Grant Applicant: **Washington Metropolitan Council of Governments (MWCOG)**

Proposed Project: **Crystal City/Potomac Yard Transit Improvements Project - Section B**

Date: **March 02, 2011**

INFORMATION REQUIRED FOR PROBABLE CATEGORICAL EXCLUSION PURSUANT TO 23 CFR § 771.117(d)

A. DETAILED PROJECT DESCRIPTON: See attachment Part A.

B. LOCATION: See attachment Part B and Appendix 1, Figure 1: Site Location & Planned Alignment Map.

C. METROPOLITAN PLANNING & AIR QUALITY CONFORMITY: See attachment Part C and Appendix 2, FY 2010 – 2015 Transportation Improvement Program, Air Quality Conformity Inputs.

D. PLANNING CONSISTENCY LAND USE & ZONING: See attachment Part D and Appendix 1, Figure 2: Zoning Map.

E. TRANSPORTATION IMPACTS: See attachment Part E and Appendix 3: Transportation and Traffic Technical Memorandum Update, 2011.

F. CO HOT SPOTS: See attachment Part F and Appendix 4: Air Quality Assessment Technical Memorandum Update, 2011.

G. CULTURAL RESOURCES: See attachment Part G and Appendix 5: Cultural Resources Technical Memorandum Update, 2011.

H. NOISE: See attachment Part H.

I. VIBRATION: See attachment Part I.

J. ACQUISITIONS & RELOCATIONS REQUIRED: See attachment Part J and Appendix 6: Acquisitions & Relocations Technical Memorandum Update, 2011.

K. HAZARDOUS MATERIALS: See attachment Part K and Appendix 7: Hazardous Materials Technical Memorandum Update, 2011.

L. COMMUNITY DISRUPTION & ENVIRONMENTAL JUSTICE: See attachment Part L.

M. PUBLIC PARKLAND & RECREATION AREAS: See attachment Part M and Appendix 1, Figure 3: Recreational & Park Facilities Map.

N. WETLAND IMPACTS: See attachment Part N and Appendix 8: Water Resources and Coastal Zone Consistency Determination.

O. FLOODPLAIN IMPACTS: See attachment Part O.

P. IMPACTS ON NAVIGABLE WATERWAYS, WATER QUALITY & COASTAL ZONES: See attachment Part P and Appendix 8: Water Resources and Coastal Zone Consistency Determination

Q. IMPACTS ON ECOLOGICALLY-SENSITIVE AREAS & ENDANGERED SPECIES: See attachment Part Q and Appendix 9: Ecologically Sensitive Areas and Sensitive Species

R. IMPACTS ON SAFETY & SECURITY: See attachment Part R.

S. IMPACTS CAUSED BY CONSTRUCTION: See attachment Part S.

APPENDICES

Appendix 1:	Figure 1: Site Location & Planned Alignment Map
	Figure 2: Zoning Map
	Figure 3: Recreational & Park Facilities Map
	Figure 4: Details 1- Recreational & Park Facilities
	Figure 5: Details 2 - Recreational & Park Facilities
Appendix 2:	FY 2010 – 2015 Transportation Improvement Program, Air Quality Conformity Inputs
Appendix 3:	Technical Memorandum Update: Traffic and Transportation
Appendix 4:	Technical Memorandum Update: Air Quality Assessment
Appendix 5:	Technical Memorandum Update: Cultural Resources
Appendix 6:	Technical Memorandum Update: Acquisitions & Relocations
Appendix 7:	Technical Memorandum Update: Hazardous Materials
Appendix 8:	Technical Memorandum Update: Water Resources and Coastal Zone Consistency Determination
Appendix 9:	Technical Memorandum: Ecologically Sensitive Areas and Sensitive Species
Appendix 10:	Public Outreach
Appendix 11:	General Plans

Note: Updates to the Technical Memoranda are incorporated 'by reference' into the 2006-2007 Technical Memoranda (see attached CD).

Attached CD includes:

- 2007 Documented Categorical Exclusion
- Appendix 1: Figure 1: Planned Alignment and CCPY Improvements
  Figure 2: Zoning in Alexandria
  Figure 3: Zoning in Arlington
- Appendix 2: National Capital Region Transportation Planning Board TIP Amendment
- Appendix 3: Technical Memorandum: Traffic and Transportation
- Appendix 4: Technical Memorandum: Air Quality Assessment
- Appendix 5: Technical Memorandum: Cultural Resources
- Appendix 6: Technical Memorandum: Noise and Vibration Assessment
- Appendix 7: Technical Memorandum: Phase I Environmental Site Assessment
- Appendix 8: Technical Memorandum: Socioeconomic and Community Resources
- Appendix 9: Technical Memorandum: Water Resources and Coastal Zone Consistency Determination
- Appendix 10: Agency Correspondence
- Appendix 11: Public Outreach

The action described above meets the criteria for a NEPA categorical exclusion (CE) in

accordance with 23 CFR Part 771.117(d) (9) ____.

_______________________________ _______________________________

Applicant's Environmental Reviewer **Date**

_______________________________ _______________________________

FTA Grant Representative **Date**

A. Detailed Project Description

In May 2010, the Metropolitan Washington Council of Government (MWCOG) on behalf of the City of Alexandria, Virginia was awarded a Transportation Investment Generating Economic Recovery (TIGER) grant to construct a transitway along US Route 1. The purpose of this Documented Categorical Exclusion (DCE), undertaken by the City of Alexandria, in coordination with the MWCOG and the Washington Metropolitan Area Transit Authority (WMATA), is to meet the federal requirements associated with receiving a TIGER grant and to obtain environmental clearance for the 0.95-mile exclusive transitway and four stations along US Route 1 from the Monroe Avenue Bridge to East Glebe Road in Alexandria, Virginia.

The entire CCPY project corridor extends from the Braddock Road Metrorail Station in the south to the Pentagon and Pentagon City in the north, a distance of approximately five miles. Although the transitway is contiguous, different sections have different issues and concerns. To adequately address these concerns and to facilitate documentation, the corridor was analyzed in six sections - A through F. The entire corridor was documented in 2007 with a DCE. However, the DCE at that time only cleared the initial operable segments of the transit route within Arlington County (Sections D and E). This DCE focuses on Section B, as shown in Figure 1, Appendix 1. While Section B is part of the larger vision of the CCPY Transitway project along US Route 1, it has independent utility due to dedicated transit lanes between the termini at Monroe Avenue Bridge and East Glebe Road, with the purpose to serve the proposed mixed-use development at Potomac Yard.

The proposed action provides an exclusive two-lane, median transitway, four stations and transit signal priority. Stations will provide level boarding and will include amenities such as benches, maps and fare machines. The Intelligent Transportation Systems (ITS) components will provide bus priority at traffic signals along the route and display real-time transit arrival information at stations along the transitway. The transitway will be constructed within a reconfigured existing US Route 1 transportation right-of-way in order to accommodate all travel lanes. The proposed transitway assumes continued use of the WMATA bus maintenance facility at Four Mile Run.

B. Location

Section B of the proposed transitway lies within the City of Alexandria, Virginia along US Route 1 between the Monroe Avenue Bridge and East Glebe Road. The planned alignment in Section B runs entirely in exclusive transit lanes in the median of the existing US Route 1 transportation right-of-way. See Figure 1, Appendix 1.

C. Metropolitan Planning and Air Quality Conformity

The project is listed in the Metropolitan Washington Council of Government's (MWCOG) Transportation Improvement Program (TIP) for fiscal years 2010-2015 and has been modeled for air quality conformity. The project supports improved regional air quality goals by providing for dedicated transit improvements, necessary for increased transit ridership in the future. See Appendix 2.

D. Planning Consistency, Land Use and Zoning

Section B of the Potomac Yard Transitway is consistent with existing zoning; see Appendix 1, Figure 2.

In 2009, the Alexandria City Council approved a revised North Potomac Yard Small Area Plan (SAP). According to the SAP, *"…dedicated high-capacity transitway and expanded local bus service, is required by the Plan to support the proposed density and accommodate new trips. These transit facilities … allow for a higher transit and non-SOV [single occupied vehicle] mode share and a high level of development density. Without the new transit infrastructure traffic congestion will overwhelm the street network capacity and the transportation network will fail."* [Pg 61]

The SAP further states *"Dedicated transit lanes are planned within the Route 1 corridor. The plans include: the widening of Route 1 to accommodate dedicated high-capacity transit within a landscaped central median; and provision of left turning movements while promoting a pedestrian-friendly environment designed as an urban boulevard with the transit vehicle within the central median. The interim route of the transit corridor will turn east at Glebe, and then north on Potomac Avenue."* [Pg 62]

E. Transportation Impacts

With the incremental background traffic growth, traffic from approved (currently un-built) developments, and the completion of the Potomac Yard mixed use development, traffic will increase on roadways and at intersections. Under the No Build conditions, increasing vehicular traffic would affect the performance of transit service along the entire corridor. An attempt to accommodate total corridor trips without dedicated transits lanes would degrade the capacity of bus service, and in some locations along the corridor it would also lead to increased traffic congestion. With the dedicated transit lanes, transit service will perform better in this corridor. Increased transit vehicle throughput and reduced travel time for passengers will result in greater passenger capacity.

Table 1: 2015 and 2030 Projected Intersection Levels of Service (LOS)

Intersections	2015 AM Peak		2015 PM Peak		2030 AM Peak		2030 PM Peak	
	No Build	Build	No Build	Build	No Build	Build	No Build	Build
US 1/E. Glebe Road	C	C	C	C	D	E	E	E
US 1/Swann Avenue	A	B	A	B	A	A	A	B
US 1/E. Custis Avenue	A	B	A	B	B	B	B	B
US 1/Howell Avenue	B	B	B	B	C	C	D	D
US 1/Potomac Avenue	B	B	B	B	C	C	C	D

The traffic analysis includes pedestrian countdown signals that allow for full crossing (i.e. from curb to curb) of US Route 1 with the median transitway. Table 1 shows the projected intersection level of service (LOS) at the study intersections based on results of the traffic simulations. In 2015, the LOS shows a minor decline at two intersections - US Route 1/Swann Avenue and US Route 1/Custis Avenue. In 2030, the proposed transitway would result in only minor LOS changes at three study intersections. However, these minor changes in LOS would not result in unacceptable conditions. In the AM peak the intersection located at US Route 1 and East Glebe Road shows a decline in LOS from D to E for the Build condition. In the PM peak, the intersection at US Route 1 and Potomac Avenue experiences a decline in LOS from C to D, and the US Route 1/Swan Avenue declines in LOS from A to B.

The design for the improvements to the existing US Route 1 is nearly complete. The improvements include construction of new northbound travel lanes to the east of the existing travel lanes, and reconstruction of the intersections at East Glebe Road and at Swann, Custis at Potomac Avenues. These improvements will be constructed in 2011; Swann Avenue will be constructed after 2015.

There is no existing or planned on-street parking along US Route 1 in Section B of the Potomac Yard transit corridor. The transitway will be constructed within an established median; therefore there will be no impacts on access to businesses. However, under the proposed action, all non-signalized intersections along Section B of the proposed transitway will only permit right in and right out movements. Northbound left turns will only be permitted at signalized intersections. In the Build condition, the signalized intersection of US Route 1 and Hume Avenue will be converted to an unsignalized one eliminating all left turns. The proposed configuration also eliminates southbound left turns at US Route 1 on to Potomac Avenue, to accommodate the proposed transit stop at Potomac Avenue. See Appendix 3, Transportation Effects Technical Memorandum Update for detailed results.

F. Carbon Monoxide (CO) Hot Spots:

The proposed dedicated transitway is not expected to violate the applicable National Ambient Air Quality Standards (NAAQS) for the criteria pollutant carbon monoxide (CO). With respect to regional emissions and conformity, the project has been shown to conform to the State Implementation Plan (SIP) by not exceeding the NAAQS.

The projected intersection LOS (see Table 1) indicates that only one intersection – US Route 1 with East Glebe Road would operate at LOS E in Build condition. For the 2007 DCE, a hot spot analysis was conducted to determine maximum pollutant concentrations of CO at the most congested intersections in the CCPY Corridor, (see Appendix 4 of the 2007 DCE on attached CD). Based on this previous analysis, maximum 1- and 8-hour concentrations of CO at the intersection of US Route 1 and Potomac Avenue (LOS E in 2015 Build conditions) were predicted to be 4.1 parts per million (ppm) and 2.7 ppm respectively.

The projected intersection LOS (see Table 1) shows that the LOS at these intersections is comparable to the predicted LOS from previous traffic analysis conducted in 2007 (see Appendix 3 of the 2007 DCE on attached CD). Therefore no new hot spot analysis was conducted. Since the LOS is comparable between 2007 and 2011 analyses, it can be assumed that the CO concentrations at these intersections would be comparable to those estimated in 2007. At 4.1 ppm and 2.7 ppm for 1- and 8-hour concentrations, these are below the NAAQS of 35 and 9 ppm respectively.

G. Cultural Resources

No impacts to cultural resources are anticipated due to the proposed transitway.

Based on the findings from the previous analysis conducted in 2007, one documented historic district is present in Section B – the Town of Potomac Historic District. The Town of Potomac Historic District is located west of the transitway corridor, and largely screened from all activities by modern development along US Route 1. The January 2007 DCE and Technical Memoranda concluded that the alignment within Section B would have no effect on any other historic resource in Section B of the alignment.

An archaeological assessment of this area was included in the *Resource Management Plan for the Potomac Yard Property, Landbays E, G, H, I, J, K, L, and M, City of Alexandria, Virginia* prepared in 2008 by Thunderbird Archaeology to comply with the City of Alexandria's Archaeological Protection Code. The report demonstrates that areas along Section B of the alignment have been significantly disturbed and warrant no further investigation. On December 21, 2010, VDHR confirmed the project would have no adverse effect on cultural resources. See Appendix 5 for relevant agency correspondence in the Technical Memorandum Update for Cultural Resources.

H. Noise

No noise impacts are predicted along Section B due to the proposed transitway.

A Noise Assessment was completed in November 2006 (see Appendix 6 of the 2007 Documented CE on attached CD). It states that "*None of the project noise or vibration levels are predicted to exceed the FTA impact criteria anywhere along the project corridor.*"

During that assessment, ambient conditions were taken and modeled at one representative location in Section B (516 E. Bellefonte Avenue (R3)). This location is classified as a Category 2 under the FTA guidelines. It was found that the day-night noise levels did not exceed 66 dBA whereas peak-hour equivalent noise level ranged from 59 dBA to 68 dBA at Receptor R3. These levels are typical of the types of dense urban land uses found along the project corridor, particularly the variety and frequency of transportation sources that range from traffic along arterials to passenger trains to jet aircraft over flights. Typical maximum noise levels from the proposed BRT vehicle passby is not expected to exceed 75 dBA at Receptor R3. This maximum noise level is slightly lower than the Metro city buses that currently operate along the project corridor and hence does not constitute an impact.

One new noise-sensitive receptor, a new mixed use building, has been identified at 650 Maskell Street. The Noise & Vibration Technical Memorandum completed in November 2006 identified no impacts to the noise-sensitive receptors in the corridor. The 2006 analysis included noise-monitoring at a site adjacent to US Route 1 within Section B of the proposed transitway. The 2006 findings still apply; transit vehicles operating along the future transitway will be operating within the same lanes that are currently used by buses and general traffic.

I. Vibration

No vibration impacts are anticipated due to the proposed transitway.

The FTA vibration impact criteria will not be exceeded for Section B of the Potomac Yard Transitway. Text from Part I of the 2007 DCE is below:

None of the estimated vibration levels are predicted to exceed FTA's impact criterion of 72 VdB (for "frequent events") at Category 2 receptors, such as residences. Therefore, no vibration impacts as a result of the project are expected to occur. Details of the vibration assessment, including results of the monitoring program, are included in the Technical Memorandum (Appendix 6) [of the 2007 DCE on CD].

J. Acquisitions and Relocations Required

There are no acquisitions or relocations associated with the proposed transitway.

All proposed transitway improvements will be within existing rights-of-way and no relocations of residents or businesses are associated with Section B of the transitway corridor. To ensure a safe transition of the northbound traffic lanes across the intersection of US Route 1 with East Glebe Road, some land will be required on the east side of US Route 1. The required right-of-way on the eastern side of US Route 1 has been dedicated by the developer to the City of Alexandria. See Appendix 6, for Technical Memorandum Update for Acquisitions and Relocations. Existing parking spaces will not be impacted.

K. Hazardous Materials

There is no property within the proposed limits of transitway construction where known contaminated or hazardous materials exist. There are properties in the project vicinity with hazardous materials.

A Phase I Environmental Site Assessment (ESA) was conducted as part of the 2007 DCE (see Appendix 7 of the 2007 DCE, attached CD). The ESA identified no properties within or adjacent to Section B of the proposed transitway where further, Phase II analysis is warranted. As part of a subsequent, independent study, a Phase II ESA was conducted in the area east of US Route 1 between Swann and Howell Avenues (*Site Characterization Report and Risk Assessment for Potomac Yard Landbay I & J)*. This assessment identified the presence of contaminants and recommended that the land developer follow Best Management Practices for protection of workers and the community during development of those parcels.

The shallow level of excavation required for the transitway project, the location of proposed transitway construction in the existing northbound lanes of US Route 1, and the historic location of the rail yard to the east of the US Route 1 right-of-way combine to limit the potential for exposure to contaminated or hazardous materials. See Appendix 7 for Technical Memorandum Update for Hazardous Materials.

Environmental contamination has been documented within the footprint of Potomac Yard, a former rail yard in the vicinity of Section B of the Crystal City/Potomac Yard. FTA has requested the City of Alexandria provide a plan to address health and safety matters that might be associated with the project, and its proximity to Potomac Yard. The City of Alexandria has agreed to provide this plan.

L. Community Disruption and Environmental Justice

The proposed transitway will not disrupt any existing communities, all project improvements will occur entirely within existing transportation right-of-way and there will be no disproportionate adverse effects on environmental justice populations.

To the west of US Route 1, neighborhoods in Section B include Mt. Jefferson, Del Ray, and Oakville. To the east of US Route 1 this Section includes Potomac Yard and the neighborhood of Potomac Greens (between the rail line and George Washington Memorial Parkway). The Mt. Jefferson and Del Ray neighborhoods consist of a mix of single-family detached homes, rowhouses, and garden apartments. Oakville is a small light-industrial section to the west of US Route 1, bounded by the abandoned Washington and Old Dominion (WO&D) right-of-way and East Raymond Avenue. Potomac Yard, a former rail yard, is currently undergoing redevelopment as a mixed-use area with housing, offices, and retail. Potomac Greens is a residential neighborhood consisting entirely of rowhouses.

All residents are expected to benefit from the provision of the planned transit improvements, which will improve overall access to activities within the corridor. However, in the build scenarios, all non-signalized intersections along Section B of the proposed transitway permit right in and right out movements only. Northbound left turns are permitted only at signalized intersections. This will eliminate certain left turning movements at two intersections in the Build scenario. These are described as follows:

US Route 1 and Hume Avenue – Motorists will be unable to make a left turn from the eastbound Hume Avenue to the northbound US Route 1. Residents along Hume Avenue must now go west to Dewitt Avenue to turn east on East Randolph Avenue before getting to Custis Avenue to make the left turn on to northbound US Route 1. Alternatively, they can go north along Montrose Avenue or Turner Avenue to Clifford Avenue to get to East Glebe Road to make the left turn on to northbound US Route 1.

US Route 1 and Potomac Avenue – The proposed configuration eliminates southbound left turns to provide a larger cross section for transit stops. Southbound motorists along US Route 1 will be unable to make a left turn on to Potomac Avenue. Residents along Windsor, Howell and Bellefonte Avenues desirous of making a left turn from southbound US Route 1 to go to the Potomac Yard Center would have to first get to Custis Avenue or Howell Avenue, via one of the north-south streets (Leslie Avenue or La Grande Avenue), where they can go straight through the intersection to get to the Potomac Yard Center.

M. Public Parkland and Recreation Areas

The proposed Section B of the transitway will be constructed within the existing right-of-way and will not result in any permanent use, proximity effects or temporary adverse effects to public parkland and recreation areas. Therefore, no Section 4(f) analysis is required.

The following parks were identified in the vicinity of the proposed transitway:

- Mount Jefferson Park & Greenway
- Simpson Stadium Park
- Landbay K Park (proposed)
- Potomac Yard Fields – privately owned by Potomac Yard Development LLC

In addition to the above, a new park has been proposed at Monroe Avenue and US Route 1and several new parks and open spaces are proposed within the Potomac Yard Center. The proposed station at Potomac Avenue would provide improved access to these parks but would not result in any permanent use, proximity effects or temporary adverse effects to public parkland and recreation areas. No impacts to public parklands and/or recreation areas have been identified. See Appendix 1: Figures 3 through 5. These detailed maps delineate property lines and US Route 1 right-of-way showing that park boundaries are not contiguous with the proposed transitway."

N. Wetland Impacts

No wetlands exist within Section B of the proposed transitway corridor; therefore there will be no impacts.

See Appendix 8 for Technical Memorandum Update for Water Resources and Coastal Zone Consistency Determination.

O. Floodplain Impacts

No floodplains exist within Section B of the proposed transitway corridor; therefore no impacts are expected.

P. Navigable Waterways, Water Quality and Coastal Zone Program Consistency

There are no navigable waterways crossed by the proposed action in Section B; therefore no impacts to navigable waterways will occur.

The proposed transitway would be accommodated within the existing impervious surface of the existing northbound travel lanes of US Route 1. As part of an ongoing separate project, US Route 1 will be reconfigured to accommodate all modes of travel and will minimally increase the amount of impervious surface within Section B. The City will adhere to all applicable local and state regulations pertaining to stormwater management.

Coordination with the Virginia Department of Environmental Quality (DEQ) through its Coastal Zone Management federal consistency review has not indicated that implementation of the transitway in Section B would be a contributing factor to degrading water quality.

Recent correspondence, dated November 30, 2010, confirms that DEQ's response to the 2006 federal consistency certification remains valid, provided there are no significant changes to the scope or alignment of Section B that would result in impacts to any of the enforceable policies of the Virginia Coastal Zone Management Program not described in 2006. Text from Part P of the 2007 DCE is below:

A Coastal Zone Consistency Management Certification application submitted to the Virginia Department of Environmental Quality has been approved (see Appendix 9), [of the 2007 DCE on CD].

See Appendix 8 for Technical Memorandum Update for Water Resources and Coastal Zone Consistency Determination.

Q. Impacts on Ecologically-Sensitive Areas and Endangered Species

There are no ecologically sensitive areas or endangered species identified within Section B of the proposed transitway; therefore no impacts are expected.

Text from Part Q of the 2007 DCE is below:

As stated in correspondence from the Virginia Department of Conservation and Recreation (VDCR) (see Appendix 10), [of the 2007 DCE on CD] *no adverse impact to natural heritage resources within the project area is anticipated.*
See Appendix 9 for Ecologically Sensitive Areas and Sensitive Species.

R. Impacts on Safety and Security

The proposed transitway will not have any impacts on safety and security.

Text from Part R of the 2007 DCE is below:

Conditions for pedestrians vary widely along the project corridor. In general, streets where existing bus service operates have sidewalks on both sides, and there are crosswalks at existing intersections. Other pedestrian amenities include countdown timers at signalized intersections and high visibility striping at crosswalks.

Many parts of the corridor are experiencing rapid change, with development being constructed or in design along the planned transit alignment. Typically, the development projects include generous sidewalks and landscaped areas that improve the pedestrian environment. Along the busway, bus lanes, and the transit corridor, particularly near station stops, pedestrian improvements will include restriped crosswalks, adequate sidewalks and ramps, and pedestrian countdown timers at signals. All of these improvements will lead to an enhanced pedestrian environment where transit passengers and local pedestrian traffic will have improved access to buildings and amenities along the planned transit route.

S. Impacts Caused by Construction

Potential construction impacts are discussed in the following paragraphs.

<u>Noise and Vibration</u>: No noise or vibration impact is expected as a result of project construction, although some minor nuisance noise might result. Project will comply with local noise ordinances.

<u>Utilities</u>: Construction operations are not anticipated to result in disruption of any energy utility to commercial, industrial, or residential customers in the vicinity.

<u>Disposal of Debris</u>: Project contract specifications will require the contractor to dispose construction generated solid waste. The disposal method will be either transportation of materials to an approved disposal facility or collection by an approved agent. No waste will be disposed or incinerated on site.

<u>Water Quality</u>: No direct alteration to wetlands, surface waters, floodplains, or resource protection areas (RPAs) is anticipated. The project requires a Virginia Pollutant Discharge Elimination System (VPDES) General Permit for Discharges of Stormwater from Construction Activities due to its disturbance of greater than one acre.
Due to work within the resource management area (RMA), an erosion and sediment control plan must be submitted to the City of Alexandria for review and approval prior to the start of work. During construction, maintaining site stability and controlling runoff from the work area are crucial to avoid the migration of pollutants from the various construction sites to nearby sensitive resource areas.

<u>Access and Distribution of Traffic</u>: Implementation would not require the closing of any street or create a major interference in the traffic flow of the surrounding roadways. Moreover, the construction of the Section B transitway will be within an established wide median

<u>Air Quality</u>: Direct emissions from construction equipment are not expected to produce adverse effects on local air quality provided that all equipment is properly operated and maintained. These potential impacts include direct emissions from construction equipment and trucks, increased emissions from motor vehicles on the streets due to disruption of traffic flow, and fugitive dust emissions. Emissions from project-related construction equipment and trucks would be much less than the total emissions from other industrial and transportation sources in the region, and therefore, are expected to be insignificant with respect to compliance with the NAAQS.

<u>Exposure to Hazardous Materials:</u> Prior to construction activities, the general contractor will prepare a Health and Safety Plan (HASP) including engineering controls to limit exposure for construction and utility workers.

Appendix 1

Figures

Appendix 1

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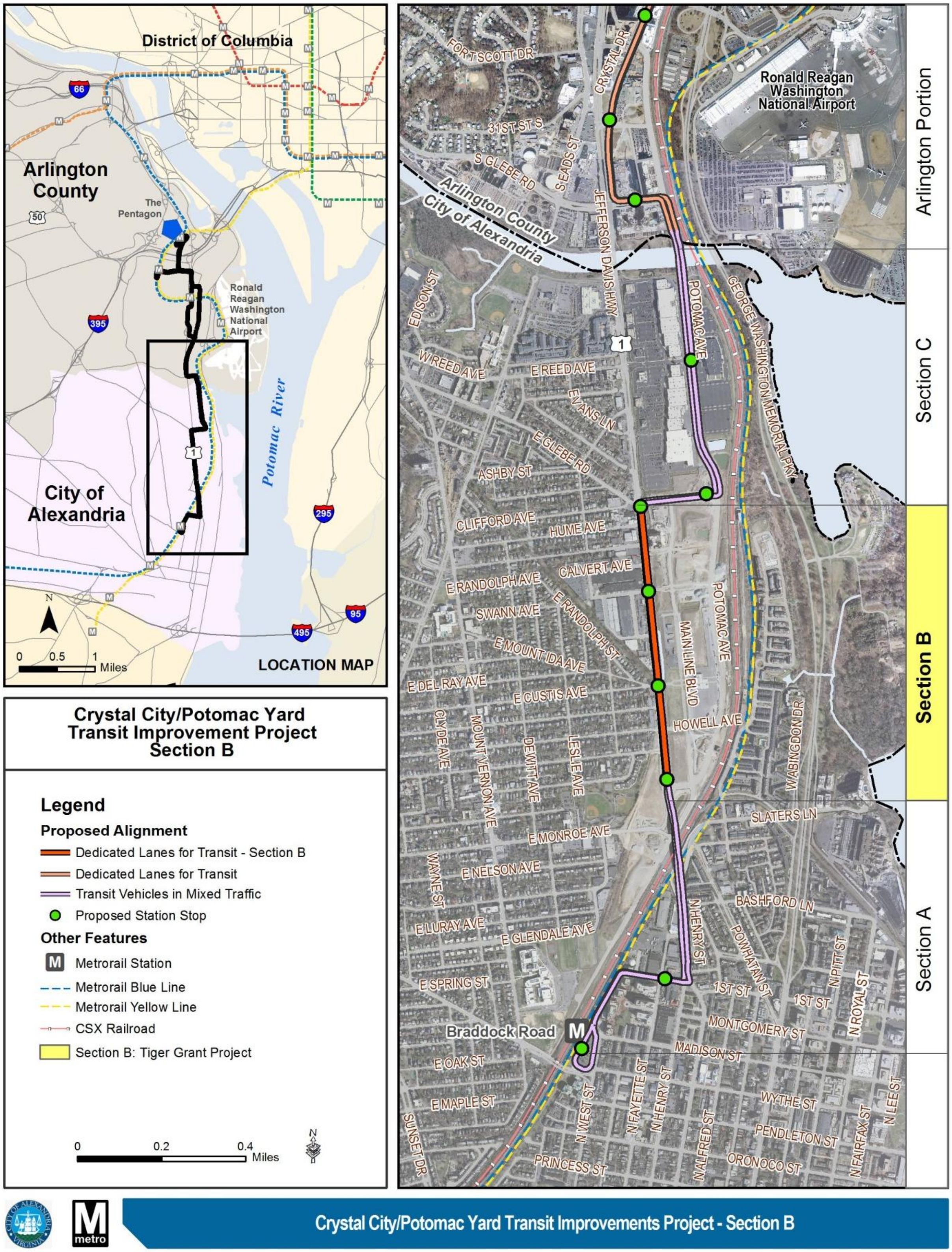
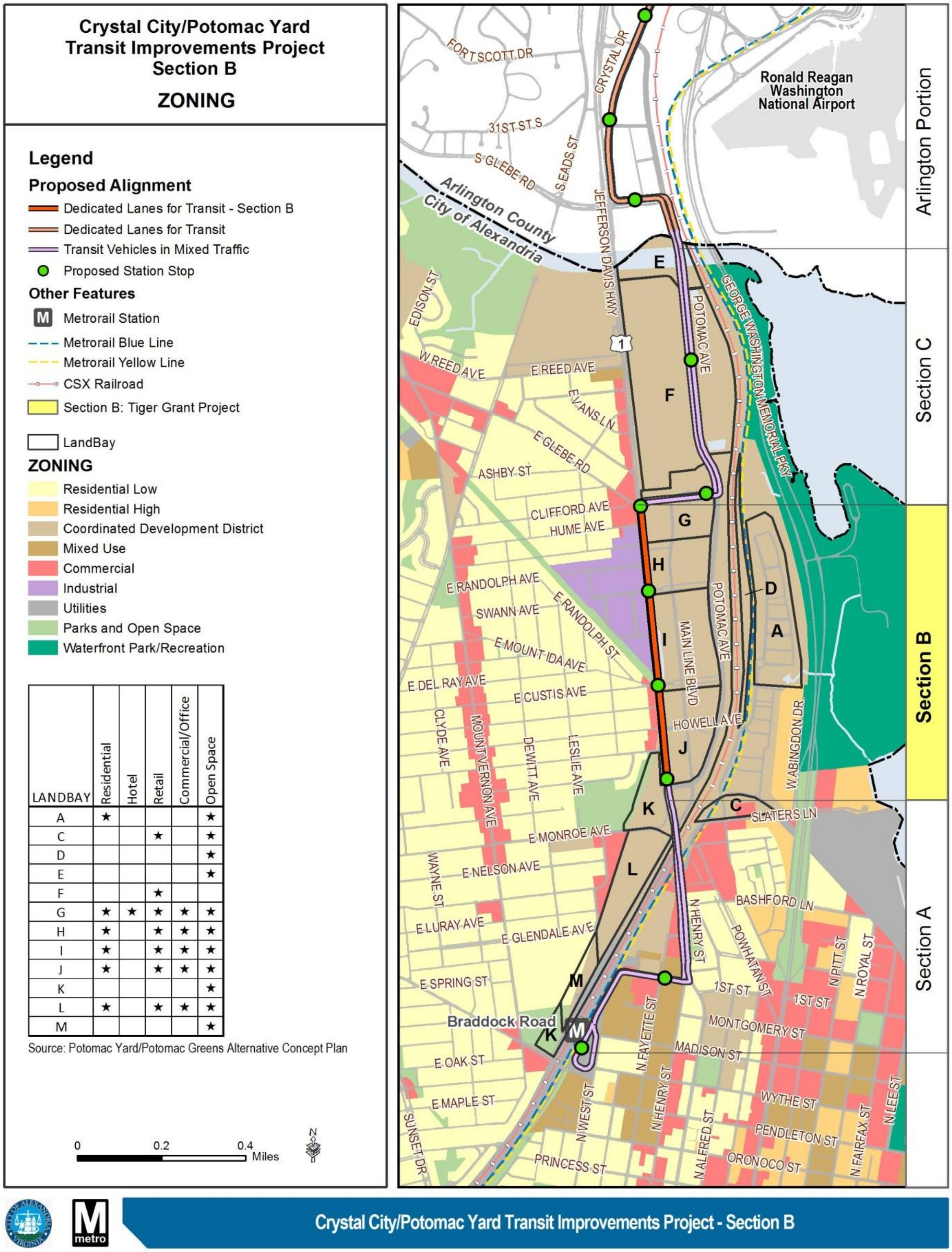
Appendix 1

Figure 1: Site Location & Planned Alignment



Appendix 1

Figure 2: Land Use & Zoning

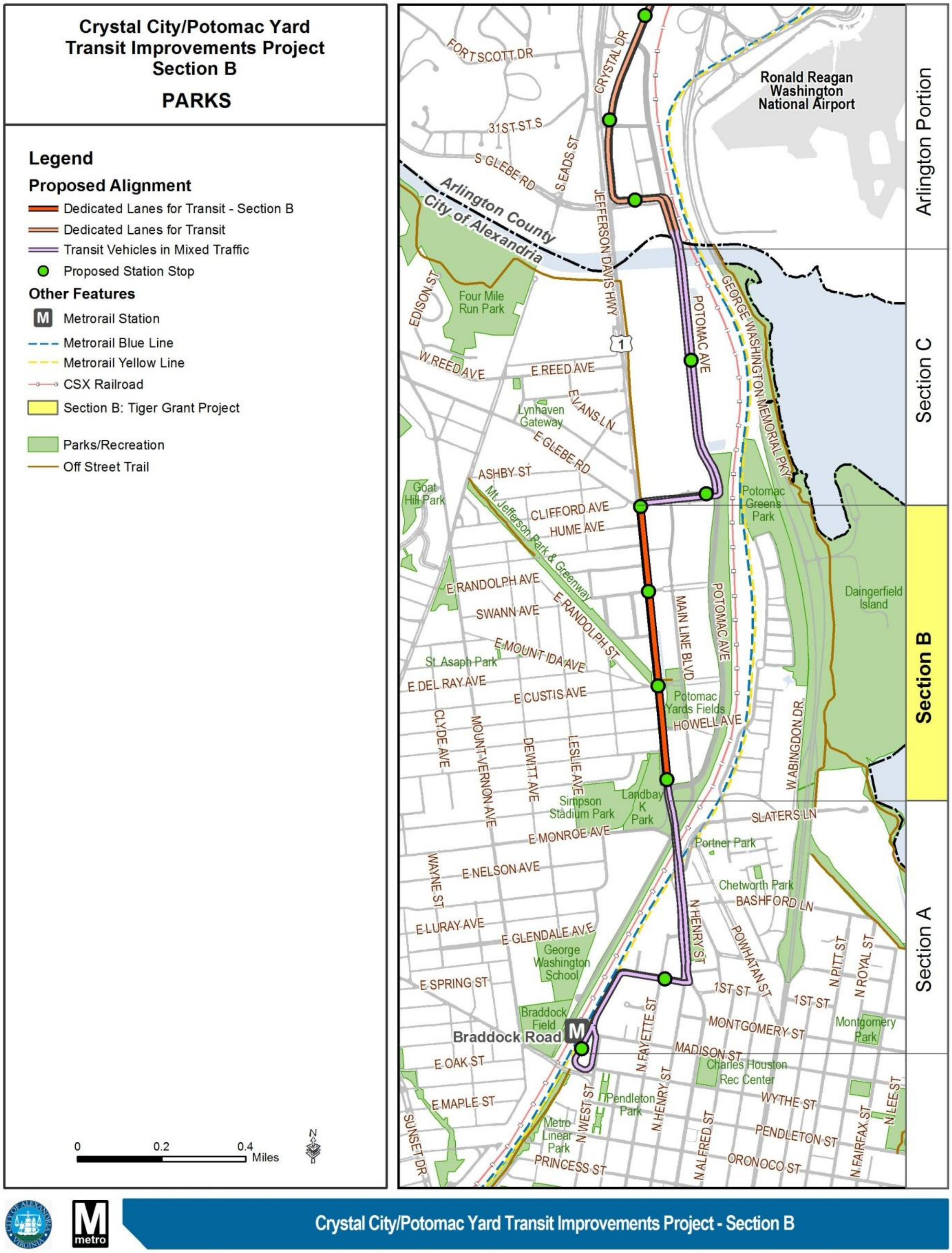


LANDBAY	Residential	Hotel	Retail	Commercial/Office	Open Space
A	★				★
C			★		★
D					★
E					★
F			★		
G	★	★	★	★	★
H	★		★	★	★
I	★		★	★	★
J	★		★	★	★
K					★
L	★		★	★	★
M					★

Source: Potomac Yard/Potomac Greens Alternative Concept Plan

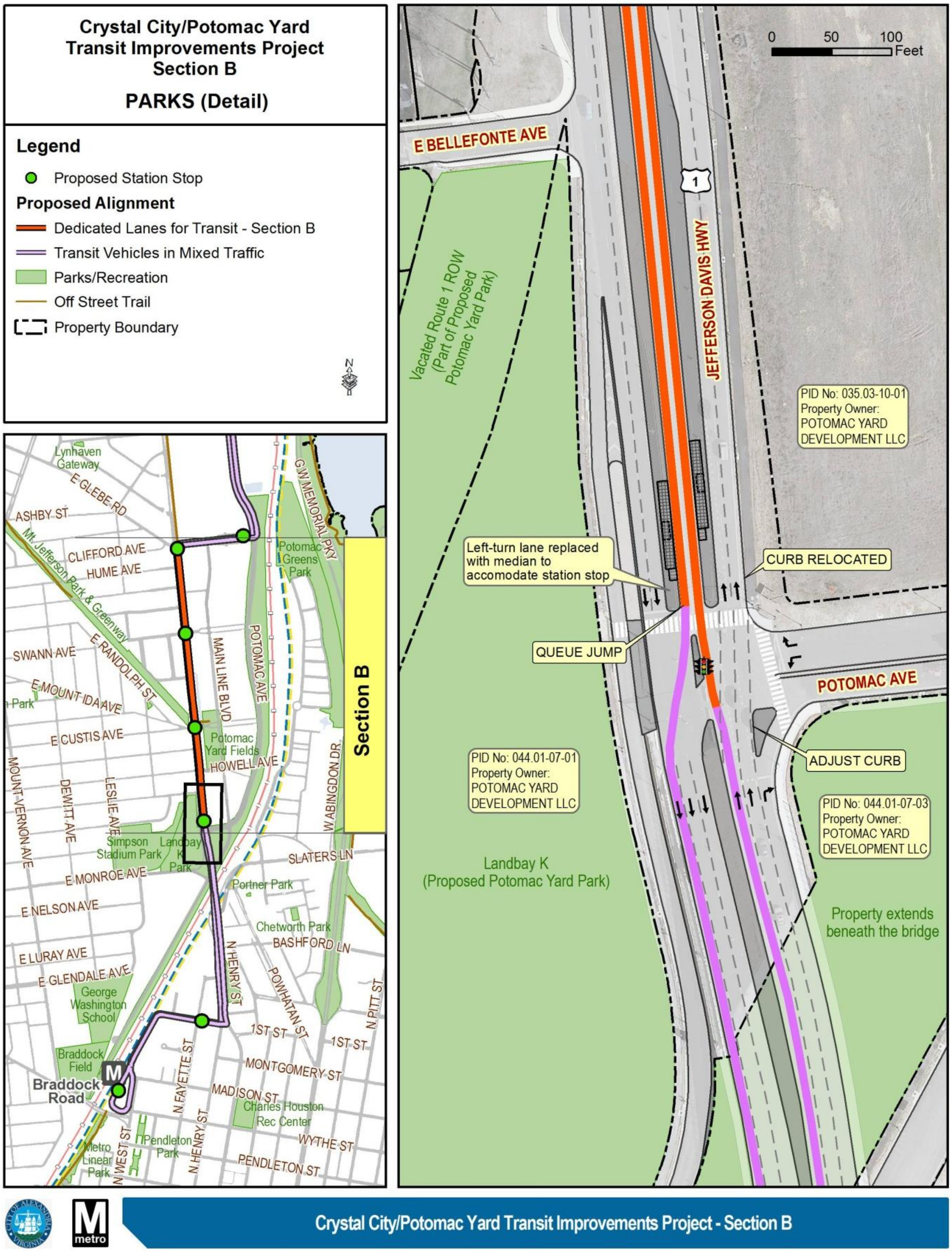
Appendix 1

Figure 3: Recreational & Park Facilities



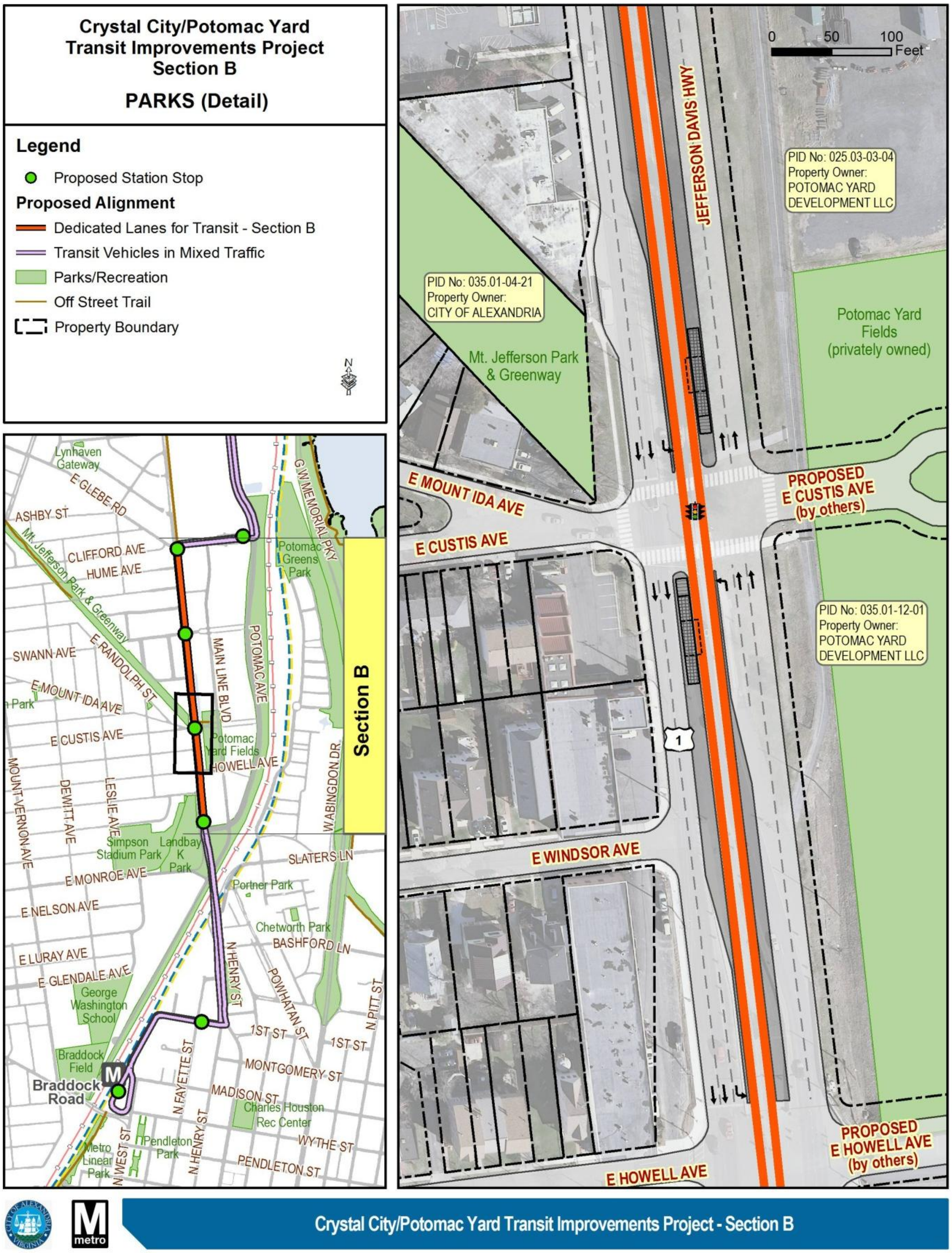
Appendix 1

Figure 4: Details 1- Recreational & Park Facilities



Appendix 1

Figure 5: Details 2- Recreational & Park Facilities



Technical Memorandum Update

Appendix 2

FY 2010-2015 Transportation Improvement Program (TIP) Air Quality Conformity Inputs

Technical Memorandum Update

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National Capital Region Transportation Planning Board
777 North Capitol Street, N.E., Suite 300, Washington, D.C. 20002-4290 (202) 962-3310 Fax: (202) 962-3202 TDD: (202) 962-3213

Item #5

MEMORANDUM

October 1, 2010

To: Transportation Planning Board

From: Ronald F. Kirby
Director, Department of
Transportation Planning

RE: Steering Committee Action

At its meeting of October 1, 2010, the TPB Steering Committee approved the following resolution:

- TPB SR8-2011 on an amendment to the FY2010-2015 Transportation Improvement Program (TIP) that is exempt from the air quality conformity requirement to include Transportation Investment Generating Economic Recovery (TIGER) funding for components of the National Capital Region Transportation Planning Board (TPB) Regional Priority Bus Project.

