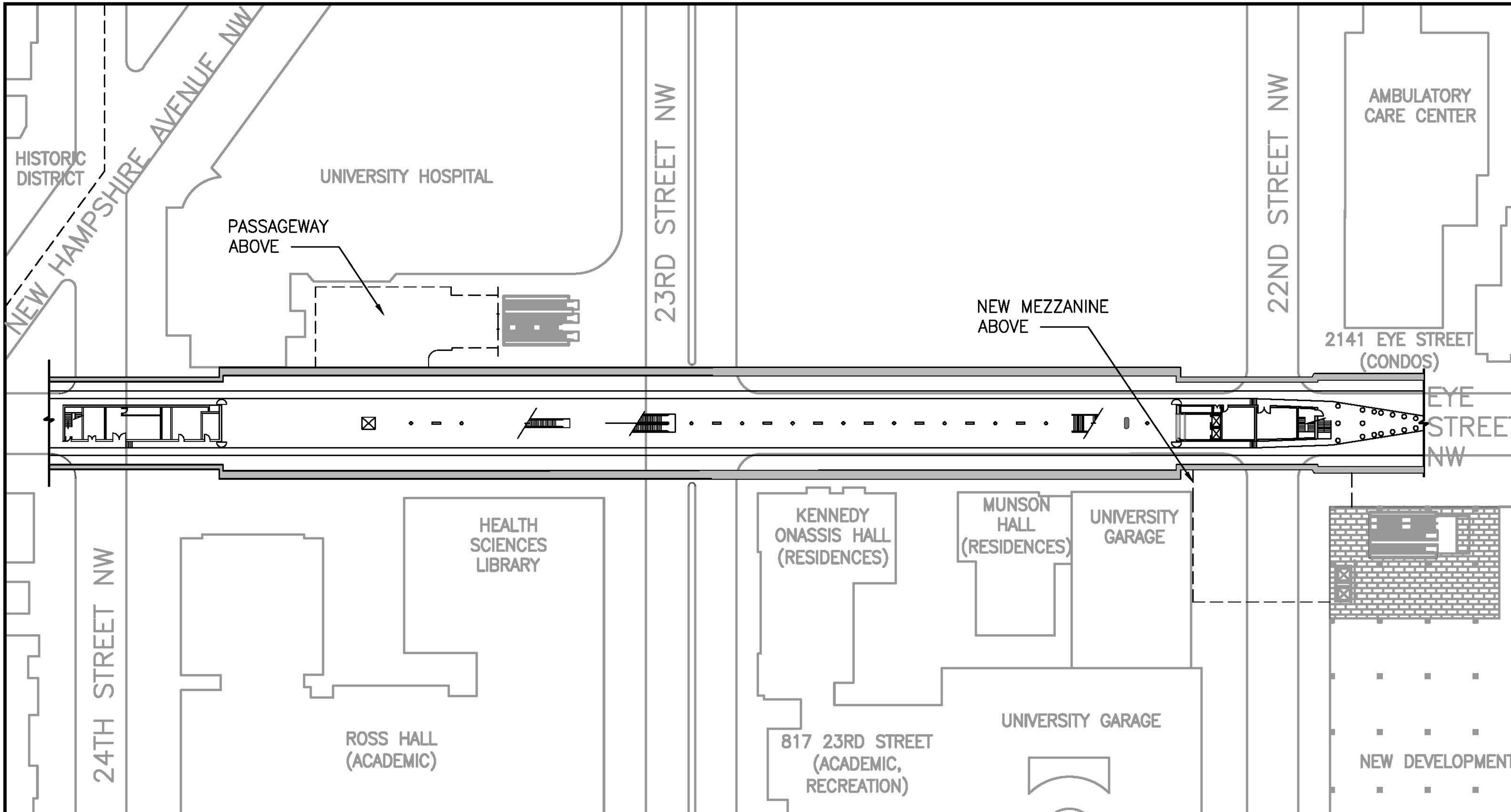
PROJECT MANAGER

FOGGY BOTTOM

MEZZANINE LEVEL STATION PLAN

SCALE 1"= 60-0"

DRAWING NO. A-03



1 PLATFORM LEVEL STATION PLAN

Scale: 1" = 60'-0"

30 0 30 60

CONTRACT NO.

DESIGNED	W.GALLAGHER	30Aug06 DATE
DRAWN	S.GARLAND	30Aug06 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

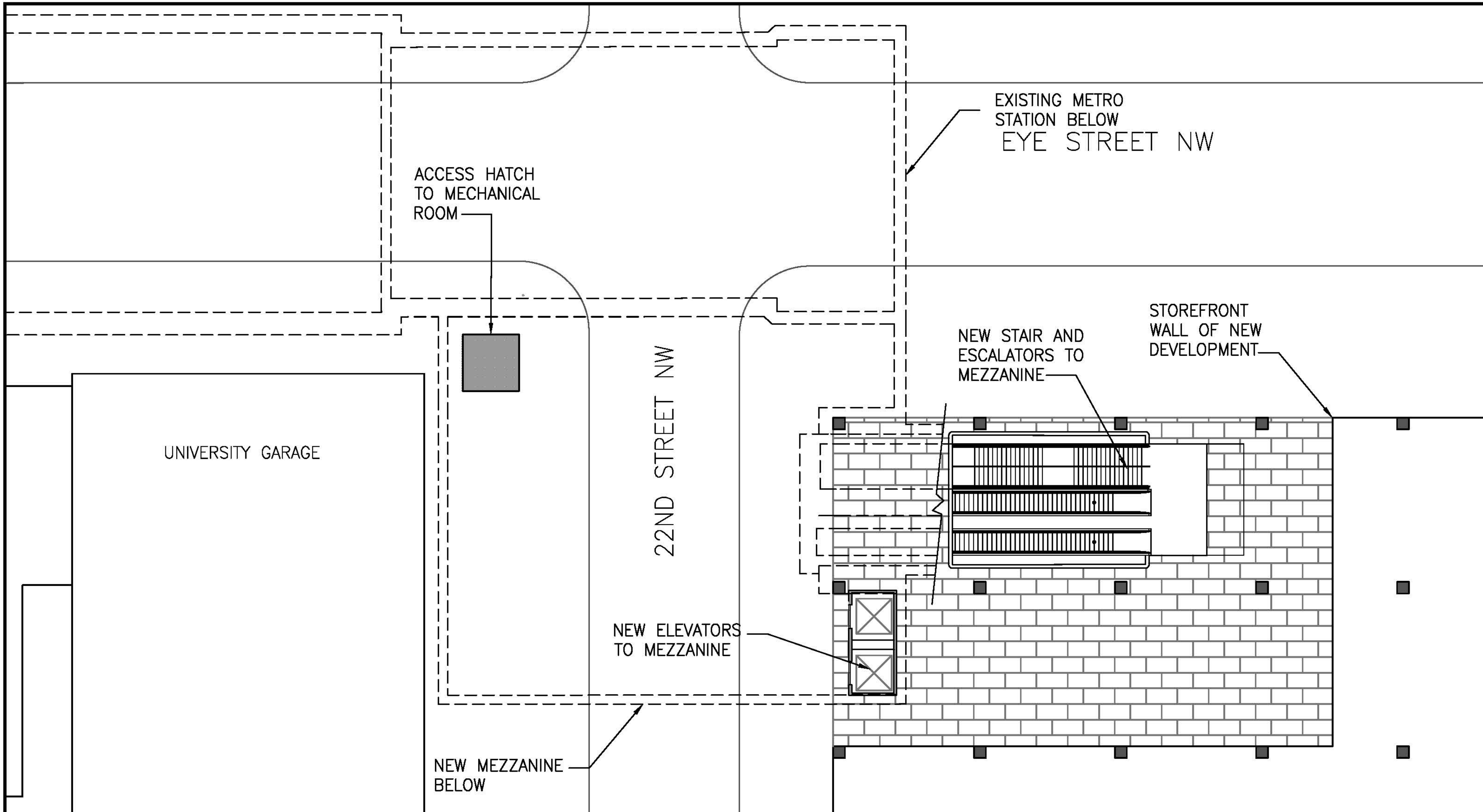
PROJECT MANAGER

FOGGY BOTTOM

PLATFORM LEVEL STATION PLAN

SCALE 1"= 60-0"

DRAWING NO. A-04



1 ENTRY PAVILION PLAN

Scale: 1" = 20'

10 0 10 20

CONTRACT NO.

DESIGNED W.GALLAGHER 29Jan07 DATE

DRAWN S.GARLAND 07Feb 07 DATE

CHECKED ______ DATE

APPROVED ______ DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS		
DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED ______

P2D SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

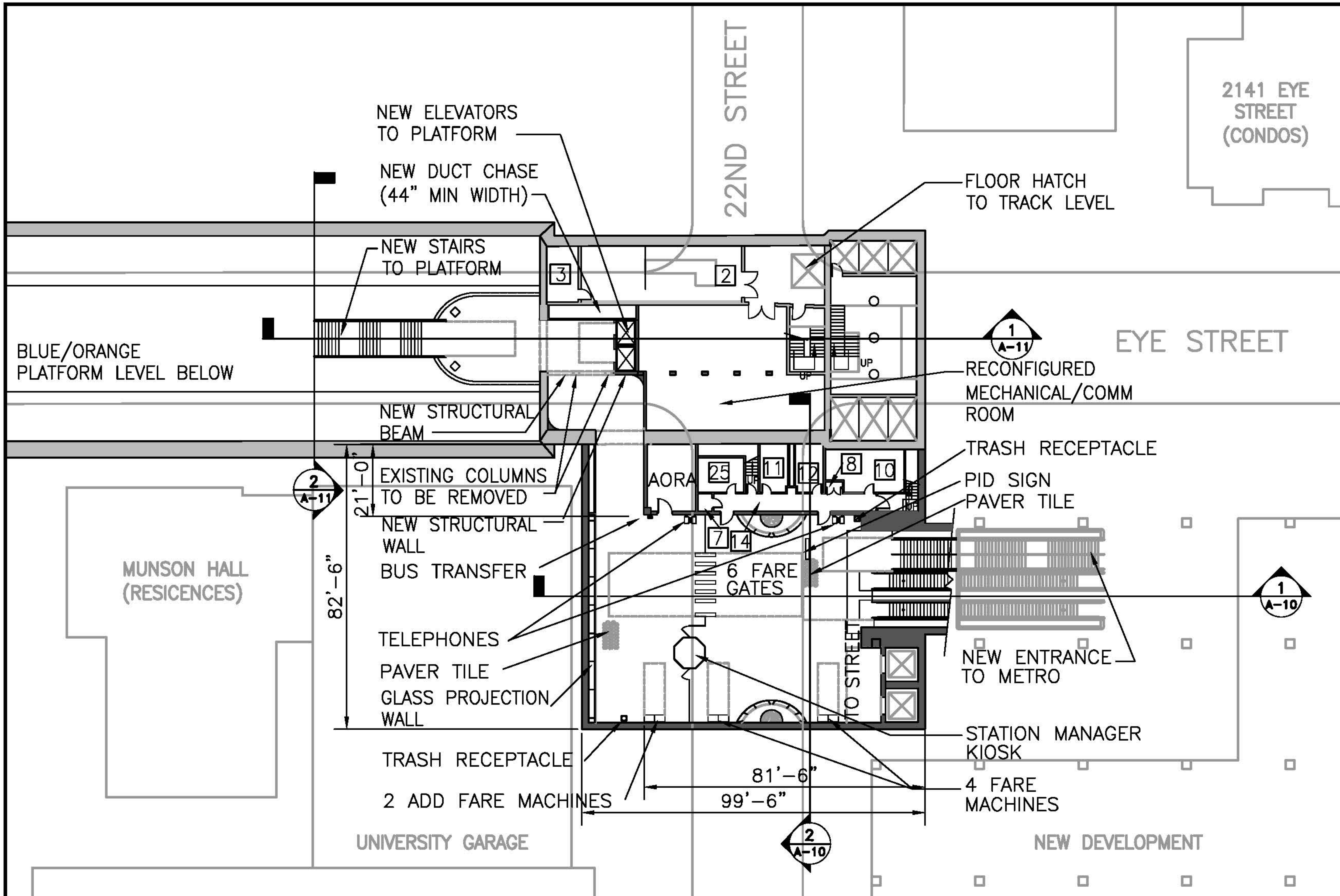
PROJECT MANAGER

FOGGY BOTTOM

PARTIAL SITE PLAN – POTENTIAL REDEVELOPMENT

SCALE 1"= 20'

DRAWING NO. A–05



ROOM LEGEND

1 MECHANICAL/FAN ROOM
2 AC SWITCH
3 BATTERY ROOM
4 COMM ROOM
7 TELEPHONE CLOSET
8 FIRE EQUIPMENT CABINET
10 EJECTOR RM/CLEANERS RM.
11 STAFF TOILET
12 PUBLIC TOILET
14 SERVICE CORRIDOR
22 ELEVATOR MACHINE ROOM
25 ELECTRICAL CLOSET

QUEUING REQUIREMENTS:

1. ESCALATOR: 20 FT.
2. STAIR: 20 FT.
3. ELEVATOR: 10 FT.
4. FARE GATES: 25 FT.
5. FARE MACHINES: 20 FT.

EXISTING WALL

NEW WALL

REMOVED WALL

1 MEZZANINE LEVEL PLAN

Scale: 1" = 30'-0"

15 0 15 30

CONTRACT NO.

DESIGNED	W.GALLAGHER	30Aug06 DATE
DRAWN	S.GARLAND	30Aug06 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

SUBMITTED

a joint venture of:
• Parsons Transportation Group Inc.
• Parson Brinckerhoff Quade & Douglas, Inc
• Delon Hampton & Associates, Chartered

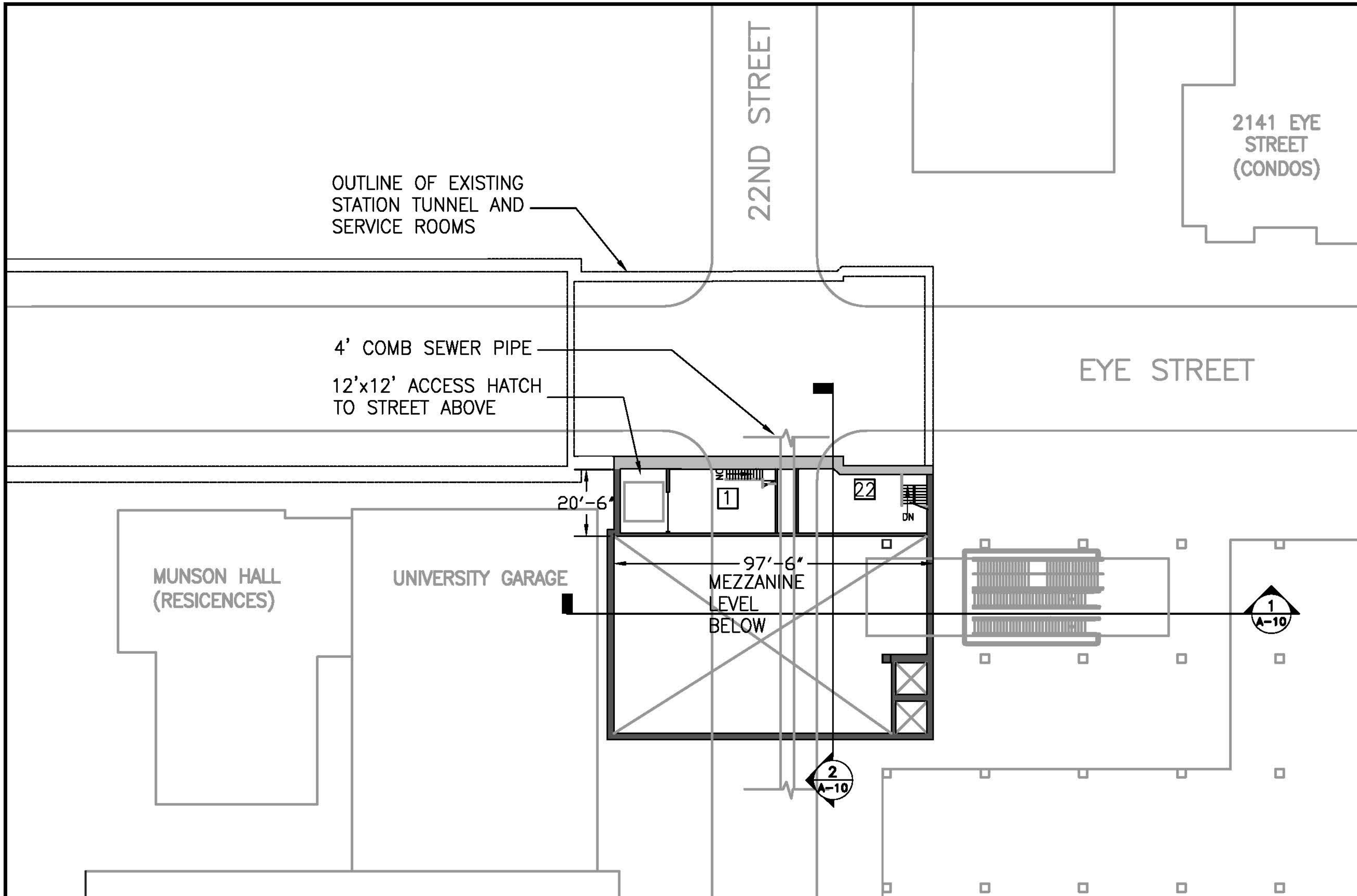
PROJECT MANAGER

FOGGY BOTTOM

EAST MEZZANINE LEVEL PLAN

SCALE 1"= 30'

DRAWING NO. A-06



ROOM LEGEND

- 1 MECHANICAL/FAN ROOM
- 2 AC SWITCH
- 3 BATTERY ROOM
- 4 COMM ROOM
- 7 TELEPHONE CLOSET
- 8 FIRE EQUIPMENT CABINET
- 10 EJECTOR RM/CLEANERS RM.
- 11 STAFF TOILET
- 12 PUBLIC TOILET
- 14 SERVICE CORRIDOR
- 22 ELEVATOR MACHINE ROOM
- 25 ELECTRICAL CLOSET

QUEUING REQUIREMENTS:

1. ESCALATOR: 20 FT.
2. STAIR: 20 FT.
3. ELEVATOR: 10 FT.
4. FARE GATES: 25 FT.
5. FARE MACHINES: 20 FT.

EXISTING WALL

NEW WALL

1 SERVICE LEVEL PLAN

Scale: 1" = 30'-0"

CONTRACT NO.

DESIGNED W.GALLAGHER 29Jan07 DATE
DRAWN S.GARLAND 07Feb07 DATE
CHECKED ______ DATE
APPROVED ______ DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED ______

P2D
a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

SUBMITTED

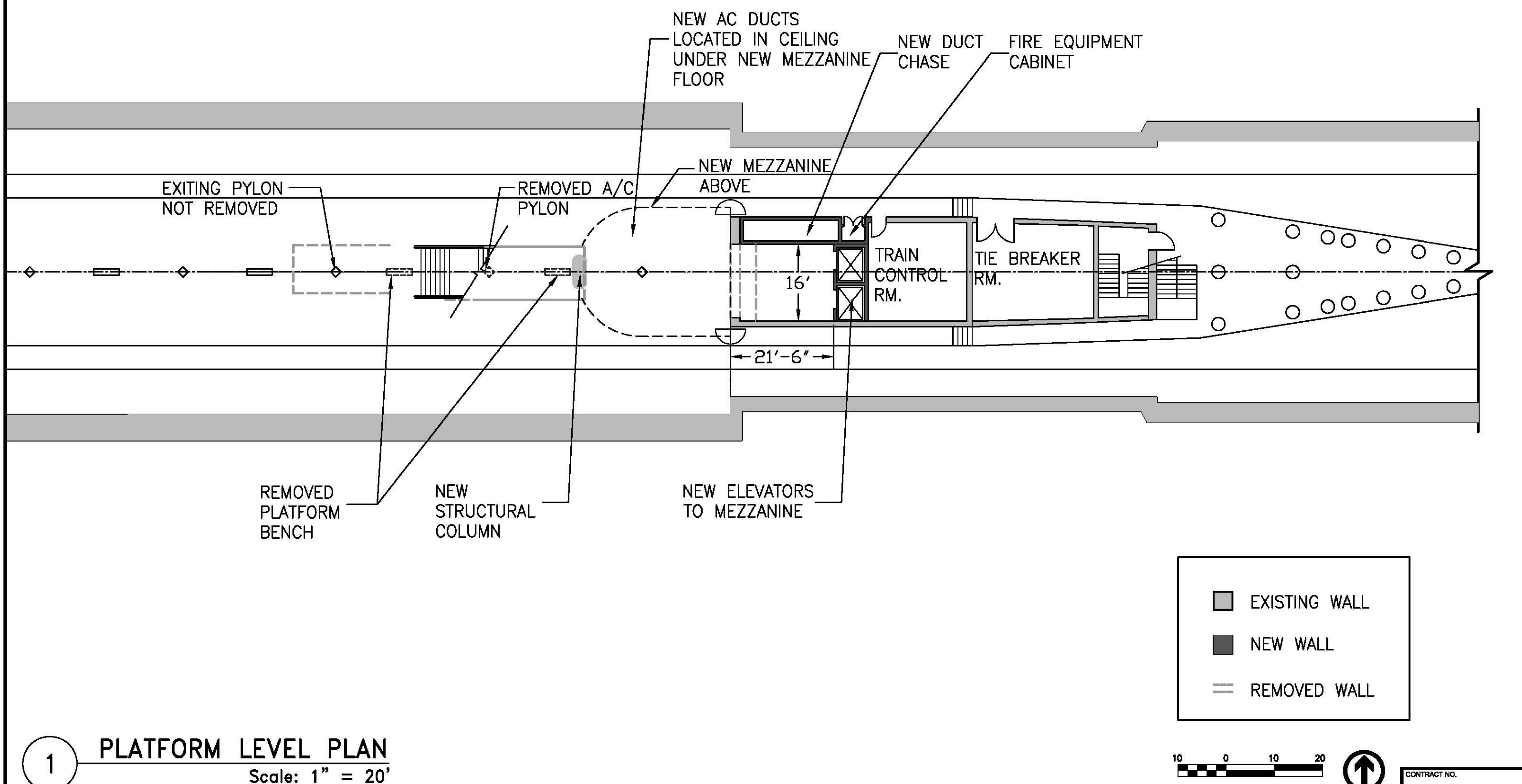
PROJECT MANAGER

FOGGY BOTTOM

MEZZANINE SERVICE LEVEL PLAN

SCALE 1"= 30'

DRAWING NO. A-07



1 PLATFORM LEVEL PLAN

Scale: 1" = 20'

CONTRACT NO.

DESIGNED W.GALLAGHER 30Aug06 DATE
DRAWN S.GARLAND 30Aug06 DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS: NUMBER | DESCRIPTION

REVISIONS: DATE | BY | DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

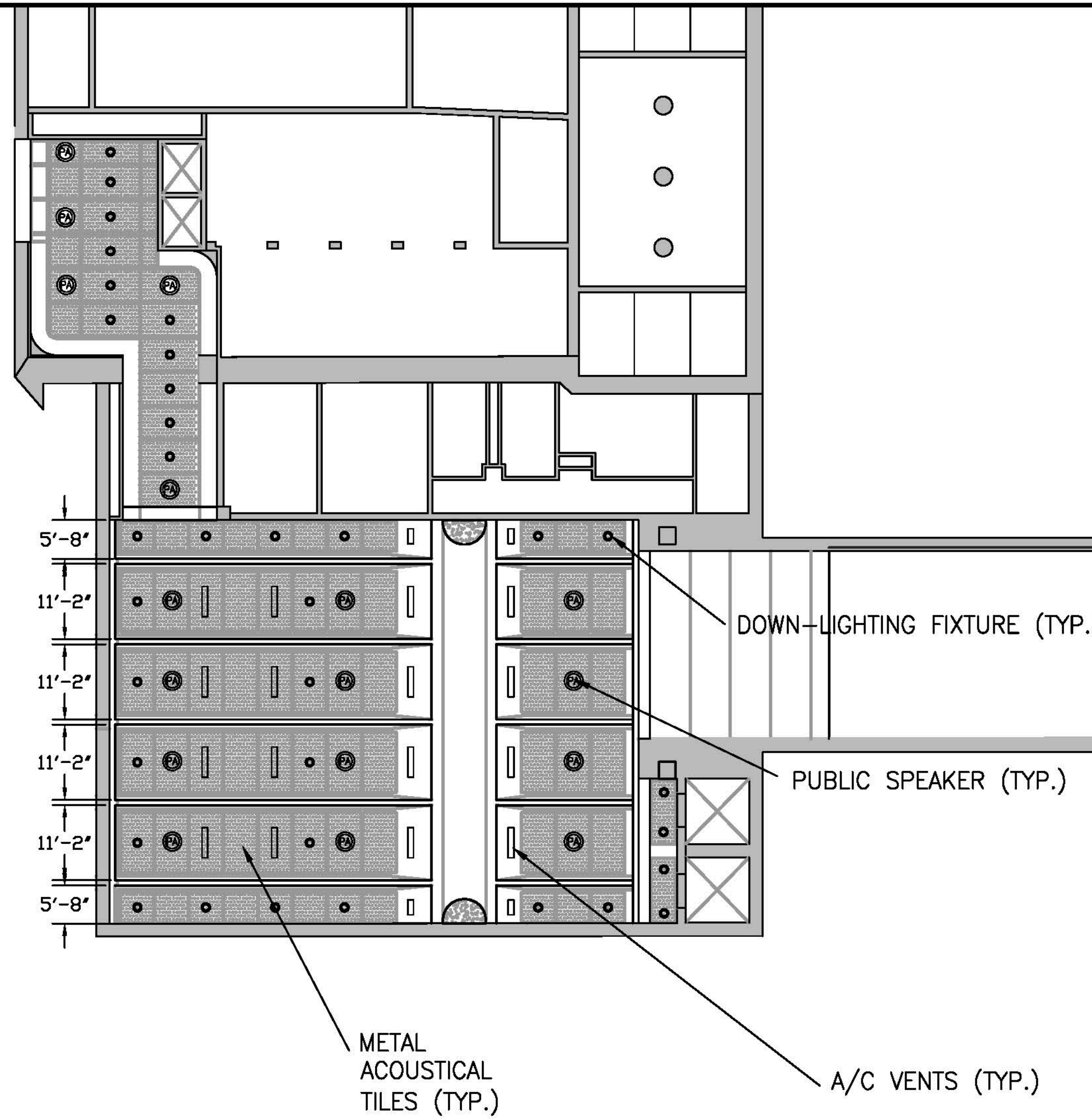
PROJECT MANAGER

FOGGY BOTTOM

EAST PLATFORM LEVEL PLAN

SCALE 1"= 20'

DRAWING NO. A-08



NOTE: INDIRECT LIGHTING EXCEPT AS OTHERWISE NOTED

1 MEZZANINE LEVEL REFLECTED CEILING PLAN

Scale: 1" = 20'

10 0 10 20

CONTRACT NO.

DESIGNED	W.GALLAGHER	29Jan07 DATE
DRAWN	S.GARLAND	07Feb07 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D

SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

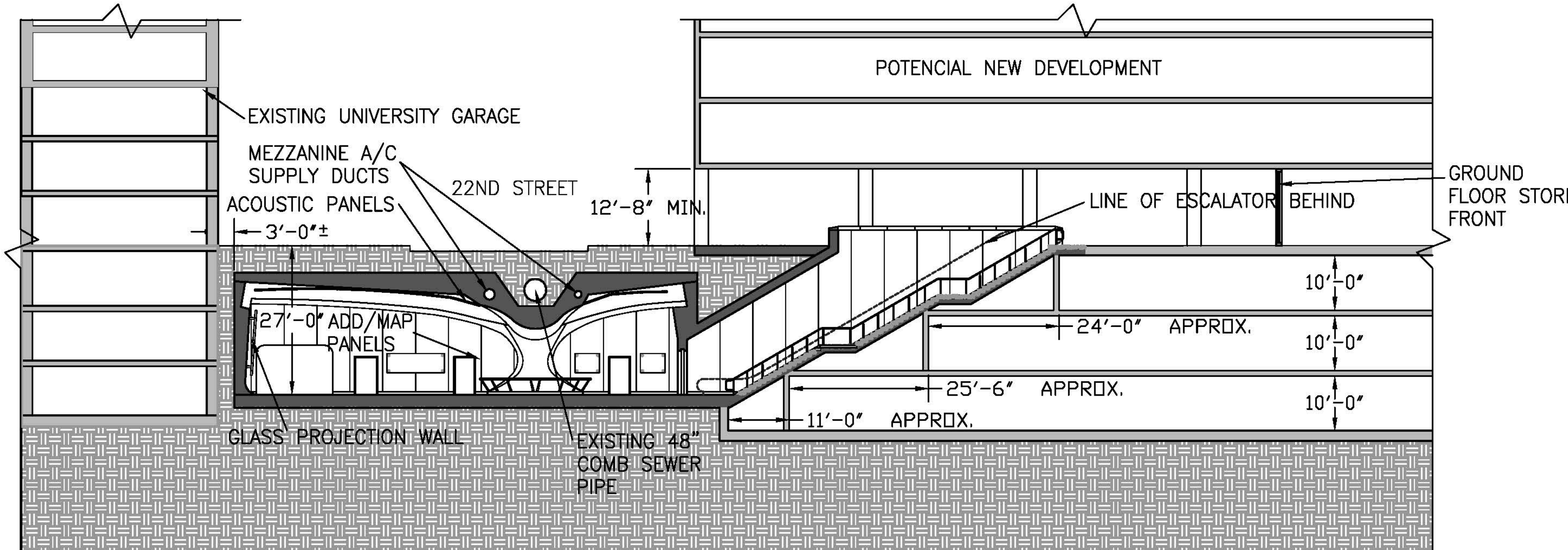
PROJECT MANAGER

FOGGY BOTTOM

EAST MEZZANINE LEVEL REFLECTED CEILING PLAN

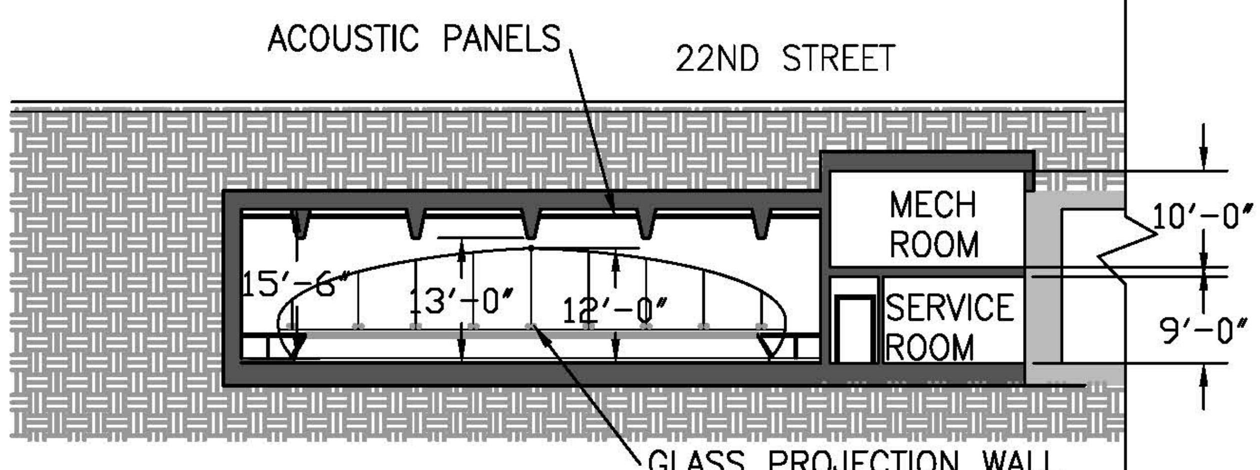
SCALE 1"= 20'

DRAWING NO. A-09



1 ENTRY/MEZZANINE LONGITUDINAL SECTION

Scale: 1" = 20'



2 MEZZANINE CROSS PLAN

Scale: 1" = 20'

EXISTING WALL

NEW WALL

10 0 10 20

CONTRACT NO.

DESIGNED	W. GALLAGHER	09Oct06 DATE
DRAWN	S.GARLAND	09Oct06 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

a joint venture of:
• Parsons Transportation Group Inc.
• Parson Brinckerhoff Quade & Douglas, Inc
• Delon Hampton & Associates, Chartered

SUBMITTED

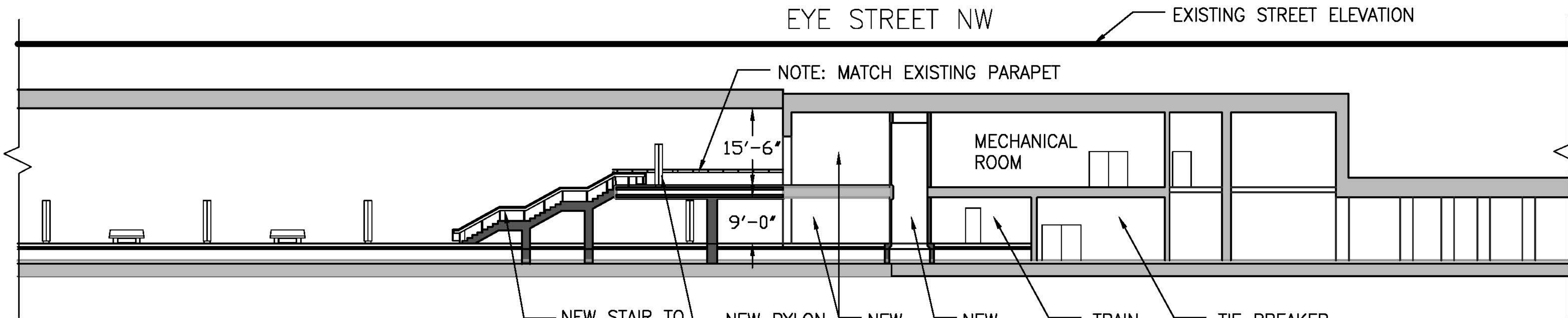
PROJECT MANAGER

FOGGY BOTTOM

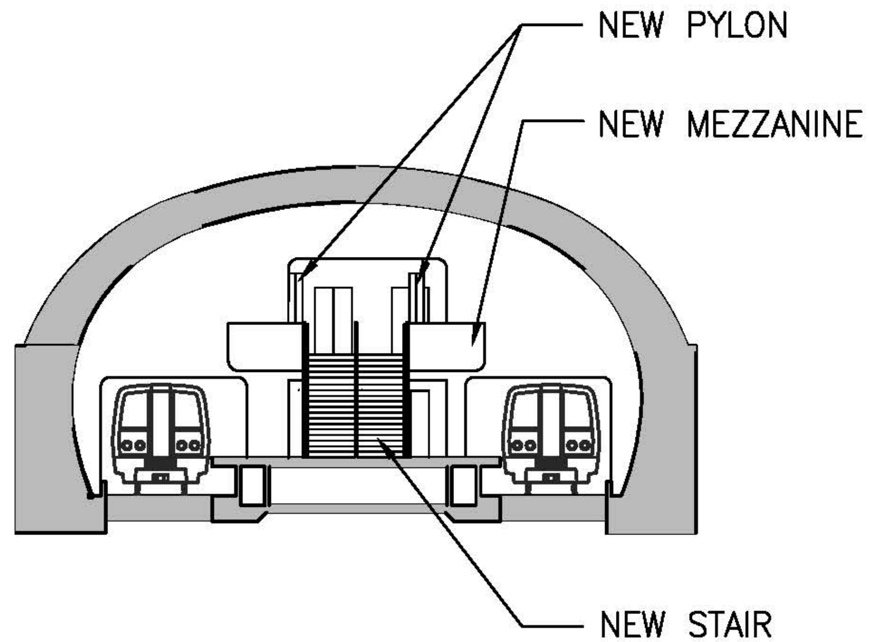
MEZZANINE SECTIONS

SCALE 1"= 20'

DRAWING NO. A–10



1 TUNNEL LONGITUDINAL SECTION
Scale: 1" = 20'-0"



2 TUNNEL TRANSVERSE SECTION
Scale: 1" = 20'-0"

EXISTING WALL
NEW WALL

10 0 10 20

CONTRACT NO.

DESIGNED W. GALLAGHER 30Aug06 DATE
DRAWN S.GARLAND 30Aug06 DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS		
DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

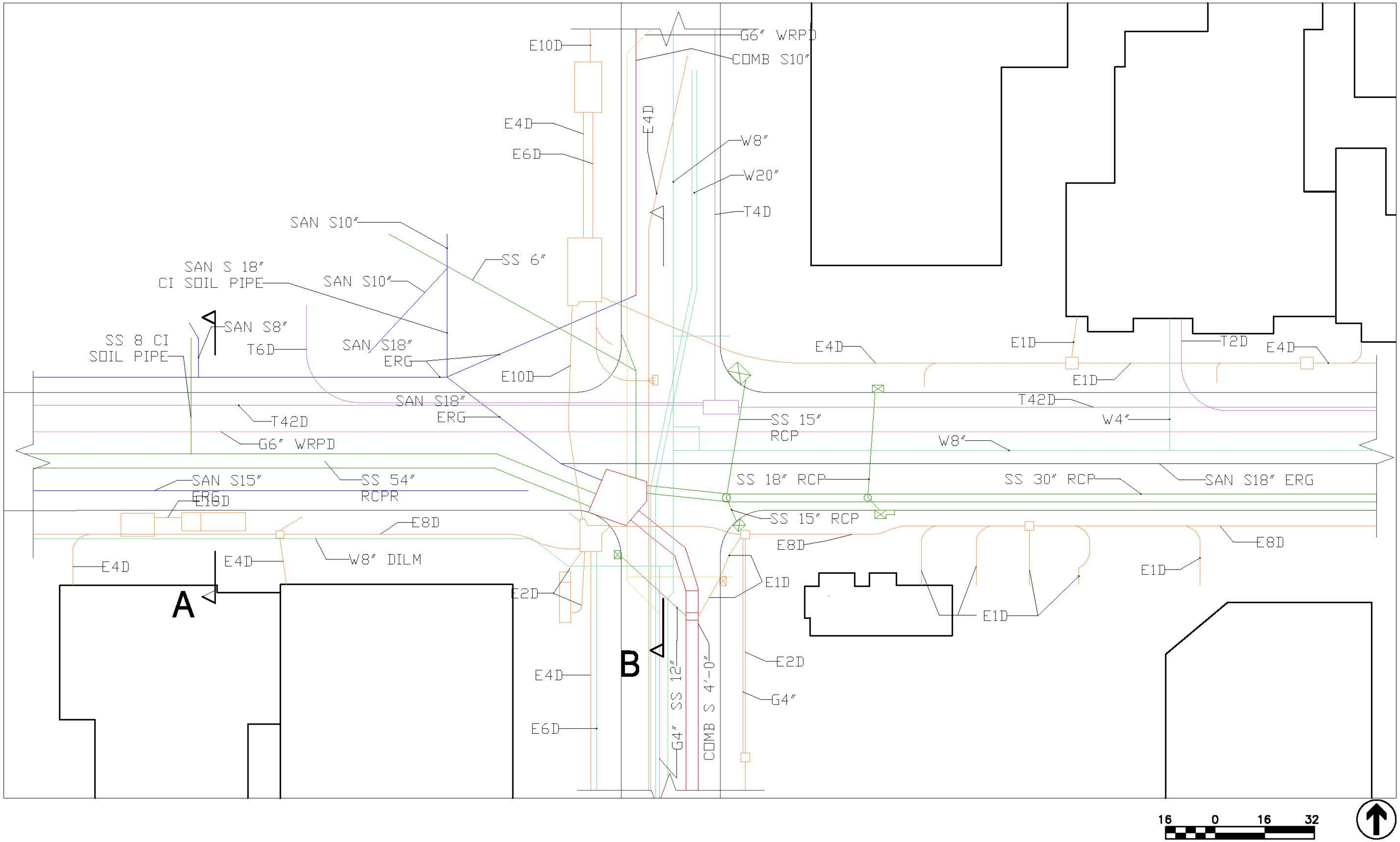
PROJECT MANAGER

FOGGY BOTTOM

EAST TUNNEL SECTION

SCALE 1"= 20'-0"

DRAWING NO. A-11



DESIGNED		DATE
DRAWN	SG	06Oct06 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D

SUBMITTED

a joint venture of:
• Parsons Transportation Group Inc.
• Parson Brinckerhoff Quade & Douglas, Inc
• Delon Hampton & Associates, Chartered

PROJECT MANAGER

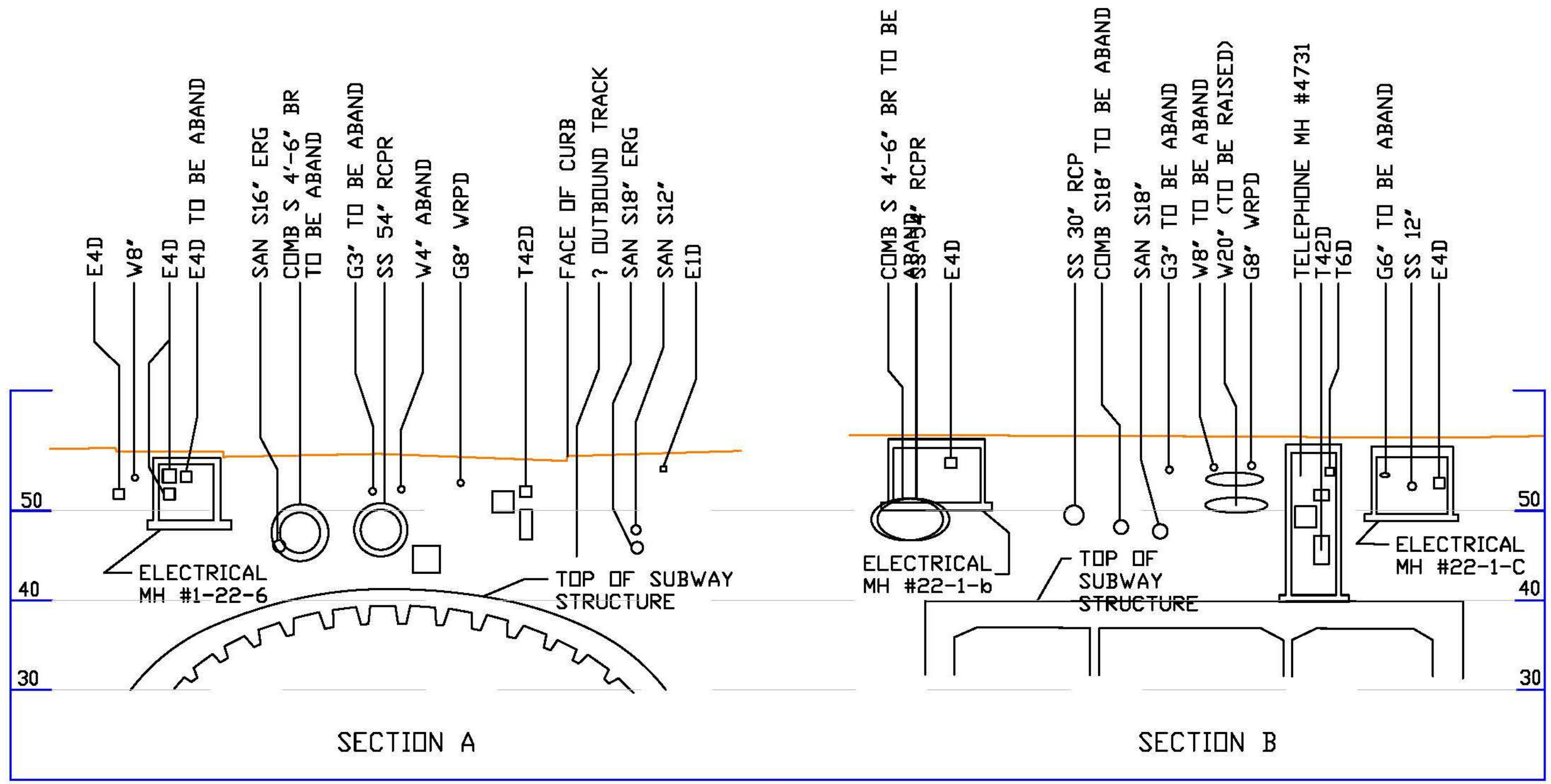
CONTRACT NO.

FOGGY BOTTOM

EXISTING UTILITY PLAN

SCALE 1"= 32'

DRAWING NO. C-01



8 0 8 16

CONTRACT NO.

DESIGNED ______ DATE
DRAWN SG 06Oct06 DATE
CHECKED ______ DATE
APPROVED ______ DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS		
DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

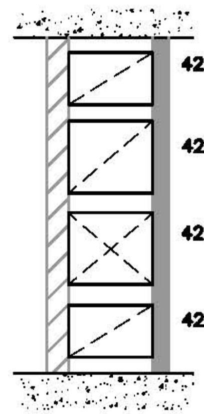
PROJECT MANAGER

FOGGY BOTTOM

EXISTING UTILITY SECTIONS

SCALE 1"= 16'

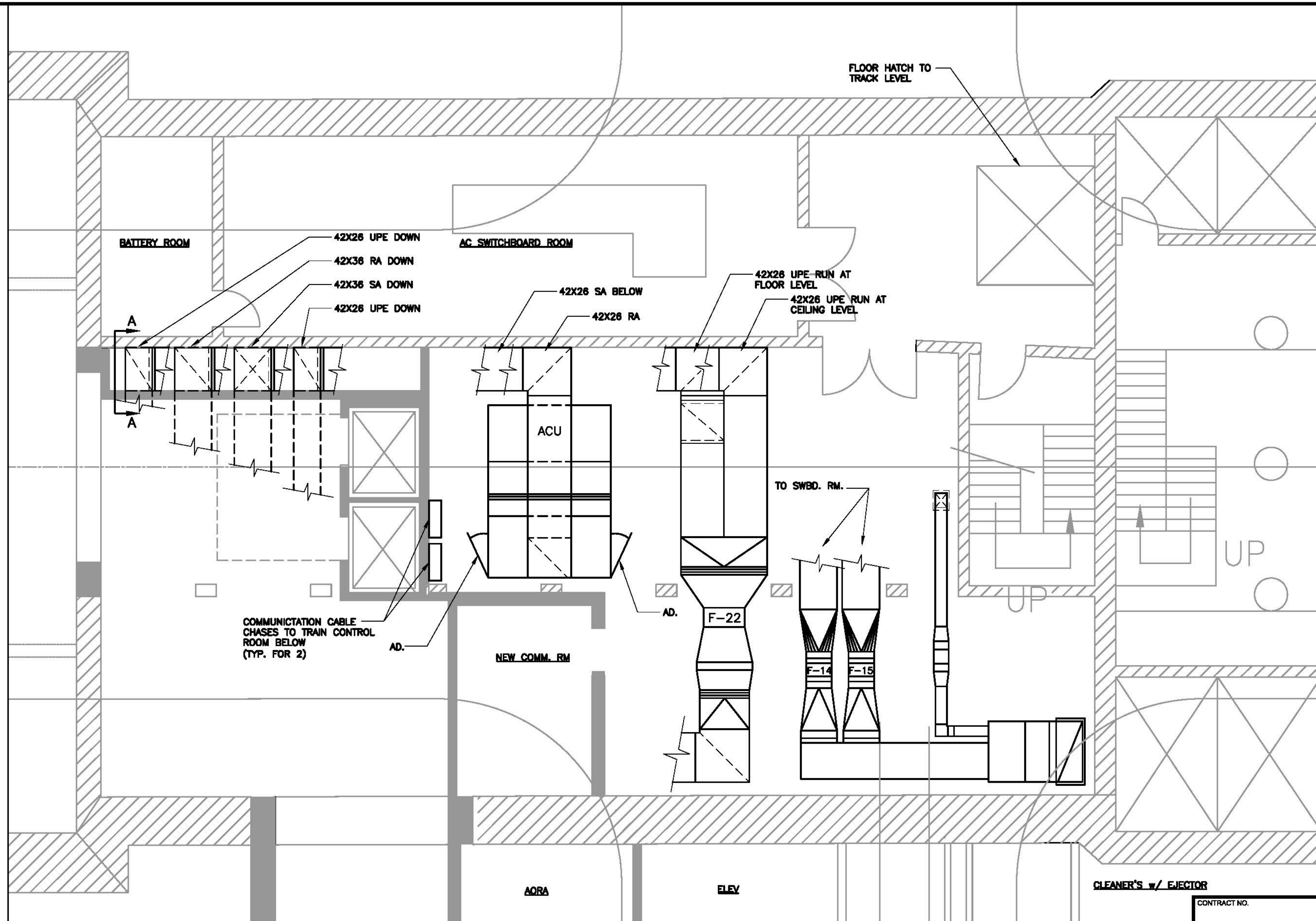
DRAWING NO. C-02



SECTION A–A

LEGEND

- UPE – UNDERPLATFORM EXHAUST
- RA – RETURN AIR
- SA – SUPPLY AIR
- COMM. – COMMUNICATION
- AD. – ACCESS DOOR
- ACU – AIR CONDITIONING UNIT
- SWBD. – SWITCHBOARD



CONTRACT NO.

DESIGNED	DATE
DRAWN	DATE
CHECKED	DATE
APPROVED	DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

PROJECT MANAGER

FOGGY BOTTOM

EAST MEZZANINE LEVEL PLAN
MECHANICAL/COMMUNICATIONS CONCEPT

SCALE

DRAWING NO. SYS–01

5.2 Structural Features

Construction of a second entrance at the east end of the Foggy Bottom-GWU station would require structural modifications to the existing station structure.

5.2.1 General Construction

Construction of the new east entrance and access for demolition of the south wall of the east service-room structure would require an open-pit excavation across the full width of the 22nd Street roadway and sidewalks and the sidewalk on the south side of I Street, requiring their closure. A slurry wall may be necessary if construction extends below the ground-water table.

Excavation for construction on the south side of the existing east service room structure would create an unbalanced earth loading condition that would require further analysis during final design.

5.2.2 Trainroom

<u>New East Mezzanine Level and stair down to platform level</u>
The columns and walls for the new east mezzanine level and stair should be designed considering the location of the return air plenums and walls that run directly below and support the platform slab. Any modification of the platform support structure and air plenums should be designed and coordinated with the mechanical requirements.

5.2.3 East Service Rooms

<u>New passageway from trainroom to new east entrance and new elevators</u>
At the mezzanine level, access for the new passageway through the east service room would require demolition to create openings in the 2'-0"-thick concrete station end wall and the 3'-0"-thick east service room south exterior wall and, at the platform level, demolition to create an opening in the 2'-0"-thick concrete station end wall to provide an entryway to the new elevators and lobby.

The new wall openings would require the design of a structural frame to support the vertical loading from the structure and earth overburden dead loads and live loads that were supported by the removed wall section.

Since the existing walls, columns, and plenum floor openings conflict with the proposed layout of the new elevators and the open elevator lobby areas at the mezzanine and platform levels, the demolition of existing and the design and construction of new platform-level walls, new duct chase, new columns, and a new mezzanine-level slab would be required. The existing outer (north and south) walls of the platform-level communication room support upper-level structural walls and columns and should remain in place.

The two existing mezzanine-level concrete columns at the west end of the east service room would be demolished to provide open space for the elevator lobby. To replace the removed columns a new load bearing wall would be constructed on the south side of the elevators and a frame constructed between the new wall and the end wall to support the roof that was supported by the columns.

5.2.4 New External Mezzanine

A new entry mezzanine would be constructed underground as a cut-and-cover operation under 22nd Street and the sidewalks to the east and west of 22nd Street, at an elevation equal to the existing upper-level east service area. The external mezzanine structure would be constructed integrally with the existing east service area structure to the north and constructed up against the University Garage to the west. The size and layout of the mezzanine would be constrained so as not to interfere with the foundations of existing buildings and future development.

The new mezzanine structure would consist of an open cast-in-place concrete structure with a central north-south arched roof beam spanning the mezzanine area and transverse roof beams framing into the arched beam. The shape and location of the arched roof beam would provide a notch in the roof mezzanine structure that would accommodate the existing 48-inch combined sewer pipe that runs beneath 22nd Street.

5.2.5 East Entrance/Elevator/Stair

The main vertical access to the new external mezzanine would be provided by a cut-and-cover, cast-in-place concrete structure for the stair/escalator array and elevators. The stair/escalator array and elevator would be incorporated into the first floor of a building that is in the GWU redevelopment plans for this parcel.

5.2.6 Temporary Support of Utilities

Temporary support of the 48-inch combined sewer pipe will be required during construction of the new external mezzanine structure. Interruption of the combined sewer service will not be allowed during construction.

5.3 Mechanical Features

Construction of a second entrance at the east end of the Foggy Bottom-GWU Metrorail station would require the mechanical features described below.

5.3.1 Station Mechanical Modifications

The proposed platform-to-mezzanine elevators would preclude using the space currently serving as a duct chase between the mezzanine and platform levels. This chase houses the under-platform exhaust and platform air conditioning system ductwork. The proposed modification would require construction of a new appropriately sized duct chase located to the north and directly adjacent to the new mezzanine-to-platform elevator hoistway. The proposed station modifications will result in the removal of an air conditioning pylon that currently serves the platform. Compensating for the loss of this pylon will require provision of a supply air outlet sized to deliver approximately 3,000 cubic feet per minute of conditioned air to the platform.

Required modifications to existing Foggy Bottom/GWU east mezzanine-level mechanical room would consist of the following:

- Replace and relocate the existing station platform air conditioning unit serving the east platform (AC-1) and reconfigure the ductwork in accordance with the new duct chase location.

Replacement of AC-1 would most likely be necessary to account for the increased pressure drop associated with ductwork modifications and the use of bag filters required by the WMATA Manual of Design Criteria (Release 7).

- Relocate the existing under-platform exhaust fan serving the east platform (F-22) and reconfigure the ductwork in accordance with the new duct chase location. A new exhaust shaft is required.
- If necessary, relocate existing AC Switchboard room ventilation fans (F-14 and F-15) to better accommodate relocated fan F-22 and air conditioning unit AC-1.
- Install new direct expansion air conditioning systems to accommodate the reconfiguration of the existing platform level Train Control room and the relocation of the existing Communications room to the mezzanine level.

5.3.2 HVAC

The new mezzanine will require air conditioning. Heating is typically not provided in station public areas. Options for a suitable air conditioning system consist of the following:

- An air conditioning system utilizing the existing station chilled water systems. The components involved would consist of the additional chilled water piping, air handling units and/or fan coil units. Unless the capacity of the chiller plant serving Foggy Bottom/GWU was increased, this option would divert chilled water from the rest of the station and result in a loss of available cooling capacity for the station platform and the existing mezzanine. Maintaining the current station platform and existing mezzanine chilled water capacity would require an upgrade to the existing chiller plant.
- 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 new mezzanine and would operate independently of the station chilled water systems. The components involved would consist of the chiller, associated chilled-water piping, chilled-water pump and air handling unit. 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. 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 mezzanine. Condenser air shafts to the surface are required. These shafts will also provide a means of equipment access.

Of the four options listed above, the self-contained air conditioning system option is preferred. This option does not require space within an adjacent building and does not affect the existing station chilled-water systems.

The new mezzanine would be air conditioned with a self-contained air conditioning unit. The estimated air conditioning requirement is approximately 15 tons. This is based on a floor area of approximately 5,000 square feet, a passenger heat load of 1,000 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 would utilize both supply and return air ductwork. A new mezzanine level mechanical room is required and associated air intake and exhaust shafts are required to house the air conditioning equipment.

New elevator machine rooms would be provided with air conditioning. A change to the current version of the WMATA Manual of Design Criteria is required since the criteria contain requirements only for ventilation. Heating is not required in underground locations by the WMATA Manual of Design Criteria.

The new mezzanine-level men's, women's, and cleaners' rooms would be ventilated and heated in accordance with the WMATA Manual of Design Criteria.

Per the WMATA Manual of Design Criteria, the area of rescue assistance (AORA) requires positive ventilation using air drawn from a source located outside the subway. The WMATA Manual of Design Criteria does not requiring heating in an AORA.

5.3.3 Fire Protection

Per the WMATA Manual of Design Criteria, limited-area sprinkler systems are required for the men's, women's, and cleaners' rooms.

5.3.4 Plumbing and Drainage

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

Because the washrooms and cleaners' room would be at mezzanine level, a sewage ejector and a water service are required. In addition to provision of domestic water, the water service will also need to supply the sprinkler system required for the new mezzanine level men's, women's, and cleaners' rooms.

5.4 Electrical and Systems Features

5.4.1 Station Electrical Modifications

Required electrical modifications include those listed below.

- New electrical equipment would be required in a mezzanine service room to provide power to lights, kiosk, fare vending equipment, emergency lights, and mechanical equipment. Electrical distribution equipment would be required in the elevator machine room. Electrical circuits installed in conduit would run from the nearest source of power in the existing passenger station AC switchgear rooms. Some modifications would 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 equipment to drive the new elevators plus additional power for associated elevator equipment requiring electricity would come from the passenger station.

5.4.2 Station Systems Modifications

Required systems modifications are listed below.

- The new elevators would require that the existing communication room at track level be relocated to within the mechanical room at the mezzanine level. Existing communication cables would have to be extended to the new communication room, or existing cables may have to be replaced and new cables installed.
- The train-control room would have to be reconfigured because of the new elevators.
- Reconfigured train-control room needs to be operational at all times.
- New communication room and new equipment needs to be installed and operational before any changes are made to the existing communication room. At no time can this equipment be taken out of service.
- Closed-circuit television (CCTV) cameras would be needed to monitor elevator and escalator access. Conduits/cables would be required between these cameras and the corresponding communication room. Additional conduits/cable would be required from the communication room to the passenger station kiosk.
- Additional fare collection equipment would be needed.
- Intrusion devices would be needed on all access doors. Conduits/cables would be required between these devices and the corresponding communication room. Additional conduits/cable may be required from the communication room to the passenger station kiosk.
- Fire-alarm devices would be required in station service rooms and with elevator equipment. Conduits/cables would be required between these devices and the corresponding communication room. Additional conduits/cable may be required from the communication room to the passenger station kiosk.
- The passenger information display system (PIDS) may require conduits/cables between the displays and the corresponding communication room.
- The passenger emergency reporting system (PERS) may require conduits/cables between the system and the corresponding communication room.

- Public address speakers may require conduits/cables between the speakers and the corresponding communication room.
- The two-way communication system in the AORA will require conduits/cables between the system and the corresponding communication room. Additional conduits/cable may be required from the communication room to the passenger station kiosk.
- Modifications will be needed to the existing kiosk to accommodate additional elevators, escalators, CCTV camera, intrusion, fire, and communication equipment. This is to be coordinated with the new kiosk.
- The location of equipment will be based on WMATA's latest Design Criteria.
- The new CCTV, fire-alarm, intrusion, public address and other communication equipment may not be compatible with the existing equipment. The existing equipment will have to be modified or replaced to operate with the new communication equipment

5.5 Cost Estimate

Order-of-magnitude costs were estimated for the construction of a second entrance at the east end of the Foggy Bottom-GWU Metrorail station. Table 14 summarizes these costs, which total $21.2 million.

Table 14: Foggy Bottom-GWU Second Entrance Cost Estimate

Category	**Cost ($1,000)**
Construction Type	
Architectural	2,185
Civil	3,195
Electrical & Elevators	2,712
Mechanical	288
Structural	3,391
General Conditions	2,943
Design Contingency	4,415
Profit	1,913
Escalation (2007)	176
Total	**21,220**

Source: PB, 2007

The costs include the following:

- A 25 percent general conditions, or indirect costs, allowance. These include supervision, engineering, and administration required by the contractor to proceed with the work. The indirects also includes costs for labor supplies and subcontracts, as well as taxes, insurance and performance bond.
- A 30 percent contingency because the design is at the concept level.
- A 10 percent profit allowance, which is an additional factor applied to the total project cost to reflect the anticipated profit. This is based on the risk evaluation of the work.
- The civil cost includes maintenance of traffic, site preparation, earthwork, utilities, drainage, foundation support, and pavement. This category also includes the temporary support of the 48-inch sanitary sewer during construction.
- The electrical cost includes power, lighting, communications, sound, video, and elevators.
- The mechanical cost includes fire protection, automation systems, piping, plumbing, and HVAC.

The cost estimate does not include fees for engineering, construction management, or right-of-way. In addition, escalation beyond the second quarter of fiscal year 2007 is not included.

Because the new station entrance would be built concurrent with the redevelopment of Square 77 and covered by a new building, the estimate does not include the cost of a separate station entrance canopy.

This page intentionally left blank

REFERENCES

DDOT, Washington DC Bicycle Map, 2004.

National Fire Protection Association, *NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems*, 2007.

Square 54 Development Team, http://www.square54.com, 2006.

The George Washington University. *The George Washington University Foggy Bottom Campus Plan: 2006-2025.* June 2006.

Transportation Research Board, *TCRP Report 100: Transit Capacity and Quality of Service Manual 2nd Edition*, 2003

WMATA, *Ballston-MU Station Exiting*, April 2006.

WMATA, Station Access and Capacity Study Data, 2006.

WMATA, Faregate Data, 2005-2006.

WMATA, *Metrorail Passenger Survey*, 2002.

WMATA, *Core Capacity Study*, 2001.

WMATA, *Manual of Design Criteria*, April 2001.

WMATA, *Bi-County Transitway/Bethesda Station Access Demand Analysis*, May 2005.

This page intentionally left blank

APPENDIX A: ANALYSIS DETAILS

Station Area Land Use

Details on the number of station area population, households, and employment forecasted for 2005, 2010, and 2030 are shown in Table 15.

Table 15: Station Area Land Use Forecasts by TAZ

	Population			*Households*			*Employment*		
Year	**2005**	**2010**	**2030**	**2005**	**2010**	**2030**	**2005**	**2010**	**2030**
City Total	577,828	600,830	711,472	253,378	264132	315,832	745,300	783,710	881,420
TAZ									
1	1,089	1,152	1,393	367	367	545	3,431	3,431	3,431
2	1,870	1,979	2,401	666	666	704	8,926	8,926	8,926
3	0	0	0	0	0	24	15,028	15,028	15,028
4	0	0	0	0	0	195	8,252	8,252	8,332
5	0	0	0	0	0	0	3,380	3,380	3,380
6	0	0	0	0	0	0	11,236	11,236	11,386
7	1,426	1,534	1,912	259	259	412	10,858	11,268	11,643
8	0	0	0	0	0	23	19,120	20,760	20,915
9	1	1	1	1	1	132	22,084	22,084	22,349
10	1,402	1,433	1,603	662	662	750	11,144	11,144	11,319
11	2,108	2,124	2,336	1,546	1587	1,884	4,341	4,341	4,341
12	1,330	1,340	1,484	1,079	1354	1,354	11,531	11,531	11,886
36	1,067	1,075	1,182	770	770	770	1,974	1,974	1,974
37	3,447	3,572	4,162	1,793	1793	1,827	1,289	1,289	1,289
38	1,201	1,875	2,018	1,031	1529	1,545	4,227	4,227	4,237
40	702	708	779	524	644	644	2,807	2,817	2,817
45	634	639	693	430	430	438	4,398	4,398	4,398
¼ Mile	12,204	13,328	15,450	6,072	6,690	7,197	44,656	45,076	45,636
½ Mile	16,277	17,432	19,964	9,128	10,062	11,247	144,026	146,086	147,651

Source: DC Office of Planning (based on MWCOG Round 7.1 household and employment forecasts), PB

Because riders primarily access the Foggy Bottom-GWU Metrorail station by walking, 2030 ridership volumes were split between the existing and proposed entrance using TAZ-level land use forecasts. The peak PM peak hour and one-half hour boardings and alightings were distributed between the two entrances based on the percent of total households and employment assumed to be walking to each entrance.

Table 16 : Percent Distribution of Walk Trips by Entrance

TAZ	AM Boardings and PM Alightings		PM Boardings and AM Alightings	
	Existing Entrance	Proposed Entrance	Existing Entrance	Proposed Entrance
1	70	30	30	70
2	100	0	0	100
3	20	0	0	20
4	100	0	0	100
5	50	50	50	50
6	70	30	30	70
7	80	20	20	80
8	30	0	0	30
9	40	0	0	40
10	60	40	40	60
11	60	40	40	60
12	50	50	50	50
36	0	100	100	0
37	0	100	100	0
38	0	100	100	0
40	0	100	100	0
45	0	100	100	0

Note: These percentages were based on where riders would walk from. Thus, since this area has a higher proportion of jobs than it does households, this distribution would apply to AM alightings and PM boardings.

Alternative Analysis Details

Table 17: Input Data for All Alternatives

Input			
A	Alighting peaking factor[1]	1.28	
B	Escalator flow rate	90	p/min
C	LOS C flow rate per stair width	10	p/ft/min
D	Peak analysis period	15	min
E	Faregate flow rate	35	p/min
F	Passengers using farecard vendor	20	%
G	Farecard vendor flow rate	2.5	p/min

1. Factor only applies to alighting volumes.

The capacity analysis used peak-hour factors based on 2006 ridership data provided by WMATA.

Table 18: Summary of 2006 Existing Capacity Analysis

Entrance(s): Existing West

15-min. Peak Hour Factor (PHF)		
	AM	PM
Boarding	0.38	0.35
Alighting	0.27	0.27

		AM			**PM**			**Critical**		**Actual[2]**		
		Alighting[1]	Boarding	Total	Alighting[1]	Boarding	Total	Alighting	Boarding	Alighting	Boarding	
H	Passengers, 1-hr. peak	4,220	910	5,130	1,307	3,666	4,973					
I	Passengers, 15-min. peak	1,139	346	1,485	353	1,283	1,636					H x PHF
J	Platform Escalators Required	2	1	3	1	1	2	2	1	2	1	(A x I) / (B x D)
K	Mezzanine Escalators Required	2	1	3	1	1	2	2	1	2(1)	1(2)	(A x I) / (B x D)
L	Elevator(s) Required[3]			1			1	1		1		
M	Faregate Aisles Required[4]	3	1	4	1	3	4	3	3	9	6	(A x I) / (D x E)
N	Farecard Vendors Required		2	2		7	7	7		12		(F x I) / (D x G)

Notes:
1. Alighting factor applies.
2. AM values (PM values) i.e. (2)1: two alighting escalators available in the AM and only one in the PM
3. Per WMATA standards, two elevators are required for redundancy. See Elevator Analysis spreadsheet for details.
4. In addition to standard faregate aisles, WMATA requires one ADA aisle that can accommodate passenger flow in both directions.

Table 19: Summary of 2030 No Build Capacity Analysis

Entrance: Existing West

15-min. Peak Hour Factor (PHF)		
	AM	PM
Boarding	0.38	0.35
Alighting	0.27	0.27

		AM			PM			Critical		Actual[2]		
		Alighting[1]	Boarding	Total	Alighting[1]	Boarding	Total	Alighting	Boarding	Alighting	Boarding	
H	Passengers, 1-hr. peak	4,751	1,045	5,796	1,515	4,207	5,722					
I	Passengers, 15-min. peak	1,283	397	1,680	409	1,472	1,882					H x PHF
J	Platform Escalators Required	2	1	3	1	2	3	2	2	2	1	(A x I) / (B x D)
K	Mezzanine Escalators Required	2	1	3	1	2	3	2	2	2(1)	1(2)	(A x I) / (B x D)
L	Elevator(s) Required[3]			1			1	1		1		
M	Faregate Aisles Required[4]	4	1	5	1	3	4	4	3	9	6	(A x I) / (D x E)
N	Farecard Vendors Required	3		3		8	8	8		12		(F x I) / (D x G)

Notes:
1. Alighting factor applies.
2. AM values (PM values) i.e. (2)1: two alighting escalators available in the AM and only one in the PM
3. Per WMATA standards, two elevators are required for redundancy. See Elevator Analysis spreadsheet for details.
4. In addition to standard faregate aisles, WMATA requires one ADA aisle that can accommodate passenger flow in both directions.