The TPB Bylaws provide that the Steering Committee "shall have the full authority to approve non-regionally significant items, and in such cases it shall advise the TPB of its action."

TPB SR8- 2011
October 1, 2010

NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD
777 North Capitol Street, N.E.
Washington, D.C. 20002

RESOLUTION ON AN AMENDMENT TO THE FY 2010- 2015 TRANSPORTATION IMPROVEMENT PROGRAM (TIP) THAT IS EXEMPT FROM THE AIR QUALITY CONFORMITY REQUIREMENT TO INCLUDE TRANSPORTATION INVESTMENT GENERATING ECONOMIC RECOVERY (TIGER) FUNDING FOR COMPONENTS OF THE NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD (TPB) REGIONAL PRIORITY BUS PROJECT

WHEREAS, the National Capital Region Transportation Planning Board (TPB), which is the metropolitan planning organization (MPO) for the Washington Region, has the responsibility under the provisions of Safe, Accountable, Flexible, and Efficient Transportation Equity Act - A Legacy for Users (SAFETEA-LU) for developing and carrying out a continuing, cooperative and comprehensive transportation planning process for the Metropolitan Area; and

WHEREAS, the TIP is required by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) as a basis and condition for all federal funding assistance to state, local and regional agencies for transportation improvements within the Washington planning area; and

WHEREAS, on July 15, 2009 the TPB adopted the FY 2010-2015 TIP; and

WHEREAS, on February 17, 2010, the TPB was awarded a $58.838 million grant from the Transportation Investment Generating Economic Recovery (TIGER) program under the American Recovery and Reinvestment Act (ARRA) for a Regional Priority Bus Project; and

WHEREAS, there are five sub-grantees that will receive funding to implement the project components of the regional priority bus project, including the City of Alexandria, the District of Columbia Department of Transportation (DDOT), the Maryland Department of Transportation (MDOT), the Potomac Rappahannock Transportation Commission (PRTC), and the Washington Metropolitan Area Transit Authority (WMATA); and

WHEREAS, on July 9, 2010 resolution SR1-2011, was approved to include $10.346 million in TIGER funding for the first two fiscal years of the FY 2010-2015 TIP; and

WHEREAS, in order for the FTA to obligate grant funding prior to the end of the calendar year, the FY 2010-2015 TIP needs to be amended to include $39.695 million in TIGER funding for the following project components that are exempt from the air quality conformity requirement, and described in the attached materials:

- Priority Bus Transit Improvements in Virginia – WMATA,
- Replacement and Rehabilitation of Bus Stops and Shelters in Prince George's County – WMATA,
- Replacement Buses and CAD/AVL System – PRTC,
- Priority Bus Transit Improvements – City of Alexandria,
- Potomac Yard Transit Improvements – City of Alexandria,
- Priority Bus Transit Enhancements – MDOT,
- Takoma/Langley Park Transit Center – MDOT,
- Real-Time Bus Information (Nextbus) – DDOT; and

WHEREAS, these project components are already included in the air quality conformity analysis or are exempt from the air quality conformity requirement, as defined in Environmental Protection Agency (EPA) regulations "40 CFR Parts 51 and 93 Transportation Conformity Rule Amendments: Flexibility and Streamlining; Final Rule," issued in the May 6, 2005, *Federal Register;*

NOW, THEREFORE, BE IT RESOLVED THAT the National Capital Region Transportation Planning Board amends the FY 2010-2015 TIP to add $39.695 million in TIGER grant funding, as described in the attached materials, for the following project components:

- Priority Bus Transit Improvements in Virginia – WMATA,
- Replacement and Rehabilitation of Bus Stops and Shelters in Prince George's County – WMATA,
- Replacement Buses and CAD/AVL System – PRTC,
- Priority Bus Transit Improvements – City of Alexandria,
- Potomac Yard Transit Improvements – City of Alexandria,
- Priority Bus Transit Enhancements – MDOT,
- Takoma/Langley Park Transit Center – MDOT,
- Real-Time Bus Information (Nextbus) – DDOT.

Adopted by the Steering Committee of the Transportation Planning Board at its regular meeting on October 1, 2010.

TRANSPORTATION IMPROVEMENT PROGRAM
CAPITAL COSTS (in $1,000)

Transit

TIP ID: 5780 Agency ID: Title: WMATA: Priority Bus Transit Improvements in Virginia Complete: 2011

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility:	ARRA/TIGER	100/0/0		1,369 c	8,818 c					10,187
From:									*Total Funds:*	*10,187*
To:										

Description: This project will pay for design and construction of bus shelter and pedestrian access improvements at the Pentagon and Franconia-Springfield Metrorail stations, as well as real-time bus information along VA-7 (Leesburg Pike) and at the two stations.

AM- 206 Amendment - Add Project Approved on: 7/9/2010
Amend project to FY 2010-2015 TIP with $4.484 million in ARRA/TIGER funding.

AM- 308 Amendment - Modify Funding Approved on: 10/1/2010
Amended to add $5.703 million in ARRA/TIGER funds to FY 11.

TIP ID: 5777 Agency ID: Title: WMATA: Replace/Rehab Bus Stops and Shelters in Prince George's County Complete: 2011

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility:	ARRA/TIGER	100/0/0		8 c	123 c	69 c				200
From:									*Total Funds:*	*200*
To:										

Description: This project will refurbish or replace bus stops and shelters at the Addison Road and Southern Avenue Metrorail stations, and on Branch Avenue, Iverson Street, and Audrey Lane.

AM- 209 Amendment - Add Project Approved on: 7/9/2010
Amend project to FY 2010-2015 TIP with $68,000 in ARRA/TIGER funding.

AM- 311 Amendment - Modify Funding Approved on: 10/1/2010
Amended to add $132,000 in ARRA/TIGER funds to FY 11 and FY 12.

TIP ID: 5779 Agency ID: Title: PRTC: Replacement Buses and CAD/AVL System Complete: 2011

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility:	ARRA/TIGER	100/0/0			4,524 c	4,619 c	842 c			9,985
From:									*Total Funds:*	*9,985*
To:										

Description: This project will pay for the procurement of 13 replacement buses and acquisition of a CAD/AVL system for management of PRTC buses.

AM- 207 Amendment - Add Project Approved on: 7/9/2010
Amend project to FY 2010-2015 TIP with $2.654 million in ARRA/TIGER funding.

AM- 309 Amendment - Modify Funding Approved on: 10/1/2010
Amended to add $7.331 million in ARRA/TIGER funds to FYs 11, 12 and 13.

NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD
TRANSPORTATION IMPROVEMENT PROGRAM
CAPITAL COSTS (in $1,000)

TIP ID: 5778 Agency ID: Title: **City of Alexandria: Van Dorn – Pentagon Rapid Bus** Complete: **2011**

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility:	ARRA/TIGER	100/0/0		6 c	223 c	46 c				275
From:										
To:									*Total Funds:*	***275***

Description: This project will install Transit Signal Priority and 2 queue jump lanes and 2 super stops along Van Dorn and Beauregard Streets.

AM- 208 Amendment - Add Project **Approved on:** 7/9/2010
Amend project to FY 2010-2015 TIP with $152,000 in ARRA/TIGER funding.

AM- 310 Amendment - Modify Funding **Approved on:** 10/1/2010
Amended to add $123,000 in ARRA/TIGER funds to FY 11 and FY 12.

TIP ID: 5789 Agency ID: **ALEX0005** Title: **Potomac Yard Transit Improvements in City of Alexandria (US 1 Transitway)** Complete: **2013**

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility: Potomac Yard Transit Improvements	ARRA/TIGER	100/0/0		75 c	208 c	2,422 c	5,803 c			8,508
From: Monroe Avenue Bridge	Section 5309-B	80/20/0	581 a 324 c	343 c						343
To: East Glebe Road									*Total Funds:*	***8,851***

Description: Develop bus way and transit service improvements in the corridor, Monroe Avenue Bridge to East Glebe Road. This project is also listed in the VDOT portion of the TIP as TIP ID 3952.

AM- 174 Amendment - Add New Project **Approved on:** 7/9/2010
Amended to add $283,000 in ARRA/TIGER funds to FY 11 and FY 12.

AM- 315 Amendment - Modify Funding **Approved on:** 10/1/2010
Amended to add $8.225 million in ARRA/TIGER funds to FY 12 and FY 13.

TIP ID: 5776 Agency ID: Title: **MDOT: Bus Corridor TSP and Real-Time Information** Complete: **2011**

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility:	ARRA/TIGER	100/0/0		7 c	523 c	383 c	304 c	277 c	165 c	1,659
From:									*Total Funds:*	***1,659***
To:										

Description: This project will install queue jump lanes, real-time bus information, and miscellaneous bus stop and shelter improvements along University Boulevard, US Route 1, and Viers Mill Road.

AM- 210 Amendment - Add Project **Approved on:** 7/9/2010
Amend project to FY 2010-2015 TIP with $463,000 in ARRA/TIGER funding.

AM- 312 Amendment - Modify Funding **Approved on:** 10/1/2010
Amended to add $1.196 million in ARRA/TIGER funds to FY 11 through FY 15.

TIP ID: 3263 Agency ID: 1164 Title: Takoma/Langley Park Transit Center Complete: 2011

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility:	ARRA/TIGER	100/0/0				2,394 c	8,671 c	1,236 c		12,301
From:	State	0/100/0	1,063 a	330 a	4,037 c					11,587
To:				7,220 c						
									Total Funds:	*23,888*

Description: Construct transit center in Langley Park at the crossroads area of the MD 193 and MD 650 intersection. This is a joint SHA/MTA project.

AM- 316 Amendment - Modify Funding **Approved on:** 10/1/2010
Amended to add $12.301 million in ARRA/TIGER funds to FY 12 through FY 14.

TIP ID: 5775 Agency ID: Title: DDOT: Bus Corridor TSP and Real-Time Information Complete: 2011

	Source	Fed/St/Loc	Previous Funding	FY 10	FY 11	FY 12	FY 13	FY14	FY 15	Source Total
Facility:	ARRA/TIGER	100/0/0		622 c	2,947 c	2,916 c	183 c	137 c		6,805
From:									*Total Funds:*	*6,805*
To:										

Description: This project will install real-time bus information (Nextbus) at bus stops along major regional bus corridors in the District of Columbia, including 16th Street NW, Georgia Avenue, Wisconsin Avenue, and H Street/Benning Road, as well as provide for the construction of miscellaneous curb extensions and a segment of bus-only lane on Georgia Avenue.

AM- 211 Amendment - Add Project **Approved on:** 7/9/2010
Amend project to FY 2010-2015 TIP with $2.063 million in ARRA/TIGER funding.

AM- 313 Amendment - Modify Funding **Approved on:** 10/1/2010
Amended to add $4.742 million in ARRA/TIGER funds to FY 11 through FY 14.

Technical Memorandum Update

Appendix 3

Traffic and Transportation Effects

Technical Memorandum Update

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Technical Memorandum Update

Appendix 3

Transportation Effects

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Technical Memorandum Update

1. INTRODUCTION

This technical memorandum provides an update for transportation effects resulting from implementation of Section B of the Crystal City-Potomac Yard (CCPY) transitway. A Transportation Effects Technical Memorandum for the 5-mile transit corridor (including Section B) was previously completed in December 2006 (see Appendix 3 of the 2007 Documented Categorical Exclusion on attached CD). The City of Alexandria updated North Potomac Yard Small Area Plan in 2009. The updated plan establishes new guidelines for development in the study area and includes recommendations to increase allowable densities, concentrate retail, encourage mixed uses, limit parking and provide additional open spaces, see Part D in the Documented Categorical Exclusion (DCE) for Section B of the CCPY transitway corridor and Appendix 1, Figure 2: Zoning Map.

Although these changes are applicable to the entire Potomac Yard corridor within the City of Alexandria, this update is limited to the section of US Route 1 extending from the Monroe Avenue Bridge to East Glebe Road, known as Section B of the CCPY transitway. This update serves as an Appendix to the DCE for Section B of the transitway corridor. It documents the existing and future transit services, traffic conditions, pedestrian effects and parking and access effects within the Section B of the transitway alignment.

2. TRANSIT OPERATIONS AND PROJECT TRANSIT SERVICE

A number of bus routes are operated along the Potomac Yard corridor by the Washington Metropolitan Area transit Authority (WMATA) and the Alexandria Transit Company's DASH service. Metrobus routes 9A and 9E are the main existing services that operate along Section B. Table 1 lists the existing transit services in the corridor.

Table 1: Existing Bus Routes to be included in the 2015 & 2030 No-Build & Build Scenarios

Route	Portion of Corridor Served	Weekdays Headways AM/Mid/PM
9A	North Old Town to the Pentagon via US Route 1 and South Eads Street	30/30/30
9E	Braddock Road Metro to the Pentagon Metro	5 trips in AM – SB only 6 trips in PM – NB only
10A	Braddock Road Metro to the Pentagon Metro	30/30/30
10B	Braddock Road Metro to Ballston-MU Metro	30/30/30
10E	Braddock Road Metrorail Station, Del Ray, & Pentagon	8 trips in AM – NB only 8 trips in PM – SB only
DASH 3	Braddock Road and Pentagon Metro	20/--/20
DASH 3/4	Braddock Road Metrorail Station	--/60/60
DASH 4	North Old Town, Braddock Road and Pentagon Metro	20/--/20
DASH 10	Potomac Yard Shopping Center	30/60/30
DASH AT 12	Alexandria Town Center and Potomac Yard Shopping Center	15/30/15
DASH AT 14	Monroe Ave. Bridge, Main Street, Alexandria Town Center, Potomac Yard Shopping Center	15/30/15
DASH Potomac Yard Circulator	Monroe Ave., Main Street, Alexandria Town Center, Potomac Yard Shopping Center, South Glebe Rd. in Arlington	15/15/15

The Metrobus 9S does not serve Section B of the proposed transitway corridor and is not included in Table 1 above. Currently 9S runs southbound on Potomac Avenue to South Glebe Road where it turns on to US Route 1 to go north. After the completion of the Potomac Avenue Bridge, the 9S route is expected to go further south to the Potomac Yard Shopping Center. This proposed route is depicted in the No Build conditions on Figure 1. Arlington Transit (ART) buses do not serve Section B of the proposed transitway corridor and are not included in Table 1 above. However ART buses serve the CCPY corridor and are depicted in Figures 1 & 2, which show the entire CCPY corridor.

2.1 No Build and Build Scenarios

The design for the reconstruction and improvement of US Route 1, a separate ongoing project, is nearly 100% complete. This project involves the construction of a wide landscaped median in the place of existing northbound lanes and relocating the northbound lanes further east. These improvements, including the intersections at Howell, Custis and Potomac Avenues, will be constructed in mid-2011. Swann Avenue will be constructed after 2015. Low-impact design techniques that reduce runoff and provide water quality treatment are required to be incorporated as part of the street design. These improvements will promote a pedestrian-friendly environment and stormwater improvements as recommended by the North Potomac Yard Small Area Plan. The dedicated transitway will be accommodated within this newly created landscaped median. However, these improvements predate the transitway project and are considered a part of the No Build conditions.

The transit operations plan for the 2015 No Build scenario assumes continuation of 9A and 9E services and addition of a new 9X service, all operating in mixed traffic along the corridor. The net service frequency in 2015 would be six buses per hour during peak periods and four buses in off-peak. For the 2030 No Build scenario, the 9X service is assumed to be split into two separate routes, 9X1 serving the Pentagon and 9X2 serving Pentagon City. The net service frequency in 2030 would be 22 buses per hour in the peak and 14 buses in the off-peak.

In the Build scenario (2015 and 2030), the 9A and 9E services continue operation as in the No Build scenario, except that these services use dedicated transit lanes in Section B. For the 2015 Build scenario, the 9X service is replaced by a CCPY "Red Line" route that uses the dedicated transit lanes. The resulting net service frequency for 2015 in Section B is six buses per hour during peak periods and four buses in off-peak. In the 2030 Build scenario, the 9X1 is replaced by CCPY "Blue Line" service at five-minute peak headways; the 9X2 is replaced by CCPY "Red Line" service, also at five-minute headways. The net service frequency for 2030 in Section B is 26 buses per hour during peak periods and 18 buses in off-peak.

Table 2 summarizes the No Build and Build scenarios in 2015 and 2030 whereas Figures 1 and 2 show these scenarios graphically.

2.2 Assumed Physical Improvements for Build Scenario

Several physical changes will be undertaken as part of the transit improvements in the Build scenario. The transitway project work also involves adjustments to lane configurations and intersection geometries, and upgrades to pedestrian and passenger facilities. Appendix 11 includes a set of general plans that details improvements associated with the transitway project.

Table 2: No Build and Build Scenarios: 9A, 9E and 9X Operations

	Descriptions	No Build	Build (Proposed Action)
2015			
9A	Serves downtown Alexandria, Crystal City providing connection between the Metrorail stations of Huntington and Pentagon	• Same frequency as today. • Runs in mixed operations only. • Operates at peak/off-peak headway of 30 minutes	• Same frequency as No Build. • Runs in dedicated transit lanes
9E	Serves Alexandria and Potomac Yard providing connection between the Metrorail stations of Braddock Road and Pentagon	• Same frequency as today. • Runs in mixed operations only. • Operates 5 buses in the AM peak SB only; 6 buses in the PM peak NB only	• Same frequency as No Build. • Runs in dedicated transit lanes
9X	Serves as the core service of the entire CCPY transitway between Braddock and Pentagon City. X is the designation for Metrobus Priority Corridor.	• Operates at peak/off-peak headways of 15/30 minutes. • Runs from Braddock Station to Pentagon City following through the entire corridor in mixed operations	• Same frequency as No Build. • 9X to be replaced by Red Line, running in dedicated transit lanes
Net	Combined headways in Section B	• Overall peak/off-peak headways of 10/15 minutes	• Same frequency as No Build.
Other existing Metrobus services will continue with current frequency and routing			
2030			
9A	Serves Old Town Alexandria, Crystal City providing connection between the Metrorail stations of Huntington and Pentagon	• Same frequency as today • Runs in mixed traffic	• Same frequency as No Build. • Runs in dedicated transit lanes
9E	Serves Alexandria and Potomac Yard providing connection between the Metrorail stations of Braddock Road and Pentagon	• Same frequency as today • Runs in mixed traffic	• Same frequency as No Build. • Runs in dedicated transit lanes
9X	In No Build Scenario only –9X will be split into 2 routes: 9X1 and 9X2, with 9X1 terminating at Pentagon and 9X2 at Pentagon City	• 9X1 to Pentagon with peak/off-peak headways of 6/10 minutes. • 9X2 to Pentagon City with peak/off-peak headways of 6/10 minutes	• 9X1 to be replaced by the Blue Line at peak/off-peak headways of 5/7minutes. • 9X2 to be replaced by Red Line with headways of 5 minutes
Net	Combined headways in Section B	• Overall headways of just under 3 minutes for peak periods and just over 4 minutes for off-peak	• Overall headways of just over 2 minutes for peak periods and just over 3 minutes for off-peak
Other existing Metrobus services will continue with current frequency and routing			

Figure 1: No Build Bus Routes

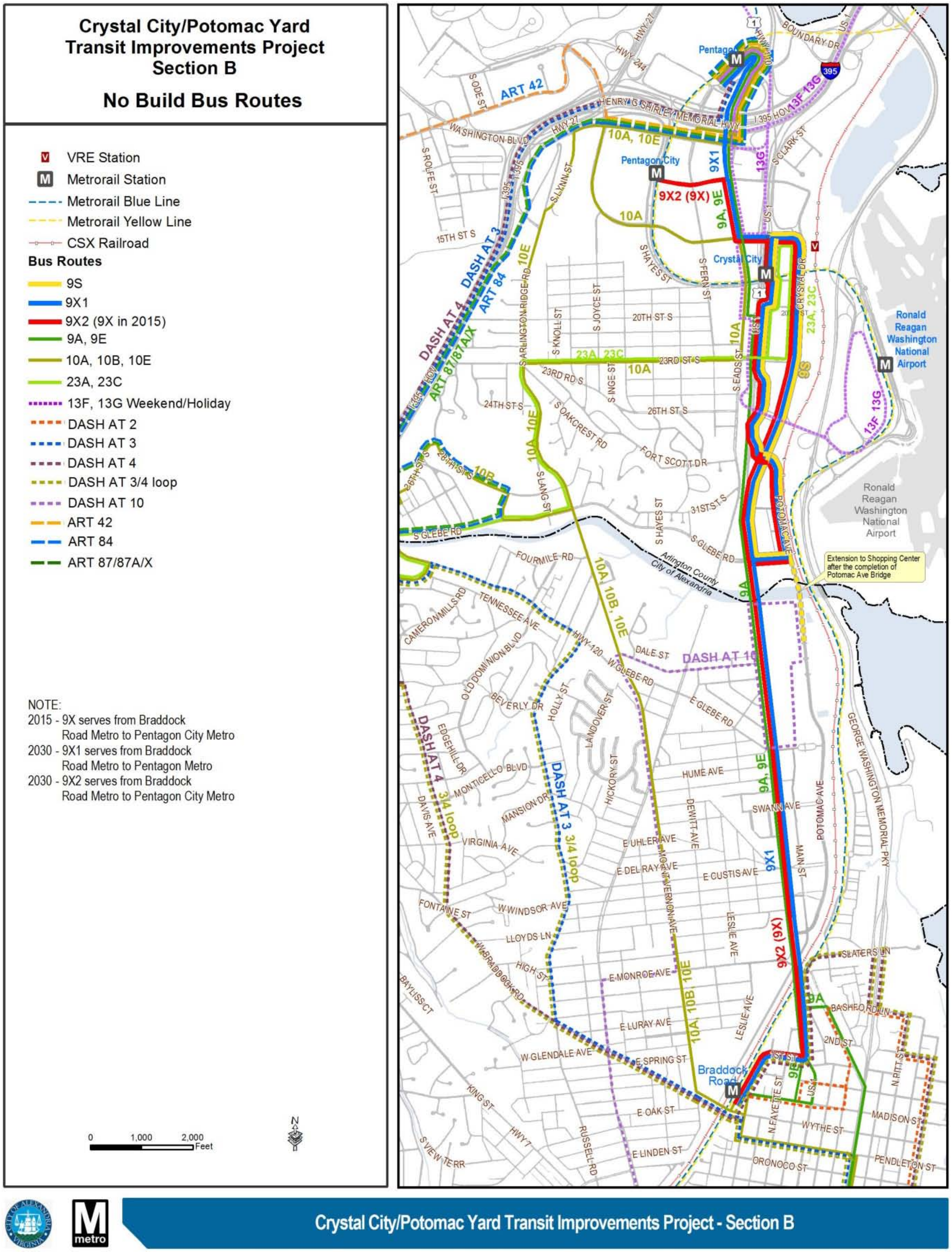

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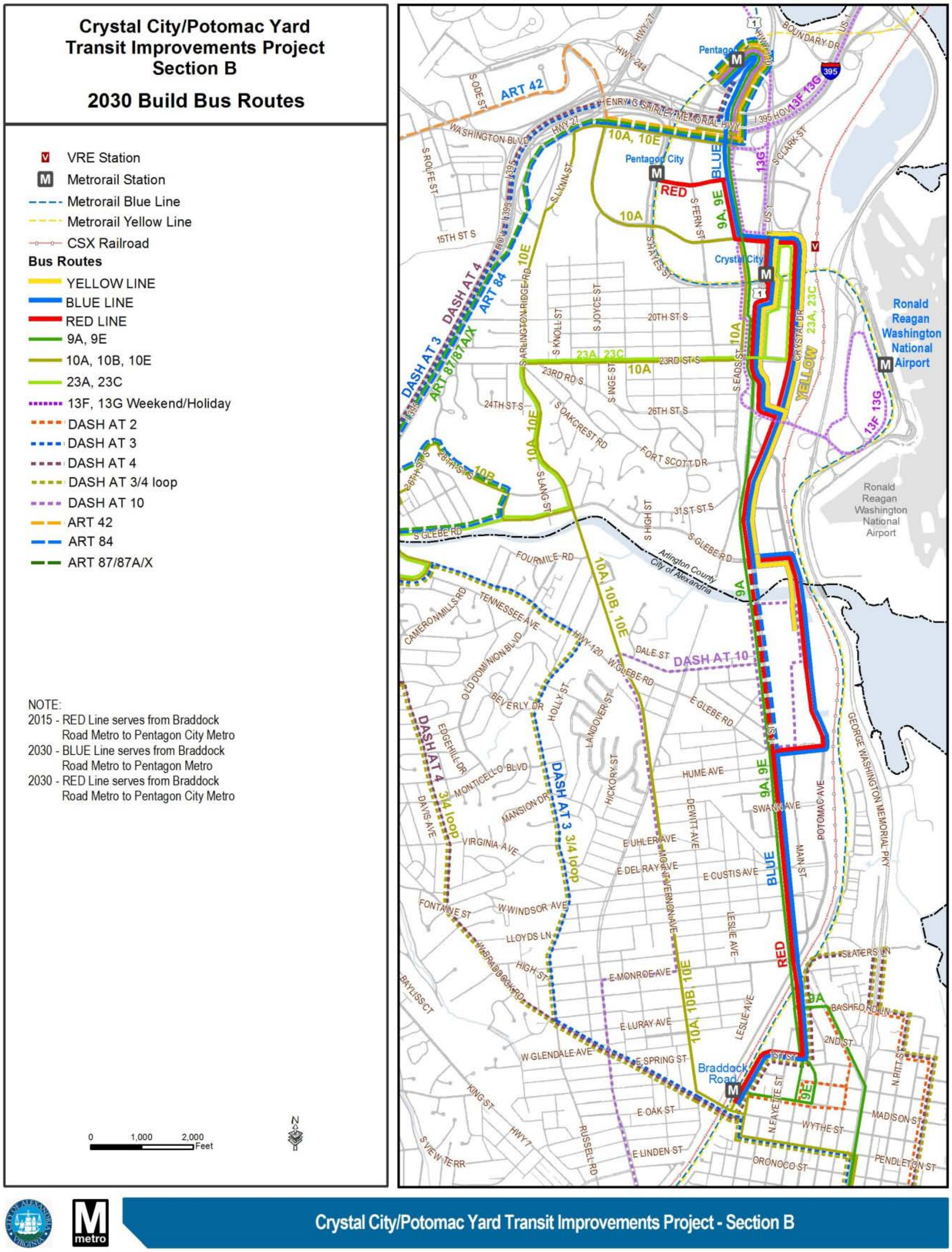
Figure 2: Build Bus Routes



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2.3 Transit Effects of the Build Scenarios

The buses will operate in dedicated transitway located in the median of US Route 1. This will streamline the transit flow, improve travel time savings and improve the reliability of the service. A faster and a reliable transit system is likely to attract choice riders. Traffic flow is also likely to improve since motorists would not vie with drivers of transit vehicles for the same right-of-way. These factors combine to improve air quality in the region by encouraging transit and improving the speeds of other vehicles.

The proposed transit stops are located ¼ mile apart at the following major intersections:

- US Route 1 and East Glebe Road
- US Route 1 and Swann Avenue
- US Route 1 and East Custis Avenue
- US Route 1 and Potomac Avenue

The proposed stops have generous boarding areas with shelters and passenger amenities such as real-time bus arrival information.

3. TRAFFIC ANALYSIS

An updated traffic analysis was performed to reflect the changes and updates since 2006. This section documents the build and no-build traffic conditions for the years 2015 and 2030 in Section B of the Potomac Yard transit corridor. The future year analyses include level of service (LOS) and delays for four study intersections in the AM and PM peaks. The study intersections are as follows:

- US Route 1 and East Glebe Road
- US Route 1 and Swann Avenue
- US Route 1 and East Custis Avenue
- US Route 1 and Howell Avenue
- US Route 1 and Potomac Avenue

3.1 Existing Conditions

The City of Alexandria provided 2009 turning movement counts at the study intersections for AM and PM peak hours. Synchro software was used to develop existing conditions analysis based on these turning movement counts, existing lanes, and existing traffic control at the study intersections. The analysis shows that existing vehicular traffic conditions along US Route 1 and at most intersections adjacent to Potomac Yard are acceptable.

Table 3: Operational Analysis Results for Existing Conditions

Intersections	Measures	Existing AM	Existing PM
US 1/E. Glebe Road	Delay	23	29
	LOS	C	C
US 1/Swann Avenue	Delay	3	3
	LOS	A	A
US 1/E. Custis Avenue	Delay	11	5
	LOS	B	A
US 1/Howell Avenue	Delay	11	11
	LOS	B	B
US 1/Potomac Avenue	Delay	11	6
	LOS	B	A

3.2 Projected Traffic Conditions

2030 PM peak hour traffic volumes were obtained from the Potomac Yard Multimodal Transportation Study dated June 2010 by Kimley-Horn & Associates. This study uses the most recent land use projections that were documented in the 2007 Wells and Associates Potomac Yard Traffic Impact Assessment and approved by the City for all landbays in Potomac Yard as well as adjacent properties.

These study results and land use assumptions were used in the current analysis to develop 2015 AM, PM and 2030 AM peak hour traffic volumes at the study intersections. Other key assumptions are as follows:

2015

- 2009 existing volumes provided by the City of Alexandria were used as base.
- Diversion for completed Potomac Avenue is assumed to be equal to 20 percent of the existing PM volume on US Route 1 at the Potomac Avenue intersection (approved methodology from the Wells & Associates Potomac Yard Traffic Impact Assessment (2007) and used for the Potomac Yard Landbay F/L transportation study).
- Annual growth of 2.4 percent for the US Route 1 through movements, of which 70 percent is applied along US Route 1 and 30 percent is applied along Potomac Avenue.
- Addition of two-thirds of the approved and unbuilt traffic volumes from the (2007) Wells & Associates Potomac Yard Traffic Impact Assessment.
- Addition of one-third of the Potomac Yard (south) traffic volumes from the (2007) Wells & Associates Potomac Yard Traffic Impact Assessment (with small adjustments to distribute turning volumes to and from various US Route 1 intersections).

2030

- 2009 existing volumes provided by the City of Alexandria were used as base.
- Diversion for completed Potomac Avenue is assumed to be equal to 20 percent of the existing PM volume on US Route 1 at the Potomac Avenue intersection.
- Growth of 10 percent for the US Route 1 through movements, of which 70 percent is applied along US Route 1 and 30 percent is applied along Potomac Avenue.
- Addition of approved and unbuilt traffic volumes from the (2007) Wells & Associates Potomac Yard Traffic Impact Assessment.
- Addition of Potomac Yard (south) traffic volumes from the (2007) Wells & Associates Potomac Yard Traffic Impact Assessment (with small adjustments to distribute turning volumes to various US Route 1 intersections).
- Removal of existing traffic volumes associated with retail at Potomac Yard Landbay F.
- Addition of traffic volumes related to the redevelopment of Landbay F and development of Landbay L, according to the Potomac Yard Multimodal transportation Study, completed in June 2010.

3.3 No Build Scenarios

No Build conditions represent the baseline conditions for comparison with and without the proposed transitway.

3.4 Build Scenario

Dedicated transit lanes would be created along US Route 1 from the Monroe Avenue Bridge to the intersection with East Glebe Road. The Build conditions also include Queue Jump for the transit vehicles along southbound US Route 1 at Potomac Avenue. All left turns from southbound US Route 1 at this intersection have been reassigned to Howell Avenue to accommodate the station stop. The Build scenario was evaluated in the AM and PM peak periods for 2015 and 2030 forecast years using Synchro traffic analysis software.

3.5 Traffic Effects

In most cases, the delays and LOS are comparable between No Build and Build conditions, showing that the proposed transitway has minimal effects on traffic, see Table 4. Specific impacts at each of the study intersections are discussed in detail.

US Route 1/East Glebe Road - In 2015, there are no changes to the LOS at this intersection. The dedicated transit lanes not only improve the flow of transit vehicles but also have a positive impact on the flow of traffic, regardless of the background traffic growth. In 2030, there is an increase in delays at this intersection. This is due to the turning movement of the transit vehicles from northbound US Route 1 to East Glebe Road. This movement would require the northbound traffic to wait longer causing the delay. This is more pronounced in the AM peak (LOS decline from D to E) because northbound is the peak direction and this traffic has to stop more frequently to allow for the transit vehicles to turn from northbound US Route 1 on to East Glebe Road. In the PM peak the delay increase is only five seconds because southbound traffic, which is the peak direction, is not impacted by the turning movement of the transit vehicles.

Table 4: Operational Analysis Results for No-Build and Build in 2015 & 2030

Intersections	Measures	2015 AM Peak		2015 PM Peak		2030 AM Peak		2030 PM Peak	
		No Build	Build	No Build	Build	No Build	Build	No Build	Build
US 1/E. Glebe Road	Delay	23	23	29	27	42	74	75	80
	LOS	C	C	C	C	D	E	E	E
US 1/Swann Avenue	Delay	5	13	4	11	8	8	8	11
	LOS	A	B	A	B	A	A	A	B
US 1/E. Custis Avenue	Delay	8	14	9	15	16	18	17	11
	LOS	A	B	A	B	B	B	B	B
US 1/Howell Avenue	Delay	16	16	15	18	26	33	40	36
	LOS	B	B	B	B	C	C	D	D
US 1 / Potomac Ave.	Delay	17	15	18	20	28	23	34	48
	LOS	B	B	B	B	C	C	C	D

US Route1/Swann Avenue and US Route1/Custis Avenue - In both 2015 and 2030, the delays and LOS at these intersections show only a marginal decline. This is because the transit vehicles travel straight and have no impact on the flow of traffic.

US Route 1/Howell Avenue – The 2030 Build conditions show a slightly longer delay at this intersection. This is due to the left turning movement from southbound US Route 1. All left turning movements from Potomac Avenue have been reassigned to this intersection.

US Route 1/Potomac Avenue - In 2015, the Build conditions show a slight decrease in delays, although there is no change in LOS. All southbound left turns from US Route 1 have been reassigned to Howell Avenue. In 2030 AM peak, the results are similar – reduced delays. However, in the PM peak, the delays are longer and LOS declines from D to E. This is due to the number of transit vehicles per hour and the proposed queue jump in the southbound direction. There are 24 transit vehicles per hour in 2030 and southbound is the peak direction in the PM. The queue jump requires the peak direction traffic to stop frequently leading to the longer delays and the decline in LOS.

4. PEDESTRIAN EFFECTS

Sidewalks exist along the western side of US Route 1 throughout the length of Section B. Marked crosswalks are located at intersections with East Glebe Road, Howell Avenue and Potomac Avenue. Other pedestrian amenities include countdown timers at signalized intersections.

The conditions for pedestrians will improve with the planned improvements. Planned reconstruction of

US Route 1 (part of a separate project) will include expanded sidewalks and crosswalks. The new configuration will provide for improved amenities including pedestrian refuge areas. The signal phases are adjusted to accommodate pedestrian clearance times to ensure the safety and convenience of users.

The Build scenario includes passenger station stops and facilities which will draw attention to pedestrian activity along US Route 1, whereas for the No-Build alternative, transit service would be comparable in intensity, but would lack the physical facilities to increase comfort and visibility for transit users. With the median location of transit lanes, transit riders boarding and alighting in Section B would cross north- or southbound lanes of US Route 1. The trade-offs between median and curbside transit lanes were discussed at length in stakeholder and public forums in 2007 and 2008; results of the forums are described in Appendix 10 of this DCE for Section B of the CCPY transitway corridor.

5. PARKING AND ACCESS EFFECTS

There is no existing or planned on-street parking along US Route 1 in Section B of the Potomac Yard transit corridor. The transitway will be constructed within an established median; therefore there will be no impacts on access to businesses. However, in the build scenarios, all non-signalized intersections along Section B of the proposed transitway permit right in and right out movements only. Northbound left turns are permitted only at signalized intersections. This will eliminate certain left turning movements at two intersections in the Build scenario. These are described as follows:

US Route 1 & Hume Avenue – Motorists will be unable to make a left turn from the eastbound Hume Avenue to the northbound US Route 1. Residents along Hume Avenue must now go west to Dewitt Avenue to turn east on East Randolph Avenue before getting to Custis Avenue to make the left turn on to northbound US Route 1. Alternatively, they can go north along Montrose Avenue or Turner Avenue to Clifford Avenue to get to East Glebe Road to make the left turn on to northbound US Route 1.

US Route 1 & Potomac Avenue – The proposed configuration eliminates southbound left turns to provide a larger cross section for transit stops. Southbound motorists along US Route 1 will be unable to make a left turn on to Potomac Avenue. The projected low volumes of left turns (46 and 11 vehicles per hour during AM & PM peak hours respectively, in 2030) would be accommodated at Howell Avenue. Southbound motorists who miss the left turn at Howell Avenue must turn right on to East Monroe Avenue to go north along Dewitt Avenue to Custis or Howell Avenue where they can go through to the Potomac Yard or turn left to go northbound on US Route 1. Similarly residents along Windsor, Howell and Bellefonte Avenues desirous of making a left turn from southbound US Route 1 to go to the Potomac Yard Center would have to first get to Custis Avenue, via one of the north-south streets (Leslie Avenue or La Grande Avenue), where they can go straight through the intersection to get to the Potomac Yard Center.