Table 20: Summary of 2030 Build 1 Capacity Analysis

Entrance: Existing West and Proposed East Entrances

15-min. Peak Hour Factor (PHF)		
	AM	PM
Boarding	0.38	0.35
Alighting	0.27	0.27

Split Factors for Volumes (SF)		
	West	East
Boarding	0.35	0.65
Alighting	0.35	0.65

		AM			PM					
		Alighting[1]	Boarding	Total	Alighting[1]	Boarding	Total			
H	Passengers, 1-hr. peak	4,751	1,045	5,796	1,515	4,207	5,722			
I	Passengers, 15-min. peak	1,283	397	1,680	409	1,472	1,882	H x PHF		
	Existing West Entrance									
J	Passengers, 15-min. peak	449	139	588	143	515	659	I x SF		
	Proposed East Entrance									
K	Passengers, 15-min. peak	834	258	1092	266	957	1223	I x SF		
								Critical		
	Existing West Entrance							Alighting	Boarding	
L	Platform Escalators Required	1	1	2	1	1	2	1	1	(A x J) / (B x D)
M	Mezzanine Escalators Required	1	1	2	1	1	2	1	1	(A x J) / (B x D)
N	Elevator(s) Required[2]			1			1	1		
O	Faregate Aisles Required[3]	2	1	3	1	1	2	2	1	(A x J) / (D x E)
P	Farecard Vendors Required		1	1		3	3		3	(F x J) / (D x G)
	Proposed East Entrance							Alighting	Boarding	
Q	Platform Stair Width Required (ft.)	10	5		5	9		10	9	(A x K)/(C x D)+30"
R	Mezzanine Escalators Required[4]	1	1	2	1	1	2	1	1	(A x K) / (B x D)
S	Elevator(s) Required[2]			1			1	1		
T	Faregate Aisles Required[3]	3	1	4	1	2	3	3	2	(A x K) / (D x E)
U	Farecard Vendors Required		3	2		6	6		6	(F x K) / (D x G)

Notes:
1. Alighting factor applies.
2. Per WMATA standards, two elevators are required for redundancy. See Elevator Analysis spreadsheet for details.
3. In addition to standard faregate aisles, WMATA requires one ADA aisle that can accommodate passenger flow in both directions.
4. WMATA prefers to install a stairway with new escalator banks.

Table 21: Summary of 2030 Build 2 Capacity Analysis

Entrance: **Existing West and Proposed West Entrances**

15-min. Peak Hour Factor (PHF)		
	AM	PM
Boarding	0.38	0.35
Alighting	0.27	0.27

Split Factors for Volumes (SF)		
	West	New West
Boarding	0.5	0.5
Alighting	0.5	0.5

		AM			PM					
		Alighting	Boarding	Total	Alighting	Boarding	Total			
H	Passengers, 1-hr. peak	4,751	1,045	5,796	1,515	4,207	5,722			
I	Passengers, 15-min. peak	1,283	397	1,680	409	1,472	1,882	H x PHF		
	Existing West Entrance									
J	Passengers, 15-min. peak	641	199	840	205	736	941	I x SF		
	New West Entrance									
K	Passengers, 15-min. peak	641	199	840	205	736	941	I x SF		
								Critical		
	Existing West Entrance							Alighting	Boarding	
L	Platform Escalators Required[2]	2	1	3	1	2	3	2	2	(A x I) / (B x D)
M	Mezzanine Escalators Required	1	1	2	1	1	2	1	1	(A x J) / (B x D)
N	Elevator(s) Required[3]			1			1	1		
O	Faregate Aisles Required[4]	2	1	3	1	2	3	2	2	(A x J) / (D x E)
P	Farecard Vendors Required		2	2		4	4		4	(F x J) / (D x G)
	New West Entrance							Alighting	Boarding	
Q	Mezzanine Escalators Required[5]	1	1	2	1	1	2	1	1	(A x K) / (B x D)
R	Elevator(s) Required[3]			1			1	1		
S	Faregate Aisles Required[4]	2	1	3	1	2	3	2	2	(A x K) / (D x E)
T	Farecard Vendors Required		2	2		4	4		4	(F x K) / (D x G)

Note:
1. Alighting factor applies.
2. Escalators required between platform to mezzanine will serve passengers transiting to-and-from both entrances.
3. Per WMATA standards, two elevators are required for redundancy. See Elevator Analysis spreadsheet for details.
4. Additional to the normal faregate aisles, the mezzanine call for one ADA aisle that can accommodate passenger flow in both directions.
5. WMATA prefers to install a stairway with new escalator banks.

Vertical Capacity Analysis

Table 22: Vertical Capacity Analysis - AM Peak Exits

Escalator Flow Rate	90	p/min
Stair (5' wide) Flow Rate	25	p/min
Stair (10' wide) Flow Rate	75	p/min
LOS C Stairway Capacity	10	p/ft/min
Peak Analysis Period	15	minutes
Peaking Factor	1.28	
Peak 1-Hour Factor	0.27	
Peak Hour Volume (2006)	4220	passengers
Peak Hour Volume (2030)	4751	passengers

Split Factors for Alighting Volumes (2030 Build 1)	
West	0.35
East	0.65

Split Factors for Alighting Volumes (2030 Build 2)	
West	0.5
New West	0.5

SCENARIO	EXIT	STREET TO MEZZANINE						MEZZANINE TO PLATFORM					
		Peak 15 min. Volume	Required Number of Escalators	Actual Number of Escalators	Required Width of Stairs	Vertical Capacity	V/C	Peak 15 min. Volume	Required Number of Escalators	Actual Number of Escalators	Required Width of Stairs	Vertical Capacity	V/C
2006	West	1458	2	2		2700	0.55	1458	2	2		2700	0.55
2030 - No Build	West	1642	2	2		2700	0.61	1642	2	2		2700	0.61
2030 - Build 1	West	575	1	2		2700	0.22	575	1	2		2700	0.22
	East	1067	1	2	5	3075	0.35	1067	0	0	10	1125	0.95
2030 - Build 2	West	821	1	2		2700	0.31	1642	2	2		2700	0.61
	New West	821	1	2	5	3075	0.27						

Note:
1. The 2030 Build 2 scenario uses the existing vertical elements for the passenger movement between the mezzanine and the platform.

\# Denotes that flow is approaching capacity; volume to capacity ratio is greater than 0.75.

Table 23: Vertical Capacity Analysis - PM Peak Entries

Escalator Flow Rate	90	p/min
Stair (5' wide) Flow Rate	25	p/min
Stair (10' wide) Flow Rate	75	p/min
LOS C Stairway Capacity	10	p/ft/min
Peak Analysis Period	15	minutes
Peaking Factor	1	
Peak 1-Hour Factor	0.35	
Peak Hour Volume (2006)	3666	passengers
Peak Hour Volume (2030)	4207	passengers

Split Factor for Boarding Volumes (2030 Build 1)	
West	0.35
East	0.65

Split Factors for Boarding Volumes (2030 Build 2)	
West	0.5
New West	0.5

SCENARIO	ENTR.	STREET TO MEZZANINE						MEZZANINE TO PLATFORM					
		Peak 15 min. volume	Required Number of Escalators	Actual Number of Escalators	Required Width of Stairs	Vertical Capacity	V/C	Peak 15 min. volume	Required Number of Escalators	Actual Number of Escalators	Required Width of Stairs	Vertical Capacity	V/C
2006	West	1283	1	2		2700	0.48	1283	1	1		1350	0.95
2030 - No Build	West	1472	2	2		2700	0.55	1472	2	1		1350	**1.09**
2030 - Build 1	West	515	1	2		2700	0.20	515	1	1		1350	0.38
	East	957	1	2	5	3075	0.32	957	0	0	9	1125	0.85
2030 - Build 2	West	736	1	2		2700	0.28	1472	2	1		1350	**1.09**
	New West	736	1	2	5	3075	0.24						

Note:
1. The 2030 Build 2 scenario uses the existing vertical elements for the passenger movement between the mezzanine and the platform.

# Denotes that flow is approaching capacity; volume to capacity ratio is greater than 0.75.

# Denotes that flow is over capacity; volume to capacity ratio is greater than 1.0.

Elevator Analysis

Table 24: 2006 and 2030 No Build Elevator Capacity Analysis

Capacity of Existing Site Analysis - West Entrance		
	Street to Mezzanine	Mezzanine to Platform
Number of Elevators	1	1
Area of Elevator (ft^2)	30.0	30.0
Boarding / Alighting	10	10
Passenger unloading top (sec)	10.5	10.5
Passenger loading top (sec)	10.5	10.5
Doors closing (sec)	2.5	2.5
Travel time(sec)	8.8	13.6
Leveling time (sec)	2.0	2.0
Doors opening (sec)	2.5	2.5
Passenger unloading bottom (sec)	10.5	10.5
Passenger Loading bottom (sec)	10.5	10.5
Doors closing (sec)	2.5	2.5
Travel time(sec)	8.8	13.6
Leveling time (sec)	2.0	2.0
Doors opening (sec)	2.5	2.5
Cycle time (sec) =	73.6	83.2
Boarding / Alighting peak 15 load	122	108
Total 15 min peak load =	**216**	**People**

2006 Existing	**West**	**Capacity**	**V/C**
AM			
Peak 15 minute load	90	216	0.42
Boarding	17	108	0.16
Alighting	73	108	0.67
PM			
Peak 15 minute load	87	216	0.40
Boarding	64	108	0.59
Alighting	23	108	0.21

2030 No Build	**West**	**Capacity**	**V/C**
AM			
Peak 15 minute load	102	216	0.47
Boarding	20	108	0.18
Alighting	82	108	0.76
PM			
Peak 15 minute load	100	216	0.46
Boarding	74	108	0.68
Alighting	26	108	0.24

# Denotes that flow is approaching capacity; volume to capacity ratio is greater than 0.75.

Table 25: 2030 Build 1 Elevator Capacity Analysis

Capacity Future Site Analysis - East and West Entrances				
	West		East	
	Street to Mezzanine	Mezzanine to Platform	Street to Mezzanine	Mezzanine to Platform
Number of Elevators	1	1	1	1
Area of Elevator (ft^2)	30.0	30.0	30.0	25.5
Boarding / Alighting	10	10	10	8.5
Passenger unloading top (sec)	10.5	10.5	10.5	8.9
Passenger loading top (sec)	10.5	10.5	10.5	8.9
Doors closing (sec)	2.5	2.5	2.5	2.5
Travel time(sec)	8.8	13.6	1.9	2.9
Leveling time (sec)	2.0	2.0	2.0	2.0
Doors opening (sec)	2.5	2.5	2.5	2.5
Passenger unloading bottom (sec)	10.5	10.5	10.5	8.9
Passenger Loading bottom (sec)	10.5	10.5	10.5	8.9
Doors closing (sec)	2.5	2.5	2.5	2.5
Travel time(sec)	8.8	13.6	1.9	2.9
Leveling time (sec)	2.0	2.0	2.0	2.0
Doors opening (sec)	2.5	2.5	2.5	2.5
Cycle time (sec) =	73.6	83.2	59.8	55.5
Boarding / Alighting peak 15 load	122	108	151	138
Total 15 min peak load =	**216**	**People**	**276**	**People**

2030 - Build 1	**West**	**Capacity**	**V/C**	**East**	**Capacity**	**V/C**
AM						
Peak 15 minute load	36	216	0.16	66	276	0.24
Boarding	7	108	0.06	13	138	0.09
Alighting	29	108	0.27	53	138	0.39
PM						
Peak 15 minute load	35	216	0.16	65	276	0.24
Boarding	26	108	0.24	48	138	0.35
Alighting	9	108	0.08	17	138	0.12

Table 26: 2030 Build 2 Elevator Capacity Analysis

Capacity Future Site Analysis - Existing and New West Entrances				
	Existing West		New West	
	Street to Mezzanine	Mezzanine to Platform	Street to Mezzanine	Mezzanine to Platform
Number of Elevators	1	1	1	1
Area of Elevator (ft^2)	30.0	30.0	30.0	25.5
Boarding / Alighting	10	10	10	8.5
Passenger unloading top (sec)	10.5	10.5	10.5	8.9
Passenger loading top (sec)	10.5	10.5	10.5	8.9
Doors closing (sec)	2.5	2.5	2.5	2.5
Travel time(sec)	8.8	13.6	1.9	2.9
Leveling time (sec)	2.0	2.0	2.0	2.0
Doors opening (sec)	2.5	2.5	2.5	2.5
Passenger unloading bottom (sec)	10.5	10.5	10.5	8.9
Passenger Loading bottom (sec)	10.5	10.5	10.5	8.9
Doors closing (sec)	2.5	2.5	2.5	2.5
Travel time(sec)	8.8	13.6	1.9	2.9
Leveling time (sec)	2.0	2.0	2.0	2.0
Doors opening (sec)	2.5	2.5	2.5	2.5
Cycle time (sec) =	73.6	83.2	59.8	55.5
Boarding / Alighting peak 15 load	122	108	151	138
Total 15 min peak load =	**216**	**People**	**276**	**People**

2030 - Build 2	**West**	**Capacity**	**V/C**	**New West**	**Capacity**	**V/C**
AM						
Peak 15 minute load	51	216	0.24	51	276	0.19
Boarding	10	108	0.09	10	138	0.07
Alighting	41	108	0.38	41	138	0.30
PM						
Peak 15 minute load	50	216	0.23	50	276	0.18
Boarding	37	108	0.34	37	138	0.27
Alighting	13	108	0.12	13	138	0.10

Platform Analysis

Table 27: Platform Capacity Analysis

			2005		2030	
Analysis Period			AM	PM	AM	PM
		Boarding	173	642	199	736
		Alighting	729	151	547	175
Total passengers on platform at one time			902	792	746	911

LOS "C" required passenger waiting space	7	ft²/p
LOS "C" required passenger walking space	15	ft²/p
Total Area Available for Passengers	**15,415**	ft²

Analysis Period	2005		2030	
	AM	PM	AM	PM
Total area required to accommodate passenger waiting on platform at one time (ft²)	6,315	5,545	5,221	6,375

NFPA-130 Analysis

Table 28: NFPA-130 Preliminary Analysis – AM Peak

WITHOUT EAST ENTRANCE				
Platform to mezzanine capacity				
	No.	width (in)	pim	p/min
Stairs	0	0	1.41	0
Escalators*	2	96	1.41	135.36
Total				135.36
% Escalators:	100%			
Faregate capacity				
West Entrance				
Faregates	16		50	800
Service gate	2	72	2.27	163.44
Total				963.44
Mezzanine to street capacity				
West Entrance				
Escalators*	2	96	1.41	135.36
Walking time for longest route				
West Entrance				
	ft	ft/min	minutes	
Platform	385	124	3.104839	
Escalator	12.3	48	0.25625	
Mezzanine	231	124	1.862903	
Escalator	32.5	48	0.677083	
Total			5.901075	

WITH EAST ENTRANCE				
Platform to mezzanine capacity				
	No.	width (in)	pim	p/min
Stairs	1	120	1.41	169.2
Escalators*	2	96	1.41	135.36
Total				304.56
% Escalators:	67%			
Faregate capacity				
West Entrance				
Faregates	16		50	800
Service gate	2	72	2.27	163.44
Total				963.44
East Entrance				
Faregates	6		50	300
Service gate	1	36	2.27	81.72
Total				381.72
Mezzanine to street capacity				
West Entrance				
Escalators	3	144	1.41	203.04
East Entrance				
Escalators*	1	48	1.41	67.68
Stairs	1	60	1.41	84.6
Total				152.28
Walking time for longest route				
West Entrance				
	ft	ft/min	minutes	
Platform	215	124	1.733871	
Escalator	12.4	50	0.248	
Mezzanine	231	124	1.862903	
Escalator	32.5	50	0.65	
Total			4.494774	
East Entrance				
Platform	132	124	1.064516	
Stair	12.4	50	0.248	
Mezzanine	164	124	1.322581	
Stair	32.5	50	0.65	
Total			3.285097	

WITH NEW WEST ENTRANCE				
Platform to mezzanine capacity				
	No.	width (in)	pim	p/min
Stairs				
Escalators*	2	96	1.41	135.36
				135.36
% Escalators:	67%			
Faregate capacity				
For Current and New West Entrances				
Faregates	15	15	50	750
ADA gate	1	1	75	75
Service gate	2	72	2.27	163.44
Total				988.44
Mezzanine to street capacity				
West Entrance				
Escalators	2	96	1.41	135.36
New West Entrance				
Escalators	2	96	1.41	135.36
Stairs	1	48	1.41	67.68
Total				203.04
Walking time for longest route				
West Entrance				
	ft	ft/min	minutes	
Platform	215	124	1.733871	
Escalator	12.4	48	0.2583333	
Mezzanine	231	124	1.8629032	
Escalator	32.5	48	0.6770833	
Total			4.5321909	
New West Entrance				
Platform	215	124	1.733871	
Escalator	12.4	48	0.2583333	
Mezzanine + Tunnel	431	124	3.4758065	
Escalator	32.5	48	0.6770833	
Total			6.1450941	

* One escalator is assumed to be out of service
Elevators are assumed to be out of service for evacuation purposes

Table 29: NFPA-130 Preliminary Analysis – PM Peak

WITHOUT EAST ENTRANCE				
Platform to mezzanine capacity				
	No.	width (in)	pim	p/min
Stairs	0	0	1.41	0
Escalators*	2	96	1.41	135.36
Total				135.36
% Escalators:		100%		
Faregate capacity				
West Entrance				
Faregates	15	15	50	750
ADA gate	1	1	75	75
Service gate	2	72	2.27	163.44
Total				988.44
Mezzanine to street capacity				
West Entrance				
Escalators	2	96	1.41	135.36
Walking time for longest route				
West Entrance				
	ft	ft/min	minutes	
Platform	385	124	3.104839	
Escalator	12.3	48	0.25625	
Mezzanine	231	124	1.862903	
Escalator	32.5	48	0.677083	
Total			5.901075	

WITH EAST ENTRANCE				
Platform to mezzanine capacity				
	No.	width (in)	pim	p/min
Stairs	1	120	1.41	169.2
Escalators*	2	96	1.41	135.36
Total				304.56
% Escalators:		67%		
Faregate capacity				
West Entrance				
Faregates	15	15	50	750
ADA gate	1	1	75	75
Service gate	2	72	2.27	163.44
Total				988.44
East Entrance				
Faregates	5	5	50	250
ADA gate	1	1	75	75
Service gate	1	36	2.27	81.72
Total				406.72
Mezzanine to street capacity*				
West Entrance				
Escalators	3	144	1.41	203.04
East Entrance				
Escalators	1	48	1.41	67.68
Stairs**	1	48	1.41	67.68
Total				135.36
Walking time for longest route				
West Entrance				
	ft	ft/min	minutes	
Platform	215	124	1.733871	
Escalator	12.4	48	0.258333	
Mezzanine	231	124	1.862903	
Escalator	32.5	48	0.677083	
Total			4.532191	
East Entrance				
Platform	132	124	1.064516	
Stair	12.4	48	0.258333	
Mezzanine	164	124	1.322581	
Stair	32.5	48	0.677083	
Total			3.322513	

WITH NEW WEST ENTRANCE				
Platform to mezzanine capacity				
	No.	width (in)	pim	p/min
Stairs				
Escalators*	2	96	1.41	135.36
				135.36
% Escalators:		67%		
Faregate capacity				
For Current and New West Entrances				
Faregates	15	15	50	750
ADA gate	1	1	75	75
Service gate	2	72	2.27	163.44
Total				988.44
Mezzanine to street capacity				
West Entrance				
Escalators*	2	96	1.41	135.36
New West Entrance				
Escalators	2	96	1.41	135.36
Stairs	1	48	1.41	67.68
Total				203.04
Walking time for longest route				
West Entrance				
	ft	ft/min	minutes	
Platform	215	124	1.733871	
Escalator	12.4	48	0.2583333	
Mezzanine	231	124	1.8629032	
Escalator	32.5	48	0.6770833	
Total			4.5321909	
New West Entrance				
Platform	215	124	1.733871	
Escalator	12.4	48	0.2583333	
Mezzanine + Tunnel	431	124	3.4758065	
Escalator	32.5	48	0.6770833	
Total			6.1450941	

* One escalator is assumed to be out of service
Elevators are assumed to be out of service for evacuation purposes

Table 30: NFPA-130 Complete Analysis - AM

Analysis period:	AM	Options			
		Existing 2005	No-build 2030	Build 1 2030	Build 2 2030
Entraining Load	Peak 1-hr period	910	1045	1045	1045
	Peak ½ hr period	475	538	538	538
B6*(0.38)	Peak 15-min period	346	397	397	397
	Headway (min)	2.5	2.5	2.5	2.5
	Entraining Load for analysis	115	132	132	132
	Cars per train[1]	6	8	8	8
	Car capacity	120	120	120	120
	Link load, peak direction	720	960	960	960
	Off-peak direction factor	0.4	0.4	0.4	0.4
	Link load, off-peak direction	288	384	384	384
	Total Occupant Load	**1123**	**1476**	**1476**	**1476**
	Time to Clear platform (min)	**8.3**	**10.9**	**4.8**	**10.9**
	Wait time at platform exit				
	West Entrance	5.2	7.8	3.1	9.2
	East Entrance			3.8	
	New West Entrance				9.2
Split	***Trips to Entrance***				
0.5	West Entrance	1123	1476	738	738
0.5	East Entrance			738	
	New West Entrance				738
	Faregate flow time				
	West Entrance	1.2	1.5	0.8	1.5
	East Entrance			1.9	
	New West Entrance[2]				1.5
	Wait time at faregates				
	West Entrance	0.0	0.0	0.0	0.0
	East Entrance			0.1	
	New West Entrance				0.0
	Street exit flow time				
	West Entrance	8.3	10.9	3.6	5.5
	East Entrance			4.8	
	New West Entrance				3.6
	Wait time at street exit				
	West Entrance	0.0	0.0	0.0	0.0
	East Entrance			0.0	
	New West Entrance				0.0
	Total exit time				
	West Entrance	14.7	20.2	7.5	16.1
	East Entrance			10.7	
	New West Entrance				14.3
	Evacuation Time (min)	**14.7**	**20.2**	**10.7**	**14.9**

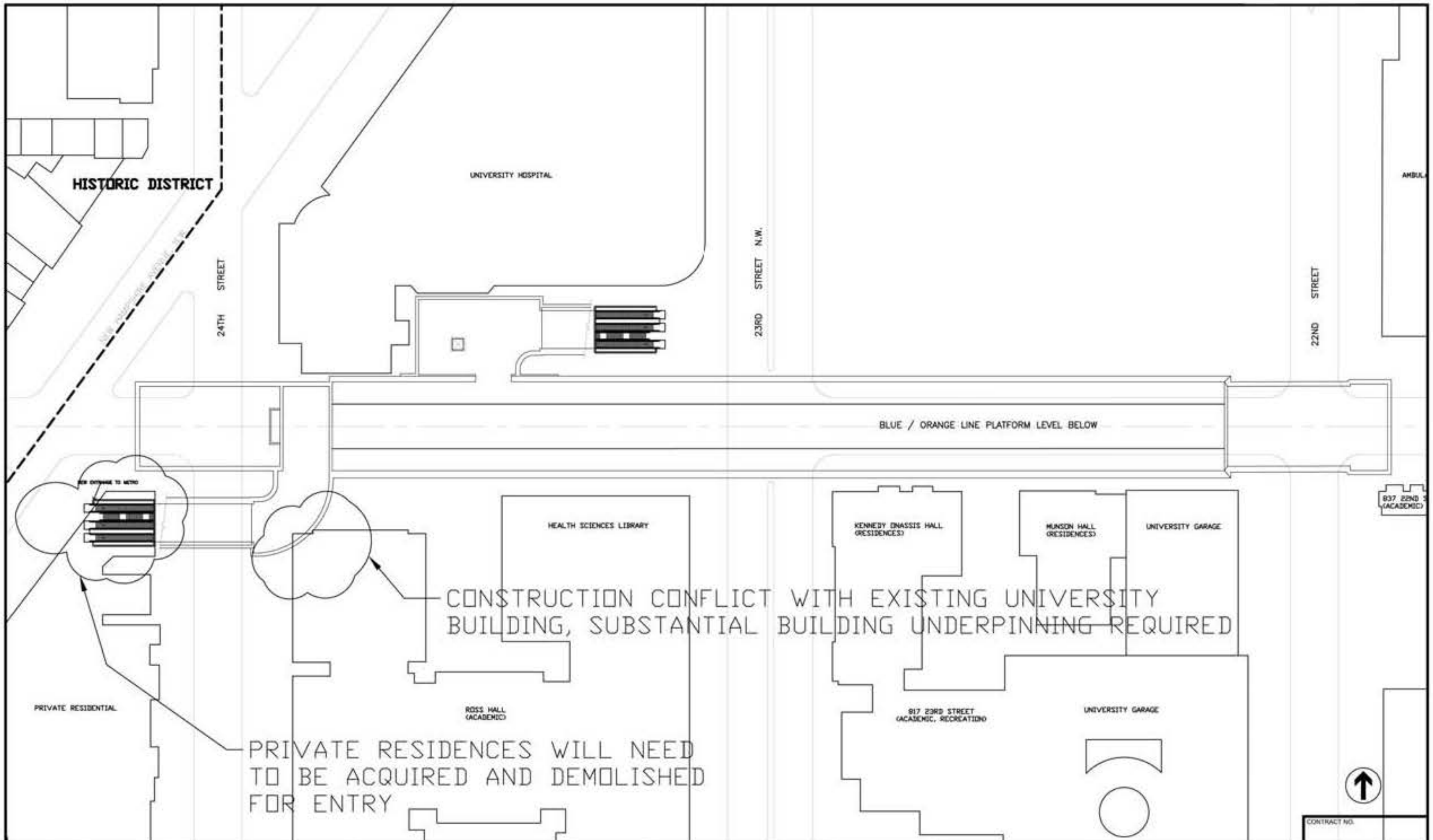
Note:
1. Future cars per train is assumed 8
2. Faregate flow time for new west entrance is the same as for the existing west entrance for 2030 - Build 2

Table 31: NFPA-130 Complete Analysis - PM

Analysis period:	**PM**	**Options**			
		Existing 2005	No-build 2030	Build 1 2030	Build 2 2030
Entraining Load	Peak 1-hr period	3666	4207	4207	4207
	Peak ½ -hr period	1943	2232	2232	2232
B5*0.35	Peak 15-min period	1283	1472	1472	1472
	Headway (min)	2.5	2.5	2.5	2.5
	Entraining Load for analysis	428	491	491	491
	Cars per train[1]	6	8	8	8
	Car capacity	120	120	120	120
	Link load, peak direction	720	960	960	960
	Off-peak direction factor	0.4	0.4	0.4	0.4
	Link load, off-peak direction	288	384	384	384
	Total Occupant Load	**1436**	**1835**	**1835**	**1835**
	Time to Clear platform (min)	**10.6**	**13.6**	**6.0**	**13.6**
	Wait time at platform exit				
	West Entrance	7.5	10.5	4.3	11.8
	East Entrance			5.0	
	New West Entrance				11.8
Split	***Trips to Entrance***				
0.5	West Entrance	1436	1835	917	917
0.5	East Entrance			917	
	New West Entrance				917
	Faregate flow time				
	West Entrance	1.5	1.9	0.9	1.9
	East Entrance			2.3	
	New West Entrance[2]				1.9
	Wait time at faregates				
	West Entrance	0.0	0.0	0.0	0.0
	East Entrance			0.0	
	New West Entrance				0.0
	Street exit flow time				
	West Entrance	10.6	13.6	4.5	6.8
	East Entrance			6.8	
	New West Entrance				4.5
	Wait time at street exit				
	West Entrance	0.0	0.0	0.0	0.0
	East Entrance			0.0	
	New West Entrance				0.0
	Total exit time				
	West Entrance	19.6	25.9	9.7	20.5
	East Entrance			14.0	
	New West Entrance				18.2
	Evacuation Time (min)	**19.6**	**25.9**	**14.0**	**18.8**

Note:
1. Future cars pert train is assumed 8
2. Faregate flow time for new west entrance is the same as for the existing west entrance for 2030 - Build 2

APPENDIX B: DRAWINGS OF INITIAL ALTERNATIVES



CONTRACT NO.

DESIGNED S. Garland 20June06 DATE
DRAWN SG 20June06 DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS: NUMBER | DESCRIPTION

REVISIONS: DATE | BY | DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D SUBMITTED

a joint venture of:
•Parsons Transportation Group Inc.
•Parsons Brinckerhoff Quade & Douglas, Inc
•Delon Hampton & Associates, Chartered

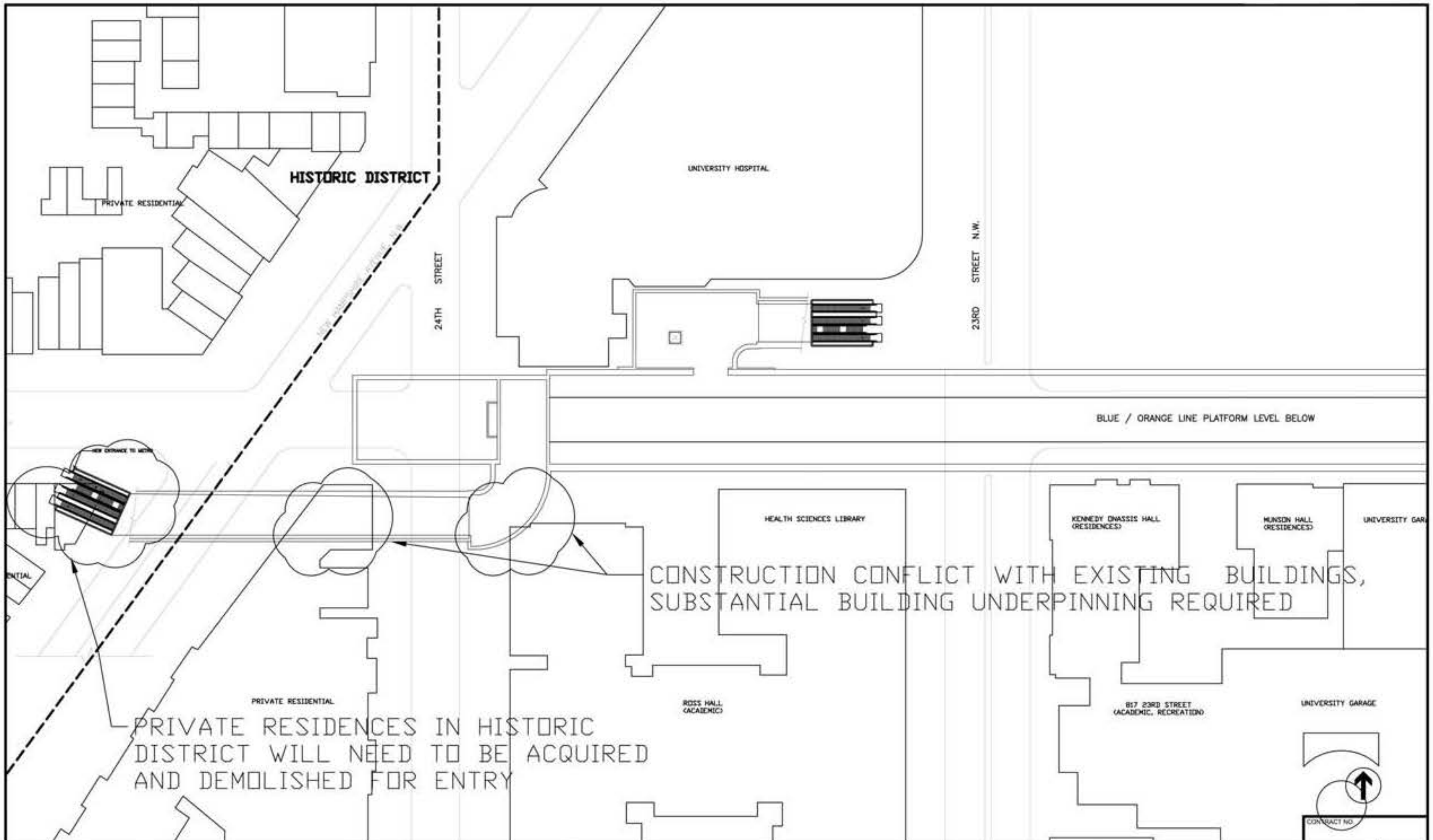
PROJECT MANAGER

FOGGY BOTTOM

SITE PLAN – WEST ENTRY OPTION 1A

SCALE 1"=60'-0"

DRAWING NO. A-03



DESIGNED	S. Garland	20June06	DATE
DRAWN	SG	20June06	DATE
CHECKED			DATE
APPROVED			DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

SUBMITTED

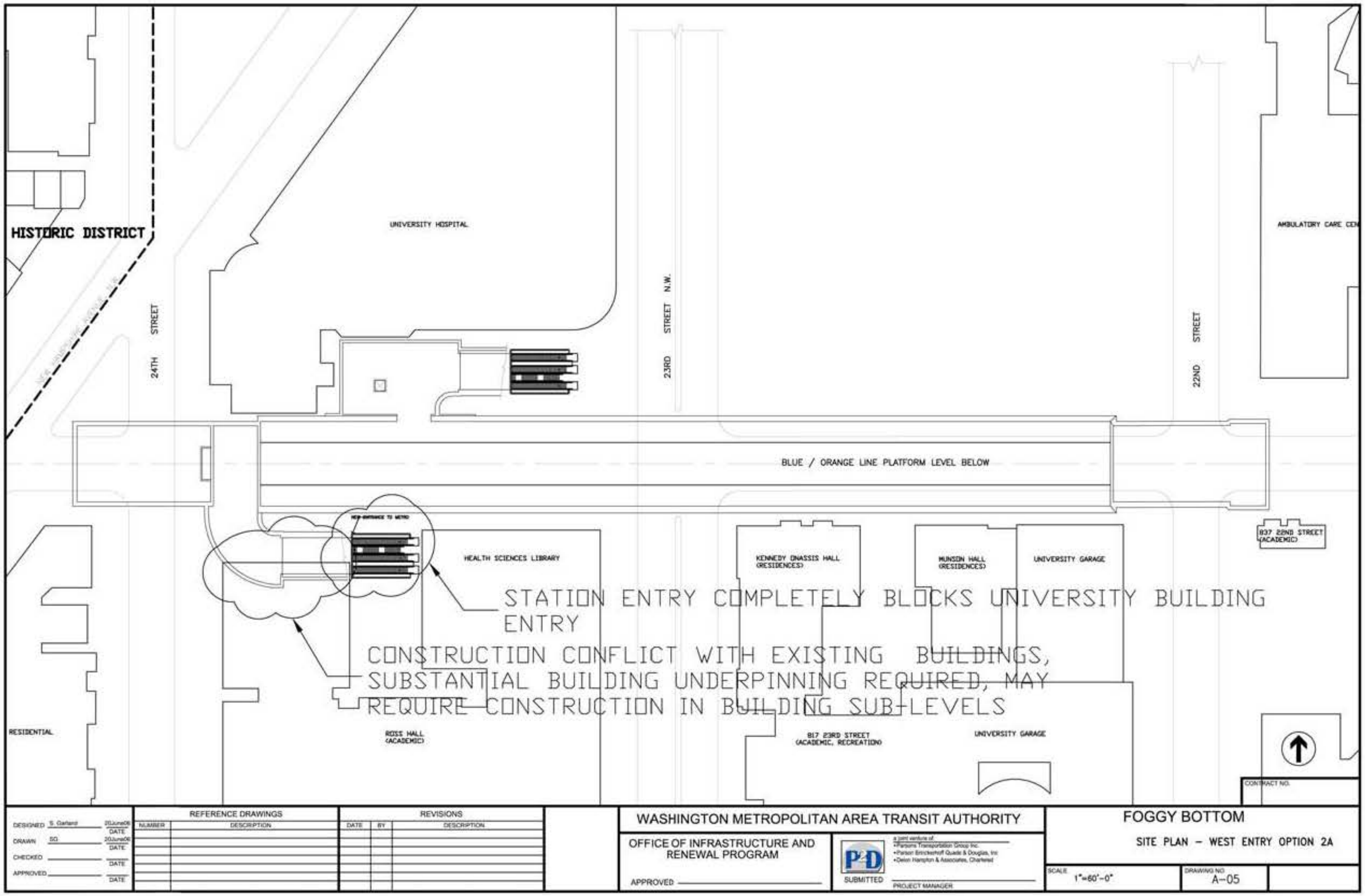
PROJECT MANAGER

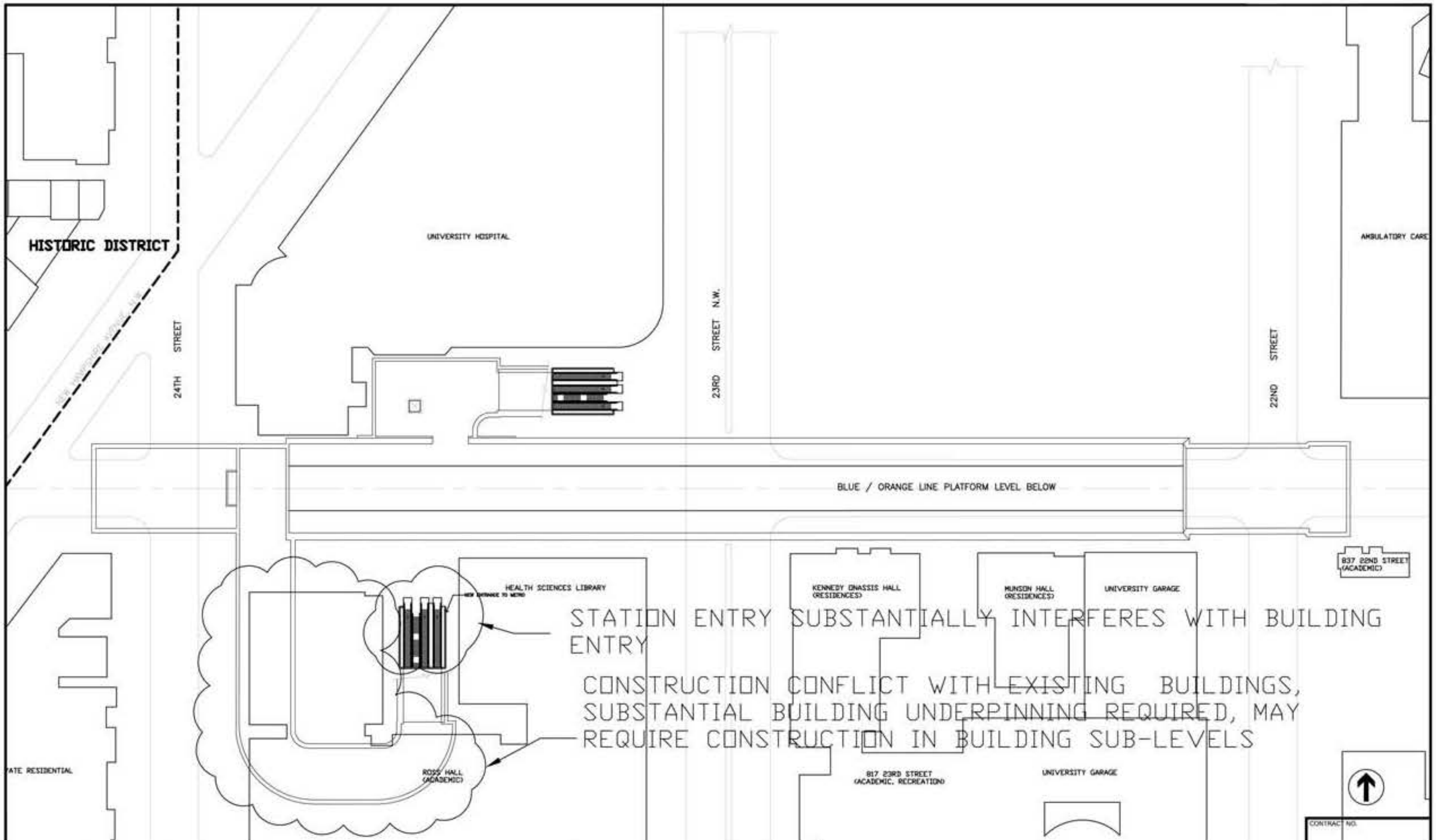
FOGGY BOTTOM

SITE PLAN – WEST ENTRY OPTION 1B

SCALE 1"=60'-0"

DRAWING NO. A-04


HISTORIC DISTRICT
UNIVERSITY HOSPITAL
AMBULATORY CARE CEN
24TH STREET
23RD STREET N.W.
22ND STREET
BLUE / ORANGE LINE PLATFORM LEVEL BELOW
HEALTH SCIENCES LIBRARY
KENNEDY ONASSIS HALL (RESIDENCES)
MUNSON HALL (RESIDENCES)
UNIVERSITY GARAGE
837 22ND STREET (ACADEMIC)
STATION ENTRY COMPLETELY BLOCKS UNIVERSITY BUILDING ENTRY
CONSTRUCTION CONFLICT WITH EXISTING BUILDINGS, SUBSTANTIAL BUILDING UNDERPINNING REQUIRED, MAY REQUIRE CONSTRUCTION IN BUILDING SUB-LEVELS
RESIDENTIAL
ROSS HALL (ACADEMIC)
817 23RD STREET (ACADEMIC, RECREATION)
UNIVERSITY GARAGE
CONTRACT NO.
DESIGNED S. Garland 20June06 DATE
DRAWN SG 20June06 DATE
CHECKED DATE
APPROVED DATE
REFERENCE DRAWINGS
NUMBER DESCRIPTION
REVISIONS
DATE BY DESCRIPTION
WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM
APPROVED
SUBMITTED
a joint venture of:
•Parsons Transportation Group Inc.
•Parson Brinckerhoff Quade & Douglas, Inc
•Delon Hampton & Associates, Chartered
PROJECT MANAGER
FOGGY BOTTOM
SITE PLAN – WEST ENTRY OPTION 2A
SCALE 1"=60'-0"
DRAWING NO A-05



DESIGNED S. Garland 20June06 DATE
DRAWN SO 20June06 DATE
CHECKED DATE
APPROVED DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS		
DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D SUBMITTED

a joint venture of:
• Parsons Transportation Group Inc.
• Parson Brinckerhoff Quade & Douglas, Inc
• Delon Hampton & Associates, Chartered

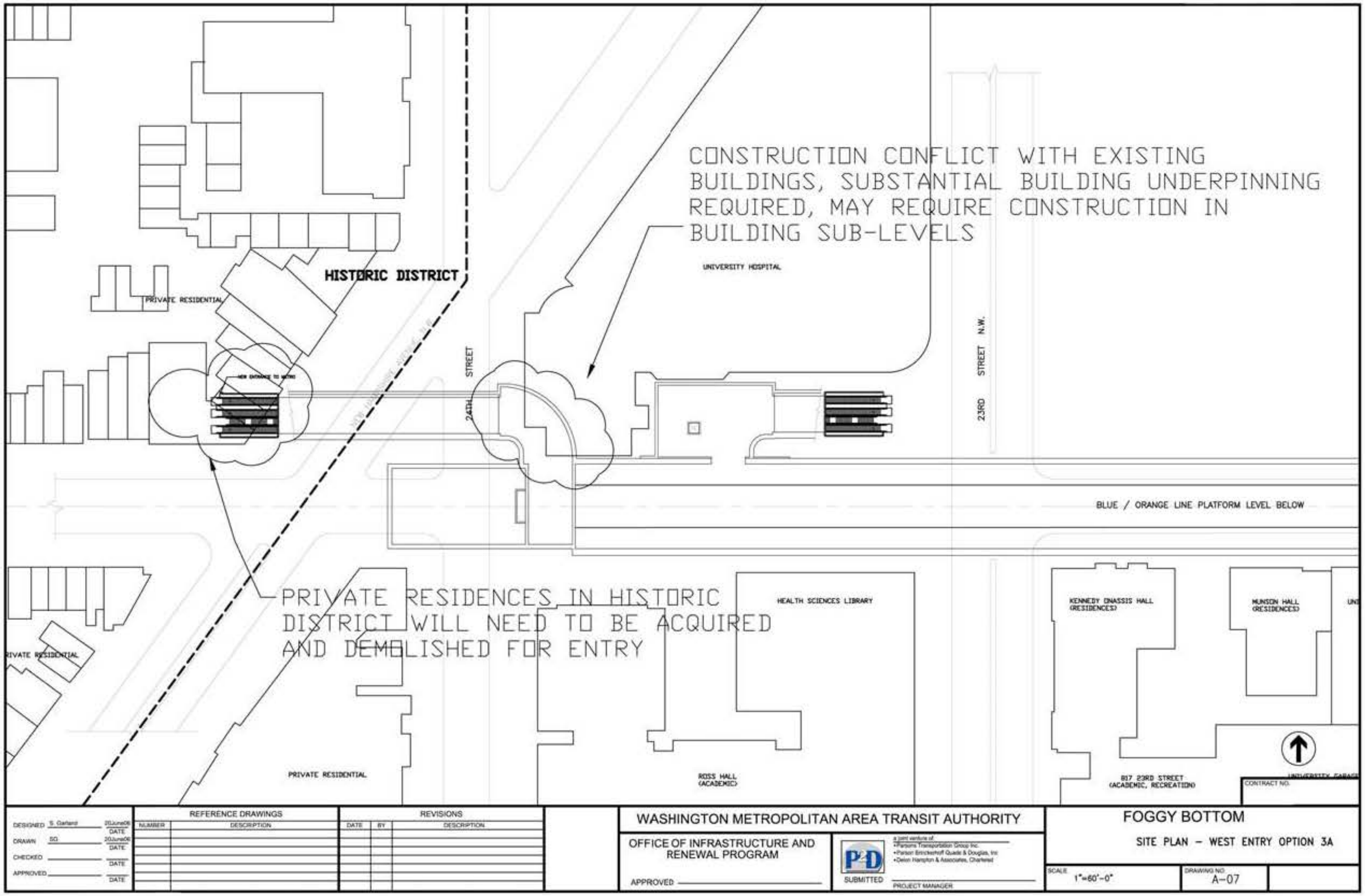
PROJECT MANAGER

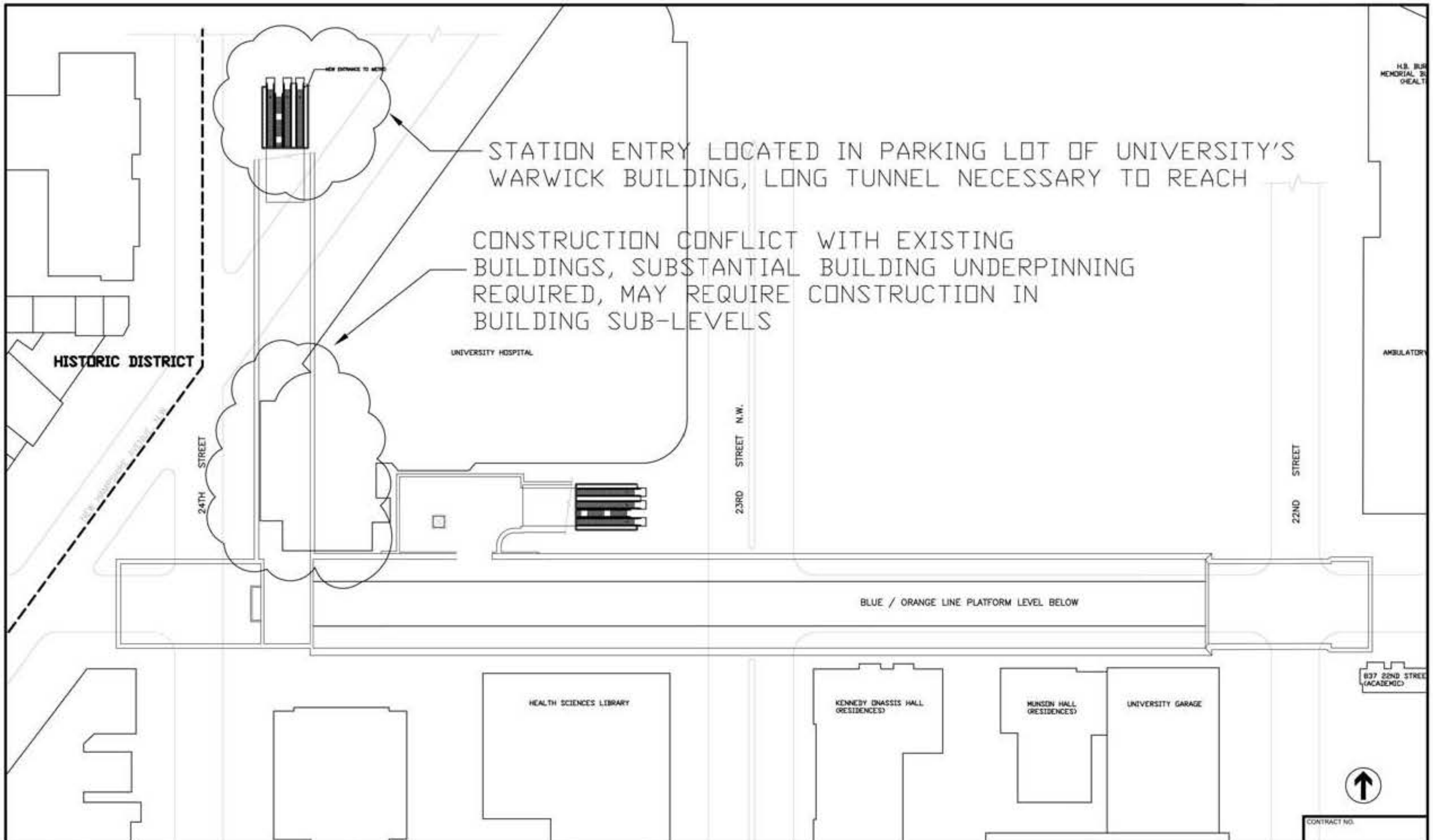
FOGGY BOTTOM

SITE PLAN – WEST ENTRY OPTION 2B

SCALE 1"=60'-0"

DRAWING NO. A-06


CONSTRUCTION CONFLICT WITH EXISTING BUILDINGS, SUBSTANTIAL BUILDING UNDERPINNING REQUIRED, MAY REQUIRE CONSTRUCTION IN BUILDING SUB-LEVELS
HISTORIC DISTRICT
PRIVATE RESIDENTIAL
UNIVERSITY HOSPITAL
24TH STREET
23RD STREET N.W.
BLUE / ORANGE LINE PLATFORM LEVEL BELOW
PRIVATE RESIDENCES IN HISTORIC DISTRICT WILL NEED TO BE ACQUIRED AND DEMOLISHED FOR ENTRY
HEALTH SCIENCES LIBRARY
KENNEDY ONASSIS HALL (RESIDENCES)
MUNSON HALL (RESIDENCES)
PRIVATE RESIDENTIAL
PRIVATE RESIDENTIAL
ROSS HALL (ACADEMIC)
817 23RD STREET (ACADEMIC, RECREATION)
CONTRACT NO.
DESIGNED S. Garland 20June06 DATE
DRAWN SG 20June06 DATE
CHECKED DATE
APPROVED DATE
REFERENCE DRAWINGS
NUMBER
DESCRIPTION
REVISIONS
DATE
BY
DESCRIPTION
WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM
APPROVED
a joint venture of:
•Parsons Transportation Group Inc.
•Parson Brinckerhoff Quade & Douglas, Inc
•Delon Hampton & Associates, Chartered
SUBMITTED
PROJECT MANAGER
FOGGY BOTTOM
SITE PLAN – WEST ENTRY OPTION 3A
SCALE 1"=60'-0"
DRAWING NO. A-07



CONTRACT NO.

DESIGNED	S. Garland	20June06 DATE
DRAWN	SO	20June06 DATE
CHECKED		DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

OFFICE OF INFRASTRUCTURE AND RENEWAL PROGRAM

APPROVED

P2D SUBMITTED

a joint venture of:
- Parsons Transportation Group Inc.
- Parson Brinckerhoff Quade & Douglas, Inc
- Delon Hampton & Associates, Chartered

PROJECT MANAGER

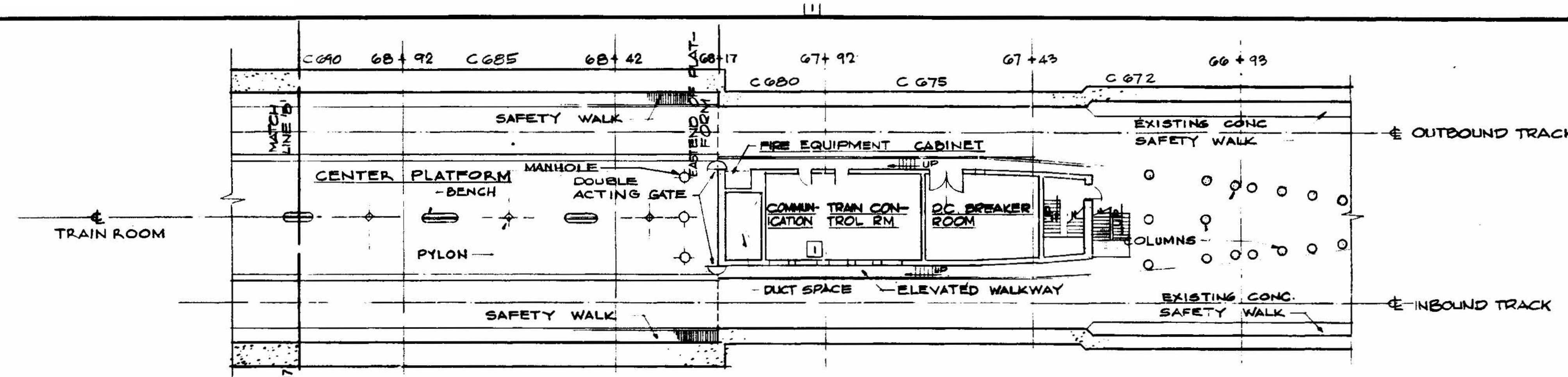
FOGGY BOTTOM

SITE PLAN – WEST ENTRY OPTION 3B

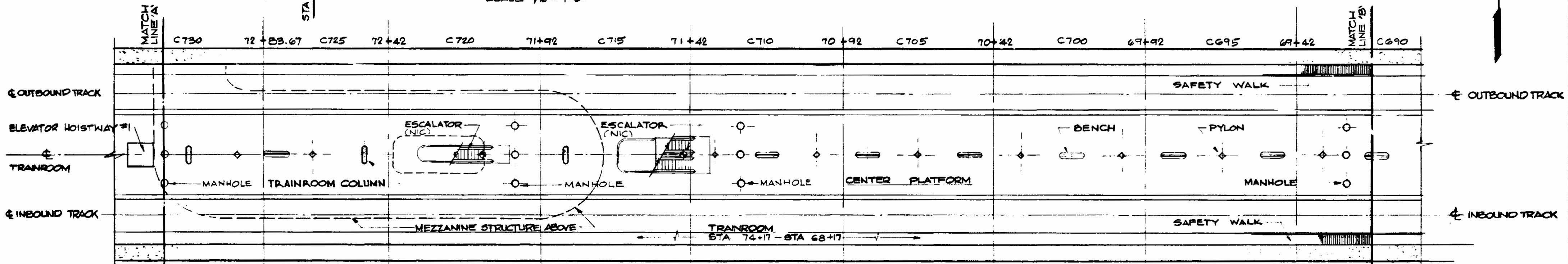
SCALE 1"=60'-0"

DRAWING NO. A-08

APPENDIX C: AS-BUILT DRAWINGS

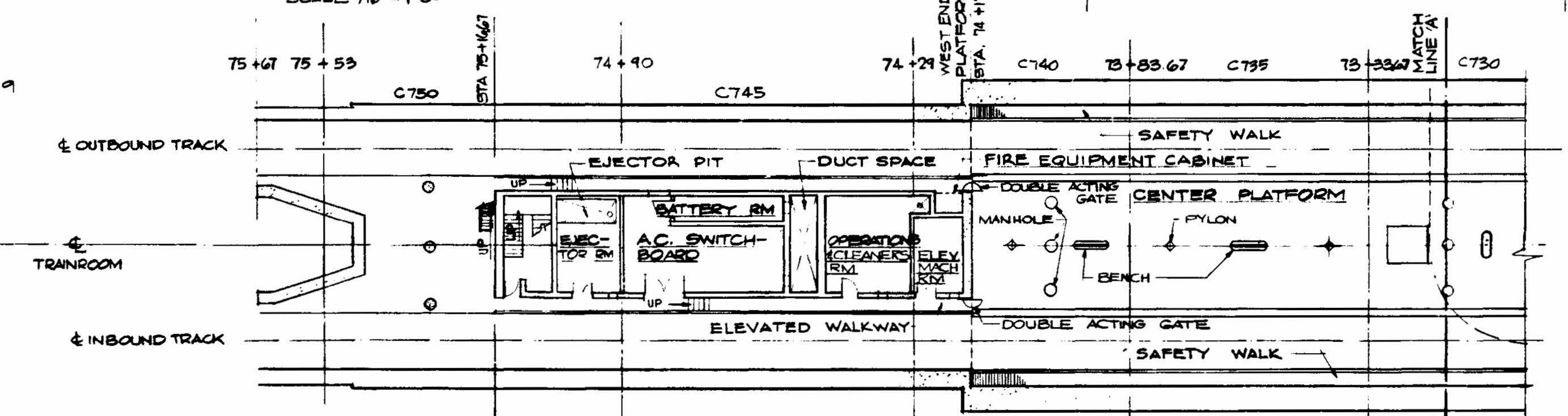


PLAN - LOWER LEVEL EAST SERVICE AREA
SCALE 1/16" = 1'-0"



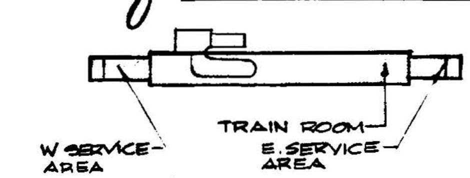
PLAN - PLATFORM
SCALE 1/16" = 1'-0"

NOTE:
FOR DETAILS AND DIMENSIONS
SEE PLAN SHEET A-4 THRU A-9



PLAN - LOWER LEVEL WEST SERVICE AREA
SCALE 1/16" = 1'-0"

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
AS-BUILT CONDITION
BY James A. Foote RESIDENT ENGINEER
MAY 27 1977 DATE



KEY PLAN

DESIGNED	UPBC	5/21/71
DRAWN	WKT	10-19
CHECKED	DCH	5/21/71
APPROVED	[signature]	7-23-71

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY		DESCRIPTION
3-8-77	SON	1	WALL DELETED PER RCO-013, "AS-BUILT"

DISTRICT OF COLUMBIA — H. BOYD DICKENSON — No 5062 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

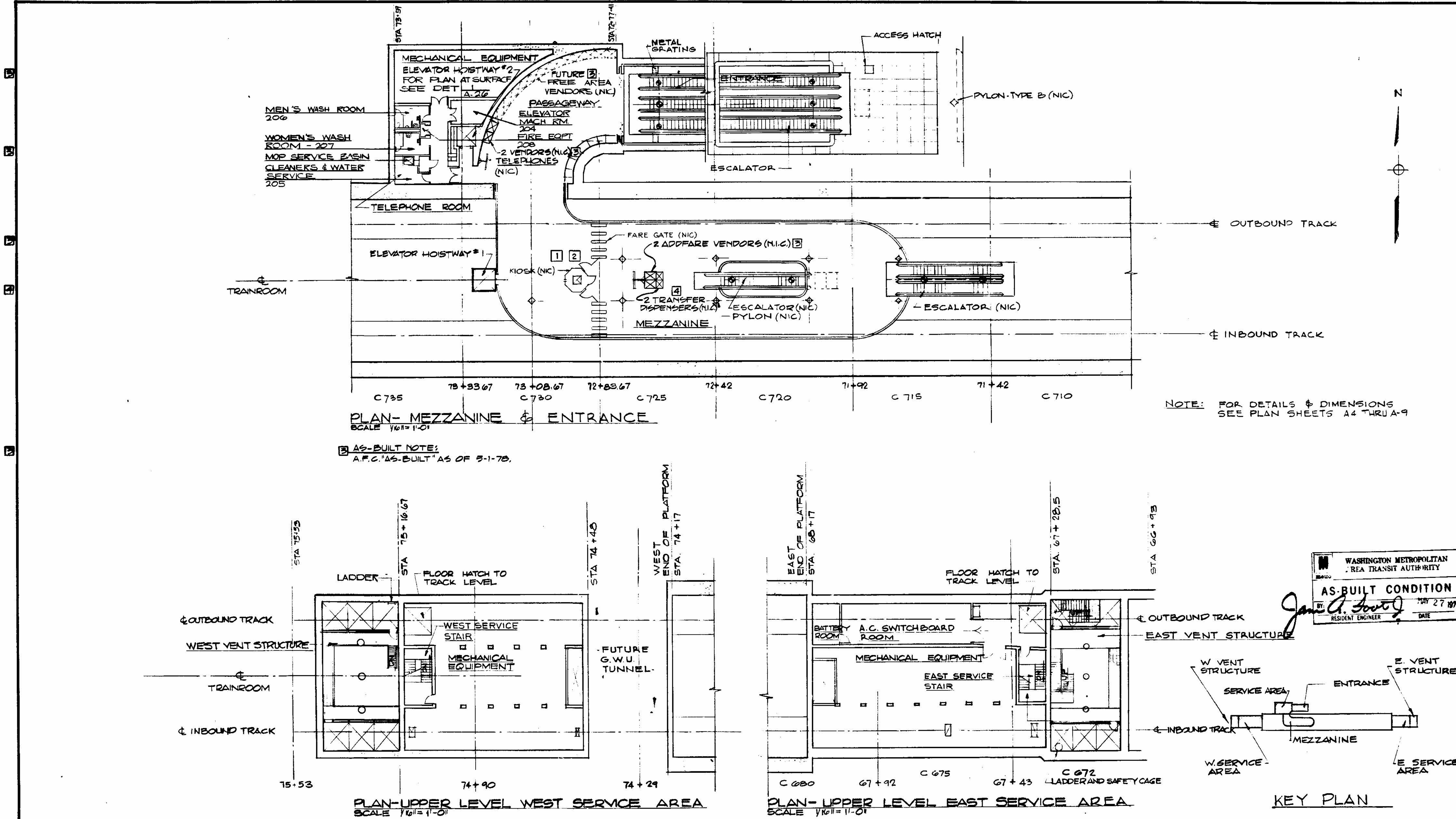
HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS
SECTION DESIGNER
SUBMITTED H. Boyd Dickenson

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANTS
APPROVED [signature]

HUNTINGTON ROUTE
FOGGY BOTTOM STATION
PLAN - LOWER LEVEL

SCALE 1/16" = 1'-0" 10 4 8 12 16 20
DRAWING NO. FC3-A-1
M42-9

COMM. 3665



DESIGNED	UPS	5/21/71
DRAWN	WKT	6-18
CHECKED	DCH	5/21/71
APPROVED		7-23-71

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY		DESCRIPTION
3-28-75	BFB	1	CHANGED EXIT GATE SWING PER PCO #3.
10-24-75	RFB	2	REVISE FARE GATES, PCO #18
7-11-78	PHU	3	REV. PER CONTRACT 2B007A, AS-BUILT.
		4	TRANSFER DISPENSERS ADDED PER CONTRACT 1B007I, AS-BUILT

DISTRICT OF COLUMBIA — H. BOYD DICKENSON — No 5062 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS
SECTION DESIGNER
SUBMITTED H. Boyd Dickenson

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT
APPROVED

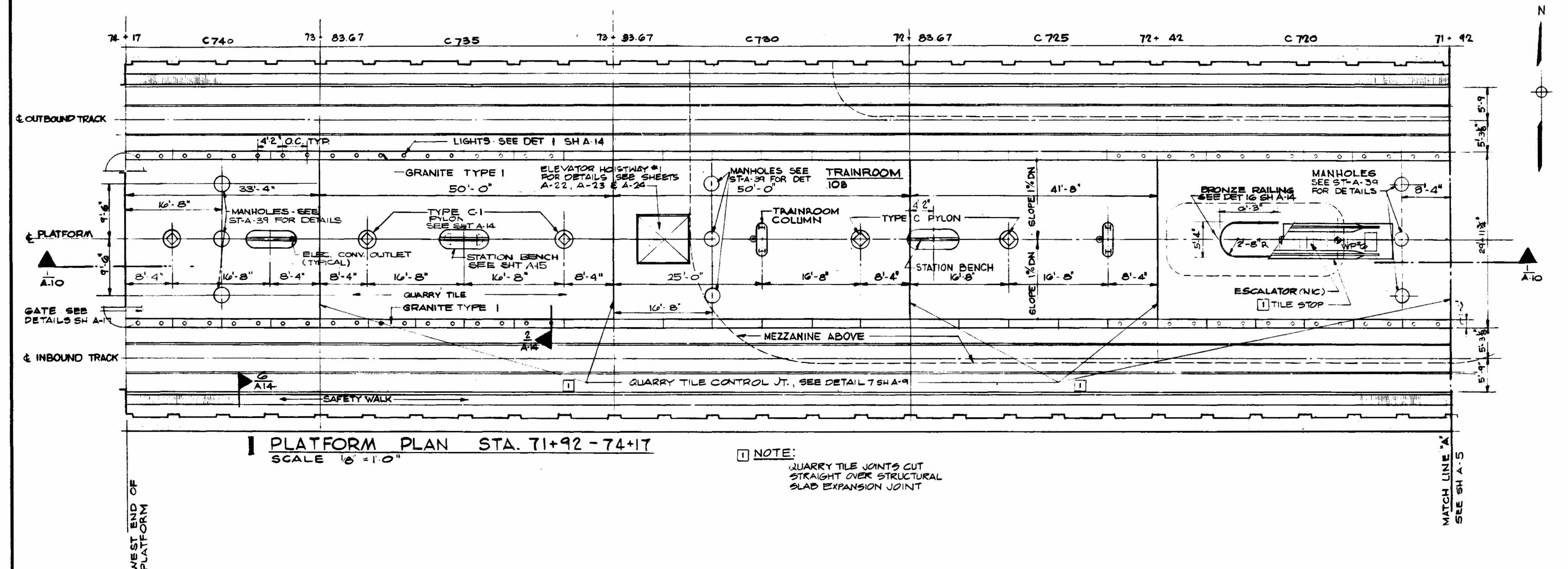
HUNTINGTON ROUTE
FOGGY BOTTOM STATION
PLAN- UPPER LEVEL

SCALE 1/16" = 1'-0" 0 4 8 12 16 20

DRAWING NO. FC3-A-2

M42-10

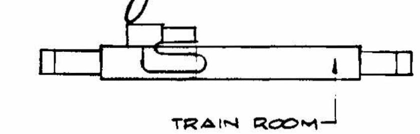
COMM. 3665



1 PLATFORM PLAN STA. 71+92 - 74+17
SCALE 1/8" = 1'-0"

1 NOTE:
QUARRY TILE JOINTS CUT
STRAIGHT OVER STRUCTURAL
SLAB EXPANSION JOINT

WASHINGTON METROPOLITAN
AREA TRANSIT AUTHORITY
AS-BUILT CONDITION
BY: [signature] MAY 27 1977
RESIDENT ENGINEER DATE



KEY PLAN

DESIGNED	[signature]	5/21/71
DRAWN	ADG JP	3/..
CHECKED	DCH	5/21/71
APPROVED	[signature]	7-23-71

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
A-10	SECTION
A-14	DETAILS & PLANS
A-15	BENCH DETAILS

REVISIONS

DATE	BY	DESCRIPTION
3-8-77	SUN	1 REVISED PER YCU-025, "AS-BUILT"

DISTRICT OF COLUMBIA — H. BOYD DICKENSON — No. 5062 — REGISTERED PROFESSIONAL ENGINEER

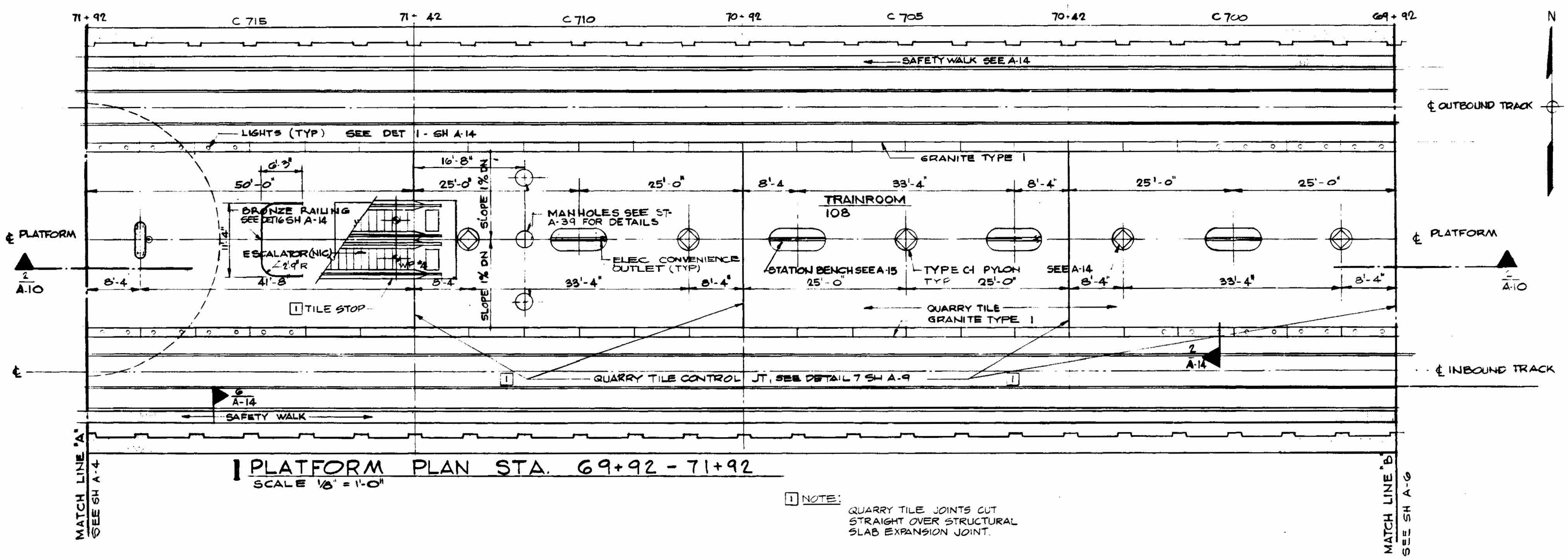
WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS
SECTION DESIGNER
SUBMITTED [signature]