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Attachment A
Synchro Outputs

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1	34	13	2	12	28	1748	9	14	990	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.97			0.94		1.00	1.00		1.00	1.00	
Flt Protected		0.96			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1757			1710		1770	3419		1770	3387	
Flt Permitted		0.78			0.88		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1422			1539		1770	3419		1770	3387	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	145	1	34	13	2	12	28	1748	9	14	990	28
RTOR Reduction (vph)	0	7	0	0	10	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	173	0	0	17	0	28	1757	0	14	1017	0
Confl. Peds. (#/hr)			2				9					9
Heavy Vehicles (%)	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	6%	6%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4			4								
Actuated Green, G (s)		22.6			22.6		3.4	97.4		2.0	96.0	
Effective Green, g (s)		25.6			25.6		6.4	100.4		5.0	99.0	
Actuated g/C Ratio		0.18			0.18		0.05	0.72		0.04	0.71	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		2.0			2.0		0.2	0.2		0.2	0.2	
Lane Grp Cap (vph)		260			281		81	2452		63	2395	
v/s Ratio Prot							c0.02	c0.51		0.01	0.30	
v/s Ratio Perm		c0.12			0.01							
v/c Ratio		0.67			0.06		0.35	0.72		0.22	0.42	
Uniform Delay, d1		53.2			47.3		64.8	11.5		65.6	8.6	
Progression Factor		1.00			1.00		1.36	0.07		1.05	0.36	
Incremental Delay, d2		4.9			0.0		0.7	1.3		0.6	0.5	
Delay (s)		58.2			47.3		88.7	2.2		69.8	3.6	
Level of Service		E			D		F	A		E	A	
Approach Delay (s)		58.2			47.3			3.5			4.5	
Approach LOS		E			D			A			A	

Intersection Summary			
HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	28	12	20	1872	1023	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	*0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1967	1553	1770	3539	4000	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1967	1553	1770	3539	3260	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	28	12	20	1872	1023	20
RTOR Reduction (vph)	0	11	0	0	0	0
Lane Group Flow (vph)	28	1	20	1872	1043	0
Confl. Peds. (#/hr)			10			10
Heavy Vehicles (%)	4%	4%	2%	2%	7%	7%
Bus Blockages (#/hr)	0	0	0	0	15	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.8	9.8	4.0	118.2	108.2	
Effective Green, g (s)	12.8	12.8	7.0	121.2	111.2	
Actuated g/C Ratio	0.09	0.09	0.05	0.87	0.79	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	2.0	2.0	3.0	2.0	0.2	
Lane Grp Cap (vph)	180	142	89	3064	3177	
v/s Ratio Prot	c0.01		0.01	c0.53	0.26	
v/s Ratio Perm		0.00				
v/c Ratio	0.16	0.01	0.22	0.61	0.33	
Uniform Delay, d1	58.6	57.8	63.9	2.7	4.0	
Progression Factor	1.00	1.00	0.76	1.42	0.46	
Incremental Delay, d2	0.1	0.0	0.9	0.7	0.3	
Delay (s)	58.8	57.8	49.6	4.5	2.1	
Level of Service	E	E	D	A	A	
Approach Delay (s)	58.5			5.0	2.1	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	4.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Hume Ave. & Jefferson Davis Highway

2/15/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	80	32	20	1859	1039	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	13	12	12
Total Lost time (s)	3.0			3.0	3.0	
Lane Util. Factor	1.00			0.95	*0.95	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	0.96			1.00	1.00	
Flt Protected	0.97			1.00	1.00	
Satd. Flow (prot)	1881			3655	4000	
Flt Permitted	0.97			0.93	1.00	
Satd. Flow (perm)	1881			3409	3346	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	32	20	1859	1039	20
RTOR Reduction (vph)	11	0	0	0	1	0
Lane Group Flow (vph)	101	0	0	1879	1058	0
Confl. Peds. (#/hr)			5			5
Heavy Vehicles (%)	0%	0%	2%	2%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	7	0
Turn Type			Perm			
Protected Phases	2			1	1	
Permitted Phases			1			
Actuated Green, G (s)	13.5			114.5	114.5	
Effective Green, g (s)	16.5			117.5	117.5	
Actuated g/C Ratio	0.12			0.84	0.84	
Clearance Time (s)	6.0			6.0	6.0	
Vehicle Extension (s)	2.0			0.2	0.2	
Lane Grp Cap (vph)	222			2861	3357	
v/s Ratio Prot	c0.05				0.26	
v/s Ratio Perm				c0.55		
v/c Ratio	0.45			0.66	0.32	
Uniform Delay, d1	57.5			4.0	2.5	
Progression Factor	1.00			0.96	0.36	
Incremental Delay, d2	0.5			1.0	0.2	
Delay (s)	58.1			4.8	1.1	
Level of Service	E			A	A	
Approach Delay (s)	58.1			4.8	1.1	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	5.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	240	26	266	13	13	29	4	240	1680	12	4	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0	3.0	3.0		3.0
Lane Util. Factor	1.00	1.00			1.00			1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	0.98			0.99			1.00	1.00	0.96		1.00
Flpb, ped/bikes	0.99	1.00			1.00			1.00	1.00	1.00		1.00
Frt	1.00	0.86			0.93			1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00			0.99			0.95	1.00	1.00		0.95
Satd. Flow (prot)	1722	1759			1098			1770	4000	1571		1703
Flt Permitted	0.71	1.00			0.83			0.95	1.00	1.00		0.95
Satd. Flow (perm)	1287	1759			920			1770	3539	1571		1703
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	240	26	266	13	13	29	4	240	1680	12	4	43
RTOR Reduction (vph)	0	202	0	0	22	0	0	0	0	3	0	0
Lane Group Flow (vph)	240	90	0	0	33	0	0	244	1680	9	0	47
Confl. Peds. (#/hr)	8		5	5		8				7		
Heavy Vehicles (%)	4%	4%	4%	57%	57%	57%	2%	2%	2%	2%	6%	6%
Turn Type	Perm			Perm			Prot	Prot		Perm	Prot	Prot
Protected Phases		4			4		1	1	6		5	5
Permitted Phases	4			4						6		
Actuated Green, G (s)	30.7	30.7			30.7			30.2	84.5	84.5		6.8
Effective Green, g (s)	33.7	33.7			33.7			33.2	87.5	87.5		9.8
Actuated g/C Ratio	0.24	0.24			0.24			0.24	0.62	0.62		0.07
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	0.2	0.2		3.0
Lane Grp Cap (vph)	310	423			221			420	2500	982		119
v/s Ratio Prot		0.05						0.14	c0.42			0.03
v/s Ratio Perm	c0.19				0.04					0.01		
v/c Ratio	0.77	0.21			0.15			0.58	0.67	0.01		0.39
Uniform Delay, d1	49.6	42.5			41.9			47.2	17.0	9.9		62.3
Progression Factor	1.00	1.00			1.00			0.71	0.45	0.14		1.00
Incremental Delay, d2	11.4	0.3			0.3			1.6	1.1	0.0		2.2
Delay (s)	61.0	42.8			42.2			35.3	8.8	1.4		64.4
Level of Service	E	D			D			D	A	A		E
Approach Delay (s)		51.0			42.2				12.1			
Approach LOS		D			D				B			

Intersection Summary			
HCM Average Control Delay	23.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↑	
Volume (vph)	802	28
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3383	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	802	28
RTOR Reduction (vph)	2	0
Lane Group Flow (vph)	828	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	61.1	
Effective Green, g (s)	64.1	
Actuated g/C Ratio	0.46	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	1831	
v/s Ratio Prot	c0.21	
v/s Ratio Perm		
v/c Ratio	0.45	
Uniform Delay, d1	25.9	
Progression Factor	1.00	
Incremental Delay, d2	0.8	
Delay (s)	26.8	
Level of Service	C	
Approach Delay (s)	28.8	
Approach LOS	C	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	431	225	1652	862	18	912
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	14
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.5	3.5	3.5	3.5	3.0	3.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	0.99	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2798	1361	4000	1538	1604	4000
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2798	1361	3557	1538	1604	3667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	431	225	1652	862	18	912
RTOR Reduction (vph)	0	65	0	64	0	0
Lane Group Flow (vph)	431	160	1652	798	18	912
Confl. Peds. (#/hr)		1		9		
Heavy Vehicles (%)	21%	21%	2%	2%	5%	5%
Turn Type		Perm		pt+ov	Prot	
Protected Phases	4		2	2 4	1	6
Permitted Phases		4				
Actuated Green, G (s)	30.0	30.0	88.3	124.8	2.7	97.0
Effective Green, g (s)	33.0	33.0	91.3	127.8	5.7	100.0
Actuated g/C Ratio	0.24	0.24	0.65	0.91	0.04	0.71
Clearance Time (s)	6.5	6.5	6.5		6.0	6.5
Vehicle Extension (s)	2.0	2.0	3.0		2.0	3.0
Lane Grp Cap (vph)	660	321	2609	1404	65	2857
v/s Ratio Prot	c0.15		c0.41	0.52	0.01	c0.23
v/s Ratio Perm		0.12				
v/c Ratio	0.65	0.50	0.63	0.57	0.28	0.32
Uniform Delay, d1	48.3	46.3	14.4	1.1	65.2	7.4
Progression Factor	1.00	1.00	1.00	1.00	0.88	1.23
Incremental Delay, d2	1.8	0.4	1.2	0.3	0.8	0.3
Delay (s)	50.1	46.8	15.6	1.4	58.2	9.4
Level of Service	D	D	B	A	E	A
Approach Delay (s)	49.0		10.7			10.3
Approach LOS	D		B			B

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	30	5	25	95	9	23	8	103	1700	27	12	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0			3.0			3.0	3.0			3.0
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.94			0.98			1.00	1.00			1.00
Flt Protected		0.98			0.96			0.95	1.00			0.95
Satd. Flow (prot)		1698			1702			1736	3462			1589
Flt Permitted		0.85			0.73			0.95	1.00			0.95
Satd. Flow (perm)		1473			1287			1736	3462			1589
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	30	5	25	95	9	23	8	103	1700	27	12	57
RTOR Reduction (vph)	0	21	0	0	7	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	39	0	0	120	0	0	111	1726	0	0	69
Confl. Peds. (#/hr)										2		
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	4%	4%	4%	4%	6%	6%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		8			4		5	5	2		1	1
Permitted Phases	8			4								
Actuated Green, G (s)		19.7			19.7			12.2	94.4			7.9
Effective Green, g (s)		22.7			22.7			15.2	97.4			10.9
Actuated g/C Ratio		0.16			0.16			0.11	0.70			0.08
Clearance Time (s)		6.0			6.0			6.0	6.0			6.0
Vehicle Extension (s)		4.0			3.0			2.0	0.2			2.0
Lane Grp Cap (vph)		239			209			188	2409			124
v/s Ratio Prot								c0.06	c0.50			0.04
v/s Ratio Perm		0.03			c0.09							
v/c Ratio		0.16			0.58			0.59	0.72			0.56
Uniform Delay, d1		50.5			54.2			59.4	12.9			62.2
Progression Factor		1.00			1.00			1.35	0.38			0.86
Incremental Delay, d2		0.4			3.8			2.7	1.5			2.8
Delay (s)		50.9			58.0			83.1	6.4			56.1
Level of Service		D			E			F	A			E
Approach Delay (s)		50.9			58.0				11.1			
Approach LOS		D			E				B			

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	976	25
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3389	
Flt Permitted	1.00	
Satd. Flow (perm)	3389	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	976	25
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1000	0
Confl. Peds. (#/hr)		7
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	90.1	
Effective Green, g (s)	93.1	
Actuated g/C Ratio	0.66	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2254	
v/s Ratio Prot	0.30	
v/s Ratio Perm		
v/c Ratio	0.44	
Uniform Delay, d1	11.1	
Progression Factor	1.18	
Incremental Delay, d2	0.6	
Delay (s)	13.7	
Level of Service	B	
Approach Delay (s)	16.4	
Approach LOS	B	

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: E Custis Ave. & Jefferson Davis Highway

2/15/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1	34	13	2	12	28	1748	9	14	990	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.97			0.94		1.00	1.00		1.00	1.00	
Flt Protected		0.96			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1757			1710		1770	3419		1770	3387	
Flt Permitted		0.78			0.88		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1422			1539		1770	3419		1770	3387	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	145	1	34	13	2	12	28	1748	9	14	990	28
RTOR Reduction (vph)	0	7	0	0	10	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	173	0	0	17	0	28	1757	0	14	1017	0
Confl. Peds. (#/hr)			2				9					9
Heavy Vehicles (%)	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	6%	6%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4			4								
Actuated Green, G (s)		22.6			22.6		3.4	97.3		2.1	96.0	
Effective Green, g (s)		25.6			25.6		6.4	100.3		5.1	99.0	
Actuated g/C Ratio		0.18			0.18		0.05	0.72		0.04	0.71	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		2.0			2.0		0.2	0.2		0.2	0.2	
Lane Grp Cap (vph)		260			281		81	2449		64	2395	
v/s Ratio Prot							c0.02	c0.51		0.01	0.30	
v/s Ratio Perm		c0.12			0.01							
v/c Ratio		0.67			0.06		0.35	0.72		0.22	0.42	
Uniform Delay, d1		53.2			47.3		64.8	11.6		65.5	8.6	
Progression Factor		1.00			1.00		1.27	0.21		0.60	2.47	
Incremental Delay, d2		4.9			0.0		0.6	1.3		0.6	0.5	
Delay (s)		58.2			47.3		83.1	3.7		39.9	21.7	
Level of Service		E			D		F	A		D	C	
Approach Delay (s)		58.2			47.3			4.9			22.0	
Approach LOS		E			D			A			C	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	28	12	34	1872	1023	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	*0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1967	1553	1770	3539	4000	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1967	1553	1770	3539	3260	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	28	12	34	1872	1023	20
RTOR Reduction (vph)	0	11	0	0	0	0
Lane Group Flow (vph)	28	1	34	1872	1043	0
Confl. Peds. (#/hr)			10			10
Heavy Vehicles (%)	4%	4%	2%	2%	7%	7%
Bus Blockages (#/hr)	0	0	0	0	15	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.8	9.8	4.5	79.6	107.7	
Effective Green, g (s)	12.8	12.8	7.5	82.6	110.7	
Actuated g/C Ratio	0.09	0.09	0.05	0.59	0.79	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	2.0	2.0	3.0	2.0	0.2	
Lane Grp Cap (vph)	180	142	95	2088	3163	
v/s Ratio Prot	c0.01		c0.02	c0.53	c0.26	
v/s Ratio Perm		0.00				
v/c Ratio	0.16	0.01	0.36	0.90	0.33	
Uniform Delay, d1	58.6	57.8	63.9	25.0	4.1	
Progression Factor	1.00	1.00	1.15	0.48	0.52	
Incremental Delay, d2	0.1	0.0	1.7	5.0	0.3	
Delay (s)	58.8	57.8	75.3	17.0	2.4	
Level of Service	E	E	E	B	A	
Approach Delay (s)	58.5			18.0	2.4	
Approach LOS	E			B	A	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	240	26	266	13	13	29	4	246	1680	12	4	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0	3.0			3.0
Lane Util. Factor	1.00	1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes	1.00	0.98			0.99			1.00	1.00			1.00
Flpb, ped/bikes	0.99	1.00			1.00			1.00	1.00			1.00
Frt	1.00	0.86			0.93			1.00	1.00			1.00
Flt Protected	0.95	1.00			0.99			0.95	1.00			0.95
Satd. Flow (prot)	1722	1759			1098			1770	4000			1703
Flt Permitted	0.71	1.00			0.82			0.95	1.00			0.95
Satd. Flow (perm)	1286	1759			910			1770	3534			1703
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	240	26	266	13	13	29	4	246	1680	12	4	43
RTOR Reduction (vph)	0	203	0	0	22	0	0	0	0	0	0	0
Lane Group Flow (vph)	240	89	0	0	33	0	0	250	1692	0	0	47
Confl. Peds. (#/hr)	8		5	5		8				7		
Heavy Vehicles (%)	4%	4%	4%	57%	57%	57%	2%	2%	2%	2%	6%	6%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		4			4		1	1	6		5	5
Permitted Phases	4			4								
Actuated Green, G (s)	30.3	30.3			30.3			29.2	69.4			5.6
Effective Green, g (s)	33.3	33.3			33.3			32.2	72.4			8.6
Actuated g/C Ratio	0.24	0.24			0.24			0.23	0.52			0.06
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	0.2			3.0
Lane Grp Cap (vph)	306	418			216			407	2069			105
v/s Ratio Prot		0.05						0.14	c0.42			0.03
v/s Ratio Perm	c0.19				0.04							
v/c Ratio	0.78	0.21			0.15			0.61	0.82			0.45
Uniform Delay, d1	50.0	42.8			42.2			48.3	28.3			63.4
Progression Factor	1.00	1.00			1.00			0.57	0.26			1.00
Incremental Delay, d2	12.4	0.3			0.3			1.5	2.1			3.0
Delay (s)	62.4	43.1			42.5			29.0	9.4			66.4
Level of Service	E	D			D			C	A			E
Approach Delay (s)		51.8			42.5				11.9			
Approach LOS		D			D				B			

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	802	28
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3383	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	802	28
RTOR Reduction (vph)	2	0
Lane Group Flow (vph)	828	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	62.5	
Effective Green, g (s)	65.5	
Actuated g/C Ratio	0.47	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	1871	
v/s Ratio Prot	c0.21	
v/s Ratio Perm		
v/c Ratio	0.44	
Uniform Delay, d1	25.0	
Progression Factor	1.00	
Incremental Delay, d2	0.8	
Delay (s)	25.8	
Level of Service	C	
Approach Delay (s)	27.9	
Approach LOS	C	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	431	225	1652	862	0	912
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	14
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.5	3.5	3.5	3.5		3.5
Lane Util. Factor	0.97	1.00	0.95	1.00		0.95
Frpb, ped/bikes	1.00	0.99	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	2798	1361	4000	1538		4000
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	2798	1361	3557	1538		3667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	431	225	1652	862	0	912
RTOR Reduction (vph)	0	18	0	0	0	0
Lane Group Flow (vph)	431	207	1652	862	0	912
Confl. Peds. (#/hr)		1		9		
Heavy Vehicles (%)	21%	21%	2%	2%	5%	5%
Turn Type		Perm		pt+ov		
Protected Phases	4		2	2 4		6
Permitted Phases		4				
Actuated Green, G (s)	30.3	30.3	96.7	140.0		71.5
Effective Green, g (s)	33.3	33.3	99.7	140.0		74.5
Actuated g/C Ratio	0.24	0.24	0.71	1.00		0.53
Clearance Time (s)	6.5	6.5	6.5			6.5
Vehicle Extension (s)	2.0	2.0	3.0			3.0
Lane Grp Cap (vph)	666	324	2849	1538		2129
v/s Ratio Prot	c0.15		c0.41	c0.56		0.23
v/s Ratio Perm		0.15				
v/c Ratio	0.65	0.64	0.58	0.56		0.43
Uniform Delay, d1	48.1	48.0	9.9	0.0		19.8
Progression Factor	1.00	1.00	1.00	1.00		0.59
Incremental Delay, d2	1.6	3.2	0.9	0.3		0.6
Delay (s)	49.7	51.2	10.7	0.3		12.3
Level of Service	D	D	B	A		B
Approach Delay (s)	50.2		7.2			12.3
Approach LOS	D		A			B

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	3.5
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	30	5	25	95	9	23	8	103	1700	27	12	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0			3.0			3.0	3.0			3.0
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.94			0.98			1.00	1.00			1.00
Flt Protected		0.98			0.96			0.95	1.00			0.95
Satd. Flow (prot)		1698			1702			1736	3462			1589
Flt Permitted		0.85			0.73			0.95	1.00			0.95
Satd. Flow (perm)		1473			1287			1736	3462			1589
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	30	5	25	95	9	23	8	103	1700	27	12	75
RTOR Reduction (vph)	0	21	0	0	7	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	39	0	0	120	0	0	111	1726	0	0	87
Confl. Peds. (#/hr)										2		
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	4%	4%	4%	4%	6%	6%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		8			4		5	5	2		1	1
Permitted Phases	8			4								
Actuated Green, G (s)		19.7			19.7			12.2	91.1			11.2
Effective Green, g (s)		22.7			22.7			15.2	94.1			14.2
Actuated g/C Ratio		0.16			0.16			0.11	0.67			0.10
Clearance Time (s)		6.0			6.0			6.0	6.0			6.0
Vehicle Extension (s)		4.0			3.0			2.0	0.2			2.0
Lane Grp Cap (vph)		239			209			188	2327			161
v/s Ratio Prot								c0.06	c0.50			0.05
v/s Ratio Perm		0.03			c0.09							
v/c Ratio		0.16			0.58			0.59	0.74			0.54
Uniform Delay, d1		50.5			54.2			59.4	15.0			59.8
Progression Factor		1.00			1.00			1.03	0.62			1.30
Incremental Delay, d2		0.4			3.8			2.7	1.8			1.9
Delay (s)		50.9			58.0			64.1	11.2			79.8
Level of Service		D			E			E	B			E
Approach Delay (s)		50.9			58.0				14.4			
Approach LOS		D			E				B			

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	976	25
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3389	
Flt Permitted	1.00	
Satd. Flow (perm)	3389	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	976	25
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1000	0
Confl. Peds. (#/hr)		7
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	90.1	
Effective Green, g (s)	93.1	
Actuated g/C Ratio	0.66	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2254	
v/s Ratio Prot	0.30	
v/s Ratio Perm		
v/c Ratio	0.44	
Uniform Delay, d1	11.1	
Progression Factor	0.36	
Incremental Delay, d2	0.6	
Delay (s)	4.6	
Level of Service	A	
Approach Delay (s)	10.6	
Approach LOS	B	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	2	45	22	3	5	41	1409	2	8	1934	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.98		1.00	1.00		1.00	0.99	
Flt Protected		0.98			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1714			1756		1787	3454		1770	3548	
Flt Permitted		0.87			0.77		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1519			1402		1787	3454		1770	3548	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	2	45	22	3	5	41	1409	2	8	1934	73
RTOR Reduction (vph)	0	33	0	0	4	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	54	0	0	26	0	41	1411	0	8	2006	0
Confl. Peds. (#/hr)			2				10					10
Heavy Vehicles (%)	0%	2%	0%	2%	2%	2%	1%	1%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4			4								
Actuated Green, G (s)		13.9			13.9		6.2	82.0		26.1	101.9	
Effective Green, g (s)		16.9			16.9		9.2	85.0		29.1	104.9	
Actuated g/C Ratio		0.12			0.12		0.07	0.61		0.21	0.75	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		2.0			2.0		3.0	0.2		0.2	0.2	
Lane Grp Cap (vph)		183			169		117	2097		368	2658	
v/s Ratio Prot							c0.02	0.41		0.00	c0.57	
v/s Ratio Perm		c0.04			0.02							
v/c Ratio		0.29			0.15		0.35	0.67		0.02	0.75	
Uniform Delay, d1		56.1			55.1		62.5	18.3		44.1	10.1	
Progression Factor		1.00			1.00		1.16	0.39		1.38	0.30	
Incremental Delay, d2		0.3			0.2		1.6	1.5		0.1	1.7	
Delay (s)		56.4			55.3		74.0	8.7		61.1	4.7	
Level of Service		E			E		E	A		E	A	
Approach Delay (s)		56.4			55.3			10.5			4.9	
Approach LOS		E			E			B			A	

Intersection Summary			
HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	40	20	20	1434	1957	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	*0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1986	1568	1787	3574	4000	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1986	1568	1787	3574	3522	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	20	20	1434	1957	44
RTOR Reduction (vph)	0	18	0	0	1	0
Lane Group Flow (vph)	40	2	20	1434	2000	0
Confl. Peds. (#/hr)	1		15			15
Heavy Vehicles (%)	3%	3%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	5	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	11.3	11.3	4.0	116.7	106.7	
Effective Green, g (s)	14.3	14.3	7.0	119.7	109.7	
Actuated g/C Ratio	0.10	0.10	0.05	0.86	0.78	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	2.0	2.0	3.0	0.2	0.2	
Lane Grp Cap (vph)	203	160	89	3056	3134	
v/s Ratio Prot	c0.02		0.01	c0.40	c0.50	
v/s Ratio Perm		0.00				
v/c Ratio	0.20	0.01	0.22	0.47	0.64	
Uniform Delay, d1	57.6	56.5	63.9	2.5	6.6	
Progression Factor	1.00	1.00	0.93	1.28	0.23	
Incremental Delay, d2	0.2	0.0	1.0	0.4	0.7	
Delay (s)	57.8	56.5	60.1	3.5	2.2	
Level of Service	E	E	E	A	A	
Approach Delay (s)	57.3			4.3	2.2	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations							
Volume (vph)	36	24	52	1427	4	1995	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	13	12	12	12
Total Lost time (s)	3.0			3.0		3.0	
Lane Util. Factor	1.00			0.95		*0.95	
Frpb, ped/bikes	1.00			1.00		1.00	
Flpb, ped/bikes	1.00			1.00		1.00	
Frt	0.95			1.00		1.00	
Flt Protected	0.97			1.00		1.00	
Satd. Flow (prot)	1861			3687		4000	
Flt Permitted	0.97			0.71		0.95	
Satd. Flow (perm)	1861			2617		3341	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	36	24	52	1427	4	1995	40
RTOR Reduction (vph)	18	0	0	0	0	0	0
Lane Group Flow (vph)	42	0	0	1479	0	2039	0
Confl. Peds. (#/hr)	1		13				13
Heavy Vehicles (%)	0%	0%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	7	0
Turn Type			Perm		Perm		
Protected Phases	2			1		1	
Permitted Phases			1		1		
Actuated Green, G (s)	11.7			116.3		116.3	
Effective Green, g (s)	14.7			119.3		119.3	
Actuated g/C Ratio	0.10			0.85		0.85	
Clearance Time (s)	6.0			6.0		6.0	
Vehicle Extension (s)	2.0			0.2		0.2	
Lane Grp Cap (vph)	195			2230		2847	
v/s Ratio Prot	c0.02						
v/s Ratio Perm				0.57		c0.61	
v/c Ratio	0.22			0.66		0.72	
Uniform Delay, d1	57.4			3.5		3.9	
Progression Factor	1.00			1.22		0.73	
Incremental Delay, d2	0.2			1.4		1.0	
Delay (s)	57.6			5.7		3.8	
Level of Service	E			A		A	
Approach Delay (s)	57.6			5.7		3.8	
Approach LOS	E			A		A	

Intersection Summary			
HCM Average Control Delay	5.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	144	26	264	24	29	69	8	230	1210	16	8	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0	4.0	4.0		3.0
Lane Util. Factor	1.00	1.00			1.00			1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	0.98			0.99			1.00	1.00	0.96		1.00
Flpb, ped/bikes	0.99	1.00			1.00			1.00	1.00	1.00		1.00
Frt	1.00	0.86			0.92			1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00			0.99			0.95	1.00	1.00		0.95
Satd. Flow (prot)	1739	1774			1715			1787	4000	1581		1787
Flt Permitted	0.54	1.00			0.56			0.95	1.00	1.00		0.95
Satd. Flow (perm)	993	1774			967			1787	3574	1581		1787
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	144	26	264	24	29	69	8	230	1210	16	8	50
RTOR Reduction (vph)	0	184	0	0	38	0	0	0	0	5	0	0
Lane Group Flow (vph)	144	106	0	0	84	0	0	238	1210	11	0	58
Confl. Peds. (#/hr)	9		6	6		9				8		
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Prot	Prot		Perm	Prot	Prot
Protected Phases		4			4		1	1	6		5	5
Permitted Phases	4			4						6		
Actuated Green, G (s)	24.5	24.5			24.5			19.2	89.1	89.1		7.4
Effective Green, g (s)	27.5	27.5			27.5			22.2	92.1	92.1		10.4
Actuated g/C Ratio	0.20	0.20			0.20			0.16	0.66	0.66		0.07
Clearance Time (s)	6.0	6.0			6.0			6.0	7.0	7.0		6.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	0.2	0.2		3.0
Lane Grp Cap (vph)	195	348			190			283	2631	1040		133
v/s Ratio Prot		0.06						c0.13	0.30			0.03
v/s Ratio Perm	c0.14				0.09					0.01		
v/c Ratio	0.74	0.30			0.44			0.84	0.46	0.01		0.44
Uniform Delay, d1	52.9	48.1			49.5			57.2	11.7	8.3		62.0
Progression Factor	1.00	1.00			1.00			1.04	0.61	0.43		1.00
Incremental Delay, d2	13.6	0.5			1.6			15.7	0.4	0.0		2.3
Delay (s)	66.5	48.6			51.2			75.0	7.6	3.5		64.3
Level of Service	E	D			D			E	A	A		E
Approach Delay (s)		54.5			51.2				18.5			
Approach LOS		D			D				B			

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	108.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	1757	216
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.98	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3496	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1757	216
RTOR Reduction (vph)	6	0
Lane Group Flow (vph)	1967	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	78.3	
Effective Green, g (s)	81.3	
Actuated g/C Ratio	0.58	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2323	
v/s Ratio Prot	c0.49	
v/s Ratio Perm		
v/c Ratio	0.85	
Uniform Delay, d1	24.2	
Progression Factor	1.00	
Incremental Delay, d2	4.0	
Delay (s)	28.3	
Level of Service	C	
Approach Delay (s)	29.3	
Approach LOS	C	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	866	189	1315	582	6	1834
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	12
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.5	3.5	3.5	3.5	3.0	3.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	0.99	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3193	1554	4000	1538	1668	4000
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3193	1554	3557	1538	1668	3574
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	866	189	1315	582	6	1834
RTOR Reduction (vph)	0	113	0	45	0	0
Lane Group Flow (vph)	866	76	1315	537	6	1834
Confl. Peds. (#/hr)		1		12		
Heavy Vehicles (%)	6%	6%	2%	2%	1%	1%
Turn Type		Perm		pt+ov	Prot	
Protected Phases	4		2	2 4	1	6
Permitted Phases		4				
Actuated Green, G (s)	44.1	44.1	75.6	126.2	1.3	82.9
Effective Green, g (s)	47.1	47.1	78.6	129.2	4.3	85.9
Actuated g/C Ratio	0.34	0.34	0.56	0.92	0.03	0.61
Clearance Time (s)	6.5	6.5	6.5		6.0	6.5
Vehicle Extension (s)	2.0	2.0	3.0		2.0	3.0
Lane Grp Cap (vph)	1074	523	2246	1419	51	2454
v/s Ratio Prot	c0.27		0.33	0.35	0.00	c0.46
v/s Ratio Perm		0.05				
v/c Ratio	0.81	0.15	0.59	0.38	0.12	0.75
Uniform Delay, d1	42.3	32.4	20.1	0.6	66.0	19.3
Progression Factor	1.00	1.00	1.00	1.00	1.31	0.23
Incremental Delay, d2	4.3	0.0	1.1	0.1	0.2	1.1
Delay (s)	46.6	32.5	21.2	0.7	86.7	5.6
Level of Service	D	C	C	A	F	A
Approach Delay (s)	44.0		14.9			5.8
Approach LOS	D		B			A

Intersection Summary			
HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	26	9	28	114	14	45	8	104	1339	43	16	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0			3.0			3.0	3.0			3.0
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		0.99			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.94			0.96			1.00	1.00			1.00
Flt Protected		0.98			0.97			0.95	1.00			0.95
Satd. Flow (prot)		1739			1716			1770	3520			1668
Flt Permitted		0.85			0.74			0.95	1.00			0.95
Satd. Flow (perm)		1517			1320			1770	3520			1668
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	26	9	28	114	14	45	8	104	1339	43	16	15
RTOR Reduction (vph)	0	23	0	0	10	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	40	0	0	163	0	0	112	1381	0	0	31
Confl. Peds. (#/hr)	1		1	1		1				2		
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		8			4		5	5	2		1	1
Permitted Phases	8			4								
Actuated Green, G (s)		22.8			22.8			12.4	94.9			4.3
Effective Green, g (s)		25.8			25.8			15.4	97.9			7.3
Actuated g/C Ratio		0.18			0.18			0.11	0.70			0.05
Clearance Time (s)		6.0			6.0			6.0	6.0			6.0
Vehicle Extension (s)		4.0			3.0			2.0	0.2			2.0
Lane Grp Cap (vph)		280			243			195	2461			87
v/s Ratio Prot								c0.06	0.39			0.02
v/s Ratio Perm		0.03			c0.12							
v/c Ratio		0.14			0.67			0.57	0.56			0.36
Uniform Delay, d1		47.8			53.2			59.2	10.4			64.1
Progression Factor		1.00			1.00			0.89	1.03			1.09
Incremental Delay, d2		0.3			7.1			2.2	0.8			0.6
Delay (s)		48.2			60.3			54.6	11.5			70.5
Level of Service		D			E			D	B			E
Approach Delay (s)		48.2			60.3				14.8			
Approach LOS		D			E				B			

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	1949	43
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3559	
Flt Permitted	1.00	
Satd. Flow (perm)	3559	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1949	43
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1991	0
Confl. Peds. (#/hr)		9
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	86.8	
Effective Green, g (s)	89.8	
Actuated g/C Ratio	0.64	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2283	
v/s Ratio Prot	c0.56	
v/s Ratio Perm		
v/c Ratio	0.87	
Uniform Delay, d1	20.4	
Progression Factor	0.32	
Incremental Delay, d2	3.4	
Delay (s)	10.1	
Level of Service	B	
Approach Delay (s)	11.0	
Approach LOS	B	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	2	45	22	3	5	41	1409	2	8	1934	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.98		1.00	1.00		1.00	0.99	
Flt Protected		0.98			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1714			1756		1787	3454		1770	3548	
Flt Permitted		0.87			0.77		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1519			1402		1787	3454		1770	3548	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	2	45	22	3	5	41	1409	2	8	1934	73
RTOR Reduction (vph)	0	33	0	0	4	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	54	0	0	26	0	41	1411	0	8	2006	0
Confl. Peds. (#/hr)			2				10					10
Heavy Vehicles (%)	0%	2%	0%	2%	2%	2%	1%	1%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4			4								
Actuated Green, G (s)		13.9			13.9		6.2	82.0		26.1	101.9	
Effective Green, g (s)		16.9			16.9		9.2	85.0		29.1	104.9	
Actuated g/C Ratio		0.12			0.12		0.07	0.61		0.21	0.75	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		2.0			2.0		3.0	0.2		0.2	0.2	
Lane Grp Cap (vph)		183			169		117	2097		368	2658	
v/s Ratio Prot							c0.02	0.41		0.00	c0.57	
v/s Ratio Perm		c0.04			0.02							
v/c Ratio		0.29			0.15		0.35	0.67		0.02	0.75	
Uniform Delay, d1		56.1			55.1		62.5	18.3		44.1	10.1	
Progression Factor		1.00			1.00		1.26	0.42		0.71	1.44	
Incremental Delay, d2		0.3			0.2		1.5	1.5		0.1	1.3	
Delay (s)		56.4			55.3		80.4	9.2		31.3	15.9	
Level of Service		E			E		F	A		C	B	
Approach Delay (s)		56.4			55.3			11.2			16.0	
Approach LOS		E			E			B			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations							
Volume (vph)	40	20	56	1434	4	1957	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0	3.0	3.0		3.0	
Lane Util. Factor	1.00	1.00	1.00	0.95		*0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00		1.00	
Frt	1.00	0.85	1.00	1.00		1.00	
Flt Protected	0.95	1.00	0.95	1.00		1.00	
Satd. Flow (prot)	1986	1568	1787	3574		4000	
Flt Permitted	0.95	1.00	0.95	1.00		0.95	
Satd. Flow (perm)	1986	1568	1787	3574		3353	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	20	56	1434	4	1957	44
RTOR Reduction (vph)	0	18	0	0	0	1	0
Lane Group Flow (vph)	40	2	56	1434	0	2004	0
Confl. Peds. (#/hr)	1		15				15
Heavy Vehicles (%)	3%	3%	1%	1%	2%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	5	0
Turn Type		Perm	Prot		Perm		
Protected Phases	4		5	2		6	
Permitted Phases		4			6		
Actuated Green, G (s)	11.3	11.3	6.9	80.8		103.8	
Effective Green, g (s)	14.3	14.3	9.9	83.8		106.8	
Actuated g/C Ratio	0.10	0.10	0.07	0.60		0.76	
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0	
Vehicle Extension (s)	2.0	2.0	3.0	0.2		0.2	
Lane Grp Cap (vph)	203	160	126	2139		2558	
v/s Ratio Prot	c0.02		c0.03	0.40			
v/s Ratio Perm		0.00				c0.60	
v/c Ratio	0.20	0.01	0.44	0.67		0.78	
Uniform Delay, d1	57.6	56.5	62.4	18.8		9.8	
Progression Factor	1.00	1.00	1.06	0.17		1.08	
Incremental Delay, d2	0.2	0.0	1.9	1.3		1.6	
Delay (s)	57.8	56.5	67.8	4.5		12.1	
Level of Service	E	E	E	A		B	
Approach Delay (s)	57.3			6.9		12.1	
Approach LOS	E			A		B	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	144	26	264	24	29	69	8	246	1210	16	8	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0	4.0			3.0
Lane Util. Factor	1.00	1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes	1.00	0.98			0.99			1.00	1.00			1.00
Flpb, ped/bikes	0.99	1.00			1.00			1.00	1.00			1.00
Frt	1.00	0.86			0.92			1.00	1.00			1.00
Flt Protected	0.95	1.00			0.99			0.95	1.00			0.95
Satd. Flow (prot)	1739	1774			1715			1787	4000			1787
Flt Permitted	0.54	1.00			0.56			0.95	1.00			0.95
Satd. Flow (perm)	993	1774			967			1787	3565			1787
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	144	26	264	24	29	69	8	246	1210	16	8	50
RTOR Reduction (vph)	0	198	0	0	38	0	0	0	0	0	0	0
Lane Group Flow (vph)	144	92	0	0	84	0	0	254	1226	0	0	58
Confl. Peds. (#/hr)	9		6	6		9				8		
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		4			4		1	1	6		5	5
Permitted Phases	4			4								
Actuated Green, G (s)	24.5	24.5			24.5			19.2	68.4			5.6
Effective Green, g (s)	27.5	27.5			27.5			22.2	71.4			8.6
Actuated g/C Ratio	0.20	0.20			0.20			0.16	0.51			0.06
Clearance Time (s)	6.0	6.0			6.0			6.0	7.0			6.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	0.2			3.0
Lane Grp Cap (vph)	195	348			190			283	2040			110
v/s Ratio Prot		0.05						c0.14	0.31			0.03
v/s Ratio Perm	c0.14				0.09							
v/c Ratio	0.74	0.26			0.44			0.90	0.60			0.53
Uniform Delay, d1	52.9	47.7			49.5			57.8	24.2			63.7
Progression Factor	1.00	1.00			1.00			0.60	0.19			1.00
Incremental Delay, d2	13.6	0.4			1.6			23.8	1.0			4.5
Delay (s)	66.5	48.1			51.2			58.7	5.7			68.2
Level of Service	E	D			D			E	A			E
Approach Delay (s)		54.2			51.2				14.8			
Approach LOS		D			D				B			

Intersection Summary			
HCM Average Control Delay	27.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	109.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	1757	216
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.98	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3496	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1757	216
RTOR Reduction (vph)	6	0
Lane Group Flow (vph)	1967	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	78.3	
Effective Green, g (s)	81.3	
Actuated g/C Ratio	0.58	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2323	
v/s Ratio Prot	c0.49	
v/s Ratio Perm		
v/c Ratio	0.85	
Uniform Delay, d1	24.2	
Progression Factor	1.00	
Incremental Delay, d2	4.0	
Delay (s)	28.3	
Level of Service	C	
Approach Delay (s)	29.4	
Approach LOS	C	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	866	189	1315	582	0	1834
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	12
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.5	3.5	3.5	3.5		3.5
Lane Util. Factor	0.97	1.00	0.95	1.00		0.95
Frpb, ped/bikes	1.00	0.99	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	3193	1554	4000	1538		4000
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	3193	1554	3557	1538		3574
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	866	189	1315	582	0	1834
RTOR Reduction (vph)	0	38	0	0	0	0
Lane Group Flow (vph)	866	151	1315	582	0	1834
Confl. Peds. (#/hr)		1		12		
Heavy Vehicles (%)	6%	6%	2%	2%	1%	1%
Turn Type		Perm		pt+ov		
Protected Phases	4		2	2 4		6
Permitted Phases		4				
Actuated Green, G (s)	42.7	42.7	84.3	140.0		73.5
Effective Green, g (s)	45.7	45.7	87.3	140.0		76.5
Actuated g/C Ratio	0.33	0.33	0.62	1.00		0.55
Clearance Time (s)	6.5	6.5	6.5			6.5
Vehicle Extension (s)	2.0	2.0	3.0			3.0
Lane Grp Cap (vph)	1042	507	2494	1538		2186
v/s Ratio Prot	c0.27		c0.33	0.38		c0.46
v/s Ratio Perm		0.10				
v/c Ratio	0.83	0.30	0.53	0.38		0.84
Uniform Delay, d1	43.6	35.2	14.8	0.0		26.6
Progression Factor	1.00	1.00	1.00	1.00		0.42
Incremental Delay, d2	5.5	0.1	0.8	0.1		2.2
Delay (s)	49.1	35.3	15.6	0.1		13.3
Level of Service	D	D	B	A		B
Approach Delay (s)	46.6		10.8			13.3
Approach LOS	D		B			B

Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	26	9	28	114	14	45	8	104	1339	43	16	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0			3.0			3.0	3.0			3.0
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		0.99			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.94			0.96			1.00	1.00			1.00
Flt Protected		0.98			0.97			0.95	1.00			0.95
Satd. Flow (prot)		1739			1716			1770	3520			1668
Flt Permitted		0.85			0.74			0.95	1.00			0.95
Satd. Flow (perm)		1517			1320			1770	3520			1668
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	26	9	28	114	14	45	8	104	1339	43	16	21
RTOR Reduction (vph)	0	23	0	0	10	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	40	0	0	163	0	0	112	1381	0	0	37
Confl. Peds. (#/hr)	1		1	1		1				2		
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		8			4		5	5	2		1	1
Permitted Phases	8			4								
Actuated Green, G (s)		22.8			22.8			12.4	93.2			6.0
Effective Green, g (s)		25.8			25.8			15.4	96.2			9.0
Actuated g/C Ratio		0.18			0.18			0.11	0.69			0.06
Clearance Time (s)		6.0			6.0			6.0	6.0			6.0
Vehicle Extension (s)		4.0			3.0			2.0	0.2			2.0
Lane Grp Cap (vph)		280			243			195	2419			107
v/s Ratio Prot								c0.06	0.39			0.02
v/s Ratio Perm		0.03			c0.12							
v/c Ratio		0.14			0.67			0.57	0.57			0.35
Uniform Delay, d1		47.8			53.2			59.2	11.3			62.7
Progression Factor		1.00			1.00			0.92	0.75			0.95
Incremental Delay, d2		0.3			7.1			2.2	0.9			0.5
Delay (s)		48.2			60.3			56.7	9.3			60.1
Level of Service		D			E			E	A			E
Approach Delay (s)		48.2			60.3				12.8			
Approach LOS		D			E				B			

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↑	
Volume (vph)	1949	43
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	3.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3559	
Flt Permitted	1.00	
Satd. Flow (perm)	3559	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1949	43
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1991	0
Confl. Peds. (#/hr)		9
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	86.8	
Effective Green, g (s)	89.8	
Actuated g/C Ratio	0.64	
Clearance Time (s)	6.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2283	
v/s Ratio Prot	c0.56	
v/s Ratio Perm		
v/c Ratio	0.87	
Uniform Delay, d1	20.4	
Progression Factor	0.61	
Incremental Delay, d2	3.5	
Delay (s)	16.0	
Level of Service	B	
Approach Delay (s)	16.8	
Approach LOS	B	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	147	3	37	40	5	36	28	2136	27	43	1385	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0		3.0	3.0		3.0	4.0		3.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.97		1.00	0.87		1.00	1.00		1.00	1.00	
Flt Protected		0.96		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1756		1770	1617		1770	3415		1770	3392	
Flt Permitted		0.74		0.72	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1359		1340	1617		1770	3415		1770	3392	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	147	3	37	40	5	36	28	2136	27	43	1385	28
RTOR Reduction (vph)	0	7	0	0	29	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	180	0	40	12	0	28	2162	0	43	1412	0
Confl. Peds. (#/hr)			2				9					9
Heavy Vehicles (%)	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	6%	6%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		24.3		24.3	24.3		4.1	90.6		6.1	92.6	
Effective Green, g (s)		27.3		27.3	27.3		7.1	93.6		9.1	95.6	
Actuated g/C Ratio		0.20		0.20	0.20		0.05	0.67		0.06	0.68	
Clearance Time (s)		6.0		6.0	6.0		6.0	7.0		6.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		265		261	315		90	2283		115	2316	
v/s Ratio Prot					0.01		0.02	c0.63		c0.02	0.42	
v/s Ratio Perm		c0.13		0.03								
v/c Ratio		0.68		0.15	0.04		0.31	0.95		0.37	0.61	
Uniform Delay, d1		52.3		46.8	45.7		64.1	21.0		62.7	12.1	
Progression Factor		1.00		1.00	1.00		1.26	0.12		0.60	1.79	
Incremental Delay, d2		6.7		0.3	0.0		0.6	3.5		1.9	1.1	
Delay (s)		59.0		47.0	45.8		81.2	6.0		39.8	22.7	
Level of Service		E		D	D		F	A		D	C	
Approach Delay (s)		59.0			46.4			7.0			23.2	
Approach LOS		E			D			A			C	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	0	12	3	0	32	20	2286	12	109	1447	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	4.0		3.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.85		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1967	1553		1770	1583		1770	3536		1770	4000	
Flt Permitted	0.74	1.00		0.75	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1525	1553		1397	1583		1770	3536		1770	3264	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	28	0	12	3	0	32	20	2286	12	109	1447	20
RTOR Reduction (vph)	0	11	0	0	29	0	0	0	0	0	0	0
Lane Group Flow (vph)	28	1	0	3	3	0	20	2298	0	109	1467	0
Confl. Peds. (#/hr)							10					10
Heavy Vehicles (%)	4%	2%	4%	2%	2%	2%	2%	2%	2%	2%	7%	7%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	15	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	10.5	10.5		10.5	10.5		3.8	96.0		14.5	106.7	
Effective Green, g (s)	13.5	13.5		13.5	13.5		6.8	99.0		17.5	109.7	
Actuated g/C Ratio	0.10	0.10		0.10	0.10		0.05	0.71		0.12	0.78	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	7.0		6.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	147	150		135	153		86	2500		221	3134	
v/s Ratio Prot		0.00			0.00		0.01	c0.65		c0.06	0.37	
v/s Ratio Perm	c0.02			0.00								
v/c Ratio	0.19	0.01		0.02	0.02		0.23	0.92		0.49	0.47	
Uniform Delay, d1	58.2	57.2		57.3	57.3		64.1	17.1		57.1	5.2	
Progression Factor	1.00	1.00		1.00	1.00		1.17	0.24		1.22	0.04	
Incremental Delay, d2	0.6	0.0		0.1	0.1		0.6	3.2		1.6	0.5	
Delay (s)	58.9	57.2		57.3	57.3		75.3	7.4		71.3	0.7	
Level of Service	E	E		E	E		E	A		E	A	
Approach Delay (s)		58.4			57.3			8.0			5.6	
Approach LOS		E			E			A			A	

Intersection Summary			
HCM Average Control Delay	7.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	80	32	20	2271	1495	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	13	12	12
Total Lost time (s)	3.0			3.0	4.0	
Lane Util. Factor	1.00			0.95	*0.95	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	0.96			1.00	1.00	
Flt Protected	0.97			1.00	1.00	
Satd. Flow (prot)	1881			3656	4000	
Flt Permitted	0.97			0.92	1.00	
Satd. Flow (perm)	1881			3371	3350	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	32	20	2271	1495	20
RTOR Reduction (vph)	12	0	0	0	0	0
Lane Group Flow (vph)	100	0	0	2291	1515	0
Confl. Peds. (#/hr)			5			5
Heavy Vehicles (%)	0%	0%	2%	2%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	7	0
Turn Type			Perm			
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	16.2			111.8	110.8	
Effective Green, g (s)	19.2			114.8	113.8	
Actuated g/C Ratio	0.14			0.82	0.81	
Clearance Time (s)	6.0			6.0	7.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	258			2764	3251	
v/s Ratio Prot	c0.05				0.38	
v/s Ratio Perm				c0.68		
v/c Ratio	0.39			0.83	0.47	
Uniform Delay, d1	55.0			7.1	3.9	
Progression Factor	1.00			0.38	0.61	
Incremental Delay, d2	1.0			1.4	0.3	
Delay (s)	56.0			4.1	2.7	
Level of Service	E			A	A	
Approach Delay (s)	56.0			4.1	2.7	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	248	159	312	28	125	79	4	263	2001	68	4	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0			3.0	4.0	4.0		3.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99			1.00	1.00	0.96		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00		1.00
Frt	1.00	0.90		1.00	0.94			1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00	1.00		0.95
Satd. Flow (prot)	1732	1843		1147	1130			1770	4000	1564		1703
Flt Permitted	0.36	1.00		0.13	1.00			0.95	1.00	1.00		0.95
Satd. Flow (perm)	661	1843		160	1130			1770	3539	1564		1703
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	248	159	312	28	125	79	4	263	2001	68	4	155
RTOR Reduction (vph)	0	54	0	0	17	0	0	0	0	15	0	0
Lane Group Flow (vph)	248	417	0	28	187	0	0	267	2001	53	0	159
Confl. Peds. (#/hr)	8		5	5		8				7		
Heavy Vehicles (%)	4%	4%	4%	57%	57%	57%	2%	2%	2%	2%	6%	6%
Turn Type	pm+pt			Perm			Prot	Prot		Perm	Prot	Prot
Protected Phases	7	4			8		5	5	2		1	1
Permitted Phases	4			8						2		
Actuated Green, G (s)	37.1	37.1		27.1	27.1			23.0	68.7	68.7		15.2
Effective Green, g (s)	40.1	40.1		30.1	30.1			26.0	71.7	71.7		18.2
Actuated g/C Ratio	0.29	0.29		0.22	0.22			0.19	0.51	0.51		0.13
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	7.0	7.0		6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	243	528		34	243			329	2049	801		221
v/s Ratio Prot	c0.05	0.23			0.17			0.15	c0.50			c0.09
v/s Ratio Perm	c0.24			0.17						0.03		
v/c Ratio	1.02	0.79		0.82	0.77			0.81	0.98	0.07		0.72
Uniform Delay, d1	50.8	46.1		52.4	51.7			54.7	33.3	17.2		58.4
Progression Factor	1.00	1.00		1.00	1.00			0.74	0.58	0.38		1.00
Incremental Delay, d2	63.1	7.7		85.0	13.6			8.4	10.4	0.1		10.7
Delay (s)	114.0	53.8		137.4	65.2			49.0	29.6	6.7		69.1
Level of Service	F	D		F	E			D	C	A		E
Approach Delay (s)		74.5			74.0				31.1			
Approach LOS		E			E				C			