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT
APPROVED [signature]

HUNTINGTON ROUTE
FOGGY BOTTOM STATION
PLATFORM PLAN
STA. 71 + 92 TO STA. 74+17

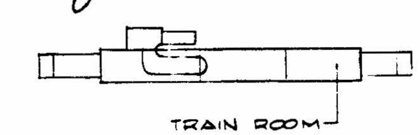
SCALE 1/8" = 1'-0" 0 2 4 6 8 10
DRAWING NO. FC3-A-4
M42-12
COMM. 3865



1 PLATFORM PLAN STA. 69+92 - 71+92
SCALE 1/8" = 1'-0"

1 NOTE: QUARRY TILE JOINTS CUT STRAIGHT OVER STRUCTURAL SLAB EXPANSION JOINT.

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
AS-BUILT CONDITION
BY: James A. Foote — RESIDENT ENGINEER
MAY 27 1977 — DATE



KEY PLAN

DESIGNED		5/24/71 DATE
DRAWN	A.D.G.JF	3-4 DATE
CHECKED	DOH	5/24/71 DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
A-10	SECTION
A-14	DETAILS & PLANS
A-15	BENCH DETAILS

REVISIONS

DATE	BY	DESCRIPTION
5-9-77		1 REVISED PER "CO-02", "AS-BUILT"

H. BOYD DICKERSON — DISTRICT OF COLUMBIA — No 5062 — REGISTERED PROFESSIONAL ENGINEER

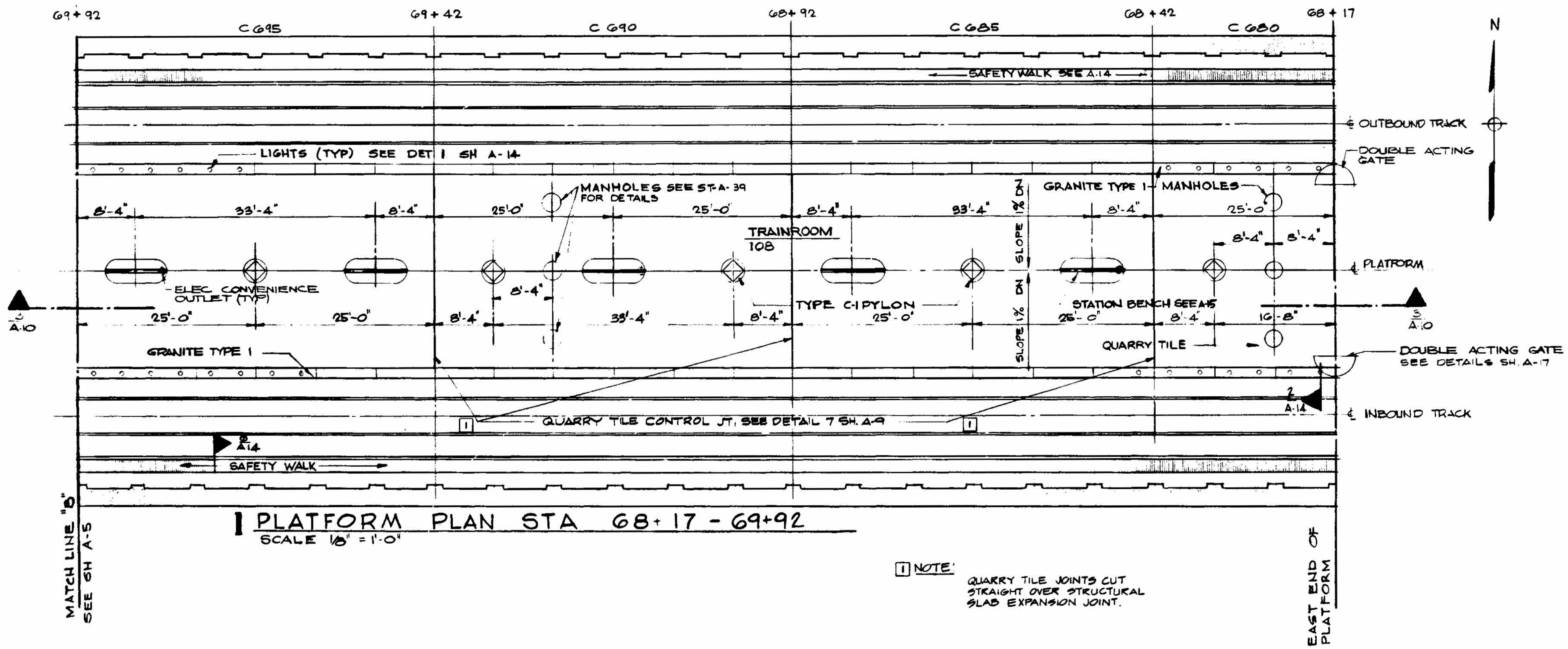
WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS
SECTION DESIGNER
SUBMITTED H. Boyd Dickerson

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT
APPROVED

HUNTINGTON ROUTE
FOGGY BOTTOM STATION
PLATFORM PLAN
STA. 69+92 TO STA. 71+92

SCALE 1/8" = 1'-0" 0 2 4 6 8 10
DRAWING NO. FC3-A-5
M42-13
COMM. 3660

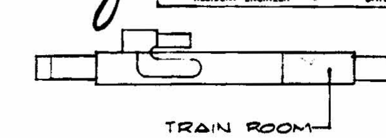


PLATFORM PLAN STA 68+17 - 69+92

SCALE 1/8" = 1'-0"

NOTE: QUARRY TILE JOINTS CUT STRAIGHT OVER STRUCTURAL SLAB EXPANSION JOINT.

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
AS-BUILT CONDITION
Jane A. Foot
RESIDENT ENGINEER
MAY 27 1977
DATE



KEY PLAN

DESIGNED	UHB	5/21/71
DRAWN	ADG JP	3/15
CHECKED	DCH	5/21/71
APPROVED	[illegible]	7-23-71

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
A-10	SECTION
A-14	DETAILS & PLANS
A-15	BENCH DETAILS

REVISIONS

DATE	BY	DESCRIPTION
3-9-77	SON	1 REVISED PER PCO-025, "AS-BUILT"

DISTRICT OF COLUMBIA — H. BOYD DICKENSON — No 5062 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS
SECTION DESIGNER
SUBMITTED H. Boyd Dickenson

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT
APPROVED J. A. Corgwood

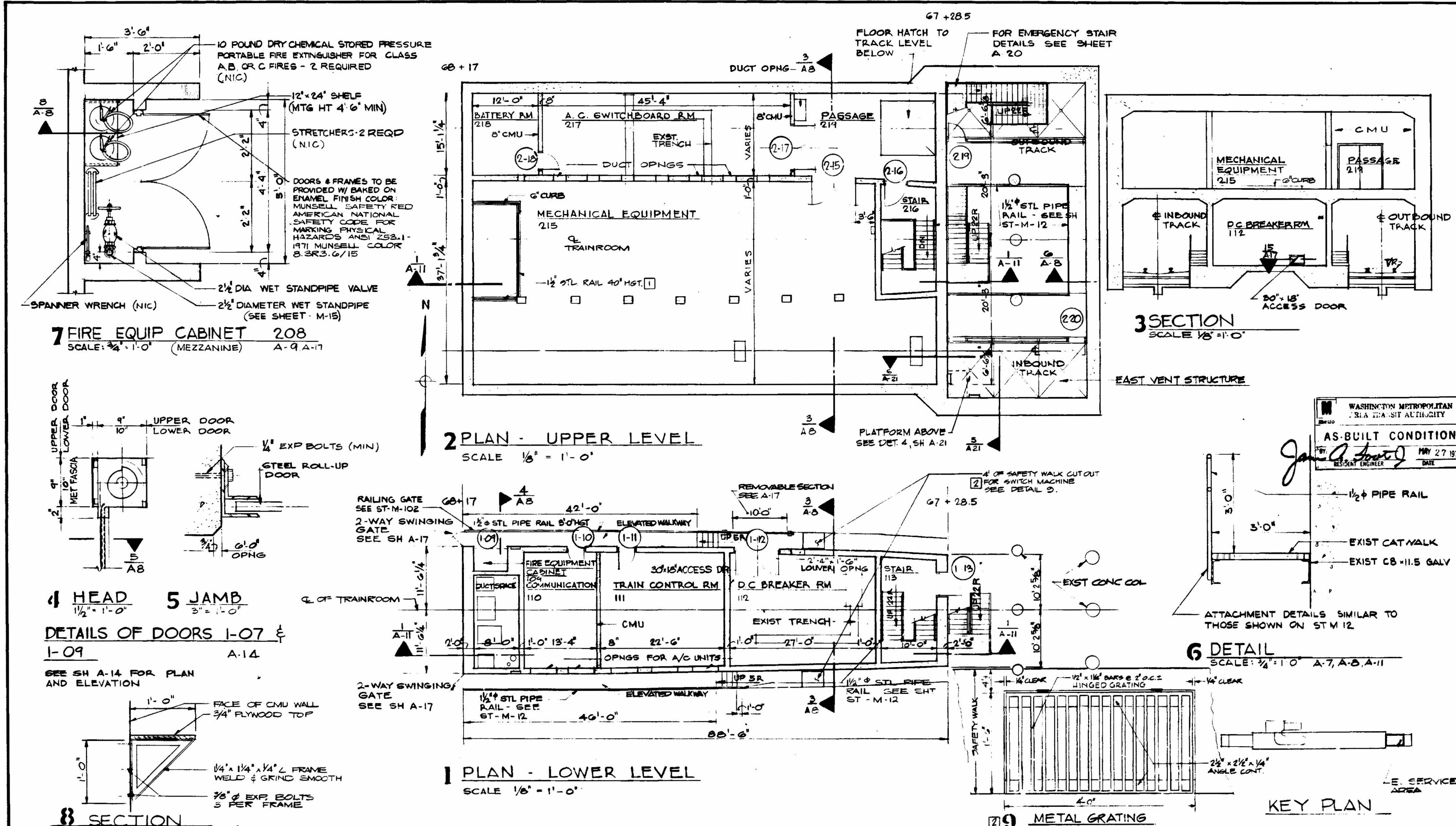
HUNTINGTON ROUTE
FOGGY BOTTOM STATION
PLATFORM PLAN
STA. 68+17 TO STA. 69+92

SCALE 1/8" = 1'-0"

DRAWING NO. FC3-A-6

M42-14

COMM. 3665



DESIGNED	DRAWN	CHECKED	APPROVED
UPB 5/21/76	ADG 3/3/76	DCH 5/21/76	7-23-76

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
A-11	SECTION
A-14, A-17, M-15	DETAILS
A-3	DOOR SCHEDULE
A-7	PLANS
A-20	STAIR DETAILS
ST-M-12	RAILING

REVISIONS

DATE	BY	DESCRIPTION
3-9-77	SON	1 REVISED PER FCO-052, "AS-BUILT"
3-9-77	SON	2 REVISED PER FCO-044, "AS-BUILT"

DISTRICT OF COLUMBIA — H. BOYD DICKENSON — No 5062 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS

SECTION DESIGNER

SUBMITTED H. Boyd Dickenson

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

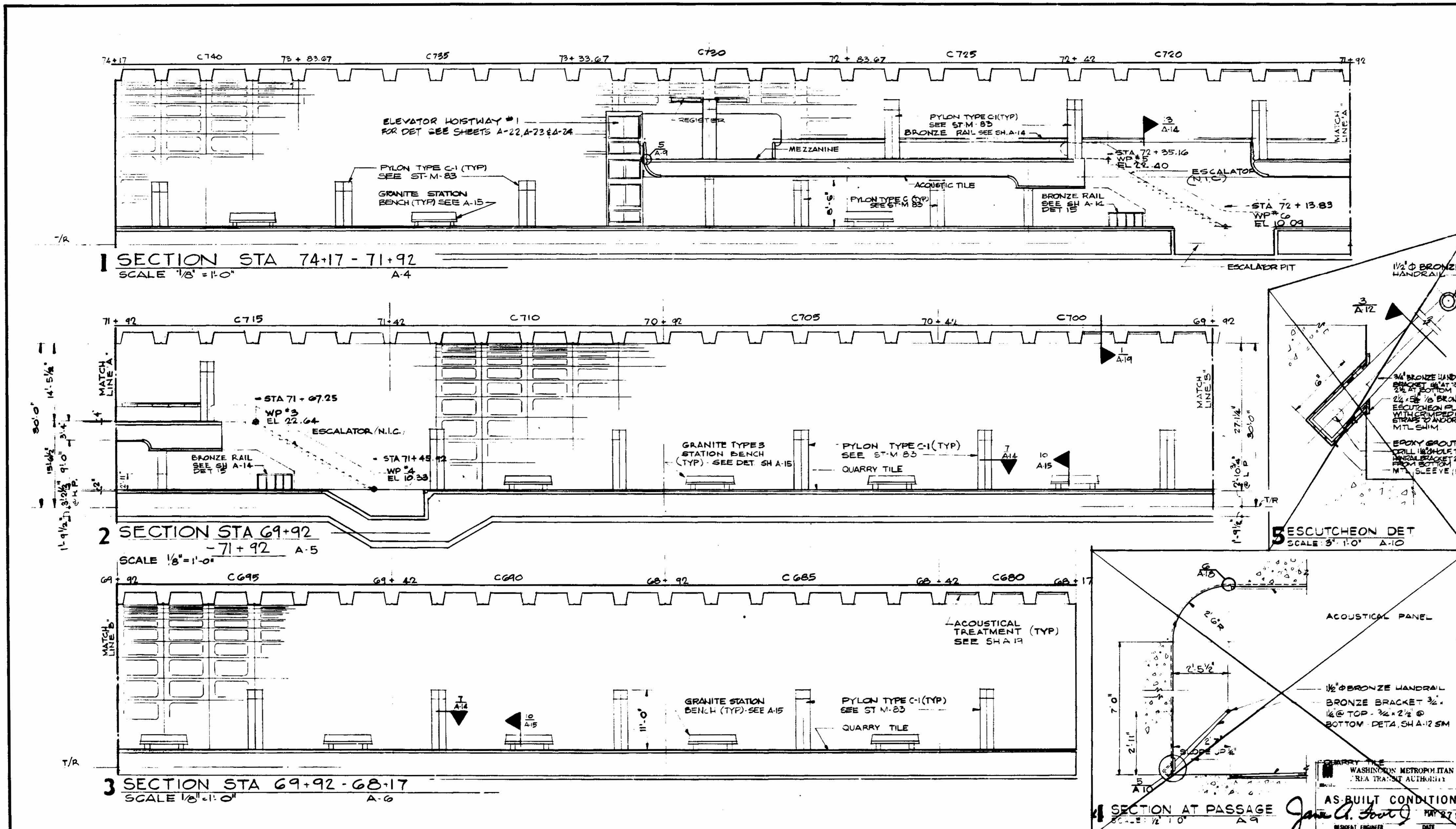
APPROVED

HUNTINGTON ROUTE
FOGGY BOTTOM STATION
PLAN-EAST SERVICE ROOMS

SCALE 1/8" = 1'-0"

DRAWING NO. FC3-A-8 | M42-16

COMM. 3660



WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

AS-BUILT CONDITION

RESIDENT ENGINEER — MAY 27 1977 — DATE

DESIGNED	LHT	5/24/71	DATE
DRAWN	ADGJP	4/1/70	DATE
CHECKED	DCH	5/24/71	DATE
APPROVED		7-23-71	DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
A-9, A-14, A-12	DETAILS
A-15	BENCH DETAILS
A-18, A-19	SECTIONS

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — H. BOYD DICKERSON — No 5062 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS

SECTION DESIGNER

SUBMITTED H. Boyd Dickerson

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED

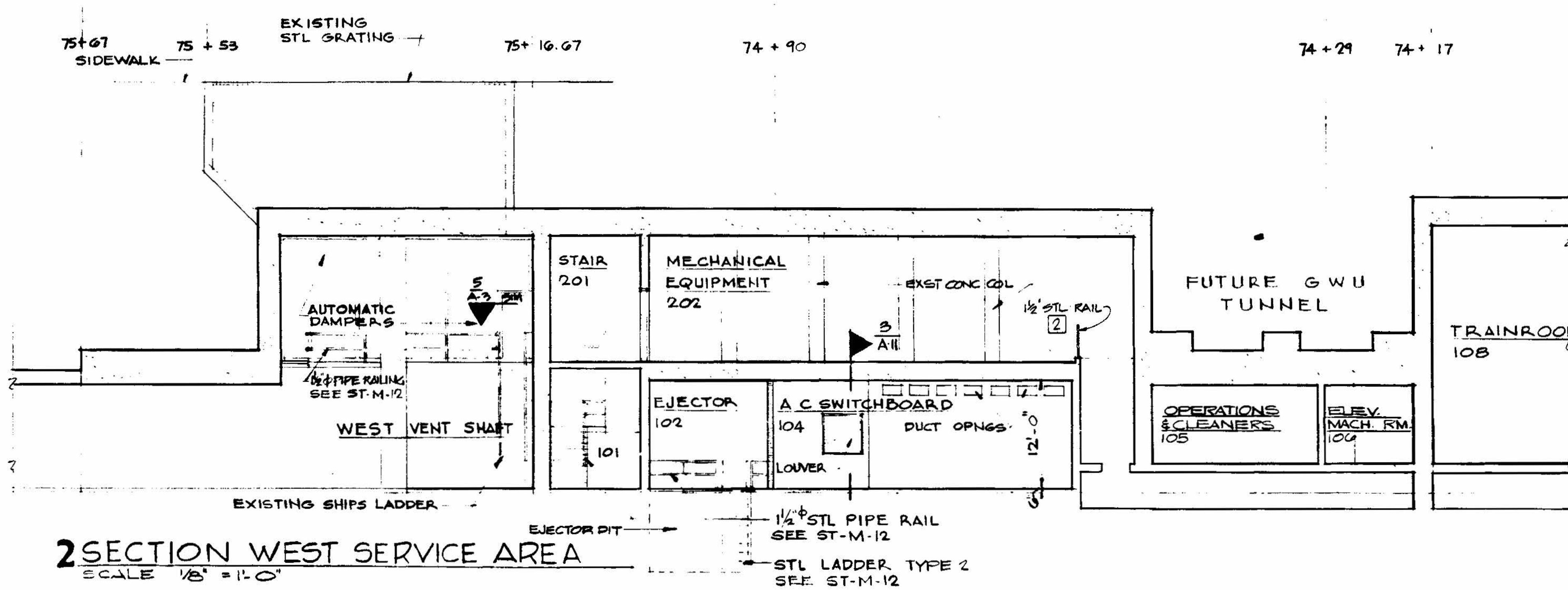
HUNTINGTON ROUTE
FOGGY BOTTOM STATION
LONGITUDINAL SECTIONS

SCALE 1/8" = 1'-0"

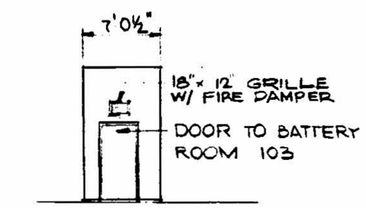
DRAWING NO. FC3-A-10

M42-18

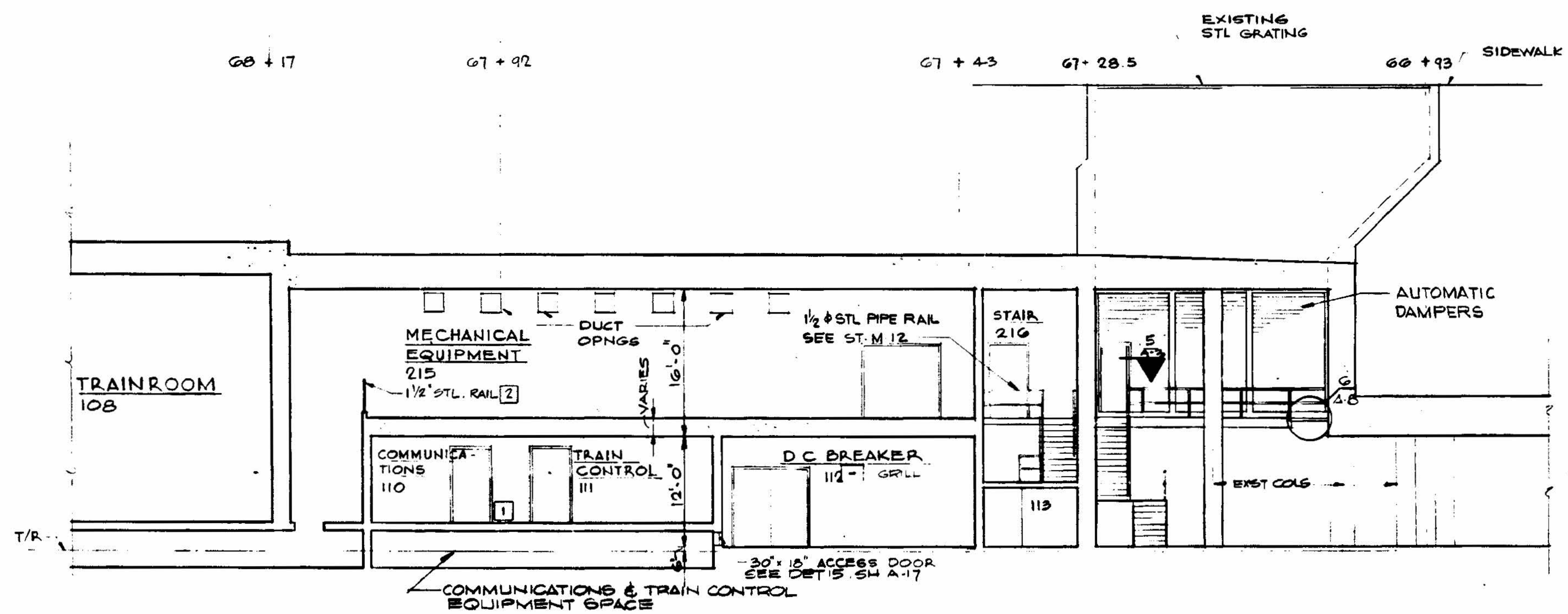
COMM. 3665



2 SECTION WEST SERVICE AREA
SCALE 1/8" = 1'-0"

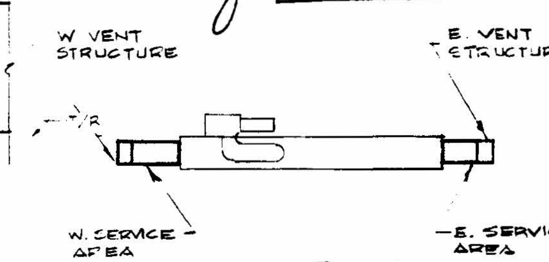


3 ELEVATION
SCALE 3" = 1'-0"



1 SECTION EAST SERVICE AREA
SCALE 1/8" = 1'0"

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
AS-BUILT CONDITION
BY: RESIDENT ENGINEER
MAY 27 1977 DATE



KEY PLAN

DESIGNED		5/21/71 DATE
DRAWN	ADGJP	4-14-70 DATE
CHECKED	DCH	5/21/71 DATE
APPROVED		7-29-71 DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
A-3	JAMB
A-17	DETAIL
ST-M-12	RAILING DETAILS

REVISIONS

DATE	BY	DESCRIPTION
3-10-77	SON	1 WALL DELETED PER PCO-015, "AS-BUILT"
3-10-77	SON	2 REVISED PER PCO-052, "AS-BUILT"

DISTRICT OF COLUMBIA H. BOYD DICKENSON No 5062 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

HAYES, SEAY, MATTERN & MATTERN
ARCHITECTS — ENGINEERS
SECTION DESIGNER
SUBMITTED H. Boyd Dickenson

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT
APPROVED J. C. Cingwood

HUNTINGTON ROUTE
FOGGY BOTTOM STATION
SERVICE AREAS SECTIONS

SCALE 1/8" = 1'-0"
DRAWING NO. FC3-A-11
M42-19
COMM. 3665

ROSSLYN STATION NEW ENTRANCE STUDY

Final Report
March 2007

Washington Metropolitan Area Transit Authority
Department of Planning and Joint Development
Office of Business Planning and Project Development

CONTENTS

(continued)

TABLES

APPENDIX CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION

The Rosslyn Metrorail station, at 1850 North Moore Street, is an important transportation center located in a high-density, mixed-use urban area of Arlington, County, serving both Orange and Blue Line trains, and eight bus lines [Figure 1].

Rosslyn Central Place (RCP)

In 2004, the JBG Companies submitted plans to redevelop the city block bounded by N. Lynn Street, 19th Street, N. Moore Street, and Wilson Boulvevard with a one million square foot, mixed-use development that would span the Rosslyn station escalatorway which connects the street level mezzanine to the train platform [Figures 2 & 9]. The development was coordinated with a principal public body, the Rosslyn Working Group (RWG), that consists of local civic associations, the Rosslyn Renaissance Urban Design Committee, Arlington County staff, WMATA's Office of Adjacent Construction, and other agencies.

Study Objective

In response to the RCP development proposal, WMATA is conducting this study for Arlington County to develop and analyze conceptual designs for a new elevator entrance to the Rosslyn station and address WMATA transit operations and access needs. A new elevator entrance would improve access to the station for Metro customers and ensure a good level of service for bus and pedestrian traffic on N. Moore Street in the future.

Figure 1: Aerial Photo – Rosslyn Station Vicinity

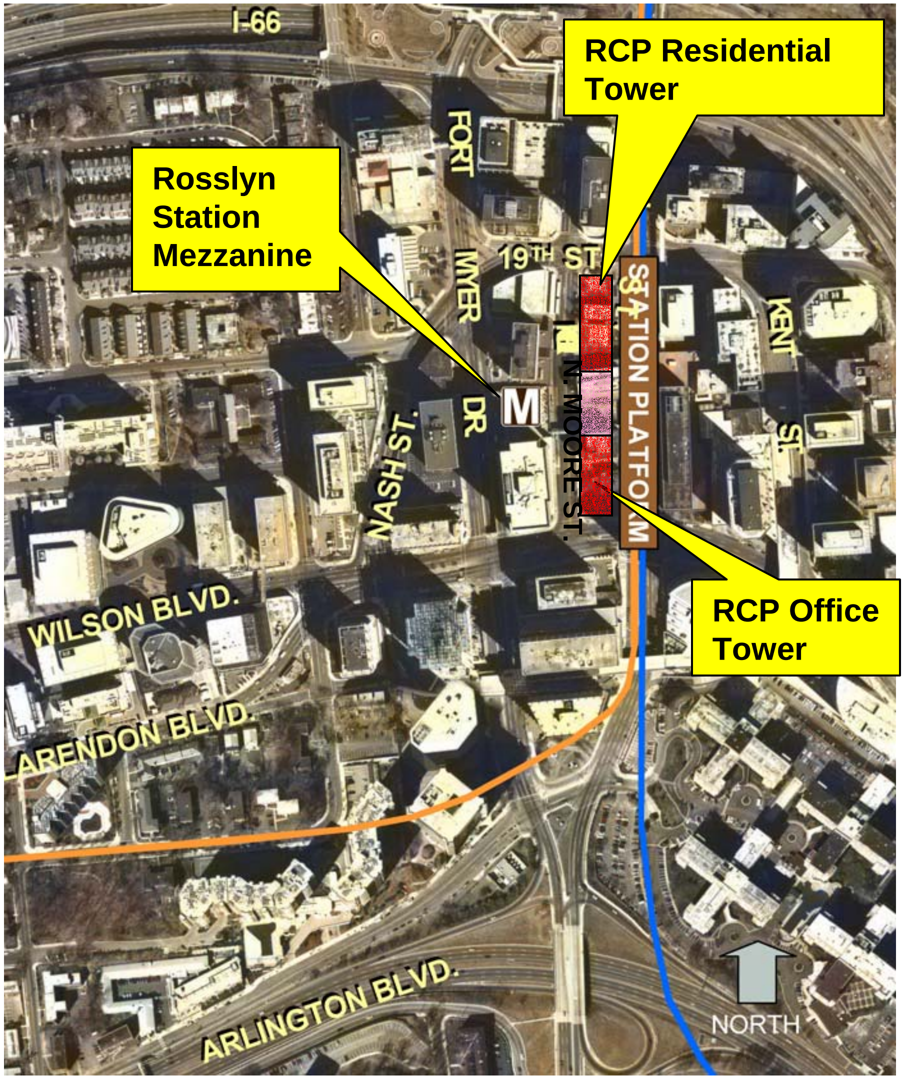


Figure 2: Rosslyn Central Place at N. Moore Street

2.0 RELATED WMATA STUDIES

2002 Rosslyn Metrorail Station Access Study

WMATA completed an earlier study for Arlington County in 2002 to identify and evaluate potential access improvements to the Rosslyn Station. The access improvements proposed in the study included improved pedestrian connections to the station, improved traffic operations on the adjacent streets, improvements for inter-modal connectivity, and also presented options for additional station entrances and mezzanines.

Two options for new station entrances were identified. The North Entrance Option included an elevator entrance at N. Lynn Street and 19th Street N. in the Waterview development that is currently under construction and includes knock-out panels in the basement structure for a future entrance. The Middle Entrance Option included a bank of three elevators from the public plaza near the existing street elevator on N. Moore Street. The proposed Rosslyn Central Place project would incorporate the new elevators into the development.

The 2002 study recommended adding at least one new entrance to the station to provide additional elevator capacity and convenient, direct access to the station platform for customers traveling from the east.

The study forecasted that Metrorail ridership at Rosslyn station would grow to 22,000 entries by 2020. With new, high-density development being proposed around the Rosslyn station or currently under construction [Table 1X], the current 2.3% annual ridership growth trend should continue, thus 22,000 daily station entries by 2020 is a realistic projection.

3.0 EXISTING CONDITIONS

The Rosslyn Station

The Rosslyn Metrorail station has a single mezzanine that can be accessed from several points: from the portal mid-block along N. Fort Meyer Drive, from the Rosslyn Center office building, from the bus bay area along North Moore Street [Figure 4], and from the skybridges, via escalators, that span N. Fort Meyer Drive and N. Moore Street [Figure 4 and Figure 5]. On the city block of the future Rosslyn Central Place project, JBG Companies is expected to acquire WMATA's fee interest for the development rights to the 3,373 sq. ft. bus alleyway, a 94 sq. ft. surface and 325 sq. ft. underground easement for the street elevator, and underground easement interests throughout the site for placement of the building foundation.