Intersection Summary			
HCM Average Control Delay	41.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	109.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	1237	24
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3392	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1237	24
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1260	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	60.9	
Effective Green, g (s)	63.9	
Actuated g/C Ratio	0.46	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1826	
v/s Ratio Prot	0.31	
v/s Ratio Perm		
v/c Ratio	0.69	
Uniform Delay, d1	30.2	
Progression Factor	1.00	
Incremental Delay, d2	2.2	
Delay (s)	32.4	
Level of Service	C	
Approach Delay (s)	36.5	
Approach LOS	D	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	674	301	2002	1235	46	1177
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	12
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	1.00	1.00	0.98	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2798	1379	4000	1505	1604	4000
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2798	1379	3557	1505	1604	3438
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	674	301	2002	1235	46	1177
RTOR Reduction (vph)	0	42	0	39	0	0
Lane Group Flow (vph)	674	259	2002	1196	46	1177
Confl. Peds. (#/hr)		1		9		
Heavy Vehicles (%)	21%	21%	2%	2%	5%	5%
Turn Type		Prot		pm+ov	Prot	
Protected Phases	8	8	2	8	1	6
Permitted Phases				2		
Actuated Green, G (s)	44.0	44.0	73.5	117.5	3.5	83.0
Effective Green, g (s)	47.0	47.0	76.5	123.5	6.5	86.0
Actuated g/C Ratio	0.34	0.34	0.55	0.88	0.05	0.61
Clearance Time (s)	6.0	6.0	7.0	6.0	6.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	939	463	2186	1328	74	2457
v/s Ratio Prot	0.24	0.19	c0.50	c0.30	c0.03	0.29
v/s Ratio Perm				0.49		
v/c Ratio	0.72	0.56	0.92	0.90	0.62	0.48
Uniform Delay, d1	40.7	38.0	28.8	4.7	65.5	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.03	1.01
Incremental Delay, d2	2.6	1.5	7.5	8.7	12.3	0.5
Delay (s)	43.3	39.5	36.3	13.4	79.9	15.4
Level of Service	D	D	D	B	E	B
Approach Delay (s)	42.2		27.6			17.9
Approach LOS	D		C			B

Intersection Summary			
HCM Average Control Delay	28.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	33	7	26	132	11	30	8	103	2093	72	12	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0		3.0	3.0			3.0	4.0			3.0
Lane Util. Factor		1.00		1.00	1.00			1.00	0.95			1.00
Frpb, ped/bikes		1.00		1.00	1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00		1.00	1.00			1.00	1.00			1.00
Frt		0.95		1.00	0.89			1.00	1.00			1.00
Flt Protected		0.98		0.95	1.00			0.95	1.00			0.95
Satd. Flow (prot)		1704		1719	1611			1736	3451			1589
Flt Permitted		0.86		0.69	1.00			0.95	1.00			0.95
Satd. Flow (perm)		1495		1245	1611			1736	3451			1589
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	33	7	26	132	11	30	8	103	2093	72	12	107
RTOR Reduction (vph)	0	19	0	0	25	0	0	0	2	0	0	0
Lane Group Flow (vph)	0	47	0	132	16	0	0	111	2163	0	0	119
Confl. Peds. (#/hr)										2		
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	4%	4%	4%	4%	6%	6%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		4			8		5	5	2		1	1
Permitted Phases	4			8								
Actuated Green, G (s)		21.3		21.3	21.3			13.0	83.6			16.1
Effective Green, g (s)		24.3		24.3	24.3			16.0	86.6			19.1
Actuated g/C Ratio		0.17		0.17	0.17			0.11	0.62			0.14
Clearance Time (s)		6.0		6.0	6.0			6.0	7.0			6.0
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		259		216	280			198	2135			217
v/s Ratio Prot					0.01			0.06	c0.63			c0.07
v/s Ratio Perm		0.03		c0.11								
v/c Ratio		0.18		0.61	0.06			0.56	1.01			0.55
Uniform Delay, d1		49.4		53.5	48.3			58.7	26.7			56.4
Progression Factor		1.00		1.00	1.00			1.23	0.28			1.15
Incremental Delay, d2		0.3		5.0	0.1			1.8	17.0			2.4
Delay (s)		49.7		58.5	48.4			73.8	24.6			67.1
Level of Service		D		E	D			E	C			E
Approach Delay (s)		49.7			56.1				27.0			
Approach LOS		D			E				C			

Intersection Summary			
HCM Average Control Delay	25.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	1350	27
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3393	
Flt Permitted	1.00	
Satd. Flow (perm)	3393	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1350	27
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1376	0
Confl. Peds. (#/hr)		7
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	86.7	
Effective Green, g (s)	89.7	
Actuated g/C Ratio	0.64	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	2174	
v/s Ratio Prot	0.41	
v/s Ratio Perm		
v/c Ratio	0.63	
Uniform Delay, d1	15.2	
Progression Factor	0.95	
Incremental Delay, d2	1.2	
Delay (s)	15.6	
Level of Service	B	
Approach Delay (s)	19.7	
Approach LOS	B	

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: E Custis Ave. & Jefferson Davis Highway

2/15/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	147	3	37	40	5	36	28	2136	27	43	1385	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0		3.0	3.0		3.0	4.0		3.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.97		1.00	0.87		1.00	1.00		1.00	1.00	
Flt Protected		0.96		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1756		1770	1617		1770	3415		1770	3392	
Flt Permitted		0.74		0.72	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1359		1340	1617		1770	3415		1770	3392	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	147	3	37	40	5	36	28	2136	27	43	1385	28
RTOR Reduction (vph)	0	7	0	0	29	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	180	0	40	12	0	28	2162	0	43	1412	0
Confl. Peds. (#/hr)			2				9					9
Heavy Vehicles (%)	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	6%	6%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		24.3		24.3	24.3		4.1	90.6		6.1	92.6	
Effective Green, g (s)		27.3		27.3	27.3		7.1	93.6		9.1	95.6	
Actuated g/C Ratio		0.20		0.20	0.20		0.05	0.67		0.06	0.68	
Clearance Time (s)		6.0		6.0	6.0		6.0	7.0		6.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		265		261	315		90	2283		115	2316	
v/s Ratio Prot					0.01		0.02	c0.63		c0.02	0.42	
v/s Ratio Perm		c0.13		0.03								
v/c Ratio		0.68		0.15	0.04		0.31	0.95		0.37	0.61	
Uniform Delay, d1		52.3		46.8	45.7		64.1	21.0		62.7	12.1	
Progression Factor		1.00		1.00	1.00		1.26	0.24		0.62	2.05	
Incremental Delay, d2		6.7		0.3	0.0		0.2	1.2		1.9	1.1	
Delay (s)		59.0		47.0	45.8		81.2	6.2		40.9	25.8	
Level of Service		E		D	D		F	A		D	C	
Approach Delay (s)		59.0			46.4			7.1			26.2	
Approach LOS		E			D			A			C	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	0	12	3	0	32	34	2286	12	109	1447	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	4.0		3.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.85		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1967	1553		1770	1583		1770	3536		1770	4000	
Flt Permitted	0.74	1.00		0.75	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1525	1553		1397	1583		1770	3536		1770	3264	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	28	0	12	3	0	32	34	2286	12	109	1447	20
RTOR Reduction (vph)	0	11	0	0	29	0	0	0	0	0	0	0
Lane Group Flow (vph)	28	1	0	3	3	0	34	2298	0	109	1467	0
Confl. Peds. (#/hr)							10					10
Heavy Vehicles (%)	4%	2%	4%	2%	2%	2%	2%	2%	2%	2%	7%	7%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	15	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	10.5	10.5		10.5	10.5		4.5	96.0		14.5	106.0	
Effective Green, g (s)	13.5	13.5		13.5	13.5		7.5	99.0		17.5	109.0	
Actuated g/C Ratio	0.10	0.10		0.10	0.10		0.05	0.71		0.12	0.78	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	7.0		6.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	147	150		135	153		95	2500		221	3114	
v/s Ratio Prot		0.00			0.00		0.02	c0.65		c0.06	0.37	
v/s Ratio Perm	c0.02			0.00								
v/c Ratio	0.19	0.01		0.02	0.02		0.36	0.92		0.49	0.47	
Uniform Delay, d1	58.2	57.2		57.3	57.3		63.9	17.1		57.1	5.4	
Progression Factor	1.00	1.00		1.00	1.00		1.13	0.20		1.01	0.41	
Incremental Delay, d2	0.6	0.0		0.1	0.1		1.0	3.2		1.3	0.4	
Delay (s)	58.9	57.2		57.3	57.3		73.4	6.8		59.3	2.6	
Level of Service	E	E		E	E		E	A		E	A	
Approach Delay (s)		58.4			57.3			7.7			6.5	
Approach LOS		E			E			A			A	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	248	159	312	28	125	79	4	269	2001	68	4	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0			3.0	4.0			3.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	0.95			1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99			1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00			1.00
Frt	1.00	0.90		1.00	0.94			1.00	1.00			1.00
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00			0.95
Satd. Flow (prot)	1732	1843		1147	1130			1770	4000			1703
Flt Permitted	0.36	1.00		0.13	1.00			0.95	1.00			0.95
Satd. Flow (perm)	661	1843		160	1130			1770	3517			1703
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	248	159	312	28	125	79	4	269	2001	68	4	155
RTOR Reduction (vph)	0	54	0	0	17	0	0	0	2	0	0	0
Lane Group Flow (vph)	248	417	0	28	187	0	0	273	2067	0	0	159
Confl. Peds. (#/hr)	8		5	5		8				7		
Heavy Vehicles (%)	4%	4%	4%	57%	57%	57%	2%	2%	2%	2%	6%	6%
Turn Type	pm+pt			Perm			Prot	Prot			Prot	Prot
Protected Phases	7	4			8		5	5	2		1	1
Permitted Phases	4			8								
Actuated Green, G (s)	37.1	37.1		27.1	27.1			23.0	60.0			7.0
Effective Green, g (s)	40.1	40.1		30.1	30.1			26.0	63.0			10.0
Actuated g/C Ratio	0.29	0.29		0.22	0.22			0.19	0.45			0.07
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	7.0			6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0			3.0
Lane Grp Cap (vph)	243	528		34	243			329	1800			122
v/s Ratio Prot	c0.05	0.23			0.17			0.15	c0.52			c0.09
v/s Ratio Perm	c0.24			0.17								
v/c Ratio	1.02	0.79		0.82	0.77			0.83	1.15			1.30
Uniform Delay, d1	50.8	46.1		52.4	51.7			54.9	38.5			65.0
Progression Factor	1.00	1.00		1.00	1.00			0.66	0.52			1.00
Incremental Delay, d2	63.1	7.7		85.0	13.6			8.5	70.5			183.6
Delay (s)	114.0	53.8		137.4	65.2			44.7	90.3			248.6
Level of Service	F	D		F	E			D	F			F
Approach Delay (s)		74.5			74.0				85.0			
Approach LOS		E			E				F			

Intersection Summary			
HCM Average Control Delay	74.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	1237	24
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3392	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1237	24
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1260	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	60.9	
Effective Green, g (s)	63.9	
Actuated g/C Ratio	0.46	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1826	
v/s Ratio Prot	c0.31	
v/s Ratio Perm		
v/c Ratio	0.69	
Uniform Delay, d1	30.2	
Progression Factor	1.00	
Incremental Delay, d2	2.2	
Delay (s)	32.4	
Level of Service	C	
Approach Delay (s)	56.6	
Approach LOS	E	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	674	301	2002	1235	0	1177
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	12
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.0	3.0	4.0	3.0		4.0
Lane Util. Factor	0.97	1.00	0.95	1.00		0.95
Frpb, ped/bikes	1.00	1.00	1.00	0.98		1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	2798	1379	4000	1506		4000
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	2798	1379	3557	1506		3438
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	674	301	2002	1235	0	1177
RTOR Reduction (vph)	0	4	0	0	0	0
Lane Group Flow (vph)	674	297	2002	1235	0	1177
Confl. Peds. (#/hr)		1		9		
Heavy Vehicles (%)	21%	21%	2%	2%	5%	5%
Turn Type		Prot		pm+ov		
Protected Phases	8	8	2	8		6
Permitted Phases				2		
Actuated Green, G (s)	48.4	48.4	78.6	127.0		65.0
Effective Green, g (s)	51.4	51.4	81.6	133.0		68.0
Actuated g/C Ratio	0.37	0.37	0.58	0.95		0.49
Clearance Time (s)	6.0	6.0	7.0	6.0		7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	1027	506	2331	1463		1943
v/s Ratio Prot	0.24	0.22	c0.50	c0.31		0.29
v/s Ratio Perm				0.51		
v/c Ratio	0.66	0.59	0.86	0.84		0.61
Uniform Delay, d1	36.9	35.7	24.4	0.9		26.2
Progression Factor	1.00	1.00	1.00	1.00		0.66
Incremental Delay, d2	1.5	1.7	4.4	4.6		1.1
Delay (s)	38.5	37.5	28.8	5.5		18.4
Level of Service	D	D	C	A		B
Approach Delay (s)	38.2		19.9			18.4
Approach LOS	D		B			B

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	3.0
Intersection Capacity Utilization	81.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	33	7	26	132	11	30	8	103	2093	72	12	153
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0		3.0	3.0			3.0	4.0			3.0
Lane Util. Factor		1.00		1.00	1.00			1.00	0.95			1.00
Frpb, ped/bikes		1.00		1.00	1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00		1.00	1.00			1.00	1.00			1.00
Frt		0.95		1.00	0.89			1.00	1.00			1.00
Flt Protected		0.98		0.95	1.00			0.95	1.00			0.95
Satd. Flow (prot)		1704		1719	1611			1736	3451			1589
Flt Permitted		0.86		0.69	1.00			0.95	1.00			0.95
Satd. Flow (perm)		1495		1245	1611			1736	3451			1589
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	33	7	26	132	11	30	8	103	2093	72	12	153
RTOR Reduction (vph)	0	19	0	0	25	0	0	0	2	0	0	0
Lane Group Flow (vph)	0	47	0	132	16	0	0	111	2163	0	0	165
Confl. Peds. (#/hr)										2		
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	4%	4%	4%	4%	6%	6%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		4			8		5	5	2		1	1
Permitted Phases	4			8								
Actuated Green, G (s)		21.3		21.3	21.3			13.0	80.9			18.8
Effective Green, g (s)		24.3		24.3	24.3			16.0	83.9			21.8
Actuated g/C Ratio		0.17		0.17	0.17			0.11	0.60			0.16
Clearance Time (s)		6.0		6.0	6.0			6.0	7.0			6.0
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		259		216	280			198	2068			247
v/s Ratio Prot					0.01			0.06	c0.63			c0.10
v/s Ratio Perm		0.03		c0.11								
v/c Ratio		0.18		0.61	0.06			0.56	1.05			0.67
Uniform Delay, d1		49.4		53.5	48.3			58.7	28.0			55.7
Progression Factor		1.00		1.00	1.00			1.05	0.49			1.29
Incremental Delay, d2		0.3		5.0	0.1			2.0	28.6			5.7
Delay (s)		49.7		58.5	48.4			63.6	42.3			77.5
Level of Service		D		E	D			E	D			E
Approach Delay (s)		49.7			56.1				43.3			
Approach LOS		D			E				D			

Intersection Summary			
HCM Average Control Delay	33.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	1350	27
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3393	
Flt Permitted	1.00	
Satd. Flow (perm)	3393	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1350	27
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	1376	0
Confl. Peds. (#/hr)		7
Heavy Vehicles (%)	6%	6%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	86.7	
Effective Green, g (s)	89.7	
Actuated g/C Ratio	0.64	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	2174	
v/s Ratio Prot	0.41	
v/s Ratio Perm		
v/c Ratio	0.63	
Uniform Delay, d1	15.2	
Progression Factor	0.45	
Incremental Delay, d2	1.2	
Delay (s)	8.1	
Level of Service	A	
Approach Delay (s)	15.5	
Approach LOS	B	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	6	46	65	10	15	42	1650	6	23	2222	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0		3.0	3.0		3.0	4.0		3.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.93		1.00	0.91		1.00	1.00		1.00	1.00	
Flt Protected		0.98		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1713		1770	1695		1787	3453		1770	3553	
Flt Permitted		0.88		0.61	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1537		1128	1695		1787	3453		1770	3553	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	6	46	65	10	15	42	1650	6	23	2222	68
RTOR Reduction (vph)	0	35	0	0	13	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	51	0	65	12	0	42	1656	0	23	2289	0
Confl. Peds. (#/hr)			2				10					10
Heavy Vehicles (%)	0%	2%	0%	2%	2%	2%	1%	1%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		16.0		16.0	16.0		6.0	101.1		3.9	99.0	
Effective Green, g (s)		19.0		19.0	19.0		9.0	104.1		6.9	102.0	
Actuated g/C Ratio		0.14		0.14	0.14		0.06	0.74		0.05	0.73	
Clearance Time (s)		6.0		6.0	6.0		6.0	7.0		6.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		209		153	230		115	2568		87	2589	
v/s Ratio Prot					0.01		c0.02	0.48		0.01	c0.64	
v/s Ratio Perm		0.03		c0.06								
v/c Ratio		0.24		0.42	0.05		0.37	0.64		0.26	0.88	
Uniform Delay, d1		54.1		55.5	52.7		62.8	8.8		64.1	14.5	
Progression Factor		1.00		1.00	1.00		0.99	0.69		0.77	1.11	
Incremental Delay, d2		0.6		1.9	0.1		1.5	1.0		1.2	3.5	
Delay (s)		54.7		57.4	52.8		63.5	7.0		50.5	19.7	
Level of Service		D		E	D		E	A		D	B	
Approach Delay (s)		54.7			56.1			8.4			20.0	
Approach LOS		D			E			A			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	83.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	0	20	53	0	37	20	1674	10	55	2221	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	4.0		3.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.85		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1984	1568		1770	1583		1787	3571		1770	4000	
Flt Permitted	0.73	1.00		0.74	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1531	1568		1386	1583		1787	3571		1770	3523	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	0	20	53	0	37	20	1674	10	55	2221	44
RTOR Reduction (vph)	0	18	0	0	33	0	0	0	0	0	1	0
Lane Group Flow (vph)	40	2	0	53	4	0	20	1684	0	55	2264	0
Confl. Peds. (#/hr)	1						15					15
Heavy Vehicles (%)	3%	2%	3%	2%	2%	2%	1%	1%	2%	2%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	5	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	13.5	13.5		13.5	13.5		3.8	100.2		7.3	103.7	
Effective Green, g (s)	16.5	16.5		16.5	16.5		6.8	103.2		10.3	106.7	
Actuated g/C Ratio	0.12	0.12		0.12	0.12		0.05	0.74		0.07	0.76	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	7.0		6.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	180	185		163	187		87	2632		130	3049	
v/s Ratio Prot		0.00			0.00		0.01	0.47		c0.03	c0.57	
v/s Ratio Perm	0.03			c0.04								
v/c Ratio	0.22	0.01		0.33	0.02		0.23	0.64		0.42	0.74	
Uniform Delay, d1	55.9	54.6		56.6	54.6		64.1	9.2		62.0	9.1	
Progression Factor	1.00	1.00		1.00	1.00		1.20	0.34		1.14	0.46	
Incremental Delay, d2	0.6	0.0		1.2	0.1		1.1	1.0		1.2	0.9	
Delay (s)	56.6	54.6		57.8	54.7		77.8	4.1		71.7	5.1	
Level of Service	E	D		E	D		E	A		E	A	
Approach Delay (s)		55.9			56.5			5.0			6.7	
Approach LOS		E			E			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations							
Volume (vph)	36	24	52	1699	4	2297	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	13	12	12	12
Total Lost time (s)	3.0			3.0		4.0	
Lane Util. Factor	1.00			0.95		*0.95	
Frpb, ped/bikes	1.00			1.00		1.00	
Flpb, ped/bikes	1.00			1.00		1.00	
Frt	0.95			1.00		1.00	
Flt Protected	0.97			1.00		1.00	
Satd. Flow (prot)	1861			3688		4000	
Flt Permitted	0.97			0.66		0.95	
Satd. Flow (perm)	1861			2444		3341	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	36	24	52	1699	4	2297	40
RTOR Reduction (vph)	9	0	0	0	0	0	0
Lane Group Flow (vph)	51	0	0	1751	0	2341	0
Confl. Peds. (#/hr)	1		13				13
Heavy Vehicles (%)	0%	0%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	7	0
Turn Type			Perm		Perm		
Protected Phases	4			2		6	
Permitted Phases			2		6		
Actuated Green, G (s)	12.6			115.4		114.4	
Effective Green, g (s)	15.6			118.4		117.4	
Actuated g/C Ratio	0.11			0.85		0.84	
Clearance Time (s)	6.0			6.0		7.0	
Vehicle Extension (s)	3.0			3.0		3.0	
Lane Grp Cap (vph)	207			2067		2802	
v/s Ratio Prot	c0.03						
v/s Ratio Perm				c0.72		0.70	
v/c Ratio	0.25			0.85		0.84	
Uniform Delay, d1	56.8			5.9		6.1	
Progression Factor	1.00			1.69		1.26	
Incremental Delay, d2	0.6			3.7		0.3	
Delay (s)	57.5			13.6		8.0	
Level of Service	E			B		A	
Approach Delay (s)	57.5			13.6		8.0	
Approach LOS	E			B		A	

Intersection Summary			
HCM Average Control Delay	11.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	124	142	288	82	198	178	8	290	1407	21	8	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0			3.0	4.0	4.0		3.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99			1.00	1.00	0.95		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00		1.00
Frt	1.00	0.90		1.00	0.93			1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00	1.00		0.95
Satd. Flow (prot)	1752	1857		1800	1746			1787	4000	1574		1787
Flt Permitted	0.13	1.00		0.25	1.00			0.95	1.00	1.00		0.95
Satd. Flow (perm)	239	1857		479	1746			1787	3574	1574		1787
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	124	142	288	82	198	178	8	290	1407	21	8	146
RTOR Reduction (vph)	0	54	0	0	23	0	0	0	0	6	0	0
Lane Group Flow (vph)	124	376	0	82	353	0	0	298	1407	15	0	154
Confl. Peds. (#/hr)	9		6	6		9				8		
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			Perm			Prot	Prot		Perm	Prot	Prot
Protected Phases	7	4			8		5	5	2		1	1
Permitted Phases	4			8						2		
Actuated Green, G (s)	40.9	40.9		30.9	30.9			17.0	65.2	65.2		14.9
Effective Green, g (s)	43.9	43.9		33.9	33.9			20.0	68.2	68.2		17.9
Actuated g/C Ratio	0.31	0.31		0.24	0.24			0.14	0.49	0.49		0.13
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	7.0	7.0		6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	151	582		116	423			255	1949	767		228
v/s Ratio Prot	c0.04	0.20			0.20			c0.17	0.35			0.09
v/s Ratio Perm	c0.22			0.17						0.01		
v/c Ratio	0.82	0.65		0.71	0.83			1.17	0.72	0.02		0.68
Uniform Delay, d1	39.7	41.4		48.5	50.4			60.0	28.4	18.6		58.3
Progression Factor	1.00	1.00		1.00	1.00			0.82	0.66	0.51		1.00
Incremental Delay, d2	28.7	2.5		17.8	13.2			96.9	1.3	0.0		7.7
Delay (s)	68.4	43.8		66.3	63.5			146.1	20.1	9.5		66.0
Level of Service	E	D		E	E			F	C	A		E
Approach Delay (s)		49.3			64.0				41.7			
Approach LOS		D			E				D			

Intersection Summary			
HCM Average Control Delay	75.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	122.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	1991	188
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3510	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1991	188
RTOR Reduction (vph)	5	0
Lane Group Flow (vph)	2174	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	63.1	
Effective Green, g (s)	66.1	
Actuated g/C Ratio	0.47	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1889	
v/s Ratio Prot	c0.54	
v/s Ratio Perm		
v/c Ratio	1.15	
Uniform Delay, d1	37.0	
Progression Factor	1.00	
Incremental Delay, d2	74.6	
Delay (s)	111.5	
Level of Service	F	
Approach Delay (s)	108.5	
Approach LOS	F	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	1414	320	1405	960	11	2094
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	12
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	1.00	1.00	0.98	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3193	1574	4000	1507	1668	4000
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3193	1574	3557	1507	1668	3574
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1414	320	1405	960	11	2094
RTOR Reduction (vph)	0	46	0	86	0	0
Lane Group Flow (vph)	1414	274	1405	874	11	2094
Confl. Peds. (#/hr)		1		12		
Heavy Vehicles (%)	6%	6%	2%	2%	1%	1%
Turn Type		Prot		pm+ov	Prot	
Protected Phases	8	8	2	8	1	6
Permitted Phases				2		
Actuated Green, G (s)	58.0	58.0	61.4	119.4	1.6	69.0
Effective Green, g (s)	61.0	61.0	64.4	125.4	4.6	72.0
Actuated g/C Ratio	0.44	0.44	0.46	0.90	0.03	0.51
Clearance Time (s)	6.0	6.0	7.0	6.0	6.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1391	686	1840	1350	55	2057
v/s Ratio Prot	c0.44	0.17	0.35	0.28	0.01	c0.52
v/s Ratio Perm				0.30		
v/c Ratio	1.02	0.40	0.76	0.65	0.20	1.02
Uniform Delay, d1	39.5	27.0	31.5	1.8	65.9	34.0
Progression Factor	1.00	1.00	1.00	1.00	1.24	0.44
Incremental Delay, d2	28.3	0.4	3.1	1.1	0.2	11.3
Delay (s)	67.8	27.4	34.5	2.9	81.9	26.4
Level of Service	E	C	C	A	F	C
Approach Delay (s)	60.4		21.7			26.7
Approach LOS	E		C			C

Intersection Summary			
HCM Average Control Delay	34.2	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	104.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
134: E Howell Ave. & Jefferson Davis Highway

2/15/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	30	10	29	197	19	95	8	104	1531	49	16	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0		3.0	3.0			3.0	4.0			3.0
Lane Util. Factor		1.00		1.00	1.00			1.00	0.95			1.00
Frpb, ped/bikes		0.99		1.00	0.99			1.00	1.00			1.00
Flpb, ped/bikes		1.00		1.00	1.00			1.00	1.00			1.00
Frt		0.94		1.00	0.88			1.00	1.00			1.00
Flt Protected		0.98		0.95	1.00			0.95	1.00			0.95
Satd. Flow (prot)		1744		1751	1596			1770	3520			1668
Flt Permitted		0.85		0.69	1.00			0.95	1.00			0.95
Satd. Flow (perm)		1522		1265	1596			1770	3520			1668
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	30	10	29	197	19	95	8	104	1531	49	16	30
RTOR Reduction (vph)	0	21	0	0	68	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	48	0	197	46	0	0	112	1579	0	0	46
Confl. Peds. (#/hr)	1		1	1		1				2		
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		4			8		5	5	2		1	1
Permitted Phases	4			8								
Actuated Green, G (s)		26.5		26.5	26.5			12.0	87.8			6.7
Effective Green, g (s)		29.5		29.5	29.5			15.0	90.8			9.7
Actuated g/C Ratio		0.21		0.21	0.21			0.11	0.65			0.07
Clearance Time (s)		6.0		6.0	6.0			6.0	7.0			6.0
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		321		267	336			190	2283			116
v/s Ratio Prot					0.03			c0.06	0.45			0.03
v/s Ratio Perm		0.03		c0.16								
v/c Ratio		0.15		0.74	0.14			0.59	0.69			0.40
Uniform Delay, d1		45.0		51.6	44.9			59.6	15.7			62.3
Progression Factor		1.00		1.00	1.00			0.84	1.01			1.27
Incremental Delay, d2		0.2		10.2	0.2			3.4	1.3			1.2
Delay (s)		45.3		61.8	45.1			53.5	17.1			80.2
Level of Service		D		E	D			D	B			F
Approach Delay (s)		45.3			55.7				19.5			
Approach LOS		D			E				B			

Intersection Summary			
HCM Average Control Delay	39.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	2261	48
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3559	
Flt Permitted	1.00	
Satd. Flow (perm)	3559	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	2261	48
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	2308	0
Confl. Peds. (#/hr)		9
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	82.5	
Effective Green, g (s)	85.5	
Actuated g/C Ratio	0.61	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	2174	
v/s Ratio Prot	c0.65	
v/s Ratio Perm		
v/c Ratio	1.06	
Uniform Delay, d1	27.2	
Progression Factor	0.65	
Incremental Delay, d2	33.8	
Delay (s)	51.6	
Level of Service	D	
Approach Delay (s)	52.2	
Approach LOS	D	

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: E Custis Ave. & Jefferson Davis Highway 2/15/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	6	46	65	10	15	42	1650	6	23	2222	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)		3.0		3.0	3.0		3.0	4.0		3.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	*0.95	
Frpb, ped/bikes		0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.93		1.00	0.91		1.00	1.00		1.00	1.00	
Flt Protected		0.98		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1713		1770	1695		1787	3453		1770	3553	
Flt Permitted		0.88		0.61	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1537		1128	1695		1787	3453		1770	3553	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	34	6	46	65	10	15	42	1650	6	23	2222	68
RTOR Reduction (vph)	0	35	0	0	13	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	51	0	65	12	0	42	1656	0	23	2289	0
Confl. Peds. (#/hr)			2				10					10
Heavy Vehicles (%)	0%	2%	0%	2%	2%	2%	1%	1%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		16.0		16.0	16.0		6.0	101.1		3.9	99.0	
Effective Green, g (s)		19.0		19.0	19.0		9.0	104.1		6.9	102.0	
Actuated g/C Ratio		0.14		0.14	0.14		0.06	0.74		0.05	0.73	
Clearance Time (s)		6.0		6.0	6.0		6.0	7.0		6.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		209		153	230		115	2568		87	2589	
v/s Ratio Prot					0.01		c0.02	0.48		0.01	c0.64	
v/s Ratio Perm		0.03		c0.06								
v/c Ratio		0.24		0.42	0.05		0.37	0.64		0.26	0.88	
Uniform Delay, d1		54.1		55.5	52.7		62.8	8.8		64.1	14.5	
Progression Factor		1.00		1.00	1.00		0.83	0.83		1.24	0.27	
Incremental Delay, d2		0.6		1.9	0.1		1.5	1.0		1.1	3.4	
Delay (s)		54.7		57.4	52.8		53.9	8.3		80.8	7.4	
Level of Service		D		E	D		D	A		F	A	
Approach Delay (s)		54.7			56.1			9.4			8.1	
Approach LOS		D			E			A			A	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	83.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Volume (vph)	40	0	20	53	0	37	56	1674	10	4	55	2221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	4.0			3.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95			1.00	*0.95
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.85		1.00	0.85		1.00	1.00			1.00	1.00
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.95	1.00
Satd. Flow (prot)	1984	1568		1770	1583		1787	3571			1770	4000
Flt Permitted	0.73	1.00		0.74	1.00		0.95	1.00			0.95	1.00
Satd. Flow (perm)	1531	1568		1386	1583		1787	3571			1770	3523
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	0	20	53	0	37	56	1674	10	4	55	2221
RTOR Reduction (vph)	0	18	0	0	33	0	0	0	0	0	0	1
Lane Group Flow (vph)	40	2	0	53	4	0	56	1684	0	0	59	2264
Confl. Peds. (#/hr)	1						15					
Heavy Vehicles (%)	3%	2%	3%	2%	2%	2%	1%	1%	2%	2%	2%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	5
Turn Type	Perm			Perm			Prot			Prot	Prot	
Protected Phases		4			8		5	2		1	1	6
Permitted Phases	4			8								
Actuated Green, G (s)	13.5	13.5		13.5	13.5		7.2	100.0			7.5	100.3
Effective Green, g (s)	16.5	16.5		16.5	16.5		10.2	103.0			10.5	103.3
Actuated g/C Ratio	0.12	0.12		0.12	0.12		0.07	0.74			0.08	0.74
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	7.0			6.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	180	185		163	187		130	2627			133	2951
v/s Ratio Prot		0.00			0.00		0.03	0.47			c0.03	c0.57
v/s Ratio Perm	0.03			c0.04								
v/c Ratio	0.22	0.01		0.33	0.02		0.43	0.64			0.44	0.77
Uniform Delay, d1	55.9	54.6		56.6	54.6		62.1	9.3			62.0	11.1
Progression Factor	1.00	1.00		1.00	1.00		0.86	1.51			1.10	0.26
Incremental Delay, d2	0.6	0.0		1.2	0.1		1.8	1.0			0.2	0.2
Delay (s)	56.6	54.6		57.8	54.7		55.1	14.9			68.4	3.1
Level of Service	E	D		E	D		E	B			E	A
Approach Delay (s)		55.9			56.5			16.2				4.7
Approach LOS		E			E			B				A

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Volume (vph)	44
Ideal Flow (vphpl)	1900
Lane Width	12
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	1.00
Adj. Flow (vph)	44
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	15
Heavy Vehicles (%)	1%
Bus Blockages (#/hr)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	124	142	288	82	198	178	8	306	1407	21	8	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	12	12	12	12	12	13	12	12
Total Lost time (s)	3.0	3.0		3.0	3.0			3.0	4.0			3.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	0.95			1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99			1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00			1.00
Frt	1.00	0.90		1.00	0.93			1.00	1.00			1.00
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00			0.95
Satd. Flow (prot)	1752	1857		1800	1746			1787	4000			1787
Flt Permitted	0.13	1.00		0.25	1.00			0.95	1.00			0.95
Satd. Flow (perm)	239	1857		479	1746			1787	3564			1787
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	124	142	288	82	198	178	8	306	1407	21	8	146
RTOR Reduction (vph)	0	54	0	0	23	0	0	0	1	0	0	0
Lane Group Flow (vph)	124	376	0	82	353	0	0	314	1427	0	0	154
Confl. Peds. (#/hr)	9		6	6		9				8		
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			Perm			Prot	Prot			Prot	Prot
Protected Phases	7	4			8		5	5	2		1	1
Permitted Phases	4			8								
Actuated Green, G (s)	40.9	40.9		30.9	30.9			16.0	55.0			12.0
Effective Green, g (s)	43.9	43.9		33.9	33.9			19.0	58.0			15.0
Actuated g/C Ratio	0.31	0.31		0.24	0.24			0.14	0.41			0.11
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	7.0			6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0			3.0
Lane Grp Cap (vph)	151	582		116	423			243	1657			191
v/s Ratio Prot	c0.04	0.20			0.20			c0.18	0.36			0.09
v/s Ratio Perm	c0.22			0.17								
v/c Ratio	0.82	0.65		0.71	0.83			1.29	0.86			0.81
Uniform Delay, d1	39.7	41.4		48.5	50.4			60.5	37.3			61.1
Progression Factor	1.00	1.00		1.00	1.00			0.83	0.71			1.00
Incremental Delay, d2	28.7	2.5		17.8	13.2			154.3	5.1			21.4
Delay (s)	68.4	43.8		66.3	63.5			204.4	31.7			82.5
Level of Service	E	D		E	E			F	C			F
Approach Delay (s)		49.3			64.0				62.8			
Approach LOS		D			E				E			

Intersection Summary			
HCM Average Control Delay	79.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	122.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↑	
Volume (vph)	1991	188
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	4000	
Flt Permitted	1.00	
Satd. Flow (perm)	3510	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	1991	188
RTOR Reduction (vph)	5	0
Lane Group Flow (vph)	2174	0
Confl. Peds. (#/hr)		11
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	64.1	
Effective Green, g (s)	67.1	
Actuated g/C Ratio	0.48	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1917	
v/s Ratio Prot	c0.54	
v/s Ratio Perm		
v/c Ratio	1.13	
Uniform Delay, d1	36.5	
Progression Factor	1.00	
Incremental Delay, d2	67.5	
Delay (s)	104.0	
Level of Service	F	
Approach Delay (s)	102.5	
Approach LOS	F	

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	1414	320	1405	960	0	2094
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	13	12	11	10	12
Grade (%)	0%		-1%			0%
Total Lost time (s)	3.0	3.0	4.0	3.0		4.0
Lane Util. Factor	0.97	1.00	0.95	1.00		0.95
Frpb, ped/bikes	1.00	1.00	1.00	0.98		1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	3193	1574	4000	1504		4000
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	3193	1574	3557	1504		3574
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1414	320	1405	960	0	2094
RTOR Reduction (vph)	0	18	0	0	0	0
Lane Group Flow (vph)	1414	302	1405	960	0	2094
Confl. Peds. (#/hr)		1		12		
Heavy Vehicles (%)	6%	6%	2%	2%	1%	1%
Turn Type		Prot		pm+ov		
Protected Phases	8	8	2	8		6
Permitted Phases				2		
Actuated Green, G (s)	54.0	54.0	73.0	127.0		65.0
Effective Green, g (s)	57.0	57.0	76.0	133.0		68.0
Actuated g/C Ratio	0.41	0.41	0.54	0.95		0.49
Clearance Time (s)	6.0	6.0	7.0	6.0		7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	1300	641	2171	1461		1943
v/s Ratio Prot	c0.44	0.19	0.35	c0.27		c0.52
v/s Ratio Perm				0.37		
v/c Ratio	1.09	0.47	0.65	0.66		1.08
Uniform Delay, d1	41.5	30.4	22.6	0.5		36.0
Progression Factor	1.00	1.00	1.00	1.00		0.56
Incremental Delay, d2	52.4	0.5	1.5	1.1		36.1
Delay (s)	93.9	31.0	24.1	1.5		56.4
Level of Service	F	C	C	A		E
Approach Delay (s)	82.3		14.9			56.4
Approach LOS	F		B			E

Intersection Summary			
HCM Average Control Delay	47.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	104.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	30	10	29	197	19	95	8	104	1531	49	16	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	10
Total Lost time (s)		3.0		3.0	3.0			3.0	4.0			3.0
Lane Util. Factor		1.00		1.00	1.00			1.00	0.95			1.00
Frpb, ped/bikes		0.99		1.00	0.99			1.00	1.00			1.00
Flpb, ped/bikes		1.00		1.00	1.00			1.00	1.00			1.00
Frt		0.94		1.00	0.88			1.00	1.00			1.00
Flt Protected		0.98		0.95	1.00			0.95	1.00			0.95
Satd. Flow (prot)		1744		1751	1596			1770	3520			1668
Flt Permitted		0.85		0.69	1.00			0.95	1.00			0.95
Satd. Flow (perm)		1522		1265	1596			1770	3520			1668
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	30	10	29	197	19	95	8	104	1531	49	16	41
RTOR Reduction (vph)	0	21	0	0	68	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	48	0	197	46	0	0	112	1579	0	0	57
Confl. Peds. (#/hr)	1		1	1		1				2		
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	2%	1%	1%
Turn Type	Perm			Perm			Prot	Prot			Prot	Prot
Protected Phases		4			8		5	5	2		1	1
Permitted Phases	4			8								
Actuated Green, G (s)		26.5		26.5	26.5			12.0	87.5			7.0
Effective Green, g (s)		29.5		29.5	29.5			15.0	90.5			10.0
Actuated g/C Ratio		0.21		0.21	0.21			0.11	0.65			0.07
Clearance Time (s)		6.0		6.0	6.0			6.0	7.0			6.0
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		321		267	336			190	2275			119
v/s Ratio Prot					0.03			c0.06	0.45			0.03
v/s Ratio Perm		0.03		c0.16								
v/c Ratio		0.15		0.74	0.14			0.59	0.69			0.48
Uniform Delay, d1		45.0		51.6	44.9			59.6	15.9			62.5
Progression Factor		1.00		1.00	1.00			1.03	0.55			1.24
Incremental Delay, d2		0.2		10.2	0.2			3.7	1.4			1.6
Delay (s)		45.3		61.8	45.1			65.1	10.2			78.8
Level of Service		D		E	D			E	B			E
Approach Delay (s)		45.3			55.7				13.8			
Approach LOS		D			E				B			

Intersection Summary			
HCM Average Control Delay	35.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↱	
Volume (vph)	2261	48
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	4.0	
Lane Util. Factor	*0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3559	
Flt Permitted	1.00	
Satd. Flow (perm)	3559	
Peak-hour factor, PHF	1.00	1.00
Adj. Flow (vph)	2261	48
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	2308	0
Confl. Peds. (#/hr)		9
Heavy Vehicles (%)	1%	1%
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	82.5	
Effective Green, g (s)	85.5	
Actuated g/C Ratio	0.61	
Clearance Time (s)	7.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	2174	
v/s Ratio Prot	c0.65	
v/s Ratio Perm		
v/c Ratio	1.06	
Uniform Delay, d1	27.2	
Progression Factor	0.51	
Incremental Delay, d2	33.9	
Delay (s)	47.7	
Level of Service	D	
Approach Delay (s)	48.5	
Approach LOS	D	

Intersection Summary

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Attachment B
Intersection Turning Movement Counts

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VEHICLE TURNING MOVEMENT COUNT - SUMMARY - TOTALS

Counted by: VCU

Intersection of: Jefferson Davis Hwy. — Date: November 17, 2009 — Day: Tuesday

and: E.Glebe Rd. — Weather: Cool, Overcast

Location: Alexandria, VA — Entered by: SB

TIME	TRAFFIC FROM NORTH on: Jefferson Davis Hwy.					TRAFFIC FROM SOUTH on: Jefferson Davis Hwy.					TRAFFIC FROM EAST on: E.Glebe Rd.					TRAFFIC FROM WEST on: E.Glebe Rd.					TOTAL N + S + E + W
	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	
AM																					
45-00	5	132	1	0	138	1	453	62	0	516	0	0	0	0	0	41	0	26	0	67	721
07:0-15	5	162	0	1	168	0	461	55	0	516	0	1	0	0	1	31	1	39	0	71	756
15-30	9	152	0	1	162	0	552	72	0	624	1	0	0	0	1	45	2	28	0	75	862
30-45	7	189	0	1	197	0	463	50	1	514	0	0	2	0	2	47	0	47	0	94	807
45-00	7	206	1	0	214	0	500	41	0	541	1	1	1	0	3	42	0	51	0	93	851
08:0-15	17	188	0	0	205	0	463	42	0	505	1	0	0	0	1	56	0	60	0	116	827
15-30	6	235	0	0	241	0	485	32	0	517	0	0	1	0	1	61	1	58	0	120	879
30-45	9	225	0	0	234	1	425	43	0	469	1	0	0	0	1	65	0	45	0	110	814
2 Hr Totals	65	1489	2	3	1559	2	3802	397	1	4202	4	2	4	0	10	388	4	354	0	746	6517
1 Hr Totals																					
645-745	26	635	1	3	665	1	1929	239	1	2170	1	1	2	0	4	164	3	140	0	307	3146
07-08	28	709	1	3	741	0	1976	218	1	2195	2	2	3	0	7	165	3	165	0	333	3276
715-815	40	735	1	2	778	0	1978	205	1	2184	3	1	3	0	7	190	2	186	0	378	3347
730-830	37	818	1	1	857	0	1911	165	1	2077	2	1	4	0	7	206	1	216	0	423	3364
745-845	39	854	1	0	894	1	1873	158	0	2032	3	1	2	0	6	224	1	214	0	439	3371
PEAK HOUR																					
745-845	39	854	1	0	894	1	1873	158	0	2032	3	1	2	0	6	224	1	214	0	439	3371
MIDDAY																					
30-45	20	255	1	0	276	0	264	29	1	294	0	1	0	0	1	44	0	42	0	86	657
45-00	19	231	0	0	250	0	273	36	0	309	1	0	0	0	1	29	0	29	0	58	618
12:0-15	23	267	1	1	292	1	287	39	1	328	2	0	1	0	3	32	1	27	0	60	683
15-30	29	285	0	1	315	1	298	29	1	329	2	0	0	0	2	34	0	44	0	78	724
30-45	21	272	0	1	294	0	275	46	0	321	1	0	0	0	1	47	0	44	0	91	707
45-00	24	331	1	1	357	0	288	32	0	320	1	0	0	0	1	30	0	39	0	69	747
01:0-15	23	320	1	0	344	0	290	45	0	335	1	0	1	0	2	41	1	29	0	71	752
15-30	24	288	0	0	312	0	251	43	0	294	0	0	1	0	1	30	2	44	0	76	683
2 Hr Totals	183	2249	4	4	2440	2	2226	299	3	2530	8	1	3	0	12	287	4	298	0	589	5571
1 Hr Totals																					
1130-1230	91	1038	2	2	1133	2	1122	133	3	1260	5	1	1	0	7	139	1	142	0	282	2682
1145-1245	92	1055	1	3	1151	2	1133	150	2	1287	6	0	1	0	7	142	1	144	0	287	2732
12-01	97	1155	2	4	1258	2	1148	146	2	1298	6	0	1	0	7	143	1	154	0	298	2861
1215-0115	97	1208	2	3	1310	1	1151	152	1	1305	5	0	1	0	6	152	1	156	0	309	2930
1230-0130	92	1211	2	2	1307	0	1104	166	0	1270	3	0	2	0	5	148	3	156	0	307	2889
PEAK HOUR																					
1215-0115	97	1208	2	3	1310	1	1151	152	1	1305	5	0	1	0	6	152	1	156	0	309	2930
PM																					
04:0-15	37	413	0	1	451	1	269	42	0	312	0	0	0	0	0	49	0	31	0	80	843
15-30	32	487	0	0	519	0	277	32	0	309	0	0	0	0	0	48	0	22	0	70	898
30-45	23	464	0	2	489	1	290	50	0	341	1	0	0	0	1	63	1	35	0	99	930
45-00	41	494	0	1	536	3	290	41	2	336	2	0	1	0	3	47	1	36	0	84	959
05:0-15	37	447	1	1	486	0	318	48	0	366	0	0	0	0	0	58	0	31	0	89	941
15-30	30	503	0	1	534	3	344	48	0	395	2	0	0	0	2	45	0	36	0	81	1012
30-45	50	431	0	0	481	4	303	51	0	358	4	1	0	0	5	46	0	36	0	82	926
45-00	54	448	0	0	502	2	312	54	1	369	2	1	0	0	3	41	0	27	0	68	942
2 Hr Totals	304	3687	1	6	3998	14	2403	366	3	2786	11	2	1	0	14	397	2	254	0	653	7451
1 Hr Totals																					
04-05	133	1858	0	4	1995	5	1126	165	2	1298	3	0	1	0	4	207	2	124	0	333	3630
415-515	133	1892	1	4	2030	4	1175	171	2	1352	3	0	1	0	4	216	2	124	0	342	3728
430-530	131	1908	1	5	2045	7	1242	187	2	1438	5	0	1	0	6	213	2	138	0	353	3842
445-545	158	1875	1	3	2037	10	1255	188	2	1455	8	1	1	0	10	196	1	139	0	336	3838
05-06	171	1829	1	2	2003	9	1277	201	1	1488	8	2	0	0	10	190	0	130	0	320	3821
PEAK HOUR																					
430-530	131	1908	1	5	2045	7	1242	187	2	1438	5	0	1	0	6	213	2	138	0	353	3842
PM																					
07:0-15	54	445	2	3	504	0	251	20	0	271	0	0	0	0	0	36	0	27	0	63	838
15-30	30	390	0	1	421	1	216	46	0	263	3	0	0	0	3	30	0	28	0	58	745
30-45	36	347	0	1	384	1	183	32	0	216	1	0	0	0	1	27	0	24	0	51	652
45-00	32	274	0	1	307	0	162	23	0	185	1	0	1	0	2	29	2	20	0	51	545
08:0-15	17	237	1	2	257	1	174	27	0	202	2	0	0	0	2	18	0	21	0	39	500
15-30	16	231	1	0	248	0	163	30	0	193	0	0	0	0	0	20	1	19	0	40	481
30-45	18	246	2	0	266	0	126	23	0	149	2	0	1	0	3	24	0	21	0	45	463
45-00	16	217	0	1	234	0	139	19	0	158	0	0	0	0	0	22	0	17	0	39	431
2 Hr Totals	219	2387	6	9	2621	3	1414	220	0	1637	9	0	2	0	11	206	3	177	0	386	4655
1 Hr Totals																					
07-08	152	1456	2	6	1616	2	812	121	0	935	5	0	1	0	6	122	2	99	0	223	2780
715-815	115	1248	1	5	1369	3	735	128	0	866	7	0	1	0	8	104	2	93	0	199	2442
730-830	101	1089	2	4	1196	2	682	112	0	796	4	0	1	0	5	94	3	84	0	181	2178
745-845	83	988	4	3	1078	1	625	103	0	729	5	0	2	0	7	91	3	81	0	175	1989
08-09	67	931	4	3	1005	1	602	99	0	702	4	0	1	0	5	84	1	78	0	163	1875
PEAK HOUR																					
07-08	152	1456	2	6	1616	2	812	121	0	935	5	0	1	0	6	122	2	99	0	223	2780

TOTAL VEHICLES TURNING MOVEMENT COUNT - SUMMARY

Counted by: VCU

Intersection of: Jefferson Davis Hwy
and: Monroe Ave
Location: Alexandria, VA

Date: November 17, 2009 Day: Tuesday
Weather: Fair, Cool
Entered by: TT

The Traffic Group

TIME	TRAFFIC FROM NORTH on: Jefferson Davis Hwy					TRAFFIC FROM SOUTH on: Jefferson Davis Hwy					TRAFFIC FROM EAST on: Monroe Ave					TRAFFIC FROM WEST on:					TOTAL N + S + E + W
	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	
AM																					
45-00	12	202	0	1	215	6	494		1	501	12		7	0	19					0	735
07:0-15	12	210	0	0	222	6	529		0	535	14		9	0	23					0	780
15-30	13	192	0	2	207	12	535		0	547	24		12	0	36					0	790
30-45	15	263	0	0	278	17	520		0	537	14		17	0	31					0	846
45-00	14	258	0	1	273	24	503		0	527	17		19	0	36					0	836
08:0-15	16	279	0	0	295	30	465		0	495	40		18	0	58					0	848
15-30	4	298	0	0	302	12	471		0	483	47		14	0	61					0	846
30-45	13	290	2	0	305	10	413		0	423	45		22	0	67					0	795
2 Hr Totals	99	1992	2	4	2097	117	3930	0	1	4048	213	0	118	0	331	0	0	0	0	0	6476
1 Hr Totals																					
645-745	52	867	0	3	922	41	2078	0	1	2120	64	0	45	0	109	0	0	0	0	0	3151
07-08	54	923	0	3	980	59	2087	0	0	2146	69	0	57	0	126	0	0	0	0	0	3252
715-815	58	992	0	3	1053	83	2023	0	0	2106	95	0	66	0	161	0	0	0	0	0	3320
730-830	49	1098	0	1	1148	83	1959	0	0	2042	118	0	68	0	186	0	0	0	0	0	3376
745-845	47	1125	2	1	1175	76	1852	0	0	1928	149	0	73	0	222	0	0	0	0	0	3325
PEAK HOUR																					
730-830	49	1098	0	1	1148	83	1959	0	0	2042	118	0	68	0	186	0	0	0	0	0	3376
MIDDAY																					
12:0-15	17	266	0	0	283	8	358		0	366	12		16	0	28					0	677
15-30	14	280	0	0	294	12	336		2	350	12		16	0	28					0	672
30-45	15	294	0	0	309	15	357		0	372	13		10	0	23					0	704
45-00	24	324	1	0	349	11	330		1	342	14		16	0	30					0	721
01:0-15	30	330	1	3	364	15	306		1	322	12		24	0	36					0	722
15-30	21	300	1	0	322	15	299		1	315	11		16	0	27					0	664
30-45	16	288	2	0	306	9	281		0	290	20		16	0	36					0	632
45-00	21	356	1	0	378	12	257		1	270	15		13	0	28					0	676
2 Hr Totals	158	2438	6	3	2605	97	2524	0	6	2627	109	0	127	0	236	0	0	0	0	0	5468
1 Hr Totals																					
12-01	70	1164	1	0	1235	46	1381	0	3	1430	51	0	58	0	109	0	0	0	0	0	2774
1215-0115	83	1228	2	3	1316	53	1329	0	4	1386	51	0	66	0	117	0	0	0	0	0	2819
1230-0130	90	1248	3	3	1344	56	1292	0	3	1351	50	0	66	0	116	0	0	0	0	0	2811
1245-0145	91	1242	5	3	1341	50	1216	0	3	1269	57	0	72	0	129	0	0	0	0	0	2739
01-02	88	1274	5	3	1370	51	1143	0	3	1197	58	0	69	0	127	0	0	0	0	0	2694
PEAK HOUR																					
1215-0115	83	1228	2	3	1316	53	1329	0	4	1386	51	0	66	0	117	0	0	0	0	0	2819
PM																					
04:0-15	19	449	0	1	469	17	297		0	314	17		15	0	32					0	815
15-30	20	506	0	0	526	20	334		0	354	9		17	0	26					0	906
30-45	24	548	1	0	573	24	335		0	359	17		16	0	33					0	965
45-00	32	495	0	0	527	19	330		0	349	17		21	0	38					0	914
05:0-15	28	481	0	0	509	32	347		0	379	20		15	0	35					0	923
15-30	40	501	1	0	542	30	382		0	412	13		14	0	27					0	981
30-45	30	455	0	0	485	37	386		0	423	16		16	0	32					0	940
45-00	29	438	0	1	468	32	332		1	365	13		14	0	27					0	860
2 Hr Totals	222	3873	2	2	4099	211	2743	0	1	2955	122	0	128	0	250	0	0	0	0	0	7304
1 Hr Totals																					
04-05	95	1998	1	1	2095	80	1296	0	0	1376	60	0	69	0	129	0	0	0	0	0	3600
415-515	104	2030	1	0	2135	95	1346	0	0	1441	63	0	69	0	132	0	0	0	0	0	3708
430-530	124	2025	2	0	2151	105	1394	0	0	1499	67	0	66	0	133	0	0	0	0	0	3783
445-545	130	1932	1	0	2063	118	1445	0	0	1563	66	0	66	0	132	0	0	0	0	0	3758
05-06	127	1875	1	1	2004	131	1447	0	1	1579	62	0	59	0	121	0	0	0	0	0	3704
PEAK HOUR																					
430-530	124	2025	2	0	2151	105	1394	0	0	1499	67	0	66	0	133	0	0	0	0	0	3783
PM																					
07:0-15	33	433	2	0	468	26	239		1	266	19		14	0	33					0	767
15-30	29	412	0	0	441	11	250		0	261	15		10	0	25					0	727
30-45	24	319	2	2	347	14	196		1	211	12		24	0	36					0	594
45-00	21	294	0	0	315	12	158		3	173	7		14	0	21					0	509
08:0-15	21	239	0	0	260	12	191		0	203	7		12	0	19					0	482
15-30	13	229	0	0	242	13	185		1	199	4		10	0	14					0	455
30-45	13	242	1	1	257	8	148		0	156	7		10	0	17					0	430
45-00	10	231	0	0	241	7	152		1	160	10		5	0	15					0	416
2 Hr Totals	164	2399	5	3	2571	103	1519	0	7	1629	81	0	99	0	180	0	0	0	0	0	4380
1 Hr Totals																					
07-08	107	1458	4	2	1571	63	843	0	5	911	53	0	62	0	115	0	0	0	0	0	2597
715-815	95	1264	2	2	1363	49	795	0	4	848	41	0	60	0	101	0	0	0	0	0	2312
730-830	79	1081	2	2	1164	51	730	0	5	786	30	0	60	0	90	0	0	0	0	0	2040
745-845	68	1004	1	1	1074	45	682	0	4	731	25	0	46	0	71	0	0	0	0	0	1876
08-09	57	941	1	1	1000	40	676	0	2	718	28	0	37	0	65	0	0	0	0	0	1783
PEAK HOUR																					
07-08	107	1458	4	2	1571	63	843	0	5	911	53	0	62	0	115	0	0	0	0	0	2597

VEHICLE TURNING MOVEMENT COUNT - SUMMARY - TOTALS

Counted by: VCU

Intersection of: Jefferson Davis Hwy. — Date: November 17, 2009 — Day: Tuesday

and: E.Custis Ave. — Weather: Cool, Overcast

Location: Alexandria, VA — Entered by: SB

TIME	TRAFFIC FROM NORTH on: Jefferson Davis Hwy.					TRAFFIC FROM SOUTH on: Jefferson Davis Hwy.					TRAFFIC FROM EAST on:					TRAFFIC FROM WEST on: E.Custis Ave.					TOTAL N + S + E + W
	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	
AM																					
45-00	6	174		0	180		504	4	0	508					0	2		10	0	12	700
07:0-15	3	185		0	188		513	2	0	515					0	3		14	0	17	720
15-30	4	173		1	178		596	2	0	598					0	8		17	0	25	801
30-45	7	231		1	239		500	3	0	503					0	4		25	0	29	771
45-00	6	244		0	250		510	7	0	517					0	8		20	0	28	795
08:0-15	7	256		0	263		466	7	0	473					0	8		36	0	44	780
15-30	4	283		0	287		506	1	0	507					0	6		24	0	30	824
30-45	7	276		0	283		420	8	0	428					0	7		25	0	32	743
2 Hr Totals	44	1822	0	2	1868	0	4015	34	0	4049	0	0	0	0	0	46	0	171	0	217	6134
1 Hr Totals																					
645-745	20	763	0	2	785	0	2113	11	0	2124	0	0	0	0	0	17	0	66	0	83	2992
07-08	20	833	0	2	855	0	2119	14	0	2133	0	0	0	0	0	23	0	76	0	99	3087
715-815	24	904	0	2	930	0	2072	19	0	2091	0	0	0	0	0	28	0	98	0	126	3147
730-830	24	1014	0	1	1039	0	1982	18	0	2000	0	0	0	0	0	26	0	105	0	131	3170
745-845	24	1059	0	0	1083	0	1902	23	0	1925	0	0	0	0	0	29	0	105	0	134	3142
PEAK HOUR																					
730-830	24	1014	0	1	1039	0	1982	18	0	2000	0	0	0	0	0	26	0	105	0	131	3170
MIDDAY																					
30-45	6	251		0	257		268	5	0	273					0	8		14	0	22	552
45-00	9	268		0	277		294	5	0	299					0	3		5	0	8	584
12:0-15	5	263		0	268		301	6	0	307					0	7		12	0	19	594
15-30	13	282		0	295		313	8	0	321					0	7		9	0	16	632
30-45	12	299		0	311		297	10	0	307					0	3		8	0	11	629
45-00	11	327		0	338		310	4	0	314					0	6		10	0	16	668
01:0-15	21	352		0	373		315	3	0	318					0	7		9	0	16	707
15-30	9	302		0	311		280	8	0	288					0	9		4	0	13	612
2 Hr Totals	86	2344	0	0	2430	0	2378	49	0	2427	0	0	0	0	0	50	0	71	0	121	4978
1 Hr Totals																					
1130-1230	33	1064	0	0	1097	0	1176	24	0	1200	0	0	0	0	0	25	0	40	0	65	2362
1145-1245	39	1112	0	0	1151	0	1205	29	0	1234	0	0	0	0	0	20	0	34	0	54	2439
12-01	41	1171	0	0	1212	0	1221	28	0	1249	0	0	0	0	0	23	0	39	0	62	2523
1215-0115	57	1260	0	0	1317	0	1235	25	0	1260	0	0	0	0	0	23	0	36	0	59	2636
1230-0130	53	1280	0	0	1333	0	1202	25	0	1227	0	0	0	0	0	25	0	31	0	56	2616
PEAK HOUR																					
1215-0115	57	1260	0	0	1317	0	1235	25	0	1260	0	0	0	0	0	23	0	36	0	59	2636
PM																					
04:0-15	7	489		0	496		292	2	1	295					0	3		11	0	14	805
15-30	11	542		0	553		304	6	0	310					0	8		11	0	19	882
30-45	15	598		1	614		327	3	0	330					0	8		3	0	11	955
45-00	6	535		0	541		316	4	0	320					0	7		10	0	17	878
05:0-15	18	498		0	516		335	2	0	337					0	6		8	0	14	867
15-30	15	529		0	544		397	10	0	407					0	11		7	0	18	969
30-45	18	478		0	496		400	5	0	405					0	6		6	0	12	913
45-00	19	459		0	478		357	1	0	358					0	7		4	0	11	847
2 Hr Totals	109	4128	0	1	4238	0	2728	33	1	2762	0	0	0	0	0	56	0	60	0	116	7116
1 Hr Totals																					
04-05	39	2164	0	1	2204	0	1239	15	1	1255	0	0	0	0	0	26	0	35	0	61	3520
415-515	50	2173	0	1	2224	0	1282	15	0	1297	0	0	0	0	0	29	0	32	0	61	3582
430-530	54	2160	0	1	2215	0	1375	19	0	1394	0	0	0	0	0	32	0	28	0	60	3669
445-545	57	2040	0	0	2097	0	1448	21	0	1469	0	0	0	0	0	30	0	31	0	61	3627
05-06	70	1964	0	0	2034	0	1489	18	0	1507	0	0	0	0	0	30	0	25	0	55	3596
PEAK HOUR																					
430-530	54	2160	0	1	2215	0	1375	19	0	1394	0	0	0	0	0	32	0	28	0	60	3669
PM																					
07:0-15	14	451		0	465		247	0	0	247					0	5		15	0	20	732
15-30	9	443		0	452		253	2	0	255					0	3		6	0	9	716
30-45	7	333		0	340		205	5	0	210					0	6		7	0	13	563
45-00	15	308		0	323		160	4	0	164					0	3		8	0	11	498
08:0-15	5	254		1	260		174	0	0	174					0	8		6	0	14	448
15-30	7	250		0	257		176	6	0	182					0	1		5	0	6	445
30-45	9	275		0	284		138	3	1	142					0	1		3	0	4	430
45-00	3	227		0	230		150	3	0	153					0	5		5	0	10	393
2 Hr Totals	69	2541	0	1	2611	0	1503	23	1	1527	0	0	0	0	0	32	0	55	0	87	4225
1 Hr Totals																					
07-08	45	1535	0	0	1580	0	865	11	0	876	0	0	0	0	0	17	0	36	0	53	2509
715-815	36	1338	0	1	1375	0	792	11	0	803	0	0	0	0	0	20	0	27	0	47	2225
730-830	34	1145	0	1	1180	0	715	15	0	730	0	0	0	0	0	18	0	26	0	44	1954
745-845	36	1087	0	1	1124	0	648	13	1	662	0	0	0	0	0	13	0	22	0	35	1821
08-09	24	1006	0	1	1031	0	638	12	1	651	0	0	0	0	0	15	0	19	0	34	1716
PEAK HOUR																					
07-08	45	1535	0	0	1580	0	865	11	0	876	0	0	0	0	0	17	0	36	0	53	2509

VEHICLE TURNING MOVEMENT COUNT - SUMMARY - TOTALS

Counted by: VCU
Intersection of: Jefferson Davis Hwy. — Date: November 17, 2009 — Day: Tuesday
and: Swann Ave. — Weather: Cool, Overcast
Location: Alexandria, VA — Entered by: SB

TIME	TRAFFIC FROM NORTH on: Jefferson Davis Hwy.					TRAFFIC FROM SOUTH on: Jefferson Davis Hwy.					TRAFFIC FROM EAST on:					TRAFFIC FROM WEST on: Swann Ave.					TOTAL N + S + E + W
	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	
AM																					
45-00	3	182		0	185		528	5	0	533					0	2		3	0	5	723
07:0-15	3	196		0	199		535	3	0	538					0	3		2	0	5	742
15-30	5	196		0	201		603	1	0	604					0	1		1	1	3	808
30-45	3	250		0	253		507	2	0	509					0	0		5	0	5	767
45-00	5	257		0	262		526	2	0	528					0	1		1	0	2	792
08:0-15	10	257		0	267		499	2	0	501					0	3		7	0	10	778
15-30	5	299		0	304		488	3	0	491					0	2		4	0	6	801
30-45	5	336		0	341		448	2	0	450					0	1		3	0	4	795
2 Hr Totals	39	1973	0	0	2012	0	4134	20	0	4154	0	0	0	0	0	13	0	26	1	40	6206
1 Hr Totals																					
645-745	14	824	0	0	838	0	2173	11	0	2184	0	0	0	0	0	6	0	11	1	18	3040
07-08	16	899	0	0	915	0	2171	8	0	2179	0	0	0	0	0	5	0	9	1	15	3109
715-815	23	960	0	0	983	0	2135	7	0	2142	0	0	0	0	0	5	0	14	1	20	3145
730-830	23	1063	0	0	1086	0	2020	9	0	2029	0	0	0	0	0	6	0	17	0	23	3138
745-845	25	1149	0	0	1174	0	1961	9	0	1970	0	0	0	0	0	7	0	15	0	22	3166
PEAK HOUR																					
715-815	23	960	0	0	983	0	2135	7	0	2142	0	0	0	0	0	5	0	14	1	20	3145
MIDDAY																					
30-45	10	260		0	270		277	3	0	280					0	5		5	0	10	560
45-00	5	267		0	272		287	1	0	288					0	1		4	0	5	565
12:0-15	3	269		0	272		323	1	0	324					0	5		9	0	14	610
15-30	5	306		0	311		314	1	0	315					0	4		6	0	10	636
30-45	8	313		0	321		306	5	1	312					0	1		6	0	7	640
45-00	7	347		0	354		314	1	0	315					0	2		5	0	7	676
01:0-15	8	356		0	364		320	4	0	324					0	7		6	0	13	701
15-30	6	296		0	302		274	1	1	276					0	2		6	0	8	586
2 Hr Totals	52	2414	0	0	2466	0	2415	17	2	2434	0	0	0	0	0	27	0	47	0	74	4974
1 Hr Totals																					
1130-1230	23	1102	0	0	1125	0	1201	6	0	1207	0	0	0	0	0	15	0	24	0	39	2371
1145-1245	21	1155	0	0	1176	0	1230	8	1	1239	0	0	0	0	0	11	0	25	0	36	2451
12-01	23	1235	0	0	1258	0	1257	8	1	1266	0	0	0	0	0	12	0	26	0	38	2562
1215-0115	28	1322	0	0	1350	0	1254	11	1	1266	0	0	0	0	0	14	0	23	0	37	2653
1230-0130	29	1312	0	0	1341	0	1214	11	2	1227	0	0	0	0	0	12	0	23	0	35	2603
PEAK HOUR																					
1215-0115	28	1322	0	0	1350	0	1254	11	1	1266	0	0	0	0	0	14	0	23	0	37	2653
PM																					
04:0-15	4	459		0	463		299	4	0	303					0	5		1	0	6	772
15-30	5	538		0	543		316	3	1	320					0	5		5	0	10	873
30-45	11	535		0	546		323	3	0	326					0	3		2	0	5	877
45-00	5	515		0	520		347	2	0	349					0	4		4	0	8	877
05:0-15	6	529		0	535		335	1	0	336					0	2		10	0	12	883
15-30	2	513		0	515		389	4	1	394					0	2		3	0	5	914
30-45	3	493		0	496		371	3	0	374					0	2		3	0	5	875
45-00	3	468		0	471		330	0	0	330					0	2		6	0	8	809
2 Hr Totals	39	4050	0	0	4089	0	2710	20	2	2732	0	0	0	0	0	25	0	34	0	59	6880
1 Hr Totals																					
04-05	25	2047	0	0	2072	0	1285	12	1	1298	0	0	0	0	0	17	0	12	0	29	3399
415-515	27	2117	0	0	2144	0	1321	9	1	1331	0	0	0	0	0	14	0	21	0	35	3510
430-530	24	2092	0	0	2116	0	1394	10	1	1405	0	0	0	0	0	11	0	19	0	30	3551
445-545	16	2050	0	0	2066	0	1442	10	1	1453	0	0	0	0	0	10	0	20	0	30	3549
05-06	14	2003	0	0	2017	0	1425	8	1	1434	0	0	0	0	0	8	0	22	0	30	3481
PEAK HOUR																					
430-530	24	2092	0	0	2116	0	1394	10	1	1405	0	0	0	0	0	11	0	19	0	30	3551
PM																					
07:0-15	5	504		0	509		258	2	0	260					0	3		11	0	14	783
15-30	2	473		0	475		251	0	0	251					0	4		4	0	8	734
30-45	0	354		0	354		211	0	0	211					0	1		1	0	2	567
45-00	2	320		0	322		175	0	0	175					0	4		5	0	9	506
08:0-15	0	265		0	265		183	1	0	184					0	9		13	0	22	471
15-30	0	231		0	231		176	0	0	176					0	7		5	0	12	419
30-45	1	272		1	274		135	0	0	135					0	1		3	0	4	413
45-00	1	267		0	268		158	0	0	158					0	0		2	0	2	428
2 Hr Totals	11	2686	0	1	2698	0	1547	3	0	1550	0	0	0	0	0	29	0	44	0	73	4321
1 Hr Totals																					
07-08	9	1651	0	0	1660	0	895	2	0	897	0	0	0	0	0	12	0	21	0	33	2590
715-815	4	1412	0	0	1416	0	820	1	0	821	0	0	0	0	0	18	0	23	0	41	2278
730-830	2	1170	0	0	1172	0	745	1	0	746	0	0	0	0	0	21	0	24	0	45	1963
745-845	3	1088	0	1	1092	0	669	1	0	670	0	0	0	0	0	21	0	26	0	47	1809
08-09	2	1035	0	1	1038	0	652	1	0	653	0	0	0	0	0	17	0	23	0	40	1731
PEAK HOUR																					
07-08	9	1651	0	0	1660	0	895	2	0	897	0	0	0	0	0	12	0	21	0	33	2590

Technical Memorandum Update

Appendix 4

Air Quality Assessment

Technical Memorandum Update

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Appendix 4

Air Quality Assessment

Since the completion of the Air Quality Assessment Technical Memorandum in November 2006 (see Appendix 4 of the 2007 Approved Documented CE on attached CD), several regulatory changes have occurred related to new pollutant standards. However, none of these changes affects the results of the original analysis. The recent regulatory changes include the following pollutant standards:

Ozone (O_3)

- The 8-hour standard was revised to 0.075 ppm (parts per million) from 0.08 ppm on May 27, 2008; and,
- The 1-hour standard of 0.12 ppm was eliminated in all areas.

Nitrogen Dioxide (NO_2)

- A new 1-hour standard of 100 ppb (parts per billion) was added on April 12, 2010; and,
- The official 8-hour standard remains unchanged at 0.053 ppm but may be documented as 53 ppb for a clearer comparison with the new 1-hour standard.

Particulate Matter ($PM_{2.5}$)

- The 24-hour standard was revised to 35 µg/m^3 from 65 µg/m^3 on December 17, 2006.

Particulate Matter (PM_{10})

- The annual standard of 50 µg/m^3 was eliminated.

As shown in **Table 1**, the measured concentrations for local pollutants (such as CO and O_3) at the Alexandria monitoring location (517 North Saint Asaph Street) demonstrate a downward trend between 2005 and 2009.

Table 1: Recent Trend of Ambient Concentrations Monitored in the Vicinity of the Project

Year	CO 1-Hour	CO 8-Hour	O_3 8-Hour	$PM_{2.5}$ 24 Hour*
2005	2.3	1.7	0.089	34.2
2006	2.4	1.9	0.123	32.5
2007	2.1	1.6	0.09	29.5
2008	1.9	1.3	0.09	23.4
2009	1.8	1.4	0.069	23.2

Source: VDEQ air quality monitoring reports, 2005 through 2009.
*$PM_{2.5}$ 24 Hour concentrations correspond to Arlington monitoring location (18th and Hayes Streets).

The attainment status for the City of Alexandria has not changed since 2006 as the region is still in non-attainment for ozone and $PM_{2.5}$. The region also continues to be a maintenance area for CO due to violations before 1996.

For the original analysis, a hot spot analysis was conducted to determine maximum pollutant concentrations of carbon monoxide (CO) at the most congested intersections in the project study area. Based on this analysis, maximum 1- and 8-hour concentrations of CO were predicted to be well below the National Ambient Air Quality Standards (NAAQS) of 35 and 9 ppm, respectively. The hot spot analysis evaluated an intersection in the City of Alexandria at US Route 1 and Potomac Avenue.

Section B of the transitway will operate in the current northbound lanes of US Route 1. The updated traffic analysis indicates that two intersections are predicted to operate at level-of-service (LOS) 'D' or 'E' indicating potentially adverse air quality conditions. Based on the recent downward trend of pollutant concentrations of CO, the background concentration in 2010 would also be lower than the background level used in the 2006 analysis resulting in even lower overall concentration levels.

Appendix 3, Transportation Effects Technical Memorandum, provides detailed estimates of intersection delays and LOS at study area intersections. At the intersection of East Glebe Road and US Route 1, the LOS is predicted to decline from 'C' under the 2015 No Build condition to 'E' under the 2030 No Build condition. For 2015, the transit project has minor effects on the function of this intersection; LOS remains at 'C' for Build condition. In 2030 AM, the LOS declines from 'D' (42-second delay) in No Build to 'E' (74-second delay) in Build conditions. However, in the 2030 PM peak, the LOS is predicted to remain the same at 'E', between the No Build and Build conditions; the expected delay increases from 75 to 80 seconds a minimal increase of five seconds.

At the intersection of Potomac Avenue and US Route 1, the LOS is predicted to decline from 'B' under the 2015 No Build condition to 'C' under the 2030 No Build condition. For 2015, the transit project has minimal effects on the function of this intersection; LOS remains at 'B' for Build condition. In 2030 AM, the LOS remains at 'C' with a five second decrease in intersection delay. In 2030 PM, the LOS declines from 'C' to 'D' (48-second delay). However, this does not create unacceptable conditions. The LOS does not decline to 'F' at any intersection in the study corridor, with maximum delays not exceeding 80 seconds.

According to the results of the modeling analysis completed in 2006, the intersection with the highest predicted concentration of CO is located at US Route 1 and Potomac Avenue. The projected delay was 40 seconds and the maximum 1- and 8-hour concentrations of CO were predicted to be 3.9 ppm and 2.6 ppm respectively, which are below the NAAQS criteria of 35 ppm and 9 ppm. According to the recent traffic analysis (see Appendix 3: Transportation Effects Technical Memorandum) the maximum delay at a study intersection is projected to be 80 seconds at the US Route 1/East Glebe Road intersection. The corresponding CO concentrations were assessed qualitatively and are unlikely to exceed 8 ppm for 1-hour and 5 ppm for 8-hour concentrations. These estimates are well within the NAAQS criteria of 35 ppm and 9 ppm respectively.

The project is not expected to cause or exacerbate a violation of the applicable NAAQS as a result of the proposed dedicated transit lanes. With respect to regional emissions and conformity, the project has been shown to conform to the State Implementation Plan (SIP) by being included in a conforming Transportation Improvement Program (TIP). The project also demonstrates transportation conformity on a project level by not exceeding the NAAQS. No mitigation measures are necessary with respect to compliance with the transportation conformity requirements.

Technical Memorandum Update

Appendix 5

Cultural Resources

Technical Memorandum Update

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Technical Memorandum Update

Appendix 5

Cultural Resources

A review of cultural resources was undertaken for this updated Documented Categorical Exclusion (DCE) for the Section B of the Crystal City Potomac Yard Transitway. The updated information relies on the previous study undertaken as part of the 2006 DCE for the entire 5-mile stretch between the Braddock Road Metro Station and Pentagon/Pentagon City; a review of recent archaeological studies related to private development within the study area; and correspondence between the Virginia Department of Historic Resources (VDHR) and the City of Alexandria from 2008.

The 2006 Cultural Resources Technical Memorandum identified one previously documented historic district in Section B - the Town of Potomac Historic District. The Town of Potomac Historic District is located to the west of the planned alignment and intersects the Area of Potential Effect (APE) in one location, at East Custis Avenue. The analysis at that time, which still holds true today, found that the historic district is screened from the existing US Route 1 and proposed transitway by modern buildings along the west side of US Route 1. Hence, there are no expected effects on any elements that make the Town of Potomac District significant. (See attached CD, Cultural Resources Technical Memorandum, October 2006).

Additionally, the October 2006 technical memorandum reviewed the potential for impacts to archaeological resources. Within Section B, no registered archaeological resources were identified. However, several potential archaeological resources were noted, as listed in Table 1.

Table 1: Potential Archaeological Resources in the Vicinity of Section B

Name	Type	Dates	Source
Washington and Alexandria Turnpike	Transportation	1808	Walker and Harper 1989
St. Asaph's Junction Station	Transportation	c1890-1957	Walker and Harper 1989
Alexandria and Washington Railroad	Transportation	1854-1906	Walker and Harper 1989
Alexandria Canal, 44-Ax-28	Transportation	1845-1886	Walker and Harper 1989
Washington & Ohio Junction Railroad Station	Transportation	1877-1950s	Walker and Harper 1989
George Hyde House	Residential	19^{th} C.	Walker and Harper 1989

Source: AECOM 2006

It was concluded in the 2006 study that it was unlikely that resources associated with the Washington and Alexandria Turnpike survive within the APE. The St. Asaph's Junction Railroad Station is not within the APE. The Alexandria and Washington Railroad alignment and the Washington and Ohio Junction Railroad Station were likely within the APE. It is unlikely that resources associated with the railroad alignment survive, but it is possible that remains associated with the station exist within the APE in the area of the East Glebe Road station stop. In addition, it is possible that canal remains are located within the APE on the east side of US Route 1 at the location of the proposed East Custis Road station stop.

Since the 2006 DCE, the City of Alexandria has had additional archaeological work conducted in the vicinity of Section B for planned private development. This study, the *Resource Management Plan for the Potomac Yard Property, Landbays E, G, H, I, J, K, L, and M, City of Alexandria, Virginia*, prepared by

Thunderbird Archeology in April 2008, documented the area between Braddock Road and approximately Four Mile Run, generally along US Route 1 and the properties to the east of US Route 1, referred to Potomac Yard Landbays E, G, H, I, J, K, L, and M. Section B of the transitway generally falls within Landbays G, H, I, J and K. The report indicates that disturbance and grading have occurred along Section B of the proposed transitway along US Route 1 in Alexandria adjacent to Potomac Yard.

Correspondence between VDHR and the City of Alexandria in December 2008 indicates that the only concern that VDHR had from the previous documentation for the Crystal City Potomac Yard Transitway was a glass factory that was located at the intersection of First and Fayette Streets, outside of Section B. This correspondence is provided as Attachment 1 to this appendix.

In December 2010, the Project Team corresponded with VDHR to confirm that there would be no adverse effect on cultural resources as a result of the proposed exclusive transitway and stations specifically as it relates to Section B. VDHR confirmed that there would be no adverse effect on historic resources as a result of the proposed improvements**.** This confirmation is attached.

Attachments

Attachment 1: City Project Determination Request to VHDR 12/16/2010

Attachment 2: VDHR Response dated 12/21/2010

Attachment 1: City Project Determination Request to VHDR

12/16/2010

City of Alexandria, Virginia

MEMORANDUM

DATE: December 16, 2010

TO: JIM MASLANKA, TRANSPORTATION AND ENVIRONMENTAL SERVICES

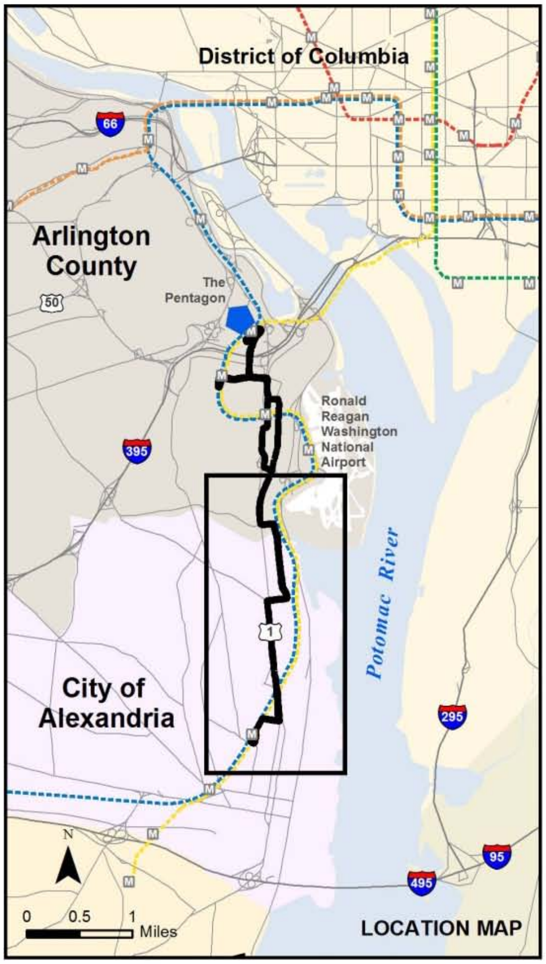
FROM: FRANCINE BROMBERG, PRESERVATION ARCHAEOLOGIST

SUBJECT: ARCHAEOLOGICAL ASSESSMENT FOR, SECTION B, ALEXANDRIA ROUTE 1 BUS TRANSITWAY

This project calls for the construction of Section B of the Bus Transitway between the north end of the Monroe Avenue Bridge and the intersection of East Glebe Road and Route 1, as shown in the attached figure. The Transitway Section B includes dedicated bus lanes, drainage structures, medians, bus shelters, signal modifications, and amenities, such as trash receptacles, lighting and benches. The project will be constructed within the existing northbound lanes of Route 1. The existing northbound lanes become a median area as part of the City project to reconfigure the transportation right-of-way to accommodate all travel lanes.

An archaeological assessment of this area was previously conducted in 2008 by Thunderbird Archaeology as part of the *Resource Management Plan for the Potomac Yard Property, Landbays E, G, H, I, J, K, L, and M, City of Alexandria, Virginia* to comply with the City of Alexandria's Archaeological Protection Code. The report indicates that disturbance and grading have occurred along Section B of the Alexandria Route 1 Bus Transitway corridor adjacent to Potomac Yard.

Based on the conclusions of the 2008 report, previous correspondence between the City of Alexandria and the Virginia Department of Historic Resources (VDHR) (included as a separate attachment), and the extent of proposed work described above, there is low potential for this project to adversely effect significant archaeological resources. No archaeological work is recommended.



Crystal City/Potomac Yard Transit Improvement Project Section B

Legend

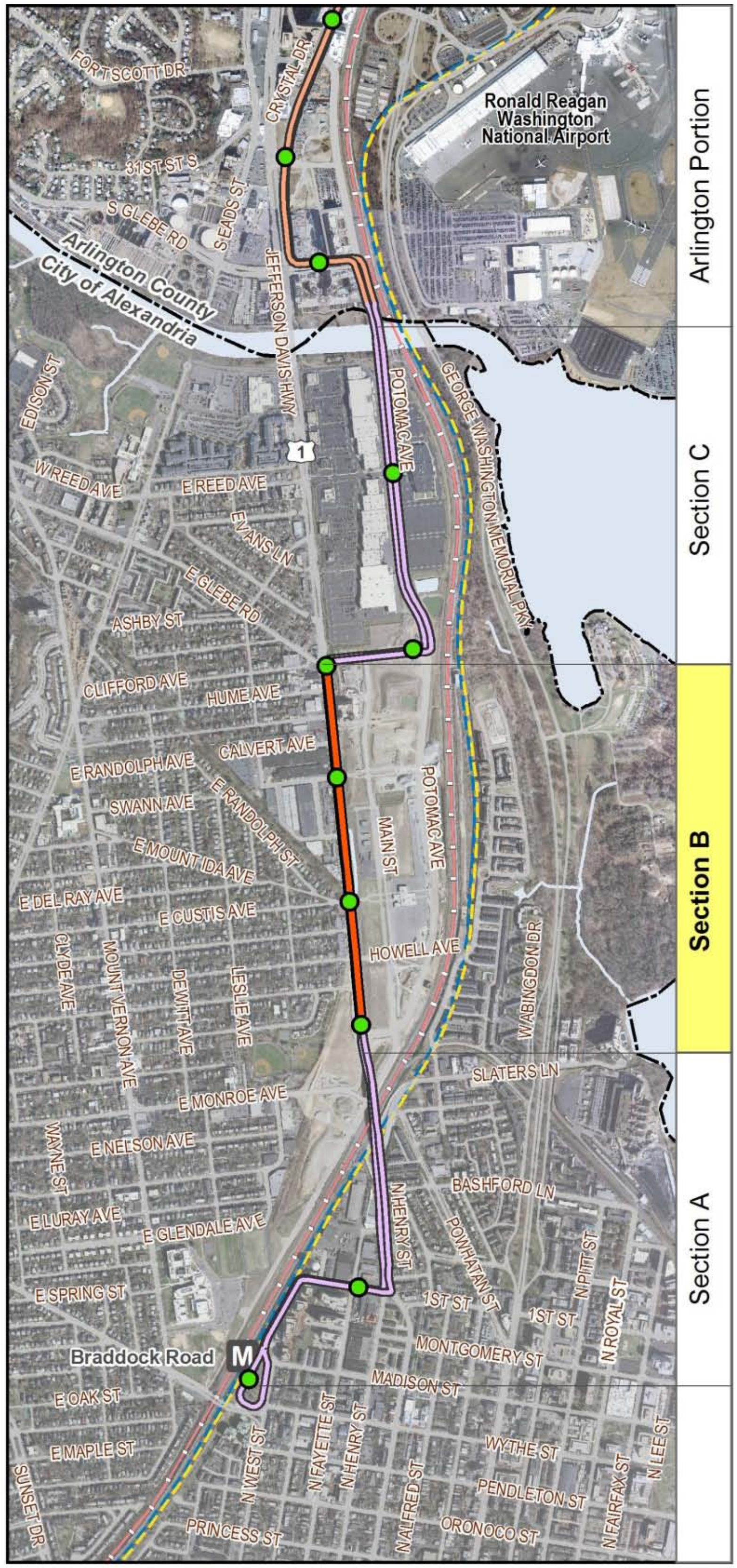
Proposed Alignment

- Dedicated Lanes for Transit - Section B
- Dedicated Lanes for Transit
- Transit Vehicles in Mixed Traffic
- Proposed Station Stop

Other Features

- Metrorail Station
- Metrorail Blue Line
- Metrorail Yellow Line
- CSX Railway
- Section B: Tiger Grant Project

0 0.2 0.4 Miles



Attachment 2: SHPO Correspondence 12/21/2010

Hachey, Alan

Subject: FW: Determination of Effect--Alexandria Rte. 1 Bus Transitway, Section B

JIm--
Here's the e-mail from Marc Holma concurring that there is no adverse effect on cultural resources.
Regards,
Fran

NOTE: OUR MAIN OFFICE AND MUSEUM NUMBER HAS CHANGED TO 703-746-4399.

Francine Bromberg
Alexandria Archaeology
105 N. Union Street
Alexandria, VA 22314

Office Phone: 703-746-4399
Direct Line: 703-746-4721
FAX: 703-838-6491
----- Forwarded by Francine Bromberg/Alex on 12/21/2010 03:09 PM -----

From: "Holma, Marc (DHR)" <Marc.Holma@dhr.virginia.gov>
To: <Francine.Bromberg@alexandriava.gov>
Date: 12/21/2010 03:07 PM
Subject: RE: Determination of Effect--Alexandria Rte. 1 Bus Transitway, Section B

Dear Ms Bromberg:

I have reviewed our file for this project to include the cultural resource survey information for Section B. We concur that No Historic Properties Will Be Affected in Section B due to this undertaking.