Figure 3: Rosslyn Station Area – Street Level

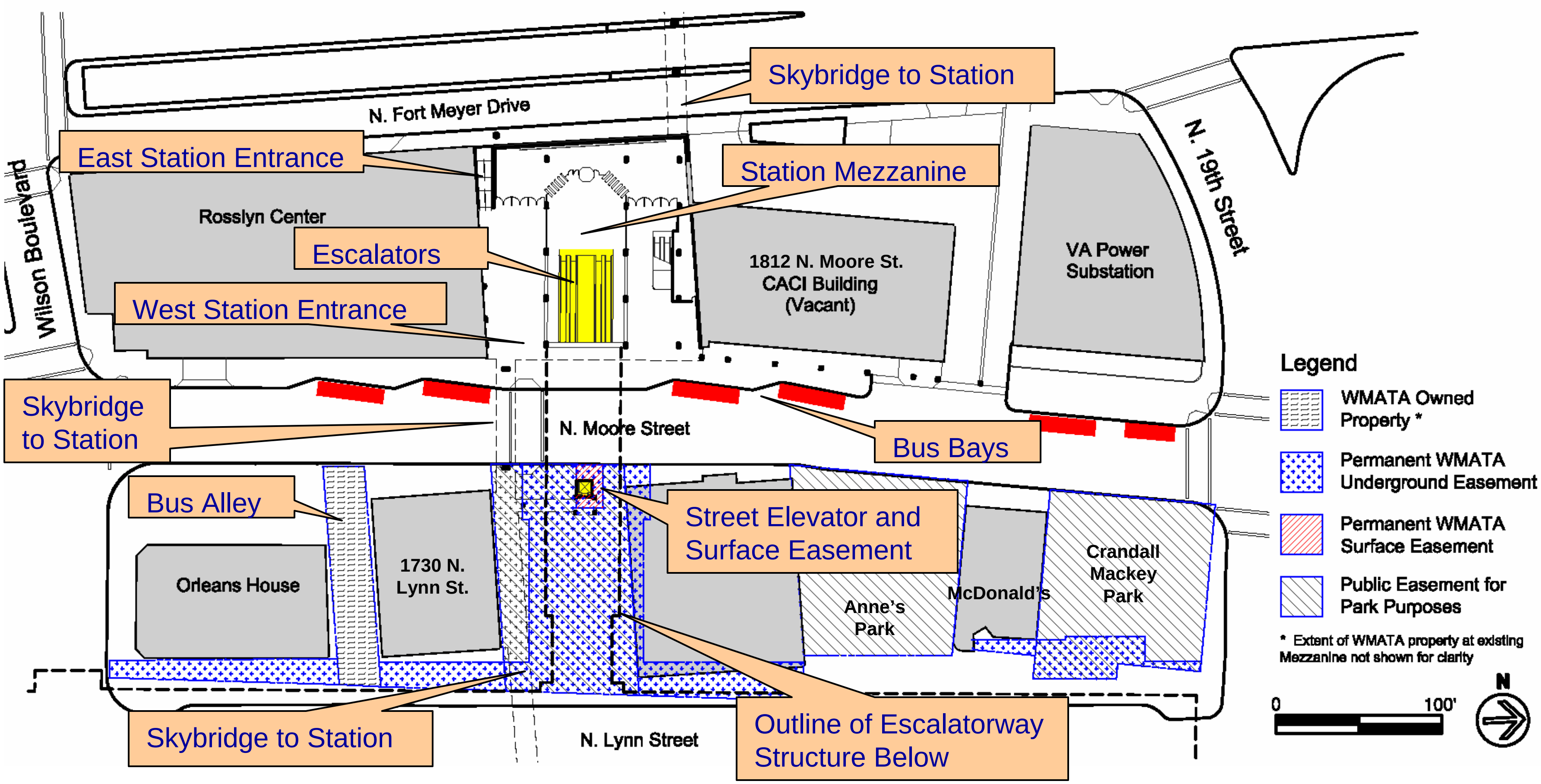


Figure 4: Rosslyn Station Entrance – N. Moore Street

Figure 5: Street Elevator in Public Park

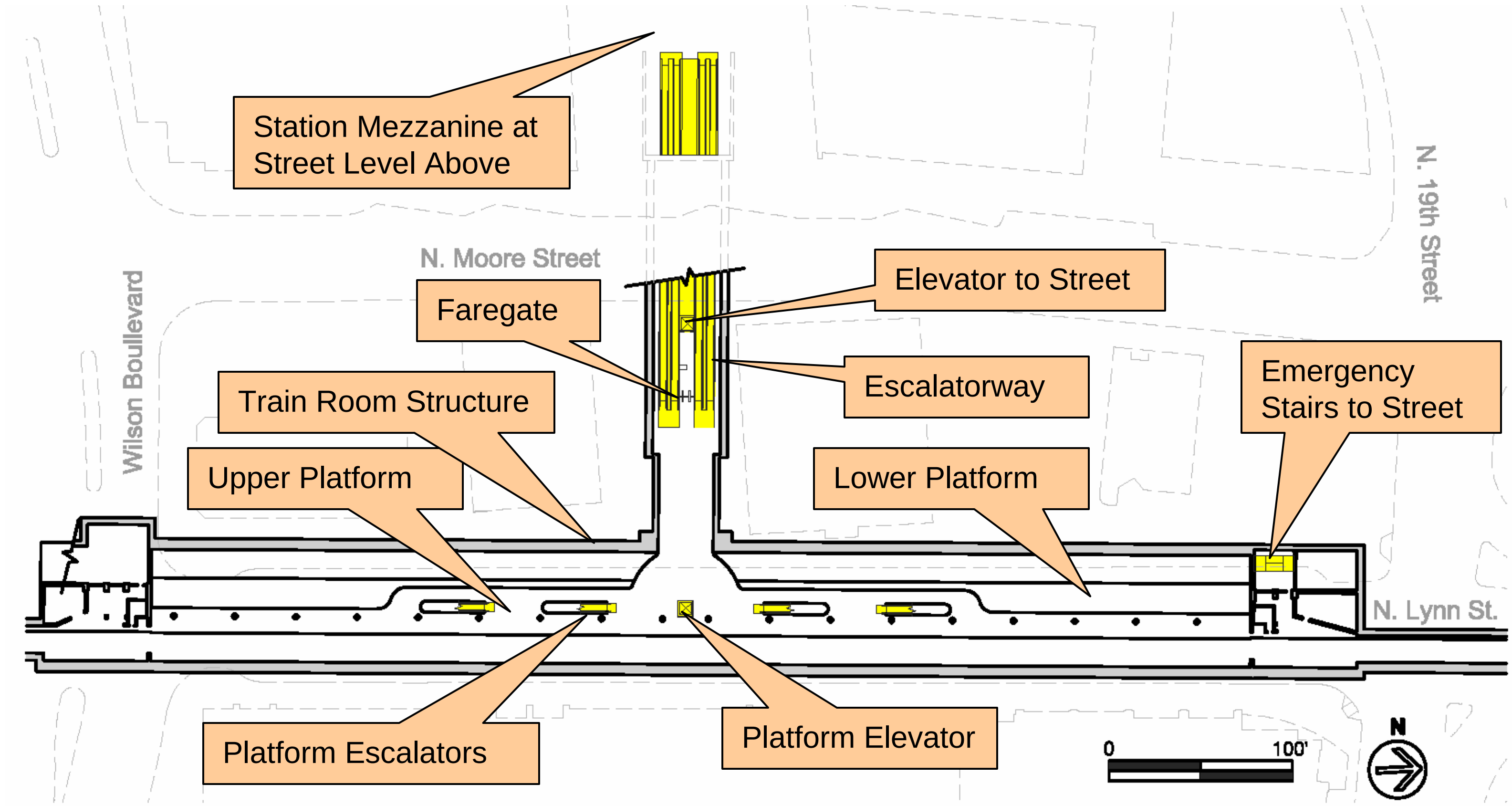
Figure 6: Bus Facilities on N. Moore Street

Figure 7: Street Elevator at Platform Level

The Rosslyn Station *(continued)*

From the street level mezzanine, customers travel 200 feet on one of the four escalators to access the upper platform level in the train room structure located below North Lynn Street [Figure 8] . Customers accessing the station via the one street elevator must use the one faregate on the platform level, between the escalators [Figure 7]. The Rosslyn Station has a split platform train room with four escalators and one elevator to the lower platform level. There is one set of emergency stairs from the upper platform level at the north end of the train room to the street level.

Figure 8: Rosslyn Station – Upper Platform Level



Metrorail Ridership

At the Rosslyn Station, rail ridership data for 2006 indicate 16,770 boardings on an average weekday, the 9th highest number of station boardings in the the system. The number of Metrorail boardings at Rosslyn Station has increased 23% over the last ten years, up from 13,590 average weekday boardings in 1996. Of the top ten Metrorail stations in ridership, only Rosslyn and Foggy Bottom-GWU stations have a single mezzanine and entrance.

Faregate data shows that 8% of the daily station entries occur during the peak PM half hour period (5:00-5:30 PM) and 4.5% of the exits occur at that same time period. The peak half hour period is used for station planning and capacity analysis.

Table 1 shows the number of rail boardings at Rosslyn Station by the mode of access, with the percentages based on data from the 2002 Metrorail Ridership Survey. The access mode share percentages are applied to the 2006 average weekday ridership figure to estimate the current number of boardings by mode share.

Table 1: 2006 Average Daily Rail Boardings by Mode Share

Access Mode	Walk	Bus	Drop-Offs	Drove & Parked	Totals
Mode Share %	72%	17%	6%	5%	100%
Boardings by Mode	12,075	2,850	1,005	840	16,770

Station Access and Capacity

The station mezzanine has 4 escalators from the upper platform level, 12 faregates, and 11 fare vendors. Data connecting to the forthcoming 2007 WMATA Station and Access Capacity Study indicates that the escalators and faregates have ample capacity to meet existing demand and should have adequate capacity to meet ridership demand in 2020, but one additional fare vendor may be needed.

The street elevator at Rosslyn Station, located across N. Moore Street from the mezzanine, is one of the highest used elevators in the system. Data from the Metrorail Transfer Station Accessibility Program shows that Rosslyn station's street elevator had the highest number of trips of all the elevators in the seven transfer stations with 68,150 trips during the month of August 2006. For comparisons, the street elevator at L'Enfant Plaza station was second with 29,260 trips during the same month. The 410 daily customers transferring between Metrorail and the Metrobus 5A route to Dulles Airport rely on the one street elevator to tote their luggage.

According to Arlington County estimates, there are approximately 3,500 bus boardings at the station on a typical weekday. Eight bus lines, consisting of 16 routes from four service providers access Rosslyn station: Metrobus; Arlington Transit (ART); Loudoun County Commuter Bus; and Georgetown University Transit (GUTS). During the peak hour, 44 buses access the on-street bus bays and approximately 25 private shuttles use N. Moore Street for picking-up and dropping-off transit customers. Nineteen buses use the WMATA

(continued)
alleyway to access N. Lynn Street (northbound) in the peak hour to avoid traffic backups at the Wilson Boulevard intersections at N. Moore Street and N. Lynn Street.

On the east side of N. Moore Street there is a curbside lane for taxis, a bus stop for the ART 61B route, an accessible pick-up/drop-off lane in front of the station street elevator, and street parking.

There can be times during the evening peak period when the combined activities of buses, pedestrians, taxis, and automobiles contribute to constrained operating conditions throughout the length of N. Moore street between Wilson Boulevard and 19th Street [Figure 6].

Station Access Deficiencies

Like most Metrorail stations, Rosslyn station is inaccessible to customers using wheelchairs when either the single street elevator or the platform elevator is out of service. When either elevator is out of service for extended rehabilitation, customers using wheelchairs must use the elevators at the nearest station, then transfer to the destination station using Metrobus shuttle service.

For short-term elevator service disruptions, a bus must be dispatched on demand. During elevator outages, customers using strollers, wheeled luggage, and seniors with balance problems are forced to request a bus shuttle or use the escalators. WMATA policy prohibits strollers and wheeled luggage on escalators for safety reasons.

Customers using the street elevator currently experience frequent problems with the single faregate when farecards become jammed, requiring assistance from the station manager [Figure 7].

4.0 NEW ELEVATOR ENTRANCE AND MEZZANINE

Design Goals

The primary objective of the study is to develop conceptual design alternatives and analysis to justify the need for a new elevator entrance that would be incorporated into the proposed Rosslyn Central Place development and be easily accessed by Metrorail customers. A major goal in the design of the new elevator entrance is to minimize impacts to the development and construction scheduling. The development should also be planned to minimize impacts to existing WMATA facilities and operations as is discussed later Sections. Indeed, the foundation system for an earlier RCP concept design with the office tower located directly above the existing station escalatorway proved too costly and the project was redesigned to relocate the public plaza to the center of the site, greatly reducing the design loads above the escalatorway and future underground mezzanine structure.

(continued)

Due to the complexity of excavating and constructing a new underground transit facility with an elevator hoistway adjacent to an existing Metrorail station and below a mixed-use development, the concept design required extensive coordination in numerous project meetings with the project study team. Members of the study team included Arlington County staff, the JBG Companies, JBG's consultants, and WMATA architects, engineers, and planners.

Demand Analysis

Planning for a new elevator entrance began with projections for future entries and exits, and an assessment of capacity requirements for the new mezzanine and the vertical transportation systems.

In determining entry and exit projections, the study assumed that all people accessing the station from east of N. Moore Street would use the new elevators in lieu of the existing escalators to reduce their travel time to the station platform by up to 2.25 minutes. Figure 1X in the Appendix shows the station area used in calculating projected transit trips to the new entrance.

Using Arlington County development forecasts, an analysis of trip generation data estimates that in the full development build-out year (2015), approximately 4,402 customers would enter the new elevator entrance in the PM peak period with 1,566 entries in the AM peak period [Table 1X]. The only new planned development in the area for trip generation calculations are two JBG Company developments: Waterview, currently under construction; and RCP. The combined transit trips from the JBG developments to the new station entrance will account for 28% of the total entries (1,252 PM/418 AM peak entries).

In station capacity planning, WMATA uses peak half-hour demand projections to ensure that the new station mezzanine and elevators can comfortably, safely, and efficiently accommodate Metrorail customers. Existing faregate data indicates that 18% of the station entries in the peak PM (4 hour) period occur during the peak half-hour period and 17% of the exits at that same time [Table 2X and 3X]. Assuming the same trend in 2015, passenger volumes at the new entrance during the PM peak half-hour would be 810 entries/261 exits [Table 1X] and 331 entries/804 exits in the AM peak half-hour period [Table 3X]. See Appendix 1.0 for a detailed description of the methodology for calculating projected entry/exits to the new elevator entrance.

Elevator Capacity

To determine the optimum number of elevators required to handle the projected passenger volumes in the peak half-hour periods, an elevator capacity analysis was performed using estimated time of arrival volumes for customers accessing the station via the elevators [Table 2].

The analysis indicates that three high-speed, high capacity elevators (350 fpm/4500 lb) can handle the

(continued)

(continued)

projected passenger volumes. The analysis assumes that the existing street elevator will be removed from service when the three new elevators are in operation.

In Scenario 1, Table 2 shows that a bank of three elevators with a travel distance of approximately 95 feet and an average of 15 passengers per car, has the capacity to handle 898 passenger entries in a 30 minute period, which is greater than the 810 entries projected in 2015 during the PM peak half-hour period. Scenario 2 shows that two elevators with 20 passengers per car could handle 680 entries in a 30-minute period but with crowded conditions and 84% of the capacity required to handle the projected peak volume of 810 entries. During periods when the demand for elevators may exceed capacity, able-bodied passengers could use the existing escalators. The escalator mezzanine would continue to be the main entrance to the station.

Table 2 also calculates the maximum queuing volumes of passengers waiting for an elevator. The queuing volumes for passengers on the street level are determined by the estimated

Table 2: Elevator Capacity and Queuing Analysis

	Scenario 1			Scenario 2		
Passengerss Per Elevator Car (entering station)	**15**			**20**		
Passengers Per Elevator Car (exiting station)	**7.5**			**10**		
Passenger unloading top(sec)	7.88			10.50		
Passenger loading top(sec)	15.75			21.00		
Doors closing (sec)	2.50			2.50		
Travel time (sec)	16.46			16.46		
Levelling time (sec)	1.00			1.00		
Doors opening (sec)	1.50			1.50		
Passenger unloading bottom(sec)	15.75			21.00		
Passenger loading bottom(sec)	7.88			10.50		
Doors closing (sec)	2.50			2.50		
Travel time (sec)	16.46			16.46		
Levelling time (sec)	1.00			1.00		
Doors opening (sec)	1.50			1.50		
Round trip time =	90.17			105.92		
Number of Elevators	**1**	**2**	**3**	**1**	**2**	**3**
Entering						
Passenger capacity per 30 minutes (entering)	299	599	**898**	340	**680**	1,020
Exiting						
Passenger capacity per 30 minutes (exiting)	150	299	449	170	340	510
Interval Between Elevators	**90.17**	**45.09**	**30.06**	**105.92**	**52.96**	**35.31**
Maximum Queueing - Street - 2020						
Entries (sec)	0.42	0.42	0.42	0.42	0.42	0.42
Interval between elevators (sec)	90.17	45.09	30.06	105.92	52.96	35.31
Passengers per elevator cycle	38	19	13	44	22	15
Passengers loaded per elevator cycle	15	15	15	20	20	20
Remaining Queue	23	4	0	24	2	0
Maximum Queue	60	23	13	68	24	15
Maximum Queueing - Mezzanine - 2020						
Exits (per train)	57.23	57.23	57.23	57.23	57.23	57.23
Interval between elevators (sec)	90.17	45.09	30.06	105.92	52.96	35.31
Interval between trains	138	138	138	138	138	138
Elevator cycle per train	1.54	3.07	4.61	1.31	2.61	3.92
Passengers loaded per elevator cycle	15	15	15	20	20	20
Initial Queue	57	57	57	57	57	57
Remaining Queue	34	11	0	31	5	0
Maximum Queue	91	68	57	88	62	57

rate of arrival and the number of elevator trips. The methodology for estimating queuing volumes for passengers waiting for an elevator on the platform is based on the number of passengers exiting two alighted trains on the station platforms. See Appendix 2.0 for the methodology used in calculating the elevator queuing capacity.

Design Concepts – Alternative 1

Important design precepts that were established by the study team for developing a conceptual design is to: optimize the layout of the mezzanine for efficiency in regards to the potential high cost of building an underground structure where rock excavation is required; minimize impacts from the elevator and stair shaft to the parking garage and public plaza above; avoid impacting existing underground station structures; and minimize impacts to the development construction scheduling and sequencing.

At the time of this study, JBG Companies intends to build the RCP project in two phases with the office tower first, then the residential tower at a latter time [Figure 9]. The new elevator entrance structure must be located within the building footprint of the Phase I office tower.

The concept designs presented in this study as Alternative 1and Alternative 2 were developed to meet: established planning goals; WMATA's design standards and criteria for station facilities; the capacity demand analysis; and the desires of Arlington County and JBG Companies to the maximum extent possible.

The Alternative 1 concept plan is shown in Figures 10 through 13 with the following program description:

<u>Concourse Plan</u> [Figure 10]: The new mezzanine would be connected to the existing passageway by cutting through the wall of the station passageway structure. Fire doors located in the passageway to air-pressurized concourse mezzanine would automatically close in the event of an emergency, creating an area of safety in the mezzanine.

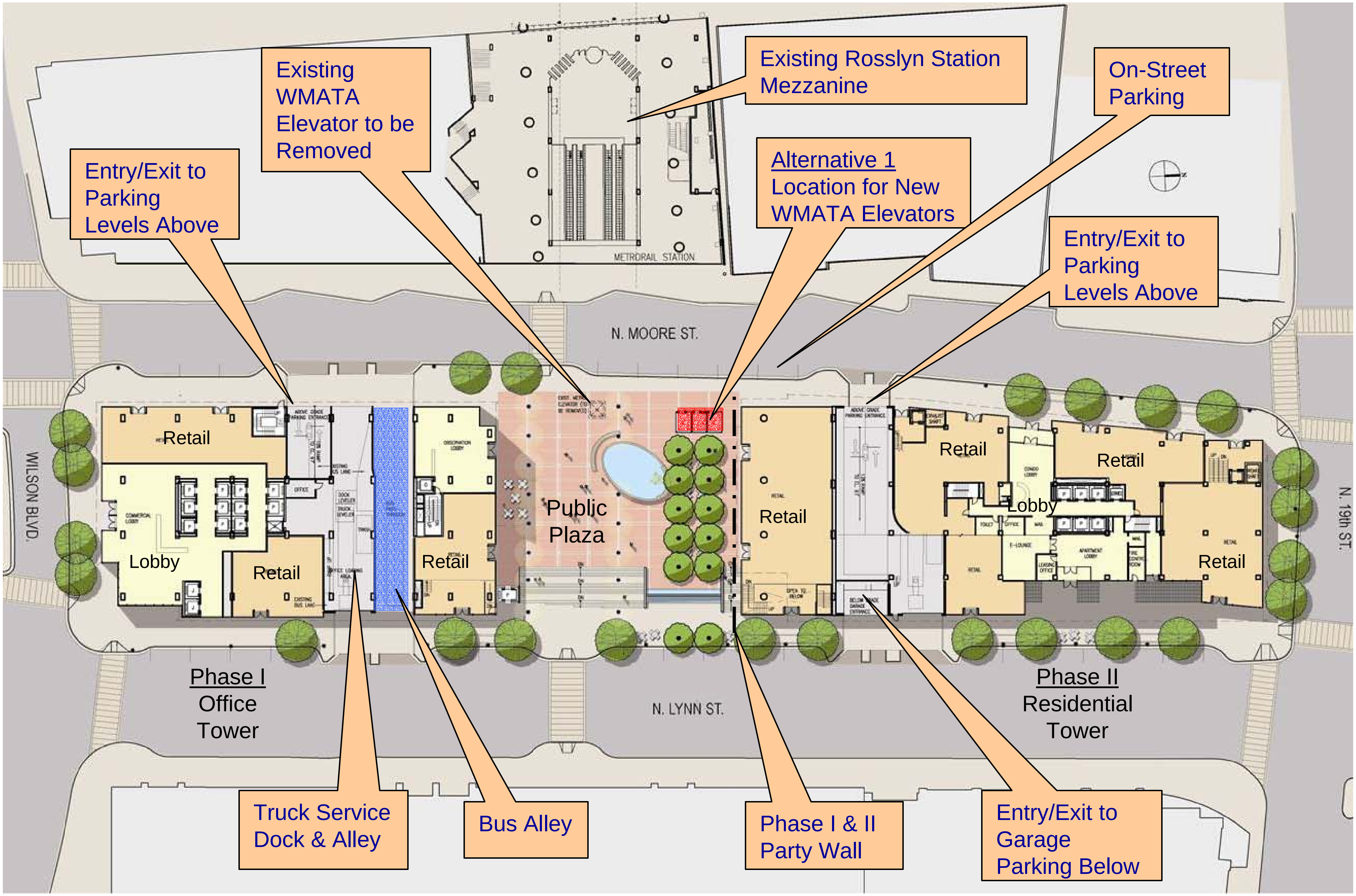
WMATA structural design criteria required a minimum 30 foot setback from the existing train room structure and a minimum 15 foot setback from the existing escalatorway structure to the new concourse structure to avoid the rock bolts used in the construction of the original station.

The north wall of the concourse structure aligns with the residential building facade above, which is the separation line between the Phase I and II buildings [Figure 9]. The elevators are located to coordinate with the garage parking aisle and structure above.

To limit the floor area of the concourse structure, only the public toilet, staff toilet, and cleaner's room are located on the same level with the manager's kiosk. An exit stair from the mezzanine to the street level is provided to meet local building codes for emergency egress requirements. The width of the stair and egress path shall be sized in accordance to capacity requirements (to be determined).

(continued on page 11)

Figure 9: Rosslyn Central Place – Ground Level Plan



The WMATA study team considered excluding the station manager’s kiosk from the program to reduce the floor area of the mezzanine, thus reducing the required area of excavation and construction costs. However, it was later determined that the enhanced communications system required for remote monitoring from the existing manager’s kiosk would exceed the cost of adding a kiosk to the new mezzanine. In addition, WMATA staff presence at the faregates is desired to serve customers who may need assistance. With remote monitoring, if a customer called the kiosk for assistance, it would take between 1 1/2 to 3 minutes for the station manager to travel to the location of the proposed mezzanine faregates.

The fare collection system consists of four faregates and five fare vendors. Table 6X in the Appendix indicates that 6 fare vendors are needed to handle transactions the peak 30 minute period, however, with wall space limited and adequate elevator queuing space needed, only 5 fare vendors can be accommodated which will be adequate, but not optimum.

The existing street elevator and fare collection system would be removed after the new elevators are in service. Eliminating the existing elevator would recapture parking spaces on the two parking garage levels above and would eliminate the frequent problems customers experience with the fare transactions at the existing remote, mini-mezzanine.

<u>N. Lynn Street Level Plan</u> [Figure 11]: Service rooms that support the concourse below are located in unused space above the parking ramp to lower parking levels and would be accessible from the sidewalk by WMATA staff.

The final locations of the service rooms will need to be coordinated with JBG as the building plans develop, however, the minimum program requirements shall be consistent: Mechanical Room (225 s.f.) with equipment and fresh air intake sized to provide conditioned and pressurized air to the mezzanine concourse as necessary; Electrical Room (25 s.f.); Telephone /Communications Room (15 s.f.); and Fire Equipment Closet (20 s.f.).

The outside wall of the elevator hoistway is located along the edge of the parking drive aisle. The bank of three elevators would ultimately displace three parking spaces on each garage level, but one space on each level would be gained when the existing elevator is removed. The exit stairway structure transitions to outside the building for access from the sidewalk along N. Moore Street.

<u>N. Moore Street Level Plan</u> [Figure 12]: The location of the elevators in the public plaza is set back from the building line to allow additional queue space on the sidewalk in front of the curb on N. Moore Street [Figure 3X]. The elevator head house and the elevator cars should be glazed on all sides for visiblity and security. The elevator location displaces a 325 sq. ft. area at the public plaza, but does not displace retail space.

<u>Longitudinal Section</u> [Figure 13]: The excavation for the concourse structure shows a rock support system similar to the construction of the existing train room and escalatorway structure; however, the preferred method for shoring, excavating, tunneling, and concrete work would be determined by actual soil conditions and costs.

(continued on page 17)

Figure 10: Alternative 1 - Concourse Plan – Upper Platform Level

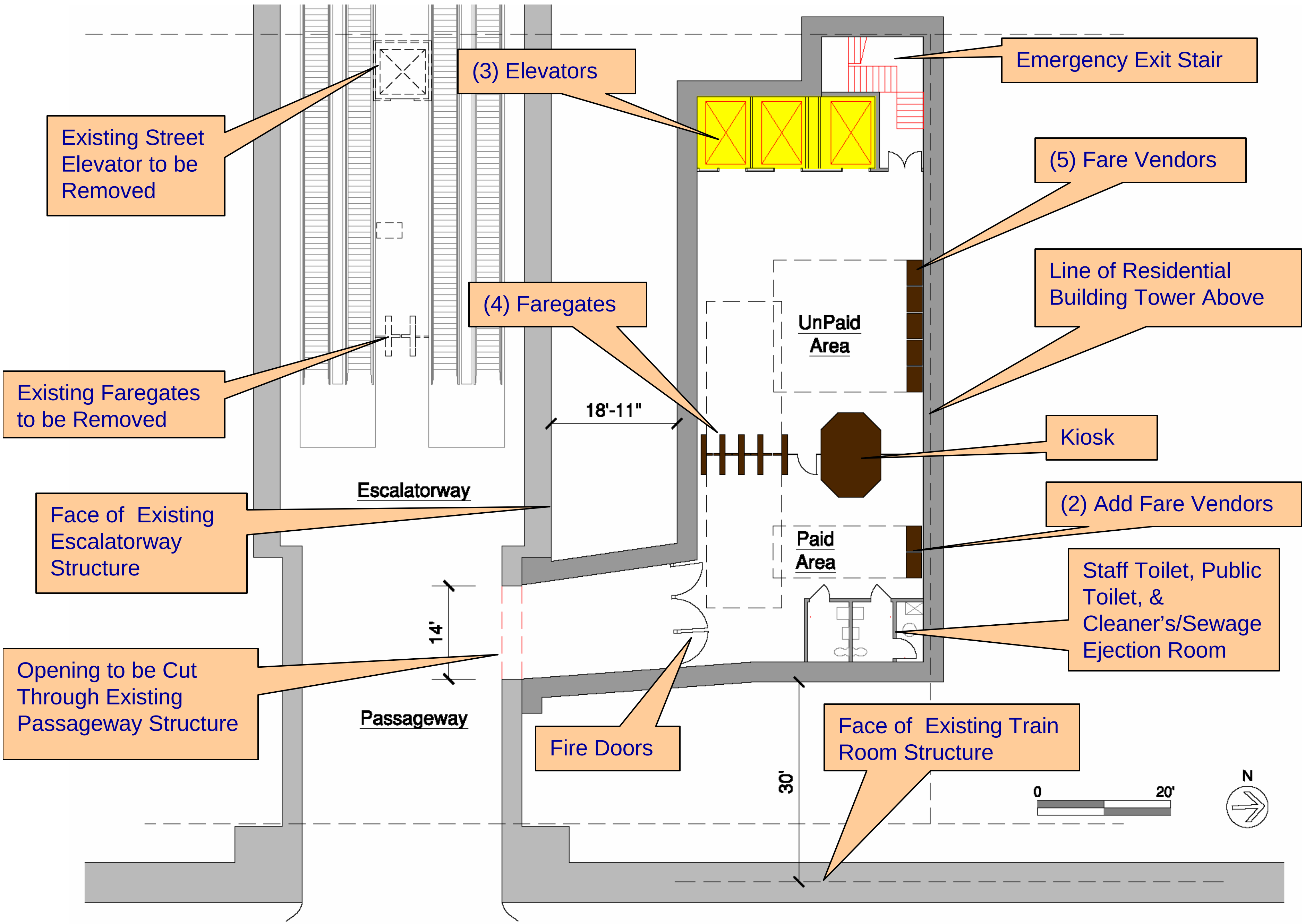


Figure 11: Alternative 1 - N. Lynn Street Level Plan

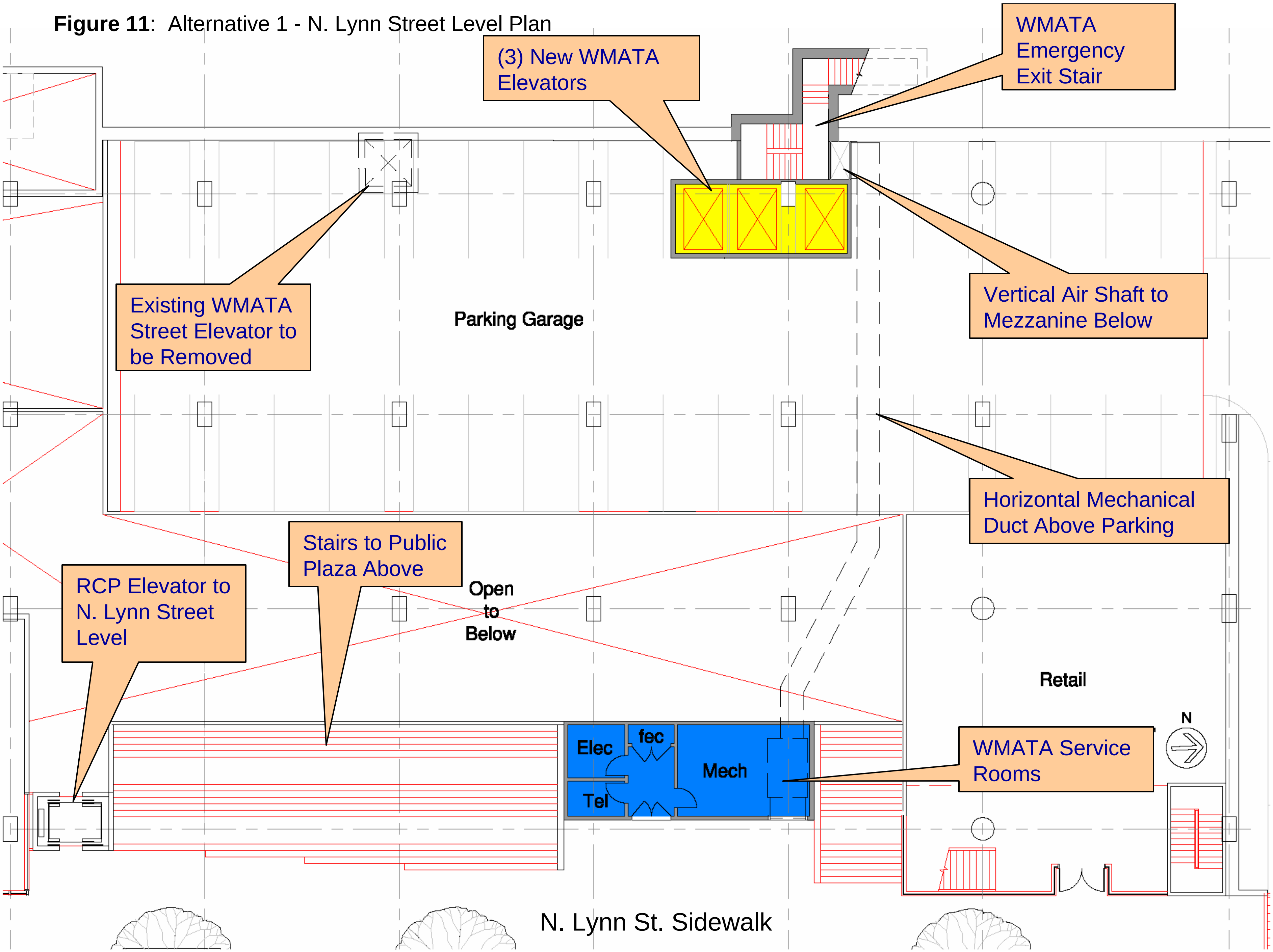
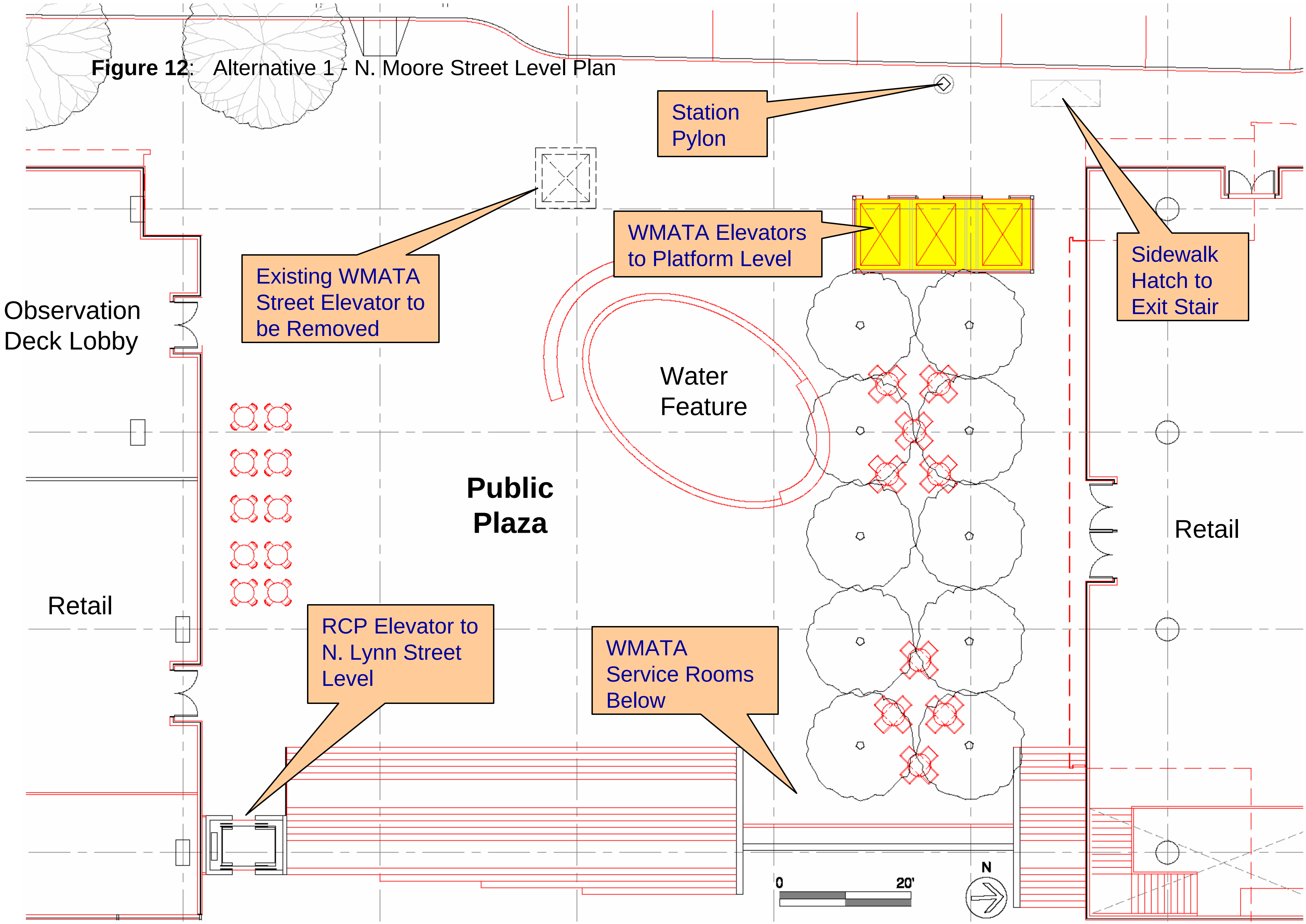


Figure 12: Alternative 1 - N. Moore Street Level Plan



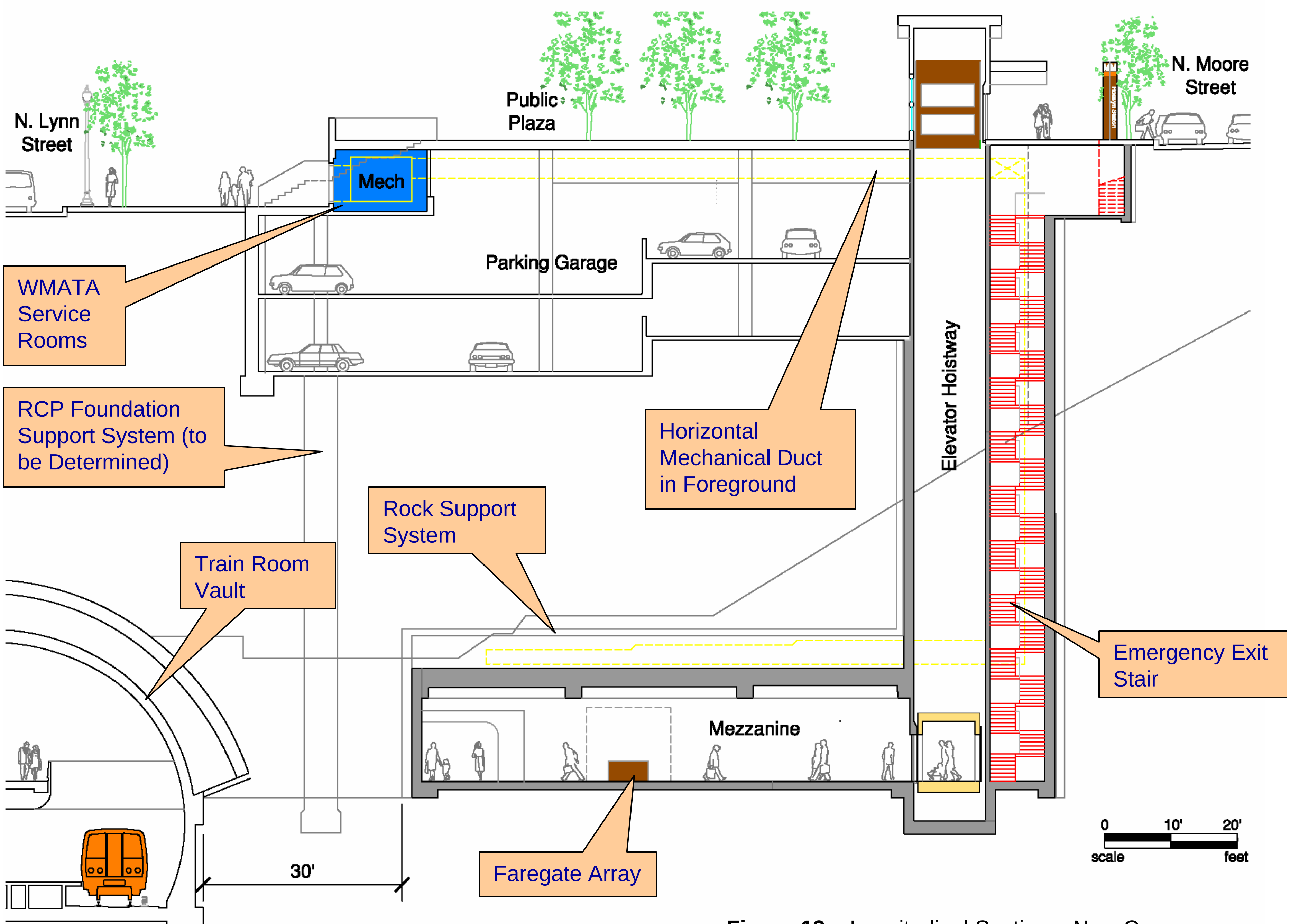


Figure 13: Longitudinal Section – New Concourse

(continued)

The drawing shows a gearless elevator system with the machine, governor, and support elements combined into a compact integrated machine structured housed at the top of the hoistway, eliminating the need for a machine room, reducing visual impacts from the public plaza.