Sincerely,

Marc Holma

Marc E. Holma, Architectural Historian
Office of Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, Virginia 23221
phone: (804) 367-2323 x114
fax: (804) 367-2391
web: www.dhr.virginia.gov

*** Learn more about DHR's ePIX - Electronic Project Information Exchange ***

From: Francine.Bromberg@alexandriava.gov [mailto:Francine.Bromberg@alexandriava.gov]
Sent: Thursday, December 16, 2010 2:44 PM
To: Holma, Marc (DHR)
Cc: Jim.Maslanka@alexandriava.gov; Jason Mumford; Alan Hachey; Susan Anderson; Tabachnick, Alan; Jim Ashe; John Dittmeier; Harris, Preeti; Pamela.Cressey@alexandriava.gov
Subject: Determination of Effect--Alexandria Rte. 1 Bus Transitway, Section B

Dear Marc:

As you know, the City of Alexandria and Arlington County are implementing a bus transitway in the Route 1 corridor. As with the Arlington portion of the corridor (recently reviewed by VDHR), the City is preparing a Documented Categorical Exclusion for a portion of the corridor (Section B) in Alexandria that is being funded through a TIGER grant.

The City is requesting from VDHR an effects determination for Section B of the Crystal City-Potomac Yard Transitway. The attached request includes a memorandum that summarizes the City of Alexandria's archaeological findings relative to the proposed project and includes a map illustrating the project location.

In addition, a second attachment includes our previous correspondence relating to the project. In 2006 your office reviewed a Documented Categorical Exclusion for the overall 5-mile transit corridor project. Subsequent to that, in 2008, the City provided archeological assessments to VDHR. At that time, VDHR confirmed the City's conclusion that there would be no adverse effects to cultural resources in the portion of the project—denoted Section B in the attached memo—that we are currently documenting. Section B does not include the glass factory property that was the subject our concern in the previous e-mails.

The City is requesting correspondence from VDHR that re-states the previous conclusions, but in the context of the current project.

Thank you for your prompt attention to this project, and please contact me if you have any questions.

Sincerely,

Fran

NOTE: OUR MAIN OFFICE AND MUSEUM NUMBER HAS CHANGED TO 703-746-4399.

Francine Bromberg
Alexandria Archaeology
105 N. Union Street
Alexandria, VA 22314

Office Phone: 703-746-4399
Direct Line: 703-746-4721
FAX: 703-838-6491

Technical Memorandum

Appendix 6

Acquisitions and Relocations

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Appendix 6

Acquisitions and Relocations

At the intersection of US Route 1 and East Glebe Road, an easement is required just north of the East Glebe Road to transition the transitway corridor. This easement was previously dedicated to the City by the property developer. Attachment 1 of this appendix provides an excerpt of development conditions, including Condition #16c and Attachment #3 for the development of Landbay F. These conditions require right of way dedication on the east side of US Route 1 between East Glebe Road and Evans Lane by the developer. This right of way is part of Landbay G has already been dedicated to the City of Alexandria. The complete document that provides conditions for the development of Landbay F in Potomac Yard is available at:
http://dockets.alexandriava.gov/fy10/061210ph/di5.pdf

Attachments:

Attachment 1: Condition #16c and Attachment #3 for the development of Landbay F commenced as determined by the Directors of P&Z and T&ES. If the Directors deem the Metrorail station has substantially commenced construction and the necessary bond financing has been issued, a memorandum shall be submitted to the Planning Commission and City Council, providing notification that the issuance of the bonds has been completed and the City has made a determination of substantial construction as defined herein. (P&Z) (T&ES)

14. **Phase IV – Development Once Metrorail Station is Operational:** Development shall be limited to blocks which are located within a ¼ mile radius of the proposed Metrorail station as generally depicted in *Attachment #1*. Once a total of 4.9 million sq.ft. of development has been constructed within a ¼ mile radius of the proposed Metrorail station as defined herein, the remainder of the block(s) may be permitted to construct the remainder of the development within CDD#19 subject to the applicable zoning conditions, a DSUP and other applicable requirements.

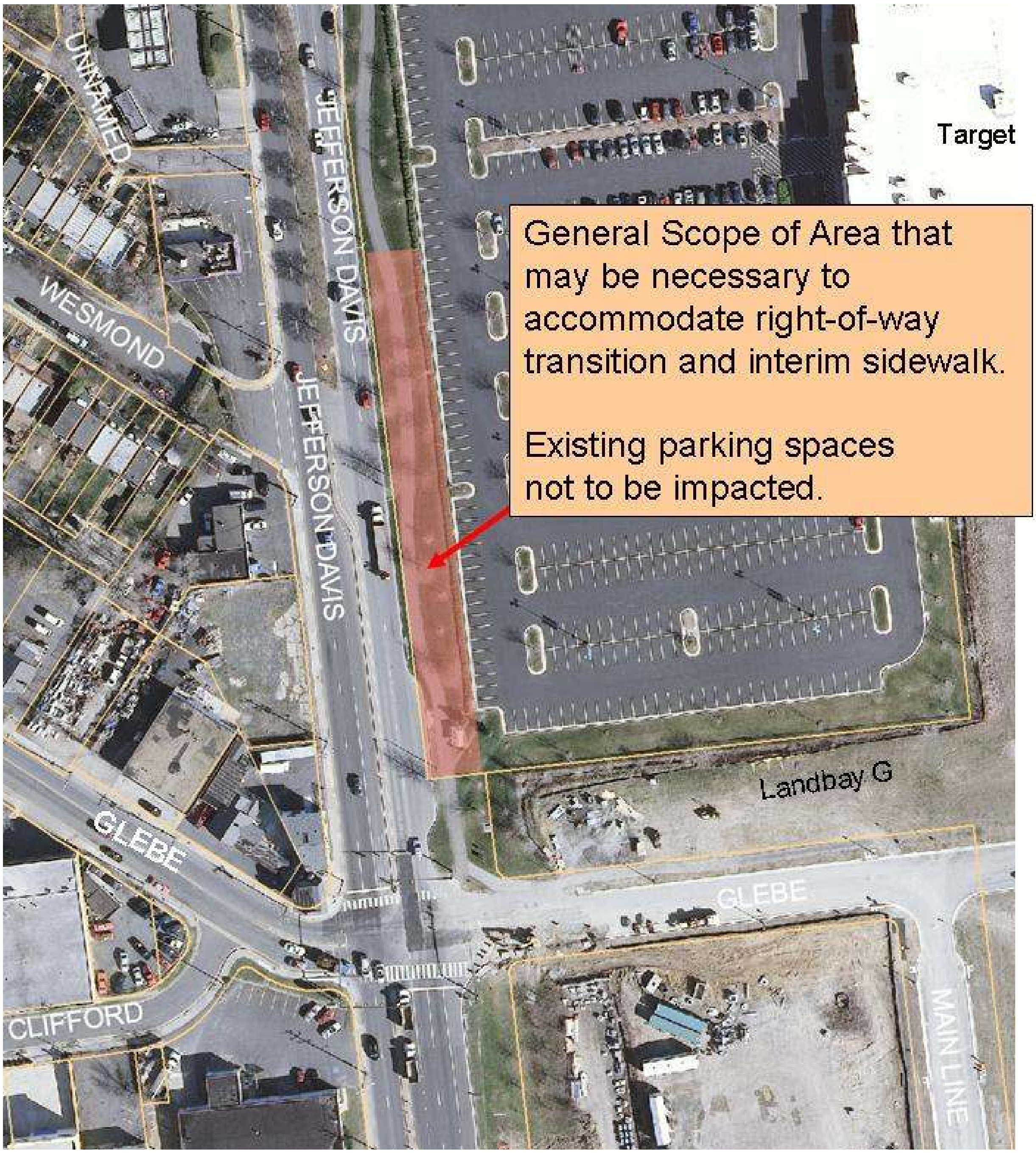
15. **Development if No Metrorail Station:** If the City determines in the future or by January 1, 2018, that a new Metrorail station is not feasible, and if the high-capacity transitway is fully functional, then the applicant may be permitted to construct 3,100,000 sq.ft. of new floor area, in addition to the 600,000 sq.ft. of floor area in existence as of June 12, 2010, subject to a future public planning process and contingent on all conditions and requirements as part of the future planning, zoning and development processes. (P&Z)

E. INFRASTRUCTURE

16. **Pre-Development Dedications/Agreements:** Within 90 days of June 12, 2010, the Applicant shall submit the necessary plans and documentation and shall within six months from June 12, 2010 dedicate to the City or as otherwise directed by the City, in fee simple or by easement the following:
    a. ***Sidewalk Trail Easement:*** A 6 ft. wide public access easement and access for any associated grading outside of the easement to the west of the existing western Potomac Avenue right-of-way line for a sidewalk-trail and associated improvements. The easement shall be from East Glebe Road to Landbay E, within CDD#19, to the satisfaction of the Directors of T&ES and P&Z. The easement shall be vacated by the City once Potomac Avenue (new alignment) and New Street "D"/ Aqua Street have been constructed and are operational.
    b. ***Circulation Agreement:*** A written agreement shall be made between the Applicant and the City to permit buses, pedestrians and vehicles on the following drive aisles and adjoining sidewalks as generally depicted in *Attachment #2* to the satisfaction of the Directors of T&ES and P&Z.
    c. ***Interim Route 1 Right-of-Way Dedication:*** Dedicate the necessary amount of right-of-way on the eastern side of Route 1, from the southern CDD#19 boundary to Evans Lane, to accommodate a smooth right-of-way transition on Route 1 from Landbay G to CDD#19, as generally depicted in *Attachment #3*.
    d. ***Pond 2 Maintenance Agreement:*** The applicant shall submit a BMP maintenance agreement to the City to share in the maintenance of Pond 2. The agreement shall remain in place and valid so long as Pond 2 is in operation. (P&Z) (T&ES)

Attachment #3

INTERIM ROUTE 1 - ROW TRANSITION



Technical Memorandum Update

Appendix 7

Hazardous and Contaminated Materials

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Appendix 7

Hazardous and Contaminated Materials

INTRODUCTION

A Phase I Environmental Site Assessment (ESA) was completed for the 5-mile Crystal City Potomac Yard (CCPY) transitway corridor in October 2006; see Appendix 7 of the 2007 Documented Categorical Exclusion (DCE) on attached CD.

In the analysis, the study area for the assessment of hazardous and contaminated materials was defined as 100 feet on either side of the planned alignment. Although sites located outside the 100-foot study area can be impacted, this study area was chosen to include potential sites within or immediately adjacent to the planned alignment due to the relatively limited construction foreseen for the project.

CURRENT USE OF ADJOINING PROPERTIES

Land use conditions along the Section B corridor are urban with a mix of commercial and residential land uses. Most of the corridor has been disturbed over the years to make way for the various developments that exist including the large railyard that once operated in the study area. Only minor natural environment areas exist within the study area.

East of Section B is the CSX rail right-of-way, WMATA right-of-way, and the George Washington Memorial Parkway and the Potomac Yard Area. The Potomac Yard area is and will be occupied by mixed-use development, parts of which are still under construction. West of Section B is the Del Ray and Oakville neighborhoods of Alexandria, higher density residential neighborhoods, fronted by commercial and light industrial land uses along US Route 1.

DOCUMENT REVIEW

The update approach involved the review of technical analyses developed for the transitway study area in 2006 to verify previous findings, and subsequent investigations completed by the City of Alexandria for the adjacent Potomac Yard area in 2010:

- Northern Virginia Transportation Commission, Arlington County Government, and Washington Metropolitan Area Transit Authority, *Crystal City / Potomac Yard Corridor Transit Improvements Project Phase I Environmental Site Assessment Hazardous and Contaminated Materials Technical Memorandum*, October 2006
- ECS LLC Mid-Atlantic, *Phase II And Risk Assessment Potomac Yards Landbay I & J, Alexandria, Virginia, ECS Project No. 9676-S For Potomac Yard Development,* May 3, 2010. The document is provided as Attachment 1 to this appendix.

FINDINGS

There is no property within the proposed limits of transitway construction where known contaminated or hazardous materials exist. There are properties in the project vicinity with hazardous materials.

A Phase I Environmental Site Assessment (ESA) was conducted as part of the 2006-2007 Documented Categorical Exclusion (see Appendix 7 of the 2007 DCE, attached CD). The ESA identified no properties within or adjacent to Section B of the proposed transitway where further, Phase II analysis is warranted.

As part of a subsequent, independent study, a Phase II ESA was conducted in the area east of US Route 1 between Swann and Howell Avenues (Site Characterization Report and Risk Assessment for Potomac Yard Landbay I & J). This assessment identified the presence of contaminants and recommended that the land developer follow Best Management Practices for protection of workers and the community during development of those parcels.

The shallow level of excavation required for the transitway project, the location of proposed transitway construction in the existing northbound lanes of US Route 1, and the historic location of the rail yard to the east of the US Route 1 right-of-way combine to limit the potential for exposure to contaminated or hazardous materials. See Appendix 7 for Technical Memorandum Update for Hazardous Materials.

In addition, as with any linear project, environmental sampling investigations will be completed in conjunction with the advancement of the geotechnical borings during preliminary design to get a better understanding of the conditions within the limits and depths of work to determine the presence/absence of any contaminated or hazardous materials. Soil and/or groundwater samples will be collected spatially along the proposed alignment to anticipated depths of construction to better quantify the potential impacts within the proposed alignment. Pre-determining the soil type will provide for upfront knowledge for any potential handling or off-site disposal issues. Additional sampling frequency will be completed at areas if extensive grading and soil volumes occur during construction.

The contaminants identified are of low enough concentrations that leaving them as is, capping the soils, and/or "natural attenuation" processes are appropriate. Unless disturbed, no further action would be needed. However, should a surplus of soil be generated during construction that cannot be reused on-site, it may require additional testing before being handled and disposed of off-site in accordance with all Federal, State and local requirements.

Environmental contamination has been documented within the footprint of Potomac Yard, a former rail yard in the vicinity of Section B of the CCPY transitway. FTA has requested the City of Alexandria provide a plan to address health and safety matters that might be associated with the project, and its proximity to Potomac Yard. The City of Alexandria has agreed to provide this plan.

Attachments

Attachment 1: ECS LLC Mid-Atlantic, *Phase II And Risk Assessment Potomac Yards Landbay I & J, Alexandria, Virginia, ECS Project No. 9676-S For Potomac Yard Development,* May 3, 2010.

ECS LLC
MID-ATLANTIC

PHASE II AND RISK ASSESSMENT
POTOMAC YARDS
LANDBAY I & J
ALEXANDRIA, VIRGINIA

ECS PROJECT NO. 9676-S

FOR

POTOMAC YARD DEVELOPMENT

MAY 3, 2010

ECS LLC
MID-ATLANTIC

May 3, 2010

Mr. Stephen Collins
Potomac Yard Development, LLC
2403 Jefferson Davis Highway
Alexandria, Virginia 22301

ECS Project No. 9676-S

Reference: Site Characterization Report and Risk Assessment, Potomac Yard Landbay I and J, Jefferson Davis Highway, Alexandria, Virginia.

Dear Mr. Collins:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Potomac Yard Development, LLC with the results of the Phase II and Risk Assessment for the above-referenced property. Our services were provided in accordance with ECS Proposal No. 32804-EP dated October 28, 2009. If you have any questions or comments regarding this report, or any other aspect of the project, please contact us at (703) 471-8400.

Respectfully submitted,

ECS MID-ATLANTIC, LLC

David J. Bookbinder
Environmental Scientist

James D. Succop, C.P.G.
Regional Environmental Director

COMMONWEALTH OF VIRGINIA
JAMES D. SUCCOP
No. 1460
CERTIFIED PROFESSIONAL GEOLOGIST

cc: Steve Liam – Bowman Consulting

(DJB/environ/rpt/9000/9676-S-SCR)

SITE CHARACTERIZATION REPORT AND RISK ASSESSMENT
POTOMACY YARD
LANDBAY I & J
ALEXANDRIA, VIRGINIA

ECS PROJECT NO. 9676-S

1.0 BACKGROUND

Potomac Yards was a former rail yard, operated by the Richmond Fredericksburg and Potomac (RF&P) railroad from approximately 1906 to 1990. The subject property, Landbay I/J, is located east of Jefferson Davis Highway, to the south of Swann Avenue and to the north of Howell Avenue in Alexandria, Virginia. The property is located south of the former Central Operations Area for the rail yard. Activities in the Central Operations Area included refueling of diesel locomotives, repair, maintenance, servicing, and cleaning. There were a minimum of eight underground storage tanks located in and around the Central Operations Area, and also four large 25,000-gallon aboveground diesel tanks. Surface spills, releases from underground tanks, and runoff from repair and maintenance activities contributed to subsurface petroleum contamination beneath large portions of the Potomac Yards site.

Based on previous environmental investigations conducted across the Potomac Yards site, much of the shallow fill used to level the rail yard appears to have been contaminated with petroleum products and/or heavy metals when it was placed. Cinder ballast, the bottom ash left over from coal burning, was used as fill material throughout large portions of the Potomac yards property. Cinder ballast commonly contains elevated levels of lead and arsenic. There is no definable pattern to the use of cinder ballast as fill; it was used to fill in holes and depressions along with other fill materials, resulting in pockets and layers of cinder ballast interspersed with other fill across the site.

Site development will consist of the construction of slab on-grade townhouses. The majority of the property will be occupied by these structures. However, areas not occupied by these structures will be covered with at least two feet of clean fill or hardscape.

In March 2004, ECS conducted a subsurface investigation on Landbays G through L. During that investigation, seven borings were advanced on the subject property to a depth of 20 feet below surface grade. Two soil samples from each boring were sent to an independent laboratory for analysis of total petroleum hydrocarbons diesel and gasoline range organics (TPH DRO and GRO), volatile organic compounds (VOCs), polychlorinated byphenols (PCBs) and RCRA 8 metals. The following tables summarize the results from the 2004 sampling.

Summary of Soil Analytical Results
(Samples collected March 2004)

Boring and depth of soil sample	DRO (mg/kg)	GRO (mg/kg)	VOCs (ug/kg)	PCBs (ug/kg)
ECS-11 – 5'	--	--	Carbon Disulfide = 34	--
ECS-11 – 15'	--	--	--	--
ECS-12 – 3'	**461**	--	--	--
ECS-12 – 10'	27	--	--	--
ECS-14 – 5'	**242**	--	--	--
ECS-14 – 15'	--	--	Acetone = 30	--
ECS-16 – 4'	**184**	--	Acetone = 73	--
ECS-16 – 12'	--	--	Acetone = 13	--
ECS-17 – 6'	**52**	--	Acetone = 17	--
ECS-17 – 18'	--	--	Acetone = 18	--
ECS-18 – 5'	--	--	Acetone = 17	--
ECS-18 – 15'	45	--	Acetone = 16	--
ECS-19 – 3'	**587**	--	Acetone = 74	--
ECS-19 – 10'	--	--	Acetone = 13	--

Notes: -- = not detected at or above the analytical detection limit.
mg/kg = milligrams per kilogram, equivalent to parts per million (ppm)
ug/kg = micrograms per kilogram, equivalent to parts per billion (ppb).
Concentrations in bold represent DRO concentrations above 50 ppm that cannot be reused as clean fill per restrictions noted on 9 VAC 20-80-700 "Soil contaminated with petroleum products."

Summary of Soil Analytical Results (continued)
(Samples collected March 2004)

Boring and depth of soil sample	Arsenic (mg/kg)	Barium (mg/kg)	Chromium (ug/kg)	Lead (ug/kg)	Mercury (mg/kg)
ECS-11 – 5'	**72.9**	95.8	43.4	66.7	--
ECS-11 – 15'	**7.8**	123	24	33.8	--
ECS-12 – 3'	**337**	79	42.4	112	0.057
ECS-12 – 10'	**5**	45.9	16.3	6.1	--
ECS-14 – 5'	**451**	117	15.2	248	--
ECS-14 – 15'	**5.1**	74.1	22.5	8	--
ECS-16 – 4'	**16.2**	36.2	11.5	23.2	--
ECS-16 – 12'	**4.9**	74.4	13.4	8.8	--
ECS-17 – 6'	**65.1**	89.1	18.5	41.1	0.051
ECS-17 – 18'	--	67	17	5	--
ECS-18 – 5'	--	17.5	4.2	--	--
ECS-18 – 15'	**2.4**	64.4	23.1	11.6	--
ECS-19 – 3'	**583**	186	76	196	0.27
ECS-19 – 10'	**5.5**	56.1	19.7	9.6	--

Notes: -- = not detected at or above the analytical detection limit.
mg/kg = milligrams per kilogram, equivalent to parts per million (ppm).
Concentrations in bold represent concentrations detected above respective VRP Tier II risk based screening level.

Analysis of the soil samples indicated that DRO was detected in seven of the fourteen soil samples at concentrations ranging from 27 to 587 parts per million (ppm). Of the seven samples with DRO detected, five of the samples were located in the fill material (upper five feet) and was also the location of the more elevated DRO concentrations. Acetone was detected in nine of the fourteen soil samples at concentrations ranging from 13 to 74 parts per billion (ppb), and carbon disulfide was detected in one soil sample (34 ppb). All of the detected VOC concentrations were significantly below their respective Virginia VRP Tier II Risk Based Screening level for a residential setting (4,570 ppb for acetone and 1,520 ppb for carbon disulfide). No other VOC was detected above the laboratory detection limit. PCBs were not detected in any of the soil samples. Barium and chromium were detected in all of the soil samples, arsenic was detected in all but two samples, lead was detected in all but one sample, and mercury was detected in the three samples located in the fill material. Only arsenic was detected above its respective Tier II risk based screening level, and all samples exceeded the screening level. The more elevated concentrations were located in the fill material with significantly lower concentrations located in the natural soils.

2.0 METHODOLOGY

A total of 14 additional borings were advanced on the Landbay I/J property. The boring locations were selected by ECS to create, along with the seven previous borings, three transects spaced along the property where future townhouses will be constructed, and to provide a broad overall look at subsurface environmental conditions beneath the property.

Over the past 3-4 years fill materials from northern portions of the Potomac yards site were brought in and stockpiled on northwestern portion of Landbay I. The stockpile and areas of engineered fill range in thickness from approximately 5 to 25 feet above original surface grades. The imported fill soils were tested for petroleum contaminants while they were being imported and placed on the site. In addition, only material which met the criteria for re-use on Potomac Yards as outlined in the original soil management plan were imported from other areas. The DRO sampling and analysis was performed as an additional level of screening. The soils have since been moisture treated with lime stabilization techniques and extensively reworked onsite. For purposes of this study and future development of the site, the overlying fill soils were considered to be clean fill materials. Therefore, sampling of the four borings advanced on the stockpile for this study began below the approximate depth of the existing fill materials, and included sampling below the original rail yard surface. For example, in areas where there was approximately fifteen feet of new fill, the top fifteen feet of the boring were ignored, and sampling began fifteen feet below the existing surface. A relatively consistent layer of cinder ballast was found in many of the borings at the 0'-6' interval below the original rail yard surface, which was useful for establishing the depth of the original surface before fill placement. The remainder of the site consisted of an at grade parking lot with one structure located on the west-central portion of Landbay I.

Borings were advanced using a track-mounted GeoProbe direct push soil sampler. The GeoProbe uses a hydraulic hammer to push steel macrocore sampling tubes into the ground in five-foot intervals. Continuous soil samples were collected at two-foot intervals from the estimated original surface grade to a depth of 20' below original grade. Boring logs describing the soil types and other observations (staining, odors, etc.) are included here as Appendix II. Samples were collected into clean plastic bags. Each sample was field-screened with a photoionization detector (PID) which measures VOCs. Based on the PID results and soil observations, two samples from each boring were transferred to clean, laboratory grade-glass jars with Teflon lids. The samples were packed on ice and submitted under chain-of-custody protocol to an independent laboratory for analysis of TPH DRO and GRO, VOCs and RCRA 8 metals.

Four of the borings were converted to temporary groundwater sampling points by inserting slotted PVC well screen into the open boreholes and allowing the temporary wells to recharge with groundwater. Adjusting for the presence of overlying fill materials, groundwater was encountered at depths ranging from 12 to 20 feet below the original rail yard surface grade. Saturated soil conditions indicative of groundwater were one to two feet thick in all well locations. One groundwater sample from each of the temporary wells was collected into clean, laboratory-grade glass bottles treated with appropriate preservative. The groundwater samples were packed on ice and transported under chain-of-custody protocol to an independent laboratory for analysis of TPH DRO GRO, VOCs and RCRA 8 metals.

3.0 RESULTS

3.1 Soil Results

Two soil samples from each boring were analyzed for DRO, GRO, VOCs and RCRA 8 metals. The laboratory results for petroleum constituents are summarized in following tables.

Soil Analytical Results
(Samples collected March 2010)

Boring and depth of soil sample	DRO (mg/kg)	GRO (mg/kg)	VOCs (ug/kg)
E-1 – 4'	**280**	--	--
E-1 – 20'	--	--	--
E-2 – 4'	**84**	0.15	Acetone = 26
E-2 – 12'	--	--	--
E-3 – 4'	**371**	--	Acetone = 21
E-3 – 12'	--	--	--
E-4 – 8'	--	--	Acetone = 17
E-4 – 12'	--	--	--
E-5 – 4'	--	--	--
E-5 – 10'	29	--	--
E-6 – 6'	23	--	--

Boring and depth of soil sample	DRO (mg/kg)	GRO (mg/kg)	VOCs (ug/kg)
E-6 – 16'	--	--	Acetone = 12
E-7 – 6'	**55**	--	Acetone = 40 p-Isopropyl toluene = 90
E-7 – 18'	--	--	--
E-8 – 6'	--	--	--
E-8 – 20'	--	--	--
E-9 – 2'	49	--	Acetone = 54
E-9 – 18'	--	--	--
E-10 – 2'	**89**	--	--
E-10 – 14'	--	--	--
E-11 – 2'	**365**	--	--
E-11 – 10'	--	--	Acetone = 20
E-12 – 6'	--	--	Acetone = 13
E-12 – 14'	--	--	Acetone = 13
E-13 – 4'	**165**	--	Acetone = 88
E-13 – 12'	--	--	Acetone = 14
E-14 – 8'	**264**	--	--
E-14 – 16'	--	--	Acetone = 20

Notes: -- = not detected at or above the analytical detection limit.
mg/kg = milligrams per kilogram, equivalent to parts per million (ppm)
ug/kg = micrograms per kilogram, equivalent to parts per billion (ppb).
Concentrations in bold represent DRO concentrations above 50 ppm that cannot be reused as clean fill per restrictions noted on 9 VAC 20-80-700 "Soil contaminated with petroleum products."

Petroleum

Petroleum compounds were detected in 11 of the 28 soil samples submitted for this investigation. The primary contaminant of concern with regard to the eventual development of the site is TPH DRO. The diesel range organics include diesel fuel, lubricating oil, hydraulic oils and other heavy petroleum products. A relatively low concentration of gasoline range organics was identified in one sample. The TPH DRO concentrations were primarily detected in the fill material located between original surface grade and six feet below original surface grade. TPH DRO was only detected in two samples analyzed beneath the fill material.

Volatile Organic Compounds

No VOCs were detected above the laboratory detection with the exception of acetone, which was detected in 12 of the 28 samples analyzed at concentrations ranging from 12 to 88 ppb and p-isopropyl toluene, which was detected in one sample at a concentration of 90 ppb. Concentrations for both analytes were significantly below their respective Virginia VRP Tier II (unrestricted/residential) Risk Based Screening Level (RBSL) which is 4,570 ppb for acetone and 17,500 ppb for p-isopropyl toluene. No other VOC was detected above the laboratory detection limit.

Metals

Soil Metal Results
(Samples collected March 2010)

Boring and depth of soil sample	Arsenic (mg/kg)	Barium (mg/kg)	Chromium (ug/kg)	Lead (ug/kg)	Mercury (mg/kg)	Selenium (mg/kg)
E-1 – 4'	**817**	126	22.4	157	0.135	2.37
E-1 – 20'	**1.96**	119	17.9	14.5	--	0.45
E-2 – 4'	**88.7**	69.1	9.22	124	0.132	0.74
E-2 – 12'	**2.79**	30.2	13.6	7.22	--	0.52
E-3 – 4'	**504**	119	18.2	129	**0.882**	0.75
E-3 – 12'	**3.73**	13.9	3.74	2.87	--	--
E-4 – 8'	**3.69**	25.0	13.5	7.38	--	--
E-4 – 12'	**4.53**	85.3	13.9	11.7	--	--
E-5 – 4'	**3.01**	48.6	10.3	7.42	--	--
E-5 – 10'	**3.41**	59.7	13.2	8.77	--	--
E-6 – 6'	**11.6**	67.1	12.1	11.8	--	0.53
E-6 – 16'	**4.76**	88.0	12.3	13.4	--	0.48
E-7 – 6'	**3.75**	59.0	13.5	16.1	--	--
E-7 – 18'	**1.78**	107	17.0	13.5	--	0.49
E-8 – 6'	**0.63**	28.9	7.27	4.20	--	--
E-8 – 20'	**2.96**	99.7	16.2	11.6	--	--
E-9 – 2'	**74.5**	55.5	9.80	14.3	--	--
E-9 – 18'	**0.96**	168	17.6	12.0	--	0.78
E-10 – 2'	**62.3**	58.7	12.2	66.8	--	0.62
E-10 – 14'	**3.58**	45.1	17.6	8.50	--	--
E-11 – 2'	**108**	51.5	12.0	58.3	--	0.88
E-11 – 10'	**1.99**	34.5	6.89	6.04	--	--
E-12 – 6'	**5.05**	116	12.7	10.5	--	--
E-12 – 14'	**4.70**	79.3	13.8	75.3	--	0.66
E-13 – 4'	**89.5**	74.6	24.6	76.8	--	0.44
E-13 – 12'	**3.32**	62.7	12.3	11.9	--	0.45
E-14 – 8'	**142**	128	11.6	203	0.101	3.15
E-14 – 16'	**4.93**	78.1	13.6	9.92	--	--

Notes: -- = not detected at or above the analytical detection limit.
mg/kg = milligrams per kilogram, equivalent to parts per million (ppm).
Concentrations in bold represent concentrations detected above respective VRP Tier II risk based screening level.

Arsenic concentrations ranged from 0.63 mg/kg to 817 mg/kg in samples analyzed from the fill material and 0.96 mg/kg to 4.93 mg/kg in samples analyzed below the fill material. For comparison purposes, the Virginia VRP Tier II RBSL for arsenic is 0.39 mg/kg; however, natural background concentrations of arsenic in soil in this geologic area can range up to 25-30 mg/kg or higher in some areas. Eight of the thirteen fill material samples tested had arsenic concentrations that were elevated above such local background levels.

Lead concentrations ranged from 4.2 mg/kg to 203 mg/kg. None of the 28 samples exceeded the Virginia VRP Tier II RBSL for lead of 270 mg/kg.

Mercury was detected in five of the fill material samples at concentrations ranging from 0.101 mg/kg to 0.882 mg/kg. The Virginia VRP Tier II RBSL for mercury is 0.43 mg/kg. Only one of the detected mercury concentrations was found to exceed the Virginia risk-based standard.

3.2 Groundwater Results

Groundwater was encountered at depths ranging from 12 to 20 below original surface grade. Four of the borings were converted into temporary monitoring wells (E-6, E-7, E-8 and E-10). A groundwater sample was collected from each of the wells and analyzed for DRO, GRO, VOCs and RCRA 8 metals. Only 80 milliliters of water was able to be collected from E-8, and therefore, only DRO was analyzed. The laboratory results are summarized in following table.

Groundwater Analytical Results
(Samples collected March 2010)

Boring	DRO (mg/L)	GRO (ug/L)	VOCs (ug/L)	Arsenic (ug/L)	Barium (ug/L)	Cadmium (ug/L)	Chromium (ug/L)
E-6	--	--	--	--	54	--	--
E-7	0.70	--	p-Isopropyl toluene = 49	--	245	--	--
E-8	--	NA	NA	NA	NA	NA	NA
E-10	--	--	--	6	57	1	1

Notes: -- = not detected at or above the analytical detection limit.
mg/L = milligrams per Liter, equivalent to parts per million (ppm).
ug/L = micrograms per Liter, equivalent to parts per billion (ppb).
NA = not analyzed.

Petroleum and VOCs
TPH DRO was detected in one of the four groundwater samples collected for this investigation. E-7 had a DRO concentration of 0.70 mg/L and was located in the southeastern portion of the property. As depicted in the table above, none of the groundwater samples exceeded the 1.0 mg/L VDEQ action level for TPH-DRO in groundwater. The E-7 sample also contained a minor concentration of p-isopropyl toluene (49 ug/L) but did not contain chlorinated solvents or other VOCs of significant concern. The detected concentration of p-isopropyl toluene was below the VRP Tier II risk based screening level 68 ug/L.

Metals
With regard to metals, arsenic (6 ug/L), cadmium (1 ug/L) and chromium (1 ug/L) were detected in one (E-10) of the three groundwater samples analyzed (E-8 only produced 80

mL of water during sampling, and therefore, was only analyzed for TPH DRO). Barium was detected in all three groundwater samples at concentrations ranging from 54 to 245 ug/L. All concentrations for metals detected were below their respective VRP Tier II Risk Based Screening Concentrations for a residential setting.

Future development of the site will consist of the construction of at-grade townhouses. Based on the depth of saturated conditions encountered, groundwater is not expected to be encountered during construction activities. Additionally, the groundwater exposure to future residents or commercial workers will be closed because the City of Alexandria has a prohibition against groundwater extraction for drinking purposes.

4.0 SITE-SPECIFIC RISK ASSESSMENT

The risk assessment methodology follows the VDEQ Voluntary Remediation Program (VRP) guidance. Risk assessments under the VRP guidance generally follow the methodology described in the EPA's Risk Assessment Guidance for Superfund (RAGS). The steps involved in this risk assessment are as follows:

1) Determine the most likely routes of exposure based on site development and future use.
2) Determine an "average" arsenic in soil concentration.
3) Quantify the risk based on VRP standard equations for the exposure route and exposure population that has the potential to present the greatest risk during site development.

4.1 Exposure Routes

As noted above, Potomac Yards Landbay I/J will be developed with slab-on-grade residential townhomes. All of the utility work associated with site development will occur on the developed portion of the site. It is our opinion that the risk pathways that have the greatest potential to present an exposure risk are utility/construction worker exposure to arsenic in soil during site development. Utility/construction workers can be exposed to arsenic and mercury in soil through one of three pathways: dermal contact, ingestion, and inhalation of air-borne dust.

4.2 Determining Soil Concentration

The sampling locations are depicted on the attached figure. Sampling consisted of collecting 42 soil samples and 4 groundwater samples in March 2004 and March 2010.

All of the soil samples collected were analyzed for metals. The deepest utilities will be storm sewers which will have a maximum depth of 6'. Consequently, soil samples collected from depths greater than 6' are below the deepest utility construction depth and were not included. Therefore, arsenic concentrations from 19 of the 42 soil samples were included. Additionally, the one soil sample for mercury that exceeded the VRP Tier II screening level was included.

For VRP risk assessments either the maximum contaminant concentration or the 95% Upper Confidence Limit (UCL) on the arithmetic mean should be used as the exposure concentration. The UCL calculation is justified when the number of samples collected is greater than thirty. A total of 19 soil samples were collected from the on-site borings by ECS in March 2004 and March 2010 at depths between the surface and six feet. Because the total number of soil samples is insufficient to warrant the calculation of a statistical average, the maximum concentration for both arsenic and mercury was used in the risk assessment.

4.3 Risks Posed by Metals in Soil

As noted above, it is our opinion that exposure of utility/construction workers to arsenic and mercury in soil through the pathways of dermal contact, ingestion, or inhalation of air-borne dust has the greatest risk potential during site development. The risk is calculated based on the average concentration in the soil and exposure times that are determined by VRP. The VRP employs the same tables to calculate risk from these three exposure routes. The only difference between utility and construction workers is the duration of their exposure.

The default exposure time for a utility/construction worker is 125 days work days over a one-year period. Based on ECS experience with construction management on similar projects in Alexandria, we believe that one month is the maximum period that a utility trench would be left open and six months is the maximum period that site excavation/grading would occur. Consequently, the risk to an above-ground construction worker would exceed that to a utility worker because of the longer period of exposure. Therefore, we employed 120 working days over a six-month period as the exposure duration. Carcinogenic risk was calculated for only arsenic, while non-carcinogenic risk was calculated for both arsenic and mercury.

The calculated carcinogenic risk for arsenic is summarized below.

Carcinogenic Risk (Soil) – Construction Worker Pathway			
	Dermal	**Ingestion**	**Inhalation**
Arsenic	7.63E-06	2.05E-05	8.58E-10

Likewise, non-carcinogenic hazard quotients are also considered additive. Therefore, the total hazard quotient is calculated by adding the quotients for both arsenic and mercury for all of the open pathways. The quantitative results of the non-carcinogenic hazard quotient assessment for the open pathways are provided in the following table.

Non-Carcinogenic Hazard Quotient (Soil) – Construction Worker Pathway			
	Dermal	Ingestion	Inhalation
Arsenic	1.19E+00	3.20E+00	9.31E-04
Mercury	8.04E-04	6.47E-03	Note 1
Total Hazard Quotient	**1.19E+00**	**3.21e+00**	**9.31E-04**

Note 1 = No inhalation unit risk factor is listed for this contaminant.

5.0 SUMMARY AND RECOMMENDATIONS

Potomac Yards was a former rail yard, operated by the Richmond Fredericksburg and Potomac (RF&P) railroad from approximately 1906 to 1990. The subject property, Landbay I/J, is located east of Jefferson Davis Highway, to the south of Swann Avenue and to the north of Howell Avenue in Alexandria, Virginia. The property is located south of the former Central Operations Area for the rail yard. Activities in the Central Operations Area included refueling of diesel locomotives, repair, maintenance, servicing, and cleaning. There were a minimum of eight underground storage tanks located in and around the Central Operations Area, and also four large 25,000-gallon aboveground diesel tanks. Surface spills, releases from underground tanks, and runoff from repair and maintenance activities contributed to subsurface petroleum contamination beneath large portions of the Potomac Yards site.

Site development will consist of the construction of slab on-grade townhouses. The majority of the property will be occupied by these structures. However, areas not occupied by these structures will be covered with at least two feet of clean fill or hardscape.

Soil contamination has been identified predominantly within the fill areas of the site (i.e. upper 6 feet). The results of the Phase II study revealed that of the constituents detected, only arsenic (in all samples) and mercury (one sample) exceeded its respective VRP Tier II risk based screening level. The details of the ECS sampling events in 2004 and 2010 were presented above. None of the contaminants detected in the groundwater exceeded their respective VRP Tier II risk based screening concentration.

The primary exposure will be to construction and utility workers whose exposure pathways are dermal, ingestion and inhalation. Therefore, an exposure assessment was performed for the construction and utility workers using the highest concentration for both arsenic and mercury. The results are as follows:

Construction and Utility Workers
Total Carcinogenic Risk and Hazard Quotients from Soil

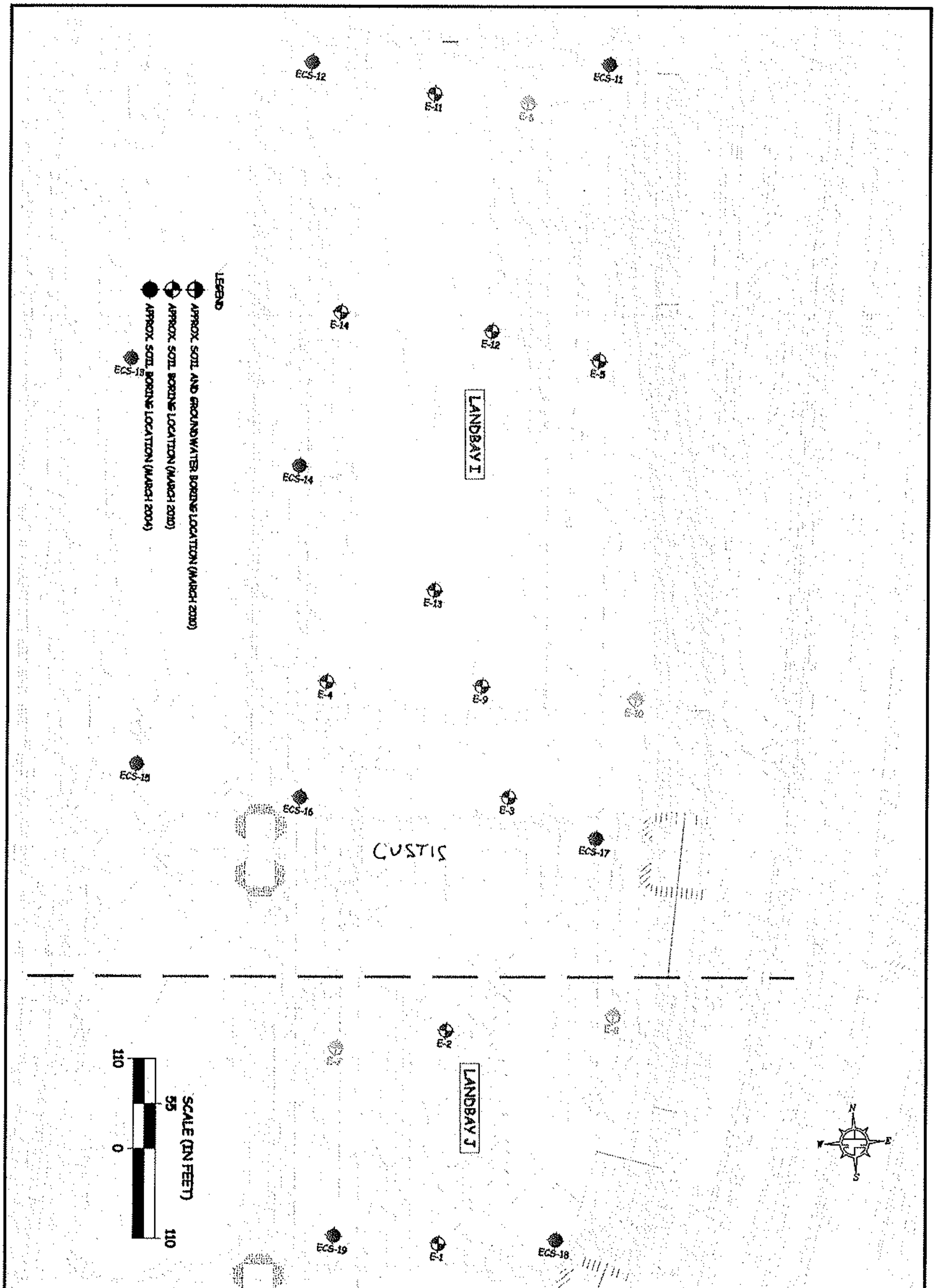
	Dermal	Ingestion	Inhalation
Total Carcinogenic Risk	7.63E-06	2.05E-05	8.58E-10
Total Hazard Quotient	1.19E+00	3.21E+00	9.31E-04

The total carcinogenic risk for the dermal and ingestion pathways for construction workers exceeds the acceptable risk of $1.0x10^{-6}$, while the inhalation pathway is less than the acceptable risk of $1.0x10^{-6}$. The total non-carcinogenic hazard quotient for the dermal and ingestion pathways exceeds the VRP target quotient of one.

Prior to construction activities, the general contractor will prepare a Health and Safety Plan (HASP). The HASP will include engineering controls to limit the construction workers exposure. These controls may include a prohibition against eating and smoking (i.e. the two primary pathways by which dermal and ingestion occur), and guidelines for on-site dust control, which would consist of site watering. The controls implemented with the HASP would effectively limit worker exposure whereby decrease the risk.

APPENDIX I

FIGURE



DATE 4/4/10	SHEET 1	PROJECT NO. 9676-S
SCALE 1" = 110'	ENGINEER DJB	DRAFTING RAC
ECS REVISIONS DJB 4/7/10		

BORING LOCATION DIAGRAM

POTOMAC YARD DEVELOPMENT

ECS LLC MID-ATLANTIC

POTOMAC YARD LANDBAY I AND J

ALEXANDRIA, VA

APPENDIX II

BORING LOGS

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E1

Contractor:	Green Services	Date:	3/29/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Asphalt and gravel base.
-1-		0.0	Sandy silt fill material with rock fragments, black and tan, moist and soft.
-2-			
-3-		0.0	
-4-			
-5-		0.0	Sand, orange and light brown, moist and soft.
-6-			
-7-		0.0	
-8-			
-9-		0.0	
-10-			
-11-		0.0	
-12-			
-13-		0.0	
-14-			Sandy clay, reddish brown, moist and tight.
-15-		0.0	
-16-			
-17-		0.0	Sandy silt, gray, damp and soft.
			Marine clay, gray, moist, tight.
-18-			
-19-		0.0	
-20-			
-21-			End of boring at 20'.
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☒		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	**SOIL BORING LOG** Potomac Yard Landbay I/J	**Boring No.** E2

Contractor:	Green Services	Date:	3/29/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Asphalt and gravel base.
-1-		0.0	Sand and gravel fill material, brown and black, moist and tight.
-2-			
-3-		0.0	
-4-			
-5-		0.0	Silty sand, gray and light brown, moist and tight. Petroleum odor encountered from 3' to 6'.
-6-			
-7-		0.0	
-8-			
-9-		0.0	
-10-			
-11-		0.0	
-12-			Sandy clay, gray and light brown, moist and tight. Saturated conditions encountered from 13 – 13.5' Saturated conditions encountered from 17.5 – 18.5'.
-13-		0.0	
-14-			
-15-		0.0	
-16-			
-17-		0.0	
-18-			
-19-		0.0	Marine clay, gray, moist and tight.
-20-			
-21-			End of boring at 20'.
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)	1	Sample Method	
Temporary Piezometer	☒	PVC	☒	Depth (ft)	20	Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)	10	Foot-Valve, Inertial Tube	☒
None	☐		☐	Slot Size (in.)	0.10	Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E3

Contractor:	Green Services	Date:	3/29/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Asphalt and gravel base.
-1-		0.8	
			Silty sand fill material, black and brown, moist and tight.
-2-			
-3-		1.1	
-4-			
-5-		0.4	Silty sand with small cobbles, brown, moist and tight.
-6-			
-7-		0.2	
			Sandy clay, brown, moist and tight.
-8-			
-9-		1.2	Sandy clay, brown and gray, moist and tight.
-10-			
-11-		0.9	
-12-			
			Sandy clay, brown and gray, saturated, soft.
-13-		2.0	Sandy clay, brown and gray, moist and tight.
-14-			
-15-		3.2	
			Sandy clay, brown and gray, saturated, soft.
-16-			
-17-		0.0	
-18-			
			Silty clay, gray, moist and tight.
-19-		0.0	
-20-			
			End of boring at 20'.
-21-			
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E4

Contractor: Green Services
Drill Method: Direct-Push
Sample Method: Macro-core
Date: 3/29/2010
ECS Project No.: 9676-S
ECS Field Geologist: Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
-1-		3.2	Asphalt and gravel base. Sandy fill material with cinder ballast, black, dry and loose.
-2-			
-3-		0.0	
-4-			
-5-		0.0	
-6-			
-7-		0.0	Sandy clay with gravel, brown, damp, tight.
-8-			
-9-		0.0	Silty clay, brown and gray, moist and tight.
-10-			
-11-		0.0	Silty sand, brown and gray, saturated, soft. Silty sand, brown and gray, damp, soft.
-12-			
-13-		0.0	Silty sand, brown, saturated, soft.
-14-			
-15-		0.0	
-16-			Sandy clay, gray, moist and tight.
-17-		0.0	Silty clay, gray, saturated, soft.
-18-			Silty clay, gray, moist and tight.
-19-		0.0	
-20-			
-21-			End of boring at 20'.
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E5

Contractor:	Green Services	Date:	3/29/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
-1-		0.0	Asphalt and gravel base. Silty sand fill material with gravel, black and brown, moist and tight.
-2-			
-3-		0.0	
-4-			
-5-		0.0	
-6-			
-7-		0.0	Sandy clay, light brown and gray, moist and tight.
-8-			
-9-		0.0	
-10-			
-11-		0.0	Sandy clay, light brown and gray, damp and soft.
-12-			
-13-		0.0	
-14-			
-15-		0.0	Sandy clay with organic matter, dark gray, moist and tight. Sandy clay with organic matter, dark gray, saturated, soft.
-16-			
-17-		0.0	Silty clay, reddish brown and gray, moist and tight.
-18-			
-19-		0.0	
-20-			
-21-			End of boring at 20'.
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, Virginia 20151
703-471-8400

SOIL BORING LOG
Potomac Yard
Landbay I/J

Boring No. E7

Contractor: Green Services
Drill Method: Direct-Push
Sample Method: Macro-core
Date: 3/30/2010
ECS Project No.: 9676-S
ECS Field Geologist: Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
-1-		0.7	Asphalt and gravel base. Sandy fill material with cinder ballast, black, dry and loose.
-2-			
-3-		0.4	
-4-			
-5-		40.0	Sandy clay, brown and gray, moist and tight.
			Wood.
-6-			Silty sand, brown, moist and soft.
-7-		2.7	
-8-			
-9-		2.6	
-10-			
-11-		1.2	Sand, brown and gray, moist and soft.
-12-			
-13-		2.8	Sand, brown and gray, saturated and soft.
			Sand, brown and gray, moist and soft.
-14-			
-15-		0.2	Silty clay, gray, moist and tight.
-16-			
-17-		0.0	
-18-			
-19-		0.8	
-20-			
-21-			End of boring at 20'.
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E8

Contractor:	Green Services	Date:	3/30/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
-1-		1.3	Asphalt and gravel base. Sandy fill material with gravel, brown and black, moist and tight.
-2-			
-3-		2.4	Silty sand, brown, moist and tight.
-4-			Sand, light brown, moist and tight.
-5-		0.0	Silty sand, brown, moist and tight.
-6-			
-7-		0.0	Silty sand, brown, saturated and soft.
-8-			
-9-		1.1	Silty sand, gray, moist and tight.
-10-			
-11-		0.0	
-12-			
-13-		0.3	
-14-			
-15-		0.0	Silty clay, gray, damp and soft.
-16-			Silty clay, brown, damp, soft.
-17-		1.7	
-18-			
-19-		0.0	
-20-			End of boring at 20'.
-21-			
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	**SOIL BORING LOG** Potomac Yard Landbay I/J	**Boring No.** E9

Contractor:	Green Services	Date:	3/30/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Asphalt and gravel base.
-1-		2.6	Sandy silt fill material, black and brown, moist and tight.
-2-			Silty sand, reddish brown, moist and tight.
-3-		0.3	
-4-			Cinder ballast, black, moist, loose.
-5-		1.8	Sandy clay, dark gray and brown, moist and tight.
-6-			
-7-		0.2	
-8-			
-9-		0.7	Silty sand, brown, moist and tight.
-10-			
-11-		1.7	
-12-			
-13-		0.9	
-14-			
-15-		0.9	Silty clay, brown and gray, moist and tight.
-16-			
-17-		1.0	
-18-			
-19-		0.0	Silty clay, gray, saturated, soft.
-20-			End of boring at 20'.
-21-			
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		**Casing Type**		Casing Dia. (in.)		**Sample Method**	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	**SOIL BORING LOG** Potomac Yard Landbay I/J	**Boring No.** E10

Contractor: Green Services
Drill Method: Direct-Push
Sample Method: Macro-core
Date: 3/30/2010
ECS Project No.: 9676-S
ECS Field Geologist: Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
-1-		5.2	Asphalt and gravel base. Silty sand fill material with gravel and cinder ballast, brown and black, moist and tight.
-2-			
-3-		0.4	
-4-			
-5-		0.0	Sandy clay, brown, moist and tight.
-6-			
-7-		5.3	Silty sand, brown, moist and tight. Sandy clay, light brown and gray, moist and tight.
-8-			
-9-		0.4	Silty sand, brown and gray, moist and tight.
-10-			
-11-		0.0	
-12-			
-13-		5.7	Sandy clay, brown and gray, moist and tight.
-14-			Sandy clay, brown and gray, saturated and soft.
-15-		2.8	Sandy clay, brown and gray, moist and tight.
-16-			
-17-		2.5	Sandy clay, brown and gray, saturated and soft. Marine clay, gray, moist and very tight.
-18-			
-19-		2.1	
-20-			
-21-			End of boring at 20'.
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		**Casing Type**		Casing Dia. (in.)		**Sample Method**	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400		**SOIL BORING LOG** Potomac Yard Landbay I/J	**Boring No.** E11 (on stockpile)
Contractor:	Green Services	Date:	3/30/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Clean fill material.
-2-			
-4-			
-6-			
-8-			
-10-			
-12-			
-14-			
-16-			
		3.8	Sandy fill material with cinder ballast, black, damp, loose.
-18-			
		0.3	
-20-			
		0.5	Sandy clay, brown, moist and soft.
-22-			
		0.2	
-24-			
		2.9	Sandy silt, gray and brown, moist and tight.
-26-			
		0.5	
-28-			
		1.8	Silty clay, gray, moist and tight.
-30-			
		1.4	
-32-			
		0.0	Sandy clay, brown, moist and soft. Saturated conditions encountered from 32 – 33'.
-34-			
		0.2	
-36-			
			End of boring at 36'.
-38-			
-40-			
-42-			
-44-			
-46-			
-48-			

Groundwater Sampling

Well Installed		**Casing Type**		Casing Dia. (in.)		**Sample Method**	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400		**SOIL BORING LOG** Potomac Yard Landbay I/J	**Boring No.** E12 (on stockpile)
Contractor:	Green Services	Date:	3/30/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Clean fill material.
-2-			
-4-			
-6-			
-8-			
-10-			
-12-			
-14-			
-16-		0.0	Silty sand fill material, black and brown, moist and tight.
-18-		2.7	
-20-		0.6	Sandy clay, reddish brown, damp, soft.
-22-		1.1	
-24-		0.9	Silty clay, brown and gray, moist and tight.
-26-		0.7	
-28-		3.0	Sandy clay, brown and gray, damp and tight. Saturated conditions encountered from 31.5 – 32.5'.
-30-		0.7	
-32-		1.4	
-34-		0.0	Clayey sand, gray, damp and soft.
-36-			End of boring at 35'.
-38-			
-40-			
-42-			
-44-			
-46-			
-48-			

Groundwater Sampling

Well Installed		**Casing Type**		Casing Dia. (in.)		**Sample Method**	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400		SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E13 (on stockpile)
Contractor:	Green Services	Date:	3/30/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Clean fill material.
-2-			
-4-			
-6-			
-8-			
-10-			
-12-			
-14-			
-16-		0.8	Silty sand fill material with rock and brick fragment, brown and black, moist and tight.
-18-		0.8	
-20-		2.6	Clayey sand, reddish brown, moist and tight.
-22-		0.8	
-24-		5.0	Cinder ballast, black, dry and loose.
			Sand clay, brown, moist and tight.
-26-		1.9	
-28-		5.9	Silty clay, gray, damp and soft.
-30-		0.7	
			Silty sand, gray, moist and soft.
-32-		1.2	Silty clay, gray, damp and soft. Saturated conditions encountered from 32 – 33'.
-34-		2.2	
-36-			End of boring at 35'.
-38-			
-40-			
-42-			
-44-			
-46-			
-48-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E14 (on stockpile)

Contractor:	Green Services	Date:	3/30/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Clean fill material.
-2-			
-4-			
-6-			
-8-			
-10-			
-12-			
-14-			
-16-		1.5	Sandy fill material with rock fragment and cinder ballast, black and brown, moist and tight.
-18-		2.3	
-20-		3.4	
			Cinder ballast, black, damp and soft.
-22-		2.0	
-24-		0.6	Silty sand, brown, moist and tight.
-26-		1.7	
-28-		0.2	
-30-		0.3	
-32-		0.4	
-34-		2.1	
-36-			End of boring at 35'.
-38-			
-40-			
-42-			
-44-			
-46-			
-48-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)		Sample Method	
Temporary Piezometer	☐	PVC	☐	Depth (ft)		Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)		Foot-Valve, Inertial Tube	☐
None	☐		☐	Slot Size (in.)		Bailer	☐

ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, Virginia 20151 703-471-8400	SOIL BORING LOG Potomac Yard Landbay I/J	Boring No. E6

Contractor:	Green Services	Date:	3/29/2010
Drill Method:	Direct-Push	ECS Project No.:	9676-S
Sample Method:	Macro-core	ECS Field Geologist:	Mike Johnson

Depth (ft)	Recovery (ft)	PID (ppm)	Soil Description and Notes
			Asphalt and gravel base.
-1-		0.0	Silty sand fill material with gravel, black and brown, moist and tight.
-2-			
-3-		0.0	
-4-			
-5-		0.0	Silty sand, brown, moist and tight. Saturated conditions encountered from 12 – 14'.
-6-			
-7-		0.0	
-8-			
-9-		0.0	
-10-			
-11-		0.0	
-12-			
-13-		0.0	
-14-			
-15-		0.0	Silty clay, light brown and gray, moist and tight.
-16-			
-17-		0.0	
-18-			
-19-		0.0	Marine clay, gray, moist and tight.
-20-			
-21-			End of boring at 20'.
-22-			
-23-			
-24-			

Groundwater Sampling

Well Installed		Casing Type		Casing Dia. (in.)	1	Sample Method	
Temporary Piezometer	☒	PVC	☒	Depth (ft)	20	Peristaltic Pump	☐
Permanent Well	☐	Stainless-Steel	☐	Length (ft)	10	Foot-Valve, Inertial Tube	☒
None	☐		☐	Slot Size (in.)	0.10	Bailer	☐

APPENDIX III

VRP TABLES

Table 3.13
Construction/Utility Worker Dermal Pathway in Soil
Potomac Yards Landbay I/J

Medium:	Soil
Exposure Medium:	Soil
Receptor Population:	Construction Worker
Exposure Route:	Dermal
Receptor Age:	Adult

Intake Equation:
DAD=CS x ABS x IF
Intake Factor Equation:
IF=SA x CF x AF x EF x ED x 1/BW x 1/AT

Parameter Code	Parameter Definition	Units	VRP Default Value	Rationale/ Reference	User Defined Value	Rationale/ Reference
DAD	Dermally Absorbed Dose	mg/kg-day				
CS	Chemical Concentration in Soil	mg/kg				
CF	Conversion Factor	kg/mg	1E-06			
AF	Soil to Skin Adherence Factor	mg/cm^2	0.9 (3)	EPA, 2001		
ABS	Absorption Factor	unitless	Chemical Specific (1)	EPA, 1995 and EPA, 2001		
SA	Skin Surface Area Available for Contact	cm2/day	3,300 (2)	EPA, 2001		
EF	Exposure Frequency	days/years	125	DEQ		
ED	Exposure Duration	years	1	DEQ		
BW	Body Weight	kg	70	DEQ		
AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1991		
AT-N	Averaging Time (Non-Cancer)	days	365	EPA, 1989		
IF-C	Intake Factor (Cancer)	days^-1	2.08E-07	EPA, 1989		
IF-N	Intake Factor (Non-cancer)	days^-1	1.45E-05	calculated		

Note: in the Rationale/Reference column the entries are printed one line lower than their parameter rows from AF down, and the second "calculated" entry has no row of its own in this layout.

DEQ= VRP Staff Professional Judgement
EPA, 1989= Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (Part A)
Office of Emergency and Remedial Response. EPA/540/1-89/002.
EPA, 1991= Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors.
Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03
EPA, 1995= Assessing Dermal Exposure from Soil. Region III. Office of Superfund Programs
EPA/903-K-95-003.
EPA, 2001= RAGS E, Chapter 3

(1) Absorption Factors are listed on VRP Table 3.23
(2) Represents face, hands, and forearms
(3) Based on soil-to-skin adherence data presented in EPA, 2001for a utility worker
Note the following AF s from RAGS E for site specific scenarios:
groundskeeper AF=0.1
construction worker AF=0.3

Revised [illegible]

Chemical of Potential Concern	Cancer Classification	Exposure Point Concentration (CS) mg/kg	Dermally Absorbed Dose (Cancer) (DADc) mg/kg-day	Adjusted Dermal Cancer Slope Factor CSFd 1/(mg/kg-day)	Cancer Risk (DADc*CSFd) Dermal unitless	Dermally Absorbed Dose (Non-Cancer) (DADn) mg/kg-day	Adjusted Dermal Reference Dose (chronic) RfDd mg/kg-day	Adjusted Dermal Reference Dose (subchronic) RfDd mg/kg-day	Hazard Quotient (DADn/RfDd) Dermal unitless	Absorption Factor (ABS)
TAL Inorganics										
Arsenic	A	6.17E+02	5.09E-06	1.50E+00	7.63E-06	3.56E-04	3.00E-04	3.00E-04	1.19E+00	3.00E-02
Mercury	D	6.62E-01				1.28E-07	1.60E-04	1.60E-04	8.01E-04	1.00E-02
Total					7.63E-06				1.19E+00	

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B	M	N	O	P	Q	R	S	T	U

Table 3.14
Construction/Utility Worker Ingestion Pathway in Soil
Potomac Yards Landbay I/J

Medium:	Soil
Exposure Medium:	Soil
Receptor Population:	Construction Worker
Exposure Route:	Ingestion
Receptor Age:	Adult

Intake Equation:
CDI = CS x IF
Intake Factor Equation:
IF= IR-S x FI x EF x ED x CF x 1/BW x 1/AT

Parameter Code	Parameter Definition	Units	VRP Default Value	Rationale/ Reference	User Defined Value	Rationale/ Reference
CDI	Chronic Daily Intake	mg/kg-day				
CS	Chemical Concentration in Soil	mg/kg				
CF	Conversion Factor	kg/mg	1E-06			
IR-S	Ingestion Rate - Soil	mg/day	480	EPA,1991		
FI	Fraction Ingested from source	unitless	0.5	DEQ		
EF	Exposure Frequency	days/years	125	DEQ		
ED	Exposure Duration	years	1	DEQ		
BW	Body Weight	kg	70	EPA, 1991		
AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989		
AT-N	Averaging Time (Non-Cancer)	days	365	EPA, 1989		
IF-C	Intake Factor (Cancer)	days^-1	1.68E-08	calculated		
IF-N	Intake Factor (Non-cancer)	days^-1	1.17E-06	calculated		

DEQ= VRP Staff Professional Judgement
EPA, 1989= Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response. EPA/540/1-89/002.
EPA, 1991= Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03
EPA, 2001= Draft SSL Guidance, March 2001

[illegible] Chemical of Potential Concern	Cancer Classification	Exposure Point Concentration (Oral) (CS) mg/kg	Chronic Daily Intake (Cancer) (CDIc) mg/kg-day	Oral Cancer Slope Factor CSFo (mg/kg-day)^-1	Cancer Risk (CDIc*CSFo) Oral unitless	Chronic Daily Intake (Non-Cancer) (CDIn) mg/kg-day	Oral Reference Dose (chronic) RfDc mg/kg-day	Oral Reference Dose (subchronic) RfDs mg/kg-day	Hazard Quotient (CDIn/RfDs) Oral unitless
(A) Inorganics									
Arsenic	A	8.17E+02	1.37E-05	1.50E+00	2.06E-05	9.58E-04	3.00E-04	3.00E-04	3.20E+00
Mercury	D	8.42E-01				1.04E-06	1.60E-04	1.60E-04	6.47E-03
Total					2.06E-05				

Table 3.15
Construction/Utility Worker Inhalation Pathway in Soil
Potomac Yards Landbay I/J

Medium:	Soil
Exposure Medium:	Air
Receptor Population:	Construction Worker
Exposure Route:	Inhalation
Receptor Age:	Adult

Intake Equation:
EC=(CA x (ET/24hrs/day) x EF x ED)/AT

Parameter Code	Parameter Definition	Units	VRP Default Value	Rationale/ Reference	User Defined Value	Rationale/ Reference
CA	Chemical Concentration in Air	mg/m^3	(1)			
EF	Exposure Frequency	days/year	125	DEQ		
ED	Exposure Duration	years	1	DEQ		
ET	Exposure Time	hours/day	4	DEQ		
AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989		
AT-N	Averaging Time (Non-Cancer)	days	365	EPA, 1989		

DEQ= VRP Staff Professional Judgement
EPA, 1989= Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response. EPA/540/1-89/002.
(1) Ambient air concentrations may be estimated by applying the particulate emission factor (PEF) or volatilization factor (VF) to soil concentrations as described in Soil Screening Guidance: Technical Background Document. U. S. EPA, Office of Solid Waste and Emergency Response. May 1996. (EPA/540/R-95/128) and Soil Screening Guidance: User's Guide. U.S.EPA, Office of Solid Waste and Emergency Response. April 1996. (EPA/540/R-96/018)
as described in Soil Screening Guidance: Technical Background Document. U. S. EPA, Office of Solid Waste

Revised 9/23/09

Chemical of Potential Concern	Cancer Classification	Soil Concentration mg/kg	Exposure Point Concentration (Inhalation) (CA) mg/m3	Exposure Concentration EC cancer mg/m3	Inhalation Unit Risk IUR (mg/m³)⁻¹	Cancer Risk (EC*IUR) unitless	Exposure Concentration EC noncancer mg/m3	Inhalation Reference Concentration (chronic) RfCi mg/m³	Inhalation Reference Concentration (subchronic) RfCi mg/m³	Hazard Quotient (EC/RfCi) unitless
TAL Inorganics										
Arsenic	A	8.17E+02	2.45E-07	1.95E-10	4.30E+00	8.56E-10	1.40E-08	1.50E-05	1.50E-05	9.31E-04
Mercury	D	8.82E-01						3.00E-04	3.00E-04	
Total						8.56E-10				9.31E-04

	B	AF	AG
50	Revised [illegible]		
51–55	Chemical of Potential Concern	Particulate Emission Factor (PEF) m3/kg	Volatilization Factor (VF) m3/kg
56	TAL Inorganics		
57	Arsenic	3.34E+09	
58	Mercury	3.34E+09	1.68E+04
59	Total		

4/23/2010

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Technical Memorandum Update

Appendix 8

Coastal Zone Consistency

Technical Memorandum Update

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Appendix 8

Coastal Zone Consistency

On November 30, 2010, the project sponsor requested a project determination from the Virginia Department of Environmental Quality (VDEQ) for the Section B corridor. Based on a review of the 5-mile transit corridor project completed by VDEQ in 2006, the agency responded that The Commonwealth's response to the 2006 federal consistency certification remains valid, provided there are no significant changes to the scope or alignment of Section B." Email correspondence with VDEQ is provided as Attachment 1.

Attachments:

Attachment 1: VDEQ Project Determination: Concurrence e-mail from VDEQ dated 11/30/2010.

Hachey, Alan

From: Fisher, John (DEQ) [John.Fisher@deq.virginia.gov]
Sent: Tuesday, November 30, 2010 3:36 PM
To: Hachey, Alan
Cc: Anderson, Susan; Irons, Ellie (DEQ)
Subject: RE: Crystal City/Potomac Yard Transit Improvement Project (Alexandria, VA)

Mr. Hachey:

The Commonwealth's response to the 2006 federal consistency certification remains valid, provided there are no significant changes to the scope or alignment of Section B that would result in impacts to any of the enforceable policies of the Virginia Coastal Zone Management Program not described in 2006. If significant changes are proposed, please submit additional information to Ms. Ellie Irons, the federal consistency point-of-contact in Virginia, for a determination of whether further review is required.

Thank you for your inquiry.

John E. Fisher
Virginia Department of Environmental Quality
Division of Environmental Enhancement
Office of Environmental Impact Review
629 East Main Street, #633
Richmond, Virginia 23219
(804) 698-4339
(804) 698-4319 fax
NEW EMAIL: john.fisher@deq.virginia.gov
www.deq.virginia.gov

From: Hachey, Alan [mailto:Alan.Hachey@aecom.com]
Sent: Tuesday, November 30, 2010 1:16 PM
To: Fisher, John (DEQ)
Cc: Anderson, Susan
Subject: Crystal City/Potomac Yard Transit Improvement Project (Alexandria, VA)

Hello Mr. Fisher:

I work as a transportation planning consultant for the Washington Metropolitan Area Transit Authority (WMATA) in Arlington. I am writing to inquire about the duration of the validity of the attached Federal Consistency Certification review document for a project previously reviewed by VDEQ. VDEQ completed a review of the Documented Categorical Exclusion in November 2006 for the proposed 5-mile alignment of the Crystal City/Potomac Yard transit corridor between Arlington and Alexandria, VA.

The proposed transitway would connect Crystal City in Arlington and the Braddock Road Metro Station in Alexandria. Attached is a map of the project alignment and the project website is located here:

http://www.ccpytransit.com/index.htm

We are specifically analyzing Section B (referred to as Segment B on the Map) of the alignment over the next few months. The NEPA analysis for Sections D and E of the transit alignment in Arlington was approved by the FTA in April 2007. The VDEQ coordinated review was helpful to determine regulatory efforts, e.g. Section 106 and project consistency with the Coastal Zone Management Act.
Since the time of the VDEQ review, the City of Alexandria has secured TIGER grant funding for Section B which is now included in the region's TIP and has been modeled for air quality conformity.

The project team expects only an incremental update to the NEPA analysis as your department previously reviewed the NEPA study which included Section B. Our goal is to complete a Documented Categorical Exclusion for Section B of the alignment within the next two months. We do need to confirm that VDEQ's previous findings are still valid, or alternatively how long it would take for a new project review. Thank you in advance for your assistance and please contact me if you have any questions.

Alan Hachey

AECOM

Alan S. Hachey, AICP
AECOM
2101 Wilson Boulevard | 8th Floor | Arlington, VA 22201
T 703.340.3114 F 703.340.3101
www.aecom.com

Technical Memorandum

Appendix 9

Ecologically Sensitive Areas and Species

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Technical Memorandum

Appendix 9

Ecologically Sensitive Areas and Species

Neither the Virginia Department of Game and Inland Fisheries (VDGIF) or Virginia Department of Conservation and Recreation (VDCR) identified endangered species habitat or other state designated natural heritage resources in their review of the 5-mile project corridor which occurred in 2006. A copy of this correspondence can be found in Appendix 10 of the 2007 Documented Categorical Exclusion (DCE). The Virginia Department of Environmental Quality (VDEQ) led a state environmental clearinghouse review in 2006, which included the VDGIF and VDCR. The US Fish and Wildlife Service (USFWS) also reviewed the project in June 2006, but did not identify any federally listed species or habitat at that time (See Appendix 10 of the 2007 DCE for agency correspondence).

For this analysis, a database search for the project was conducted through the USFWS Virginia Field Office website on December 14, 2010. The USFWS Virginia Field Office does not identify any federally listed endangered or threatened species in the City of Alexandria.[1] Habitat and species information provided by the USFWS Virginia Field Office website for the City is summarized in Table 1. Additionally, the College of William and Mary, Center for Conservation Biology, maintains a database of bald eagles nests within the Commonwealth but does not identify any bald eagle nests in the City.

[1] United States Fish and Wildlife Service, Virginia Field Office, *Endangered Species County Lists,* http://www.fws.gov/northeast/virginiafield/PDF/EndSpecies/County_Lists/Alexandria.pdf, Accessed 12/14/10.

Table 1: USFWS Federally Listed Species Findings for the City of Alexandria, Virginia (Species Conclusion Table)

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Federal Endangered Species Act (ESA) listed species	Species not present	Not likely to adversely affect	Project study area is located within an urbanized, developed area of the City of Alexandria, with little or no natural habitat.
Federally Designated Critical Habitat	No critical habitat present	No effect	
Haliaeetus leucocephalus Bald Eagle	Unlikely to disturb nesting bald eagles	No Eagle Act permit required	No nests within 660' and not within a concentration area.
Stygobromus phreaticus Northern Virginia well amphipod (Species of Concern)	Species not present	No effect	Required habitat for this species includes groundwater or groundwater-related subterranean habitats, for example, caves, seeps, small springs, wells, interstices, and rarely deep lakes. Habitat assessment indicated no potential habitat present.
Pycnanthemum torrei Torrey's mountain-mint (Species of Concern)	Species not present	No effect	Required habitat for this species includes grasslands, shrublands, open woodlands, open wetlands/bogs, shale barrens, rock outcrops, tallus slopes and/or early successional woody habitat. Habitat assessment indicated no potential habitat present.

Source: US Fish and Wildlife Service, Virginia Field Office, *Endangered Species County Lists*, http://www.fws.gov/northeast/virginiafield/endspecies/county_lists.html, Accessed December 12, 2010.

Technical Memorandum

Appendix 10

Public Outreach

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Technical Memorandum

Appendix 10

Public Outreach

This appendix provides public outreach material for the project resulting from two public meetings held on March 2, 2006 and March 8, 2007.

Public Meeting Presentation

Crystal City/Potomac Yard Transit Corridor Community Workshop

March 2, 2006

7:00 to 9:00 PM

George Washington Middle School

Crystal City/Potomac Yard Transit Corridor
Community Workshop

March 2, 2006
7:00 to 9:00 PM
George Washington Middle School

Agenda

Sign-In .... 6:45 PM

Welcome .... 7:00 PM

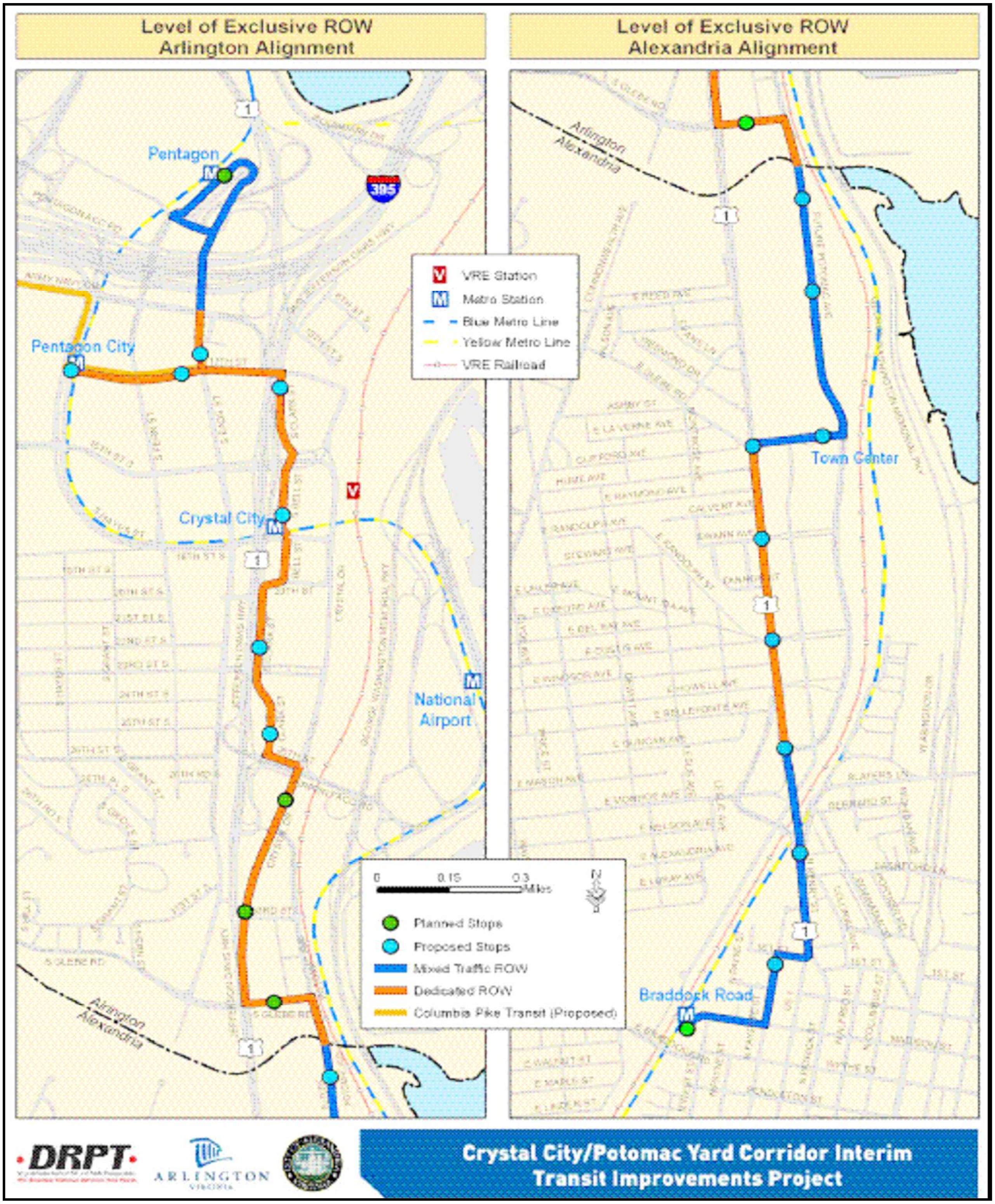
Project Overview and Background .... 7:10 PM

Alternative Transit Corridor Configurations
And Group Exercise .... 7:30 PM

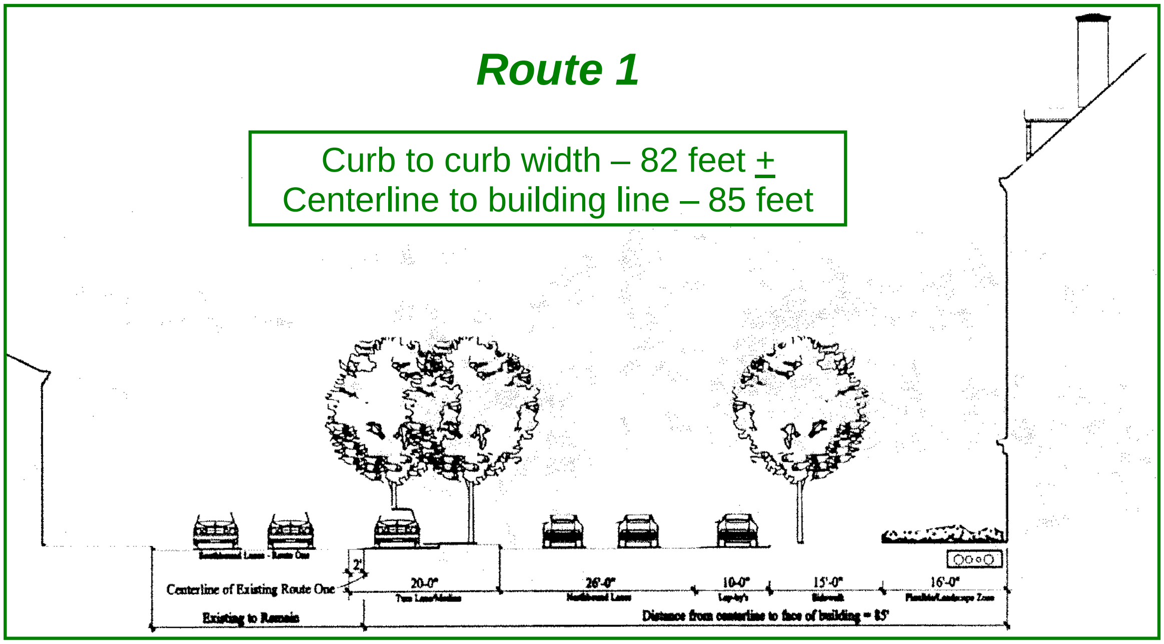
Wrap Up and Next Steps.. 8:30 PM

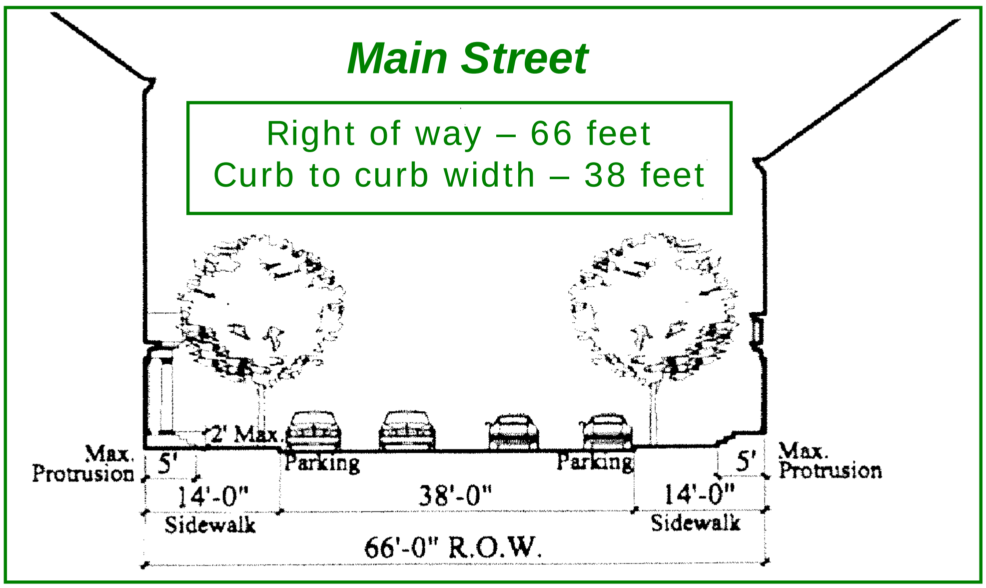
Crystal City / Potomac Yard Transit Corridor

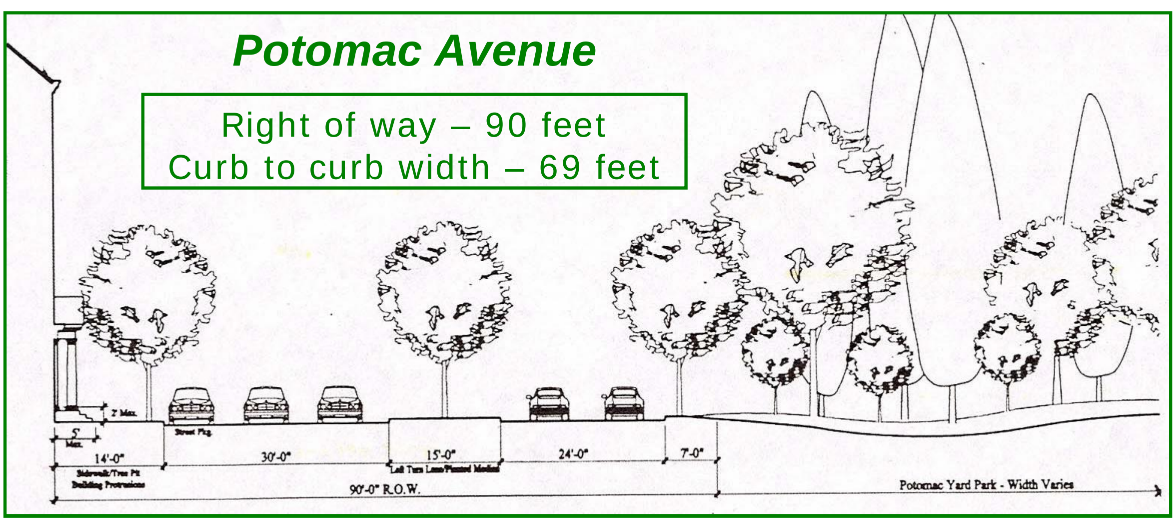
Proposed Corridor Alignment and
Level of Exclusive Right-of-Way



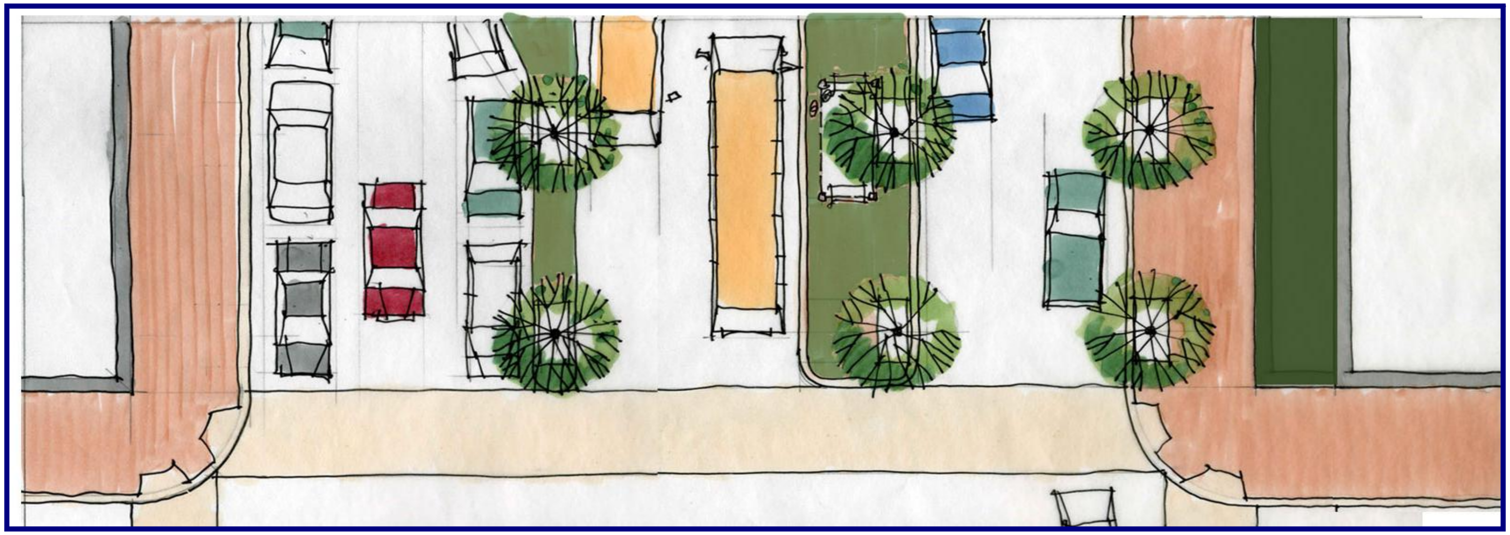
Potomac Yard Urban Design Guidelines
Street Sections



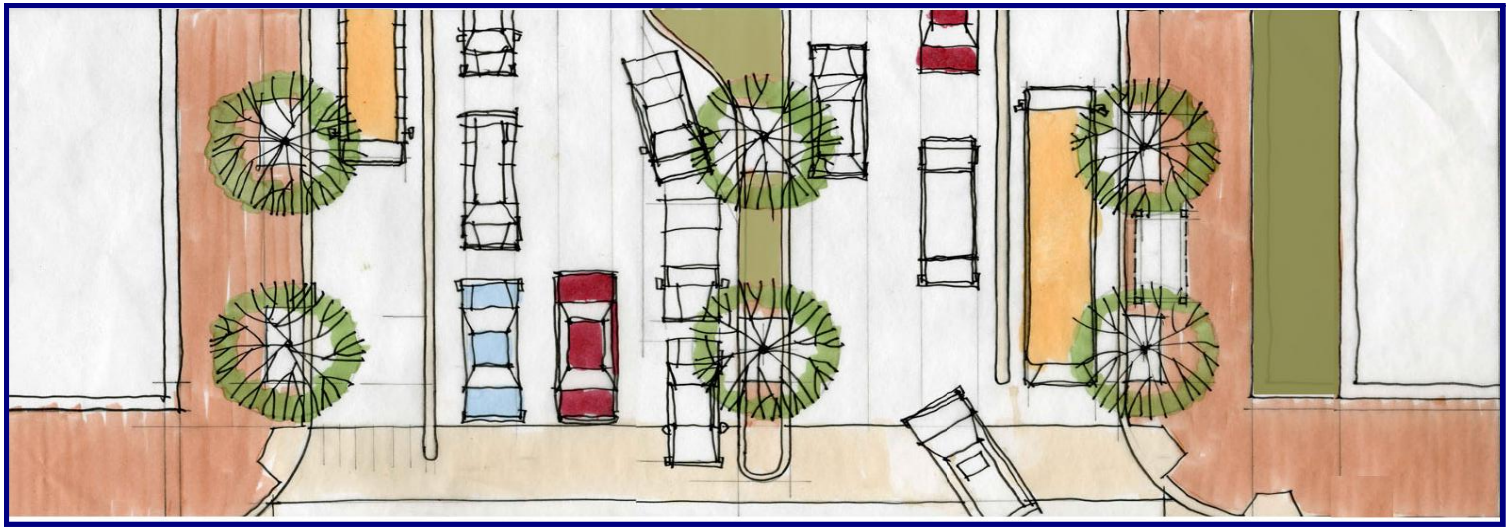




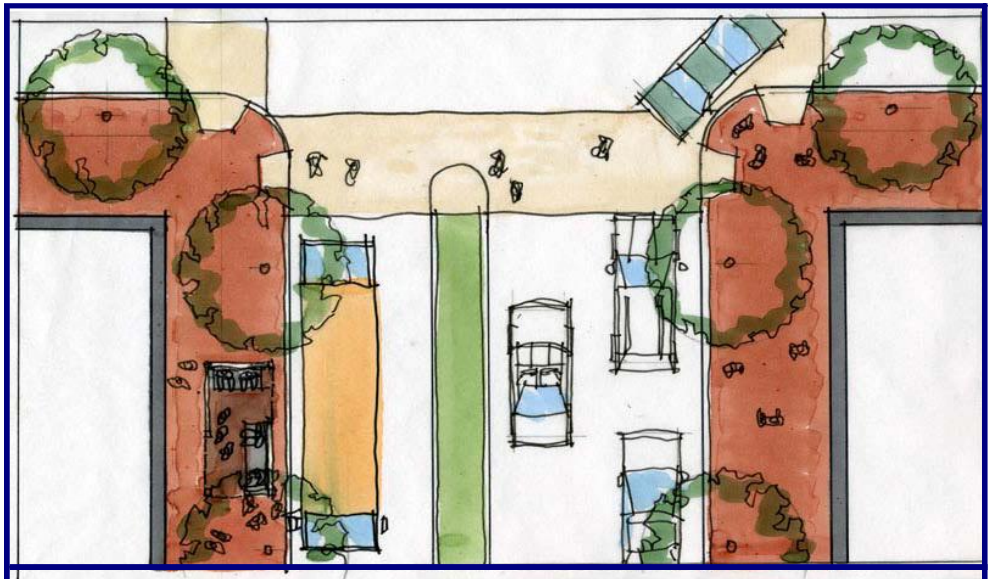
Crystal City / Potomac Yard Transit Corridor
Median Transit Corridor – Route 1