The Order of Magnitude Cost Estimate for Alternative 1 is shown in Table 3. Given the high cost of excavating and building an underground mezzanine structure in solid rock, another Alternative was considered that reduces the extent of underground excavation.

Design Concepts – Alternative 2

The concept design for Alternative 2 locates the mezzanine facilities on the public plaza at ground level to minimize the extent of rock excavation [Figures 14 through 16].

<u>Concourse Level Plan</u> [Figure 14]: The station mezzanine facility is located on the street level reducing the area of rock excavation for the concourse to approximately 4,935 cubic yards, which is 4,180 less cublic yards than Alternative 1. A new tunnel connects the existing passageway to the an elevator vestibule with three elevators and an emergency exit stair shaft leading to the sidewalk on N. Lynn Street. The Vestibule is air-pressurized with the fire doors.

<u>N. Lynn Street Level Plan</u> [Figure 15]: A hoistway for three elevator would displace four parking spaces on each garage level. The egress stair shaft transfers below the slab of the B2 garage level to the outside of the building foundation and exits on the sidewalk at N. Lynn Street. Similar to the Alternative 1 plan, WMATA service rooms that support the concourse below may be located in the unused space above the parking ramp to lower parking levels with access from the adjacent sidewalk. A staff toilet for the station manager would be included in the Service Room program.

<u>N. Moore Street Level Plan</u> [Figure 16]: At street level, the new station mezzanine pavilion is accessed directly from the public plaza between the office and residential towers. The mezzanine pavilion would be constructed of glazed walls, designed to match the exterior finish systems of the Rosslyn Central Place development. With less rock excavation required, locating the mezzanine on the street level would be less costly to build than Alternative 1, but would displace approximately 2,440 square feet (19%) of the public plaza.

The Rosslyn Central Place development will displace approximately 28,000 sq. ft. of public park easements [Figure 3]. The 12,725 sq. ft. public plaza is being provided by the developer as one of the community benefits requested by the Rosslyn Working Group, so opposition to the mezzanine pavilion could be expected. The street elevators in Alternative 1 would have minimal impact to the public plaza.

Surrounded by 47,000 sq. ft. of retail and directly connected to the publicly-accessible observation deck on the office tower's 20^{th} floor via an express elevator, the public plaza should become the main activity center of Rosslyn. With conference facilities, a café, an outdoor terrace, and panoramic views of Washington's

(continued on page 21)

Figure 14: Alternative 2 - Concourse Level Plan

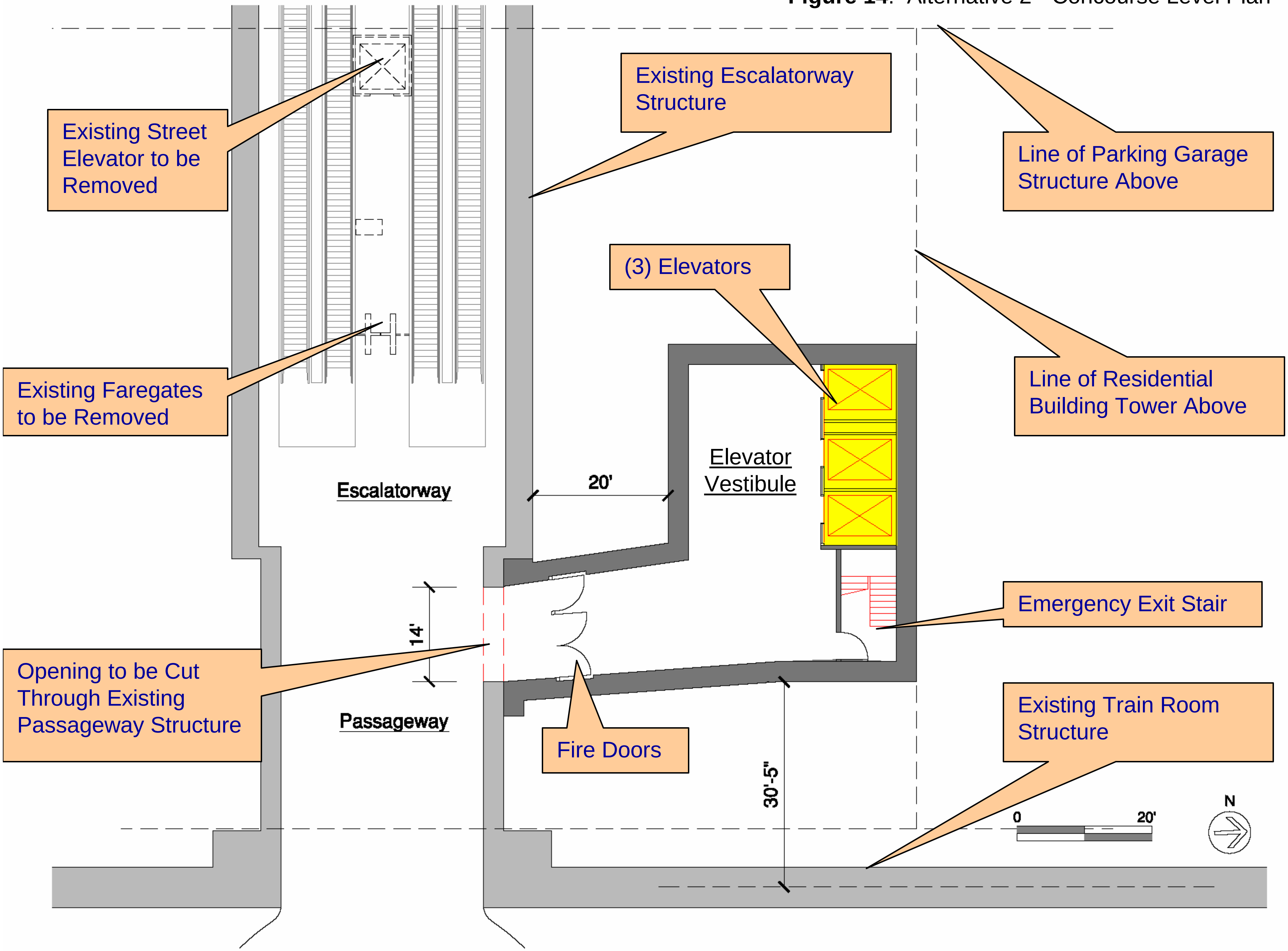


Figure 15: Alternative 2 – N. Lynn Street Level Plan

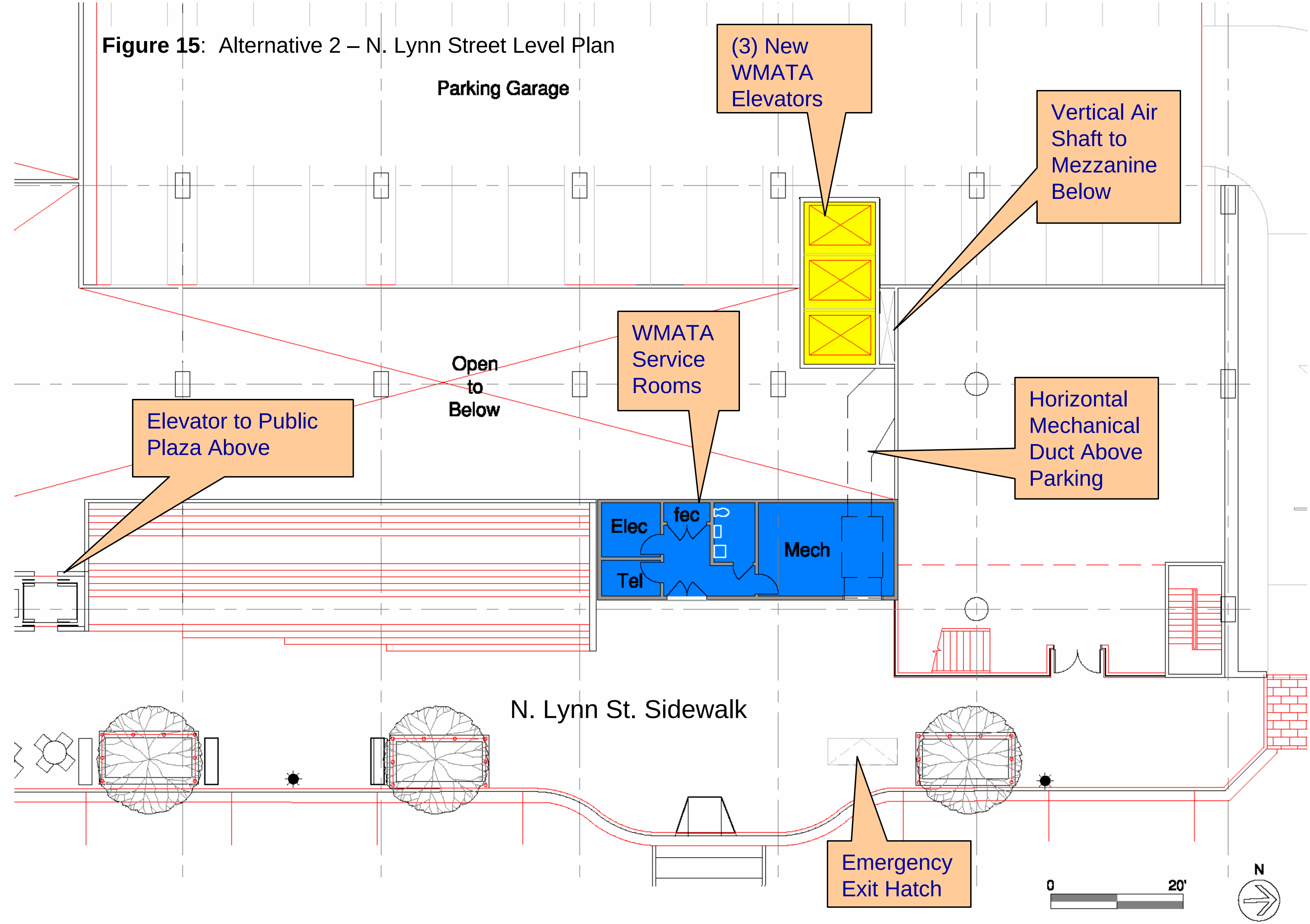
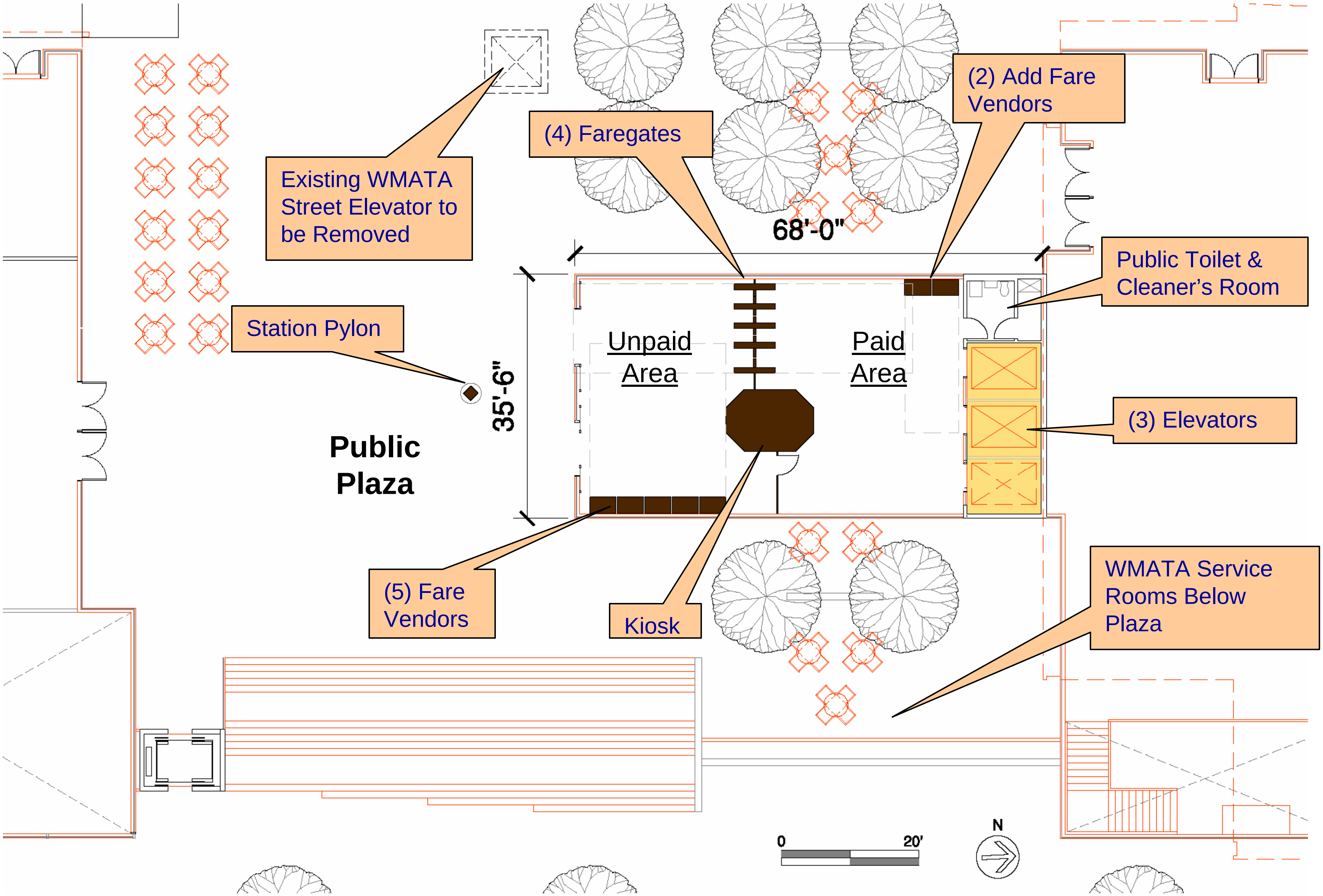


Figure 16: Alternative 2 – N. Moore Street Level Plan



(continued)

monumental core, JBG Companies expects the two-level observation deck to draw up to 450,000 visitors annually. The new station elevators at the public plaza would support the developer's goal of making the RCP development a new Rosslyn destination.

Order of Magnitude

Tables 3 and 4 show the order of magnitude cost estimates respectively, for both Alternative 1 and Alternative 2. For both Tables, the construction costs included in Item 10 are: materials, labor, contractor's overhead and profit in addition to a 10-15% design contingency. The Soft Costs shown in Item 12 are 35% of the estimated construction cost for design and construction management.

In Alternative 2, much of the cost savings from not having to excavate through rock for a underground mezzanine, is offset by the cost of the mezzanine pavilion. For the total construction cost, the difference between Alternative 1 and Alternative 2 is only $3,062,100. The cost delta between the two Alternates for rock excavation and hauling is $5,243,825. The cost of the mezzanine pavilion in Alternative 2 is $2,259,170.

The cost savings in the development's foundation structure from not having to span over a larger underground mezzanine structure is not considered since the design and costs are unknown at this time.

5.0 TRAFFIC AND DEVELOPMENT IMPACTS

The Rosslyn Central Place development is expected to impact pedestrian and automobile traffic on N. Moore Street where the station bus facilities are located. It is in WMATA's interest to preserve the functionality of the Rosslyn station serving bus as well as rail customers.

WMATA is committed to preserving the facilities that support reliable bus operation and movement. To this end, WMATA provided Arlington County with two key requirements and one critical need in regards to the RCP project: requirements for the bus alley location; requirements for the transit facilities located on N. Moore Street; and the need for the new elevator entrance.

Bus Alley Requirements

The WMATA bus alleyway from N. Moore Street to N. Lynn Street is located near the existing location adjacent to the office buildings pull-through service dock. WMATA had requested that the bus alleyway entrance be located 150 to 200 feet from the Wilson Boulevard intersection and north of the truck dock and parking entrances to minimize traffic conflicts between the buses, trucks, and automobiles. JBG ultimately located the bus alleyway 180 feet from Wilson Boulevard which allows. enough queuing distance in front of the Wilson Boulevard intersection for buses to make the turn into the alleyway entrance without waiting for the traffic to clear.

The entrance must have a 22 foot minimum width to accommodate a wide bus turning radius and a minimum

(continued on page 23)

Table 3: Alternative 1 – Order of Magnitude

Item No.	Element	Approx. Cost (FY06 $)
1	Demolition and Site Preparation	$1,300,820
2	Elevator/Stair Shaft Excavation & Structure	$6,785,060
3	Mezzanine Excavation & Structure	$7,136,000
4	Passageway Excavation & Structure	$1,123,950
5	Escalatorway/Passageway Connection	$437,260
6	Interior Architectural Construction	$553,580
7	Station Equipment & Finishes	$1,913,090
8	Vertical Transportation Systems	$3,996,900
9	Mechanical, Plumbing, & Electrical	$2,027,180
10	**Construction Contract Cost**	**$25,303,840**
11	Soft Costs: Design+Engineering (10%), Design Management (10%), Construction Support (10%), Insurance/Bond (5%)	$8,856,340
12	**Total Project Cost**	**$**34,160,180

Estimate in FY06 dollars with 10%-15% design contingency and priced as stand alone construction contract.

Table 4: Alternative 2 – Order of Magnitude

Item No.	Element	Approx. Cost (FY06 $)
1	Demolition and Site Preparation	$1,300,820
2	Elevator/Stair Shaft Excavation & Structure	$6,776,780
3	Mezzanine Excavation & Structure	$2,597,780
4	Passageway Excavation & Structure	$1,124,660
5	Escalatorway/Passageway Connection	$437,260
6	Interior Architectural Construction	$654,780
7	Station Equipment & Finishes	$1,946,620
8	Vertical Transportation Systems	$3,996,900
9	Mechanical, Plumbing, & Electrical	$1,146,970
10	**Mezzanine Pavillion**	**$2,259,170**
11	**Construction Contract Cost**	**$22,241,740**
12	Soft Costs: Design+Engineering (10%), Design Management (10%), Construction Support (10%), Insurance/Bond (5%)	$7,784,610
13	**Total Project Cost**	**$30,026,350**

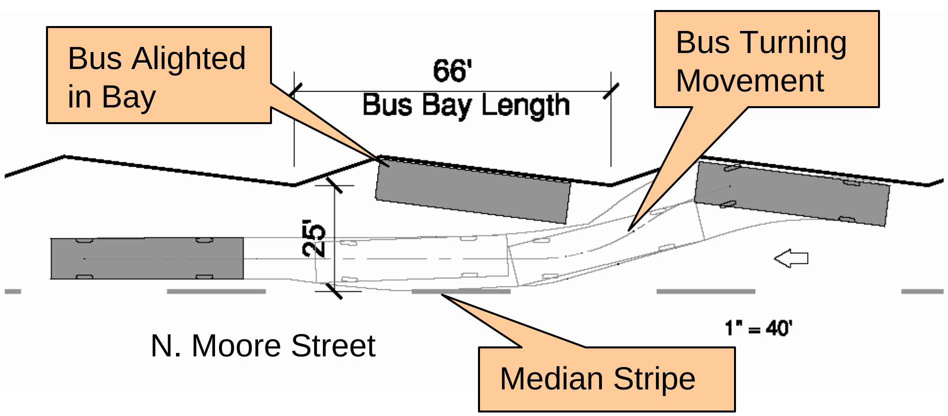
(continued)

14'-6" vertical height clearance for entire length of the alleyway. JBG was advised to coordinate requirements for bus facilities systems under structure with the Arlington County Fire Marshall in regards to compressed natural gas powered (CNG) buses.

Transit Facility Requirements on N. Moore Street

The RCP plan proposes to reduce the overall width of North Moore Street by approximately 3 feet, 6 inches to accommodate a wider building footprint which in turn, reduces the width of the southbound lanes from 25 feet to 21 feet, 6 inches. A 25 foot width, measured from the outside corner of the sawtooth bus bays to center median stripe, must be maintained to allow buses adequate clearance to pull around another bus parked in a bay without encroaching on the northbound travel lane [Figure 17].

Figure 17: Bus Turning Movements



The RCP plan also proposes to eliminate most of the curbside parking spaces along the northbound lane to provide a wider sidewalk. To maintain traffic flow in the northbound lane, the street plan should include adequate curbside space for taxis, automobile pick-up/drop-off activity, private shuttle buses, and the ART 61 bus stop.

Traffic Impacts from Development

According to the 2005 RCP Traffic Analysis and Transportation Management Plan by Well & Associates, the RCP development will ultimately generate approximately 362 net-new AM peak hour vehicle trips and 378 net-new PM peak hour trips. In the peak PM hour, 83 automobiles are expected to enter and 160 automobiles are expected to exit the RCP development at the two access points onto N. Moore Street from the 445 spaces in each of the above-grade parking levels[Figure 9]. Currently, there is only one garage exit on the southbound lane from 129 spaces for the office building at 1730 N. Moore Street. The entry/exit for the 395 spaces in the RCP below grade parking is located on N. Lynn Street.

The proposed 30 story office tower at 1812 N. Moore Street which is currently under review by the County is located adjacent to the station mezzanine and would replace the vacant 97,000 sq. ft. CACI building. The development proposes 541 parking spaces with 122 garage spaces that would enter and exit from N. Moore Street. The remaining 419 spaces would be accessed from Ft. Myer Drive. The CACI building currently has 164 parking spaces in the garage. *(continued)*

(continued)

Using the trip generations from development east of N. Moore Street [Figure 1X and Table 1X] with existing faregate data, we estimate that 1,541 station entries and 454 exits will occur during the PM peak hour in build-out year 2015 [Table 4X]. Without the new elevator entrance, the two JBG developments would generate a 34% increase in station entries from pedestrian trips across N. Moore Street at the mid-block crosswalk and the crosswalks at 19th Street. Table 4X shows that the combined transit trips from the two JBG developments would generate 517 peak PM hour entries and 142 exits: 285 station entries/83 exits from the RCP development; and 232 station entries/59 exits from the Waterview development.

Due to the high volume of bus traffic on N. Moore Street and the need to maintain a good level of service for bus operations, it is important to analyze pedestrian trips crossing N. Moore Street since many pedestrians access the station via the non-signalized, mid-block crossing and the RCP development will add additional automobile traffic on the already busy street. In addition, the RCP project will eliminate the pedestrian skybridge which connects the existing station mezzanine with the building on the east side of N. Lynn Street.

The following assessment of vehicular and pedestrian traffic is for the PM peak hour and assumes full development build-out without the proposed station elevator entrance.

Pedestrian Traffic Assessment

This assessment utilized methodologies in the 2000 HCM (Highway Capacity Manual) to analyze the operating conditions of the crosswalks at the intersections of N. Moore/N. 19th Street and N. Moore/Wilson Blvd. The analysis assumed 15 foot wide crosswalks and existing signal timing plans.

The south crosswalk at the intersection of N. Moore and N. 19 Street would operate at LOS E during PM peak hour. The corners of N. Moore Street and N. 19 Street would operate at LOS B. The results indicated that mitigation measures would be required to improve the crossing.

The north crosswalk at the intersection of N. Moore Street and Wilson Blvd. would operate at LOS C during PM peak hour. The corners of N. Moore Street and Wilson Blvd. would operate at LOS D.

The analysis of the mid-block crossing at the front of Metro Station utilized the concept of “critical gap” established in the HCM. Crossing the street requires pedestrian judgment in selecting an acceptable gap. With two-way traffic and buses impeding sight-lines, the vehicle traffic, particularly bus traffic, would be blocked by pedestrian movements since buses are required to stop at the mid-block crossing even when pedestrian are not present. When a pedestrian steps from the curb, a bus cannot proceed until the pedestrian clears the crosswalk. The percent of traffic blocked at the mid-.

(continued)

(continued)

block crosswalk would be about 80%, the LOS for vehicles would be F (230 seconds approach delay), and traffic flow (including buses) would experience significant delays. A traffic study would be needed to evaluate mitigation measures

Vehicular Traffic Assessment

The intersection of N. 19th street and N. Moore Street would operate at an acceptable LOS C, however, the northbound approach will experience delays, up to 7.1 seconds, and the LOS would be E. The intersection of N. Moore Street and Wilson Blvd. would operate at LOS C without significant delays.

Traffic Assessment with New Station Entrance

The traffic conditions would be significantly worse without the three new elevators to divert pedestrian crossings on N. Moore Street. Assuming 75% of the pedestrian from the east of N. Moore Street would use the new elevators, the mid-block traffic operation would be improved to LOS C (from LOS F), and the delay for vehicles would be reduced to 21 seconds (from 230 seconds). The safety of pedestrian would be greatly improved with less crossings and good bus service on N. Moore Street could be maintained.

WMATA Recommendations

Given the impacts from the new development projects around Rosslyn station and increased Metrorail ridership, it is critical that the proposed new elevator entrance be implemented concurrent with the RCP development to ensure and acceptable level of service for bus operations. At a minimum, the RCP project development should provide civil and structural construction and/or accommodation so as not to preclude construction of a station elevator entrance in the future. The design and construction of any new WMATA station facility shall: conform to the design principles described and shown in this Report, must meet the requirements of the latest WMATA Standards and Criteria; and be subject to WMATA review and approval.

WMATA staff recommends that any new station entrance design be subject to further analysis for impacts to the existing station in regards to local jurisdictional codes and NFPA 130 requirements for emergency exiting capacity. Any conclusions developed from this study shall be in agreement with Arlington County Fire Code Officials.

6.0 NEXT STEPS

In December 2006, the Arlington County Board voted to defer approval of the Rosslyn Central Place project. There were several unresolved issues, including finalizing the community benefits package, which was expected to include a contribution toward the construction of the new elevator entrance. The project is to be re-considered by the County Board in April 2007.

(continued)

(continued)
The Rosslyn Central Place project will be subject to further review and coordination from WMATA and Arlington County for the elevator entrance project, the bus alleyway, and the transportation facilities on N. Moore Street. In earlier meeting with the developer's consultants for the 1812 N. Moore Street project, the Office of Adjacent Construction and Joint Development (ADJC) advised Arlington County and the developer to coordinate the sequence of construction and maintenance of traffic along N. Moore Street with WMATA and JBG Companies project. Both the RCP and 1812 N. Moore Street projects were recently submitted to WMATA for the formal Adjacent Construction review process.

WMATA is currently participating in Arlington County's Site Plan Review Committee (SPRC) meetings for the 1812 N. Moore Street project.

APPENDIX 1.0 METHODOLOGY FOR FORECASTING ENTRY/EXITS

Area Development Pattern

For the purpose of estimating entries and exits, this analysis assumes that all potential Metrorail customers accessing the new elevators will arrive from areas east of N. Moore Street. By using the new elevators, customers can reduce their walking time and avoid crossing traffic on N. Moore to reach the existing escalators. For example, a customer walking to the station from the northeast could reduce their travel time by approximately 2 ½ minutes by accessing the station platform via the new elevators in lieu of riding down the existing escalators.

The analysis also assumes that Metrorail customers accessing the station from the west of N. Moore Street will continue to use the existing escalators.

(continued)

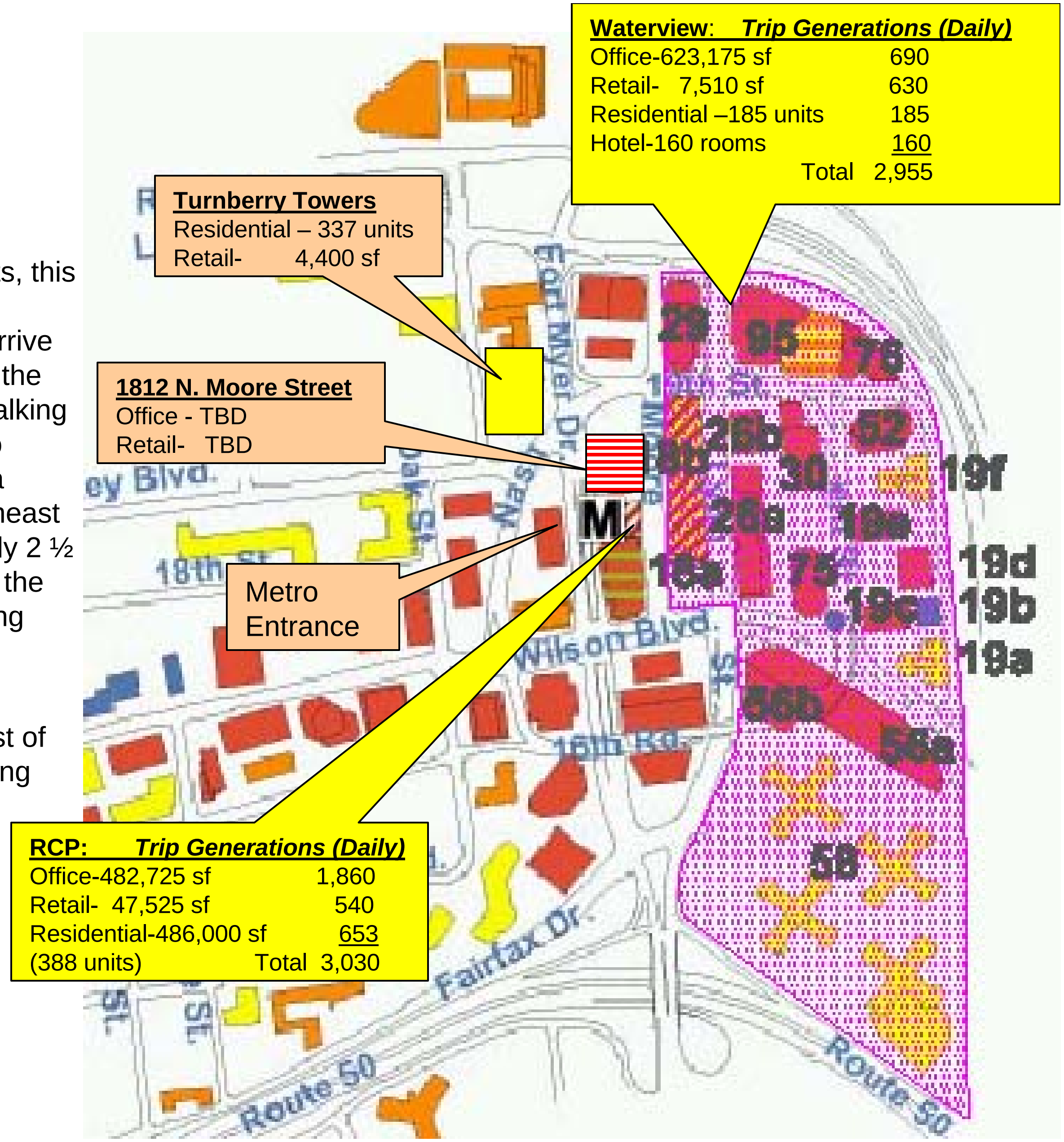


Figure 1X: Area of Trip Generations to New Entrance

(continued)

Like the development surrounding the Rosslyn station area, the area east of N. Moore Street shown in Figure 1X includes a mix of land uses such as office (3.76 million square feet), retail (375,000 square feet), hotel (160 units) and residential (over 2,000 residential units). Additionally, the study area includes a 9,000 square feet theater which is not considered in the analysis because it does not impact ridership during the peak period.

Figure 1x also shows two major projects in the development pipeline on the west side of N. Moore Street; 1812 N. Moore Street and Turnberry Towers, which are not included in this analysis.

New Elevator Entrance Demand

The demand for the new elevators during the peak periods is derived by applying the Metrorail mode split factor from WMATA's 2005 Development Related Ridership Survey (DRRS) to trip generation estimates from the ITE Trip Generation Manual - 7th Edition. The DRRS provides the latest estimates of Metrorail mode split by distance to the station.

Because higher demand for Metrorail access and egress typically occurs during the peak periods, this analysis further breaks out estimates for the AM and PM peak, 4 hour periods [Table 3X]. For development within 500 feet of the new street elevators, the analysis assumes that the office development would generate 35% Metrorial customers during the AM and PM peak periods, 54% from the residential units, 27% from the hotels, and 29% from retail. The transit share decreases incrementally the further the walking distance is from building entrance to the station entrance.

Variations in access and egress patterns between the morning and afternoon peak periods are also captured in the analysis. For office-generated trips, 15% of the morning peak trips are assumed to use elevators to enter Metro and 85% use elevators to exit Metro. Likewise, 73% of the residential morning peak trips would access Metro via elevators and 17% exit Metro via elevators. The ratios for office and residential trips are reversed in the afternoon peak period. For both hotels and retail, the split between entries and exits is even for both peak periods.

Table 1X: Transit Trip Generations from Development East of N. Moore Street

		Land Use				Metrorail mode choice by distancem (2005 survey)				Trip Generation Daily Metro Entry/Exits (ITE Rates)				Trip Generation Per Peak Period Metorail Trips				Trip Generation AM Peak Period (4hr) Metro Entries				Trip Generation PM Peak Period (4hr) Metro Entries			
	Distance in ft	Office	Retail	Residential	Hotel	Office	Retail	Residential	Hotel	Office ,000 sqft	Retail, 000ft	Residential	Hotel	Office	Retail	Residential	Hotel	Office ,000 sqft	Retail, 000ft	Residential	Hotel	Office ,000 sqft	Retail, 000ft	Residential	Hotel
Trip Orgin										11.01	49.21	4.2	8.17	33%	10%	20%	20%	0.15	0.5	0.73	0.5	0.85	0.5	0.27	0.5
18a-RCP Office	100	482,726	11,539			0.35	0.29	0.54	0.27	1,860	165	0	0	619	16	0	0	93	8	0	0	527	8	0	0
18b-RCP Res	230	0	35,988	288		0.35	0.23	0.54	0.27	0	407	653	0	0	41	131	0	0	20	95	0	0	20	35	0
26a	100	249,536	18,412			0.35	0.23	0.54	0.27	962	208	0	0	320	21	0	0	48	10	0	0	272	10	0	0
26b	500	347,295	6,565	0		0.33	0.23	0.52	0.27	1,262	74	0	0	420	7	0	0	63	4	0	0	357	4	0	0
29	500	128,000	6,565			0.31	0.23	0.5	0.27	437	74	0	0	145	7	0	0	22	4	0	0	124	4	0	0
30	500	201,400	55,600			0.31	0.23	0.5	0.27	687	629	0	0	229	63	0	0	34	31	0	0	195	31	0	0
75	500	243,700	15,766			0.31	0.23	0.5	0.27	832	178	0	0	277	18	0	0	42	9	0	0	235	9	0	0
95-Waterview	500	623,176	7,510	185	160	0.31	0.23	0.5	0.27	2,127	85	389	353	708	9	78	71	106	4	57	35	602	4	21	35
52	750	295,948				0.28	0.23	0.48	0.27	912	0	0	0	304	0	0	0	46	0	0	0	258	0	0	0
76	750	252,193				0.28	0.23	0.48	0.27	777	0	0	0	259	0	0	0	39	0	0	0	220	0	0	0
19a	1100			99		0.28	0.23	0.48	0.27	0	0	200	0	0	0	40	0	0	0	29	0	0	0	11	0
19c	950	142,500	10,800			0.28	0.23	0.48	0.27	439	122	0	0	146	12	0	0	22	6	0	0	124	6	0	0
56b	750	457,900	43,000			0.28	0.23	0.48	0.27	1,412	487	0	0	470	49	0	0	71	24	0	0	400	24	0	0
19b	1000					0.26	0.23	0.45	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19d	1100	147,500	3,000			0.26	0.23	0.45	0.27	422	34	0	0	141	3	0	0	21	2	0	0	120	2	0	0
19e	1000	148,732				0.26	0.23	0.45	0.27	426	0	0	0	142	0	0	0	21	0	0	0	121	0	0	0
19f	1000			94		0.26	0.23	0.45	0.27	0	0	178	0	0	0	36	0	0	0	26	0	0	0	10	0
56a	1100	446,500	36,400			0.26	0.23	0.45	0.27	1,278	412	0	0	426	41	0	0	64	21	0	0	362	21	0	0
58	1500		139,000	1,633		0.21	0.23	0.41	0.27	0	1,573	2,812	0	0	157	562	0	0	79	411	0	0	79	152	0
Trips by Use Type by Building										**13,833**	**4,450**	**4,231**	**353**	**4,607**	**445**	**846**	**71**	**691**	**222**	**618**	**35**	**3,916**	**222**	**228**	**35**
All trips by building										**22,867**								**1,566**				**4,402**			
Arrival rate at entrance (people per minute)																		**7**				**18**			

Table 2X: Projected PM Peak Entry/Exits at New Entrance in 2015

	Time	Entries	Exits
PM Peak Period Entry/Exits *	3:00 - 3:30	533	356
(4 Hr Period)	3:30 - 4:00	794	384
	4:00 - 4:30	1001	490
	4:30 - 5:00	1216	556
	5:00 - 5:30	1357	773
	5:30 - 6:00	1134	820
	6:00 - 6:30	830	762
	6:30 - 7:00	512	501
2006 Peak PM Period Entries/Exits (Existing)	**Totals**	**7377**	**4642**
1/2 Hr. Peak Entries/Exits (%) (Existing)		0.18	0.17
2015 Projected Entry/Exits (New Entrance)		4,402	1,566
2015 PM Peak 1/2 Hr Entry/Exits (New Entrance)		**810**	**261**

Table 3X: Projected AM Peak Entry/Exits at New Entrance in 2015

	Time	Entries	Exits
PM Peak Period Entry/Exits *	3:00 - 3:30	533	356
(4 Hr Period)	3:30 - 4:00	794	384
	4:00 - 4:30	1001	490
	4:30 - 5:00	1216	556
	5:00 - 5:30	1357	773
	5:30 - 6:00	1134	820
	6:00 - 6:30	830	762
	6:30 - 7:00	512	501
2006 Peak PM Period Entries/Exits (Existing)	**Totals**	**7377**	**4642**
1/2 Hr. Peak Entries/Exits (%) (Existing)		0.18	0.17
2015 Projected Entry/Exits (New Entrance)		4,402	1,566
2015 PM Peak 1/2 Hr Entry/Exits (New Entrance)		**810**	**261**

Table 4X: JBG Development Peak Hour Enty/Eixts in 2015

	Time	Entries	Exits
PM Peak Period Entry/Exits *	3:00 - 3:30	533	356
(4 Hr Period)	3:30 - 4:00	794	384
	4:00 - 4:30	1001	490
	4:30 - 5:00	1216	556
	5:00 - 5:30	1357	773
	5:30 - 6:00	1134	820
	6:00 - 6:30	830	762
	6:30 - 7:00	512	501
2006 Peak PM Period Entries/Exits	**Totals**	**7377**	**4642**
1 Hr. Peak Entries/Exits (%)		0.35	0.29
2020 PM Peak Period Entry/Exits (from East)		4,402	1566
PM Peak 1 Hr Entry/Exits from East		**1,541**	**454**
JBG Development PM Peak Period Entry/Exits		1,477	488
PM Peak 1 Hr Entry/Exits from JBG Waterview & RCP Developments		**517**	**142**
% JBG Entry/Exists from East of Station		0.34	0.31

APPENDIX 2.0 ELEVATOR QUEUING CAPACITY

Alternative 1

As discussed in the Demand Analysis and Elevator Capacity Section, WMATA uses peak half-hour demand projections when planning new station mezzanines and elevators to ensure they can comfortably, safely, and efficiently accommodate Metrorail customers during periods of peak capacity. Figure 2X shows a diagram of passengers queuing in front of the elevators on the concourse level. For our purposes, the diagram shows 28 customers waiting for an elevator in lieu of the projected 57 passengers shown in Table 2 since, in most instances, only one train would normally arrive in the station instead of two trains simultaneously as was analyzed.

If the mezzanine was designed to accommodate the maximum queue capacity for 57 passengers waiting for an elevator, then additional elevators would be necessary to handle the load. More than 3 elevators would not easily fit into the Rosslyn Central Place development and could place an unfair burden on the development. On those rare occasions when crowded conditions may occur, customers could use the existing escalators to avoid a long wait time for an elevator.

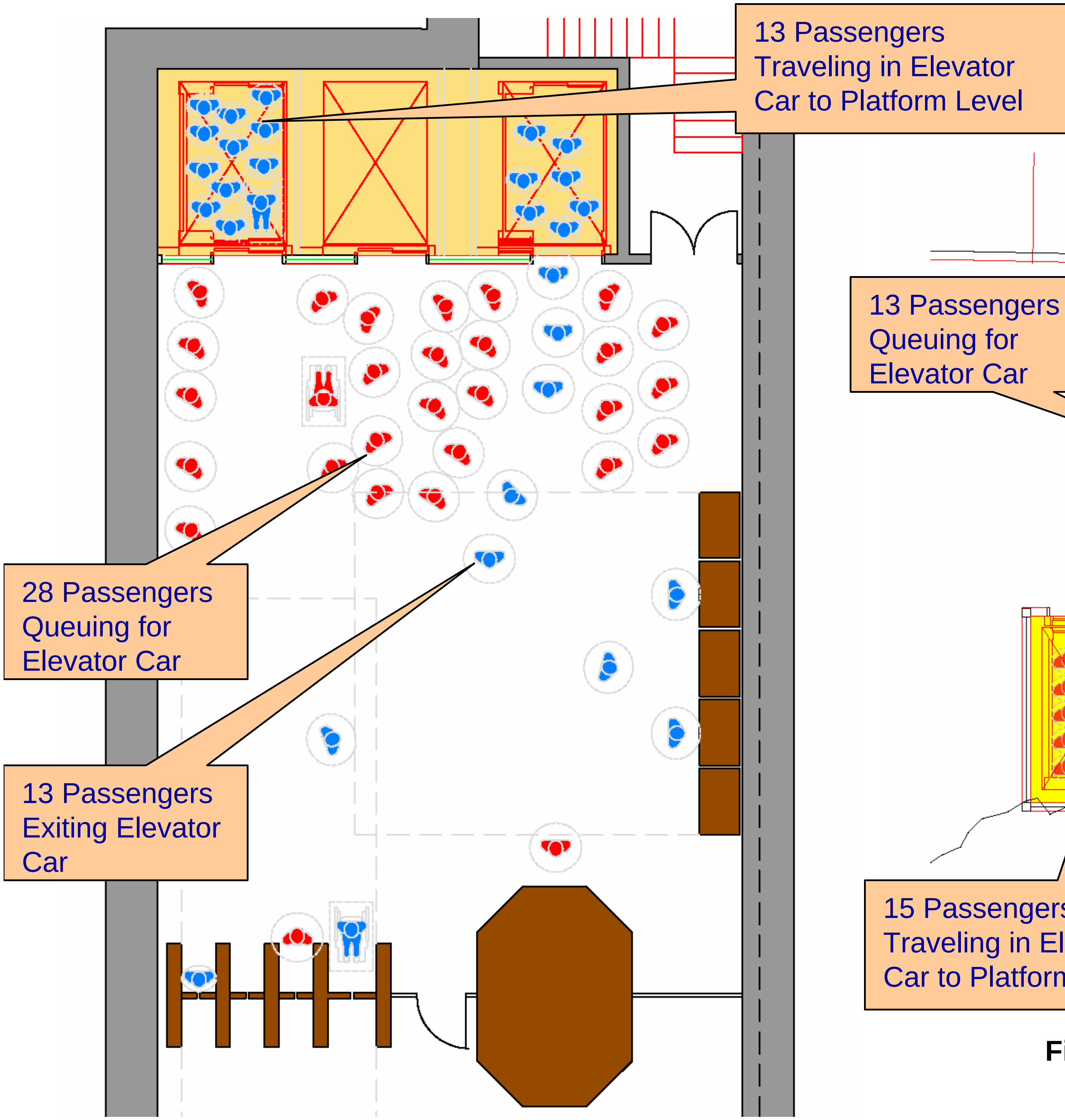
At the street level, Figure 3X shows that 13 customers queuing in front of the elevators can be accommodated on the sidewalk in the PM peak half-hour period without crowding.

Alternative 2

Figure 4X shows a diagram of passengers queuing in front of the elevators in the concourse at the platform level. The diagram shows 28 customers waiting for an elevator and 15 passengers exiting one elevator. A second elevator car with another 15 passengers is shown in transit from the street level while some of the 28 customers begin to queue. An early audible and visible signal from the hall lantern could give customers ample time to queue in front of an approaching elevator which would help avoid conflicts with passengers exiting the elevator car and speed the process.

At the street level, Figure 5X shows that 15 customers queuing in front of the elevators can be accommodated in the Paid Area of the Mezzanine in the PM peak half-hour period without overcrowding.

Figure 2X: Alternative 1: Concourse Level – Queuing in AM Peak ½ Hour



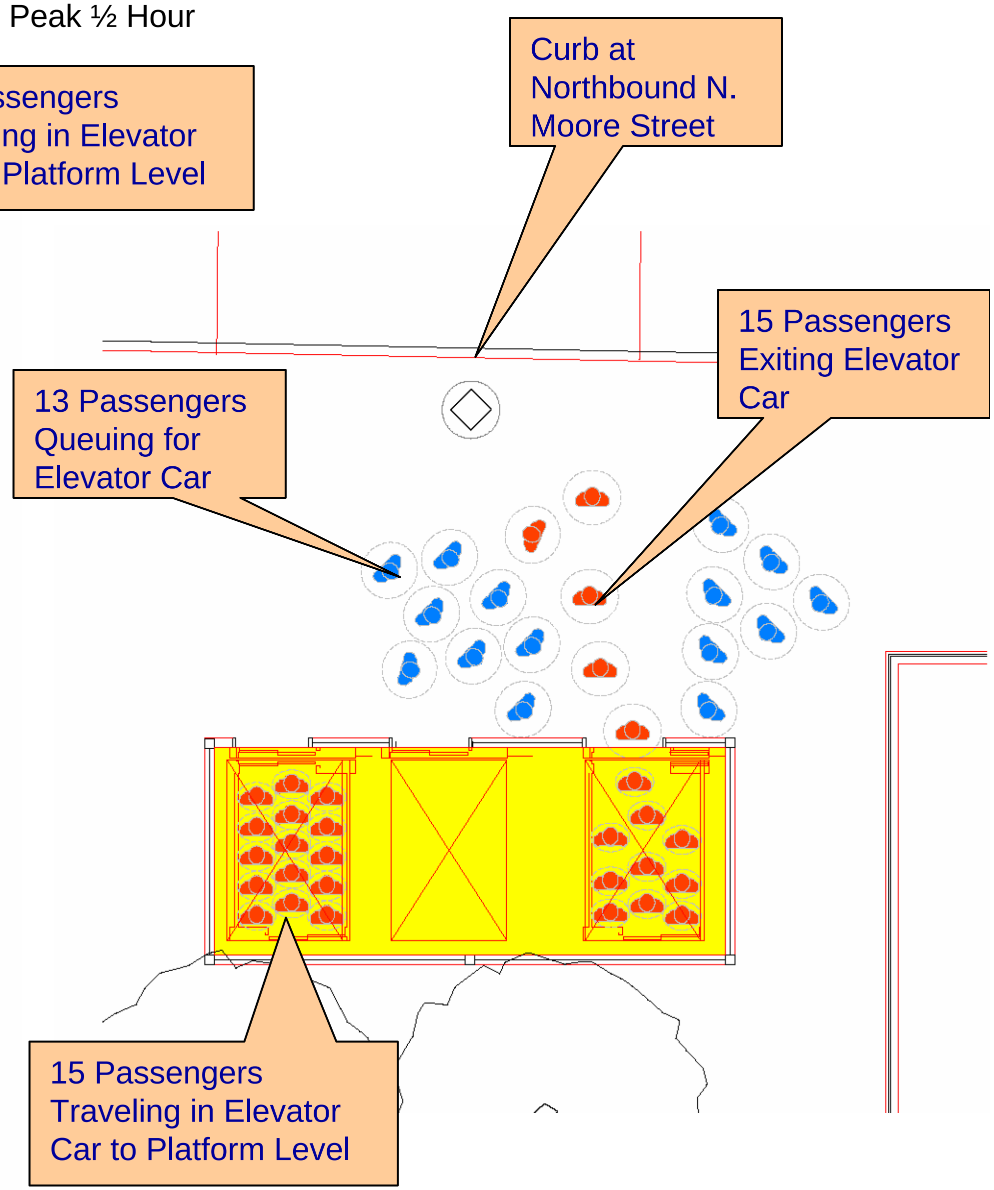


Figure 3X: Alternative 1: Street Level – Queuing in PM Peak ½ Hour

Figure 4X: Alternative 2: Concourse Level – Queuing in AM Peak ½ Hour

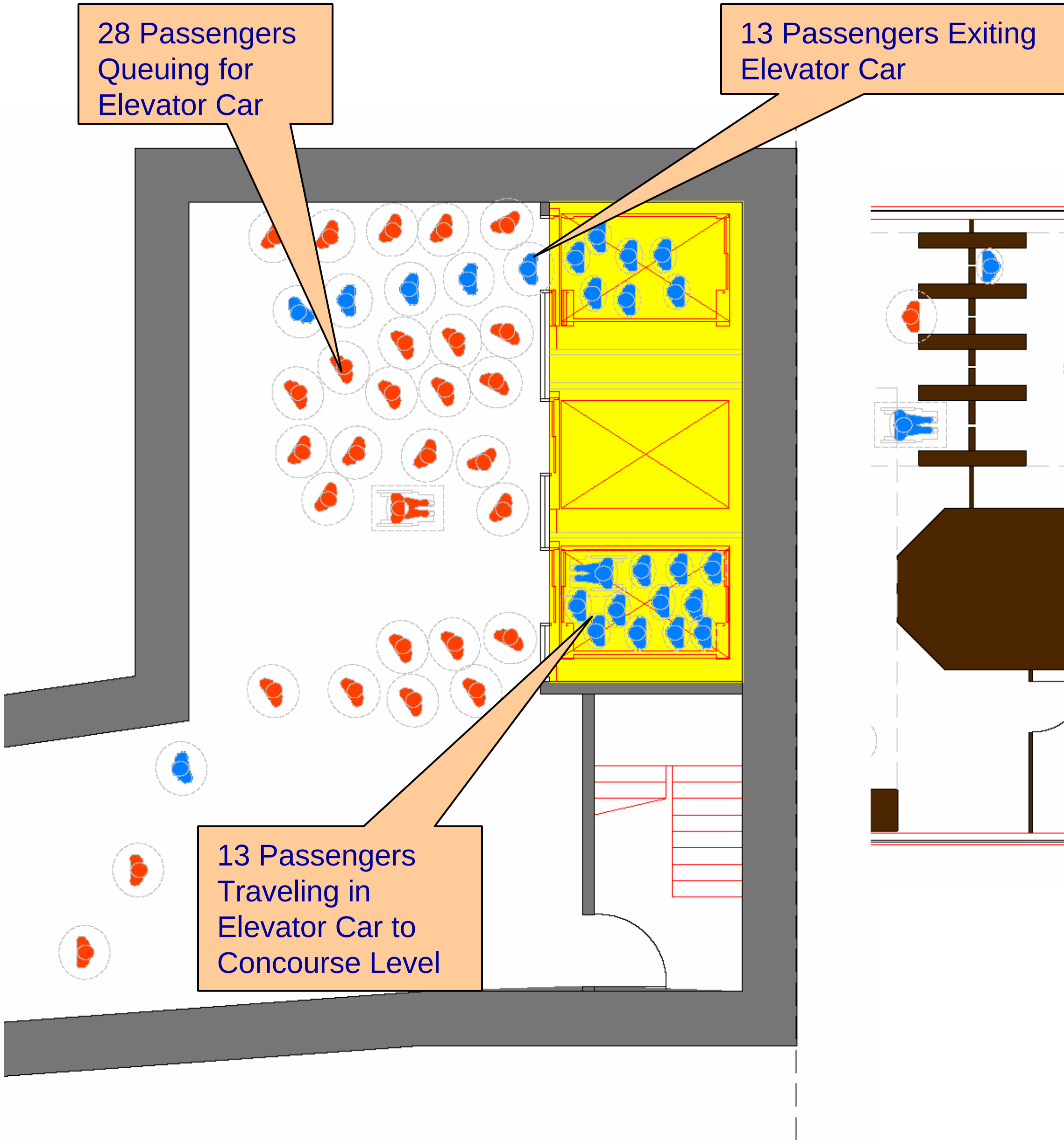
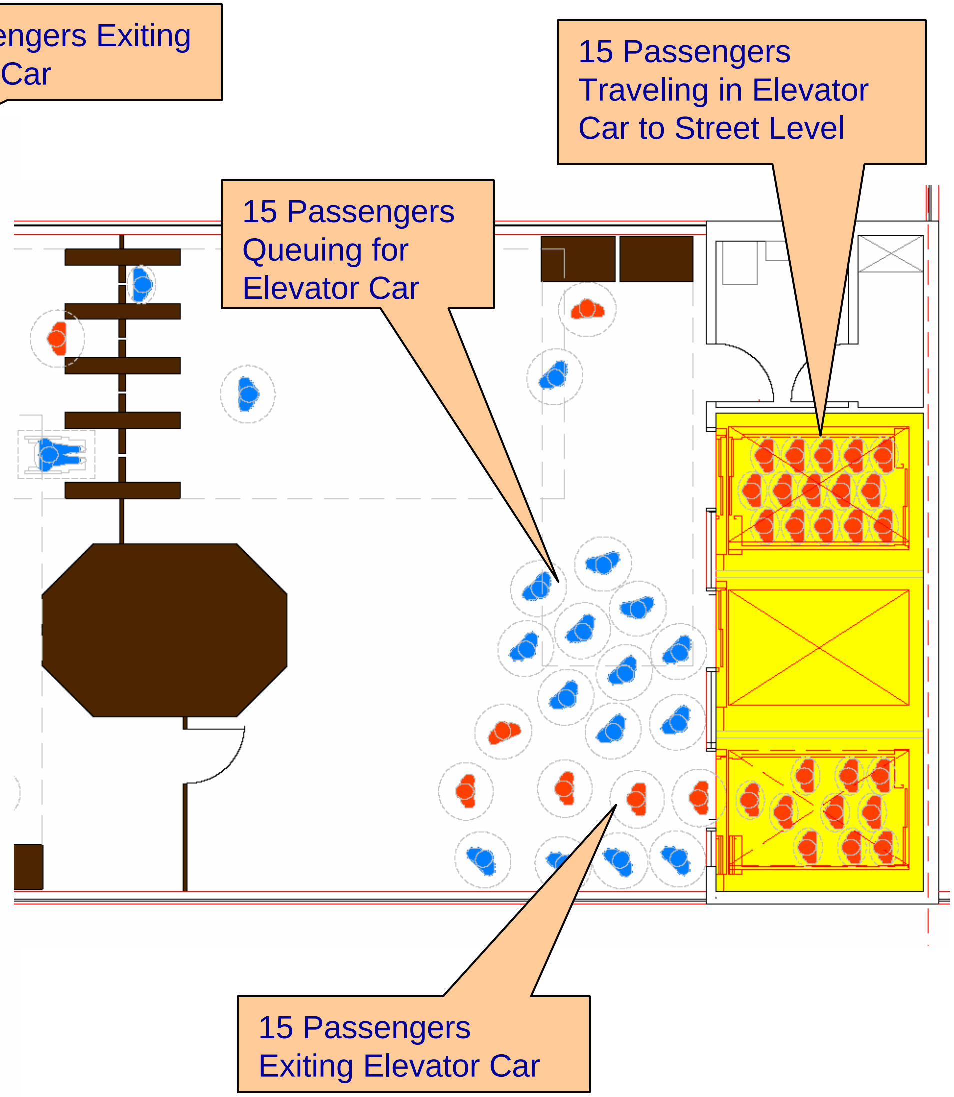


Figure 5X: Alternative 2: Street Level – Queuing in PM Peak ½ Hour



Customer Queue Area

The Vertical Transportation Handbook was referenced to provide standard queuing areas for each of the body figures shown in Figures 10, 11, 17, and 18. The dashed line shown around the body of the customers queuing in front of the elevators is considered a nominal 7 square foot area for queuing.

The minimum queue area for a customer in a wheelchair, which is included in the analysis, is 10 square feet (30 x 48 inches). The dashed line shown around the body of the customers in the elevator car is a 3 square feet area and is considered a crowded condition for elevator queuing but is acceptable for riding inside of an elevator car.

Methodology for Calculating Queuing

The methodology for calculating the number of passengers queuing at the elevators in the concourse on the platform level assumed the worst-case scenario of two trains arriving together at the station and unloading simultaneously [Figure 7X]. Further assumption included: (1) three elevators with an average cycle time of 30 seconds; (2) more passengers would alight from cars closer to the exit; (3) one-third of each car's alightings occurred at each set of doors; (4) future alightings will take place on the upper and lower platforms in the same proportions as today; (5) peak 2 hour alightings would be uniformly distributed throughout the time period; and (6) the elevators would carry an average of 15 passengers per car.

At the street level, the queuing analysis used a 30 second average elevator cycle time for three operating elevator cars. It also assumed that all patrons arriving in the peak 30 minute period were evenly distributed.

Figure 6X: Travel Distances from Train Car Doors

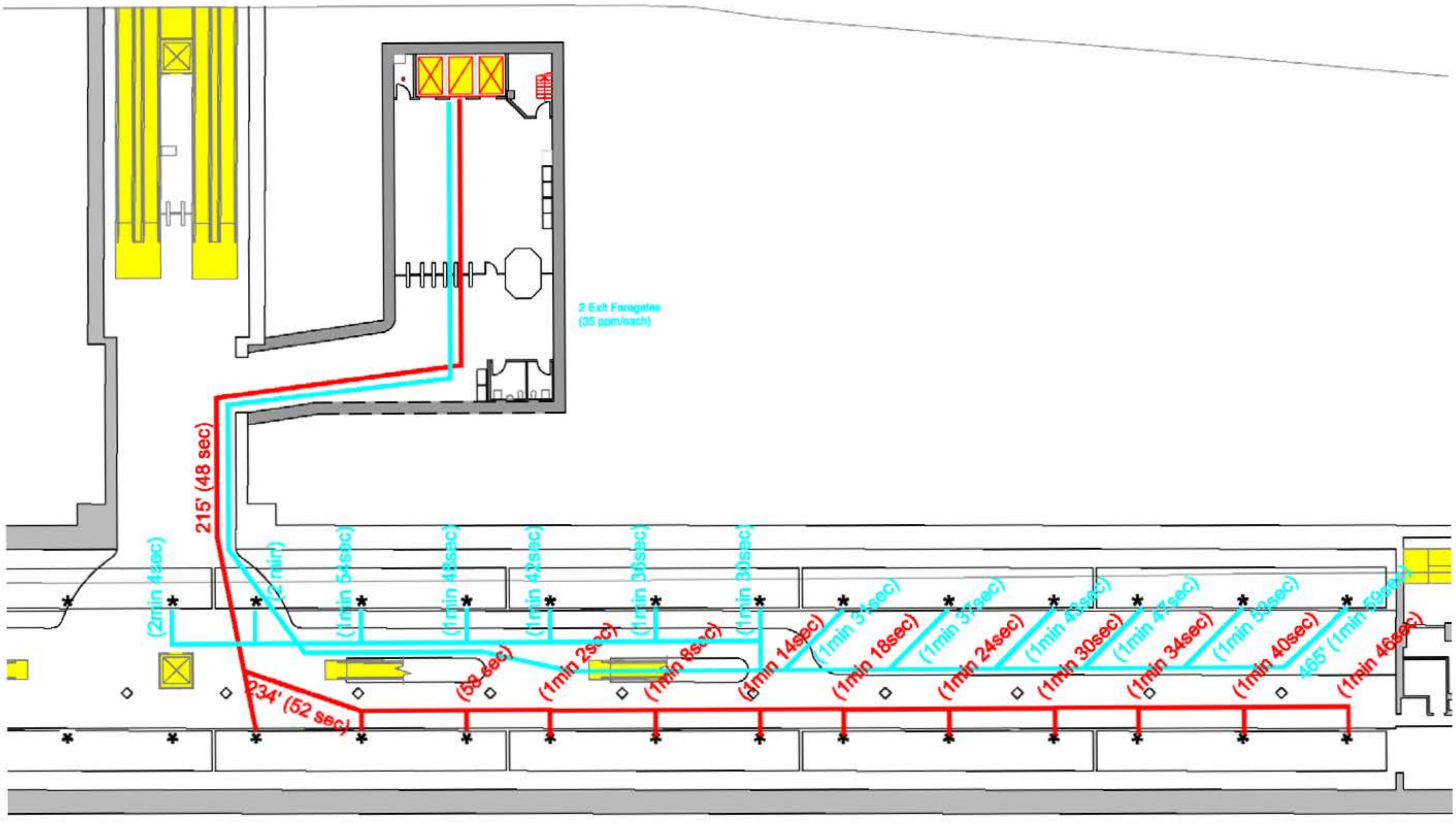


Table 5X: Train Car Exiting Distribution

3 Elevators																				
		Train Loading Car																		
		1			2			3			4			5			6			
Inbound	0.483	91			118			91			102			98			77			
		77			92			82			77			79			39			
		87			92			69			78			88			66			
		85			97			85			90			107			71			
Average		85			99.75			81.75			86.75			93			63.25			509.5
		16.7%			19.6%			16.0%			17.0%			18.3%			12.4%			
		10.0%			15.0%			25.0%			25.0%			15.0%			10.0%			100.0%
		3.3%	3.3%	3.3%	5.0%	5.0%	5.0%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	5.0%	5.0%	5.0%	3.3%	3.3%	3.3%	100.0%
Cycle		2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	
	28	0.93	0.93	0.93	1.39	1.39	1.39	2.32	2.32	2.32	2.32	2.32	2.32	1.39	1.39	1.39	0.93	0.93	0.93	28
Outbound	0.517																			
		15.0%			20.0%			15.0%			15.0%			20.0%			15.0%			100.0%
		5.0%	5.0%	5.0%	6.7%	6.7%	6.7%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	6.7%	6.7%	6.7%	5.0%	5.0%	5.0%	100.0%
Cycle		2	2	2	2	2	2	2	3	3	3	3	2	2	2	2	2	2	2	
	30	1.49	1.49	1.49	1.99	1.99	1.99	1.49	1.49	1.49	1.49	1.49	1.49	1.99	1.99	1.99	1.49	1.49	1.49	30
	Cycle 1	0	0	0.929	1.393	1.393	1.393	2.322	2.322	2.322	2.322	2.322	2.322	1.393	1.393	1.393	0.929	0	0	24.1
	Cycle 2	2.42	2.42	1.491	1.988	1.988	1.988	1.491	0	0	0	0	1.491	1.988	1.988	1.988	1.491	2.42	2.42	27.6
	Cycle 3	0	0	0	0	0	0	0	1.491	1.491	1.491	1.491	0	0	0	0	0	0	0	6.0
																				57.7

Assumptions

1. 3-minute headways during peak hours
2. Fare Gate service rate: 35 passengers/minute
3. Volume to capacity ratio: 0.70 (Level of Service of D, NY MTA CEQR manual)
4. Traffic Volume for 2020: 719 (entry)/156 (exit), 30-minute peak volume

Number of fare gates required (2020)

Number of fare gates for passengers entering the station

Adjusted volume: 719/0.8 (peak hour factor) = 899.
Capacity required: 899/30 minutes/X (capacity of fare gates required) = 0.7. X = 42 persons/minute.
Number of fare gates required: 42/35 = 2 fare gates.

Number of fare gates for passengers exiting the station

Adjusted volume: 156/0.8 (peak hour factor) = 195.
Capacity required: 195/10 (number of trains during the peak 30 minutes)/X (capacity of fare gates required) = 0.7 X = 28 persons/minute.
Number of fare gates required: 28/35 = 1 fare gates.

Total number of fare gates required: 2 (for entering) + 1 (for exiting) + 1 (ADA) = 4.

Number of fare vending machine required (2020)

Analysis Assumptions

1. Express Vendor Service Rate: 90 transactions per hour.
2. Peak Hour Factor: 0.95.
3. 20% of the total entries and exits during the peak hour using fare vending machine.
4. 0.7 Volume to Capacity ratio is used for threshold.

0.2*(719 + 156)/0.95 = 184 customers would use fare vending machines during the peak 30-minute period.
184/X/45 = 0.7 **X = 6** : **Total number of fare vending machine required (Not including fare adding machines)**