Crystal City / Potomac Yard Transit Corridor
Curbside Transit Corridors (Directional) – Route 1



Crystal City / Potomac Yard Transit Corridor
Curbside Transit Corridor (One-Way) – Main Street

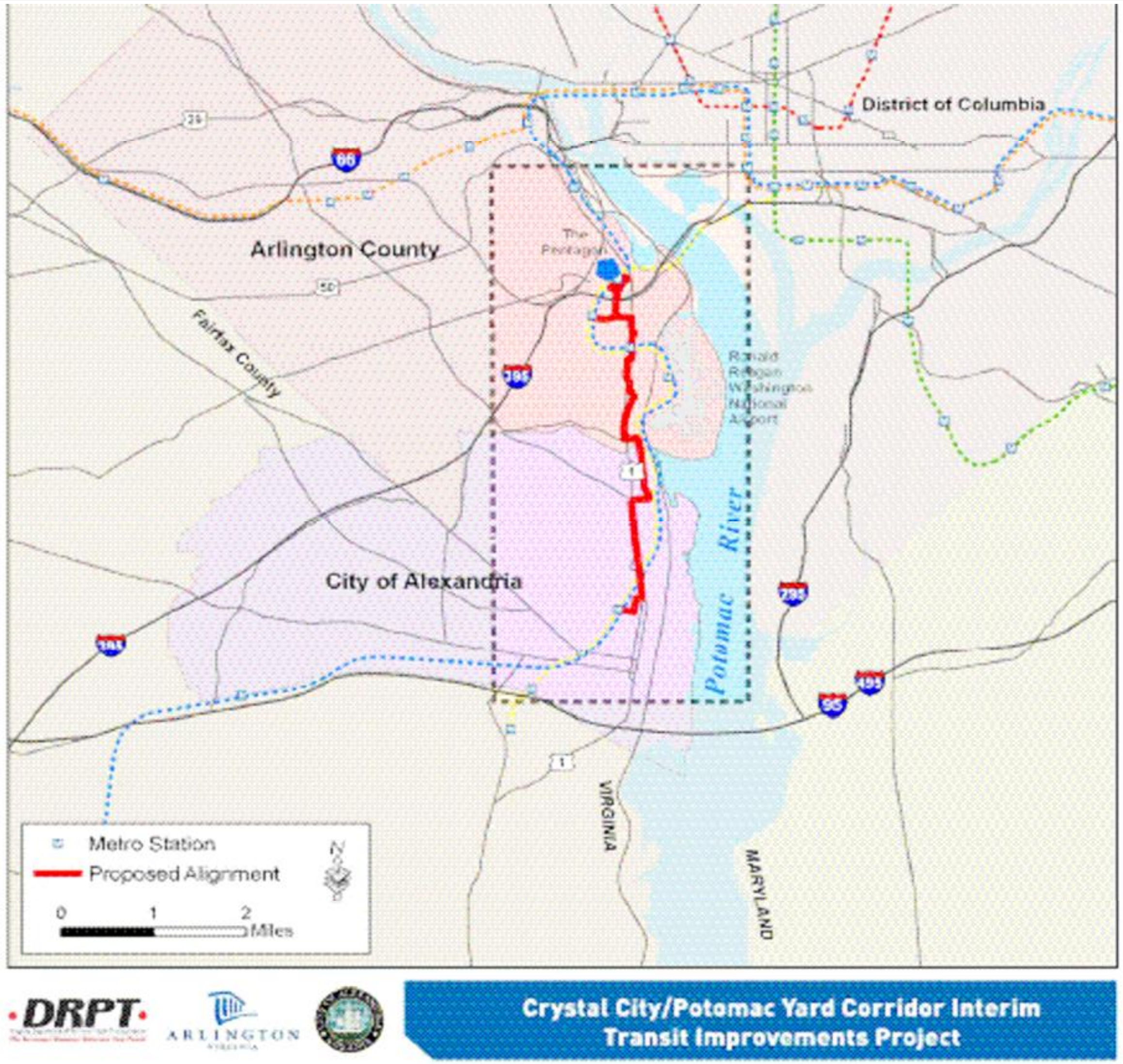


Crystal City/Potomac Yard Transit Corridor

Community Workshop

March 2, 2006

Crystal City/Potomac Yard Transit Corridor



Goal

Develop a high-capacity transit alternative for travel within the Crystal City/ Potomac Yard area

Crystal City/Potomac Yard Transit Corridor

Development Studies

Crystal City/Potomac Yard Area Transportation Study (SJR 406, HJR 567), October 1999

Crystal City/Potomac Yard Corridor Transit Alternatives Analysis, March 2003

Crystal City/Potomac Yard Corridor Interim Improvement Project, December 2005

Crystal City/Potomac Yard Area Transportation Study

Recommendations (Transit Needs):

- Shuttle bus service from the site to existing Metro stations until a higher level of transit is in place
- Implementation of light rail or equivalent transit service. Additional study should be conducted to determine appropriate service requirements and characteristics
- Reservation for a Metro Station at Potomac Yard should be maintained, so as not to preclude future options.

Crystal City/Potomac Yard Corridor Transit Alternatives Analysis

Recommendations:

- BRT should be advanced as locally preferred alternative for FTA New Start Evaluation
- BRT, LRT and Metrorail are all viable options and should be carried forward to EIS
- Selection of BRT should not preclude construction of one or more future Metrorail stations

Crystal City/Potomac Yard Corridor Interim Transit Improvement Project

- Developed phased service and corridor improvement plan (immediate, short-term and mid-term) for implementing high-capacity transit service
- Proposed a corridor alignment and levels of exclusive right-of-way desired for mid-term service
- Identified proposed stop locations and station design guidelines
- Developed project development checklist and general cost estimates
- Defined necessary “next steps” in project development

Crystal City/Potomac Yard Transit Corridor Public Involvement

<u>CC/PY Area Transportation Study</u>

- Citizen outreach meeting

<u>CC/PY Corridor Transit Alternatives Analysis</u>

- Extensive Public Participation Program
- Community and Group Meetings

<u>CC/PY Corridor Interim Transit Improvement Project</u>

- Stakeholder Meetings
- Civic Associations, Committees and Associations Meeting
- Public Workshop and Open House

Crystal City/Potomac Yard Transit Corridor Public Involvement

CC/PY Corridor Transit Alternatives Analysis

Public Participation Program:

- Mailing database
- Toll-free telephone hotline and project website
- E-mail links to project staff
- Briefings for local officials
- Individual meetings with community groups
- Meetings with local governing boards and agencies
- Two public information meetings near beginning of project
- Two public information meetings near end of project
- Educational materials and comments database

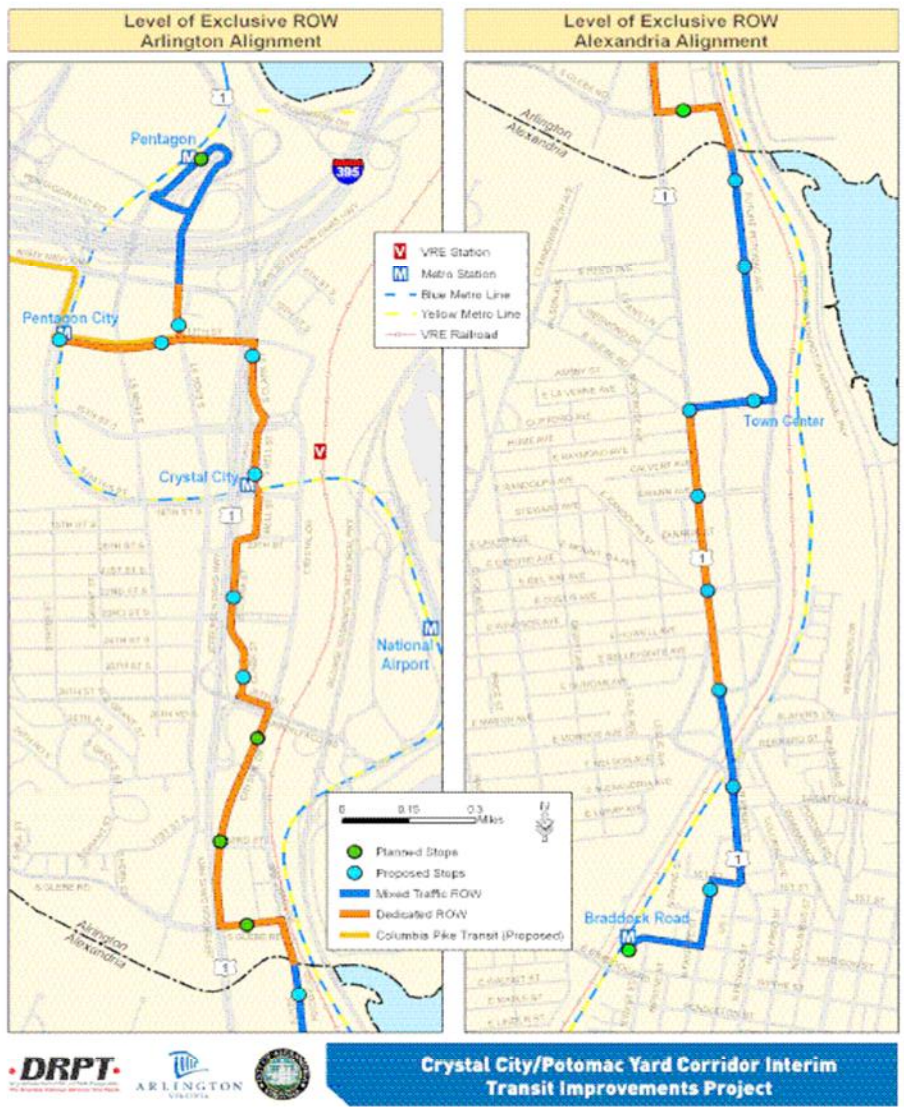
Crystal City/Potomac Yard Transit Corridor Public Involvement

CC/PY Corridor Transit Alternatives Analysis

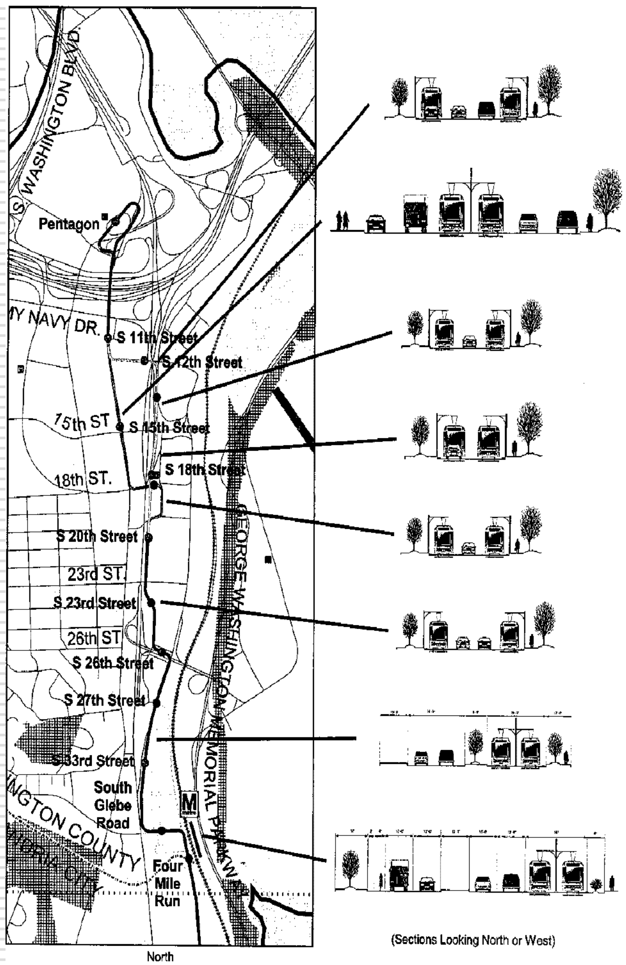
Community and Group Meetings:

- Alexandria Chamber of Commerce
- Northeast Citizens Association
- Mount Jefferson Civic Association
- Del Ray Citizens Association
- Lynhaven Civic Association
- Colecroft Owners Association

Crystal City/Potomac Yard Transit Corridor

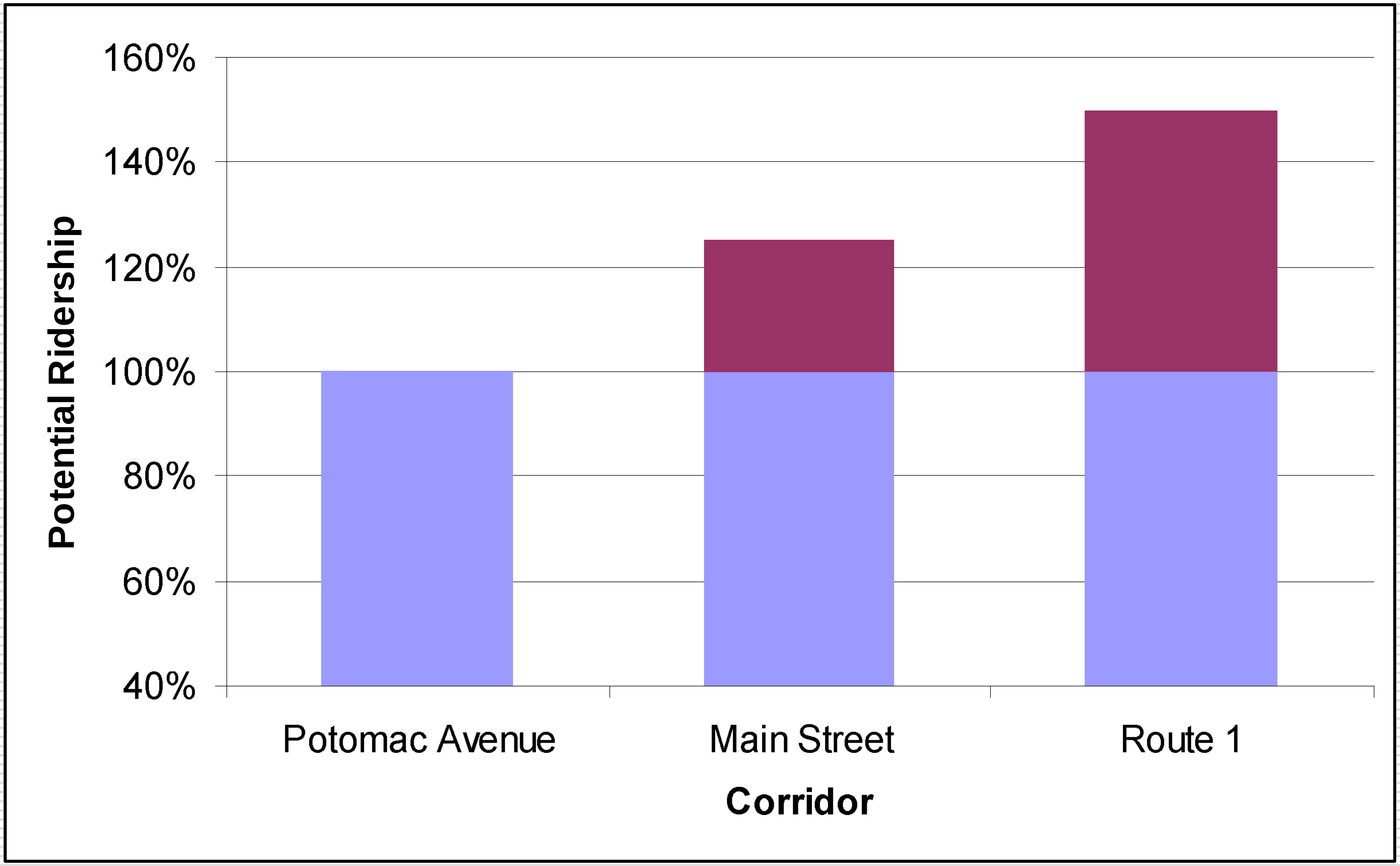


Alternatives Analysis
Preferred Corridor Alignment



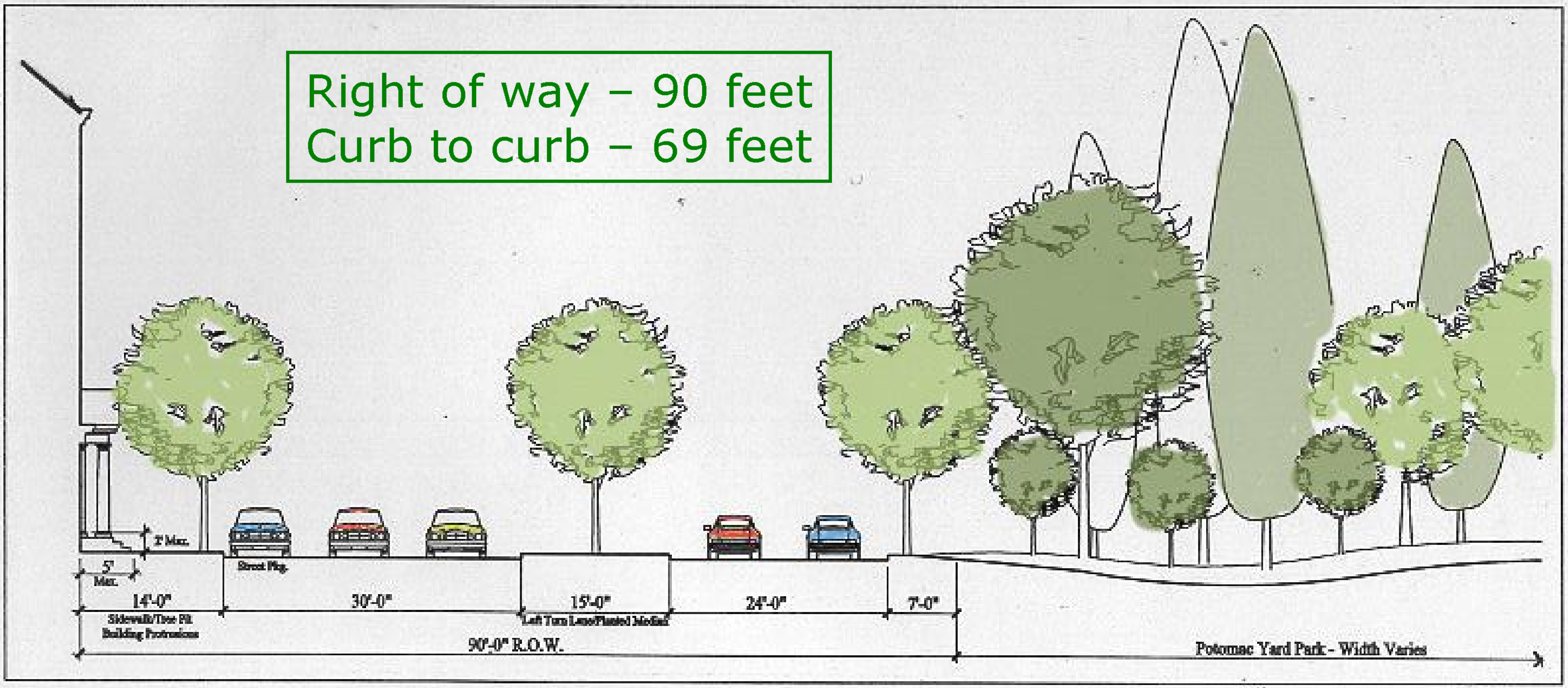
Proposed Transitway Alignment

Why the Route 1 Corridor?



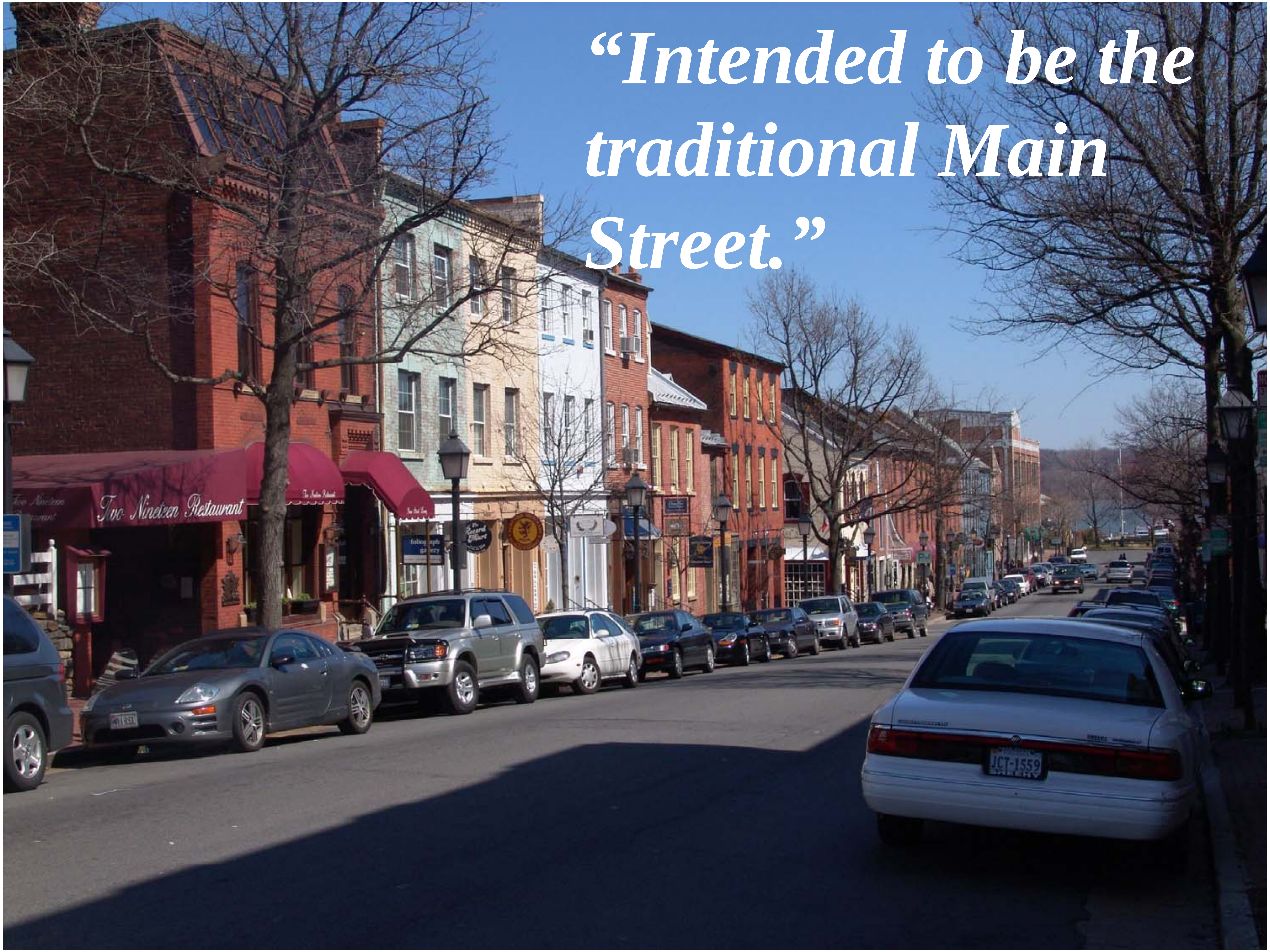
Potomac Avenue Design Guidelines

Curvilinear in alignment and park-like in character."



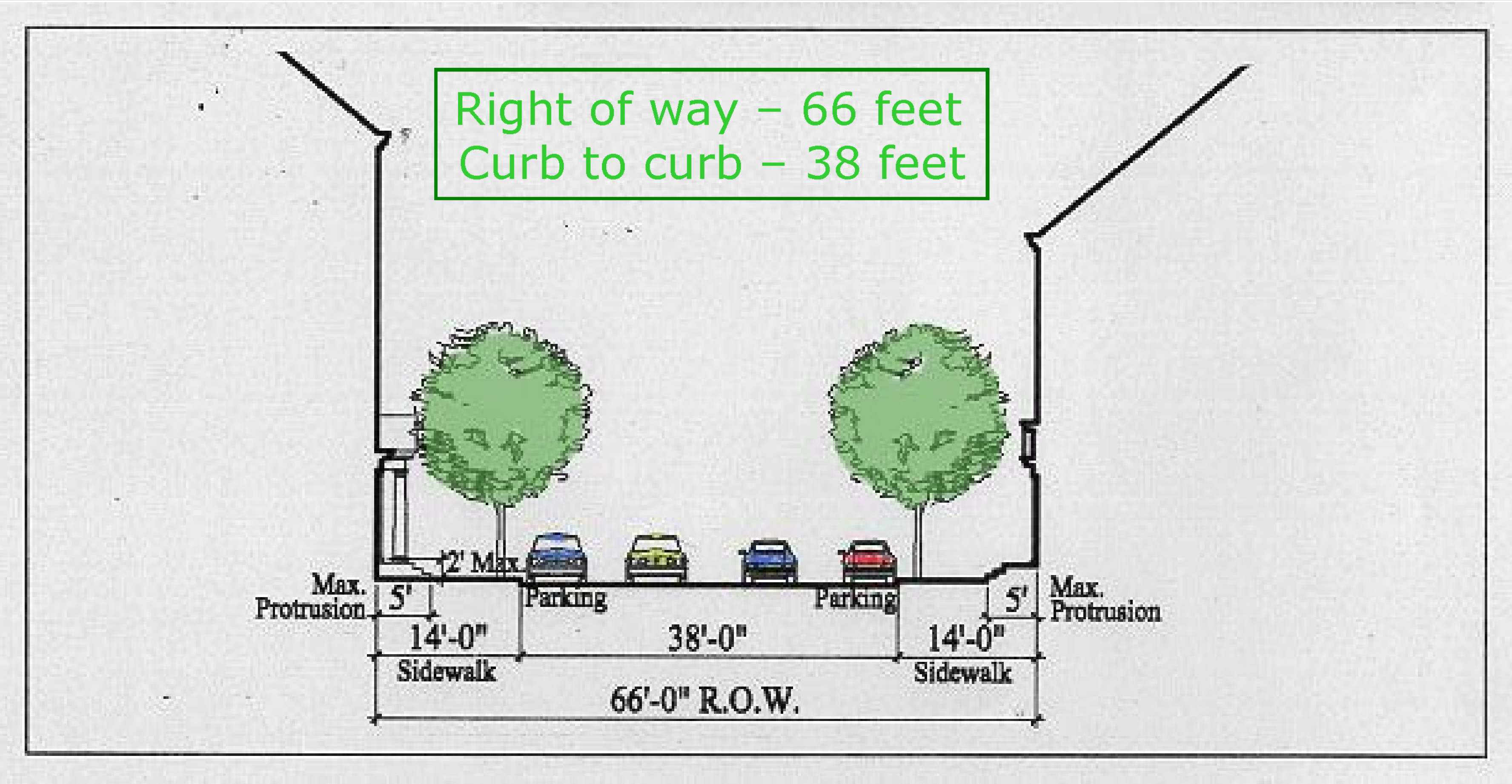
Alternative Corridor Alignments

Alignment	Positive Features	Negative Features
Potomac Avenue	• Least conflict with existing or future auto traffic. • Could be constructed with no intersections (Type IV).	• Lowest potential ridership • Reduced service area – no ridership on east side. • Would require widening to provide dedicated transit lanes • Widening would eliminate a significant amount of open space –landscaping within the future park to the east. • Widening would result in the reduction or elimination of the central median. • Use adjacent to Potomac Avenue are lower density townhomes and residential uses. • Widening for BRT would eliminate the curvilinear street that was intended to function as a green landscaped Parkway. • Negative impacts for pedestrian crossings to the future park.


"Intended to be the traditional Main Street."
Two Nineteen Restaurant

Main Street Design Guidelines

Intended to be a traditional main street

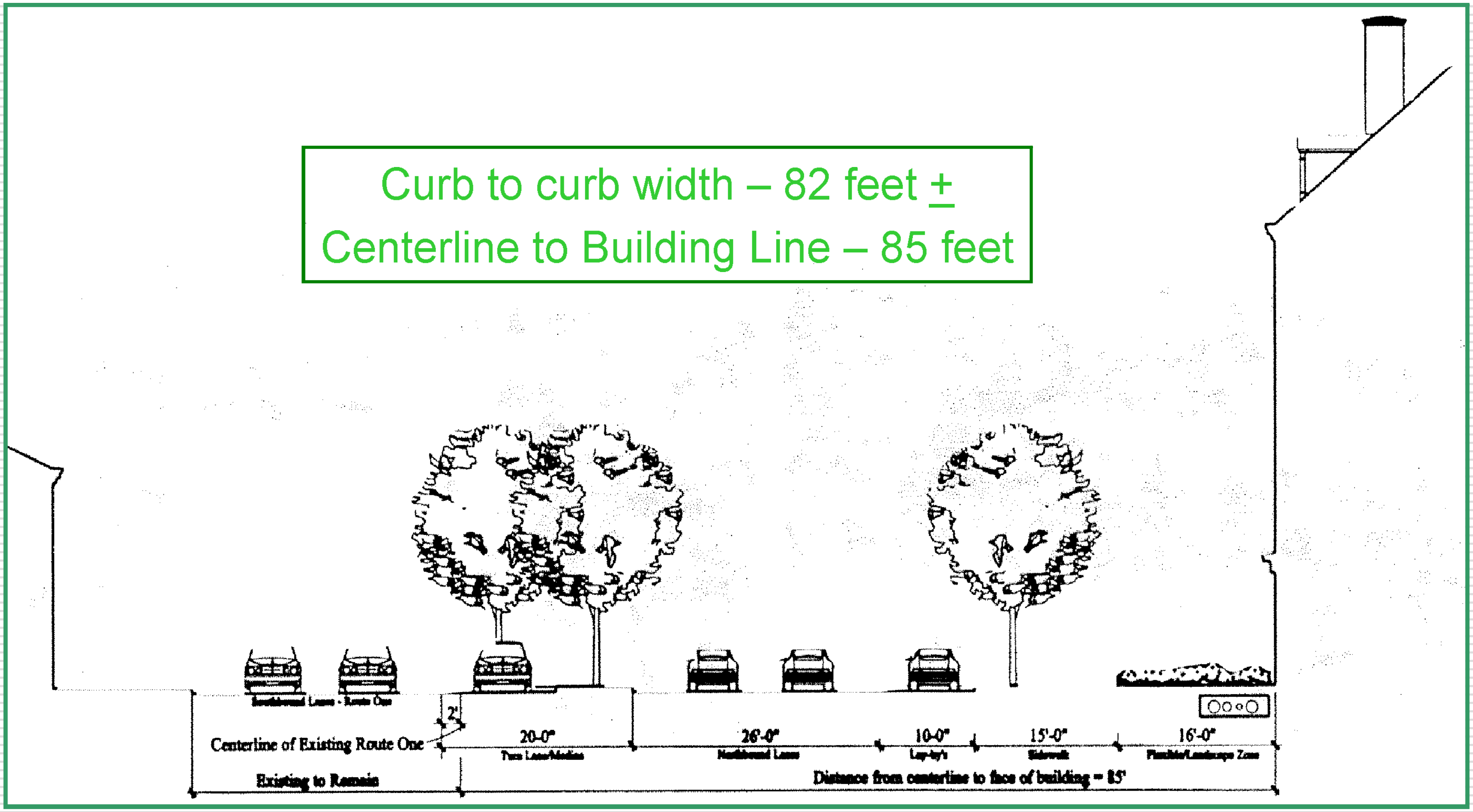


Alternative Corridor Alignments

Alignment	Positive Features	Negative Features
Main Street	• Increases potential ridership 10% to 25% above Potomac Avenue alignment • Best service to Potomac Yards development. • Best service to commercial areas. • Potomac Yards residents would not need to cross any major roadway to access service.	• A high speed dedicated transit way on Main Street would significantly impact the character of this street as the primary north-soth pedestrian spine for the development. • BRT service would eliminate the on-street parking , which will negatively impact the retail uses on Main Street. • Elimination of parking will significantly impact the pedestrian environment and walkability of Main Street. • Express transit operations not compatible with pedestrian focus of Main Street • Would require widening and parking removal to provide dedicated transit lanes. • Residents west of Route 1 would have to fully cross Route 1 to access service.


ACECO
“Urban Boulevard, center median
and larger right-of-way.”

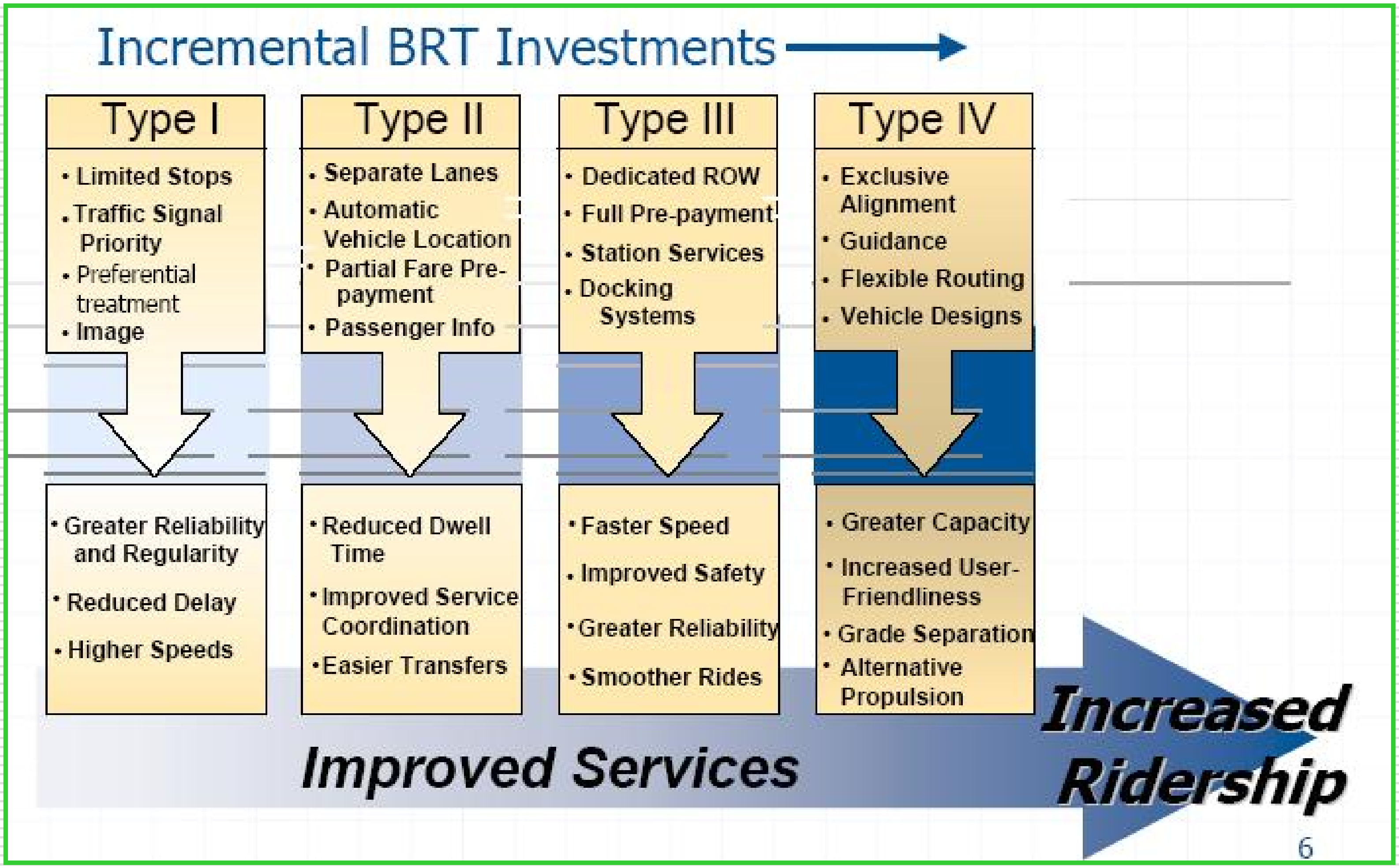
Route 1 Design Guidelines



Alternative Corridor Alignments

Alignment	Positive Features	Negative Features
Route 1	• Increases potential ridership 25% to 50% above Potomac Avenue alignment • Balanced service for both Potomac Yard and areas west of Route 1. • High-capacity transit most compatible with roadway and adjacent uses. • Alignment would best connect to Arlington and Fairfax systems and future BRT. • Higher density (multi-family uses) adjacent to Route 1. • Commercial office and retail uses adjacent to Route 1. • Sidewalk, landscaping and street trees and setback of approximately 30 ft. provided on Route 1. • Stations within the central median enable landscaping and green median to be retained, except where turn lanes are provided.	• Greatest conflicts with auto traffic. • Would require widening to provide dedicated transit lanes. • Transit signal priority could impact turns and cross-traffic. • Impacts to Route 1 frontage and character.

BRT Systems


Incremental BRT Investments
Type I
• Limited Stops
• Traffic Signal Priority
• Preferential treatment
• Image
Type II
• Separate Lanes
• Automatic Vehicle Location
• Partial Fare Pre-payment
• Passenger Info
Type III
• Dedicated ROW
• Full Pre-payment
• Station Services
• Docking Systems
Type IV
• Exclusive Alignment
• Guidance
• Flexible Routing
• Vehicle Designs
• Greater Reliability and Regularity
• Reduced Delay
• Higher Speeds
• Reduced Dwell Time
• Improved Service Coordination
• Easier Transfers
• Faster Speed
• Improved Safety
• Greater Reliability
• Smoother Rides
• Greater Capacity
• Increased User-Friendliness
• Grade Separation
• Alternative Propulsion
Improved Services
Increased Ridership
6

Bus Rapid Transit vs Light Rail

Rapid Transit Mode Comparisons

Statistic	Rapid Transit Mode	
	BRT	**LRT**
ROW Options	Exclusive or Mixed Traffic	Exclusive or Mixed Traffic
Station Spacing	1/4 to 1 Mile	1/4 to 1 Mile
Vehicle Seated Capacity	40 to 85 Passengers	65 to 85 Passengers
Average Speed	15-30 mph	15-30 mph
P/H/D (exclusive ROW)	Up to 30,000	Up to 30,000
P/H/D (arterial)	Up to 10,000	Up to 10,000
Capital ROW Cost/Mile	$0.2M to $25M/Mile	$20M to $55M/Mile
Capital Cost/Vehicle	$0.45M to $1.5M	$1.5M to $3.5M
O&M/SH	$65 to $100	$150 to $200

Source: SpeedLink- A Rapid Transit Option for Greater Detroit. June 2001.

Alternative Transit Corridor Configurations

1. Two-way transit corridor in median of Route 1
2. Two-way transit corridor on east side of Route 1
3. Directional transit corridors on east and west sides of Route 1 (northbound on east side and southbound on west side)
4. Directional transit corridors on Route 1 and Main Street (northbound on east side of Route 1 and southbound on west side of Main Street

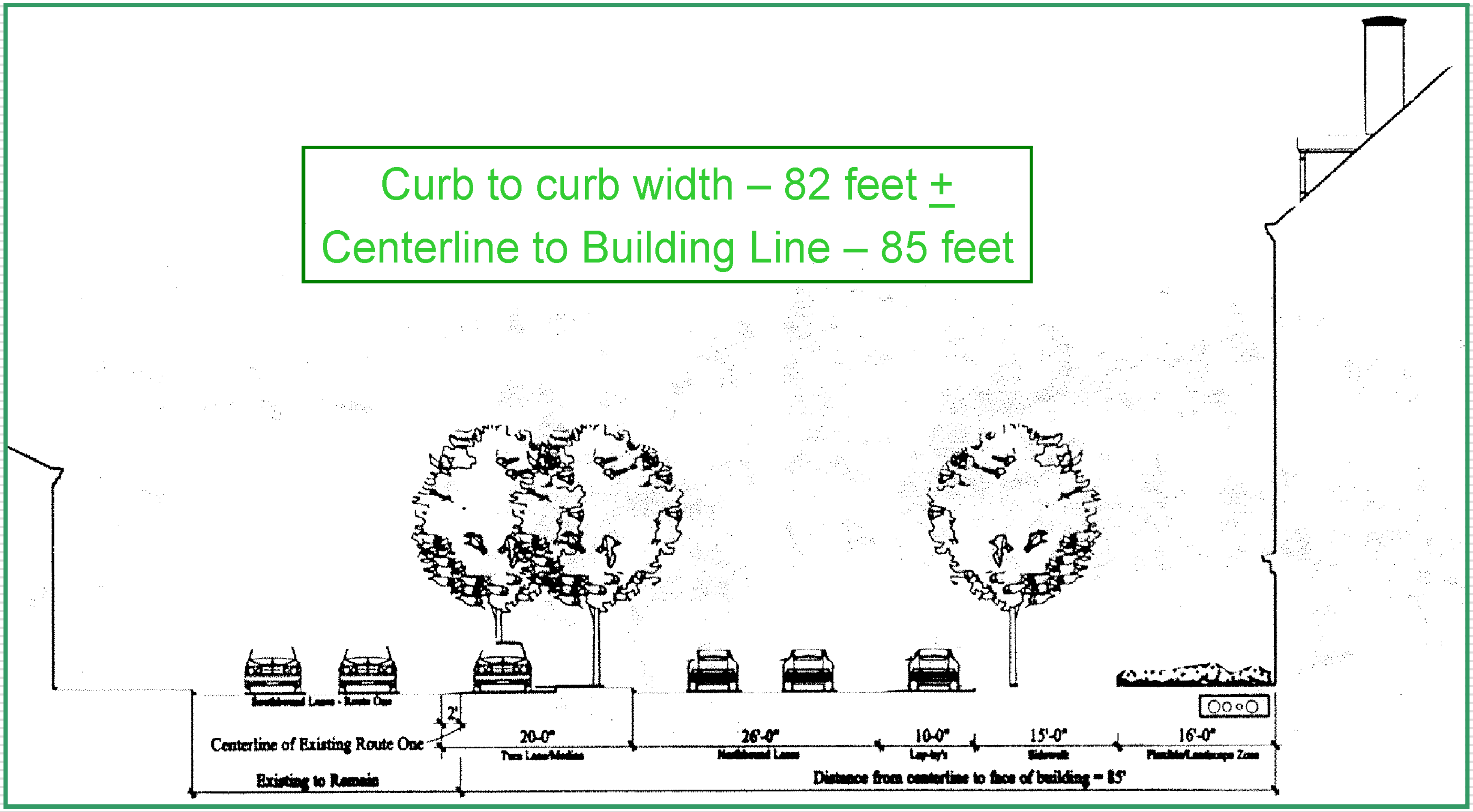
Considerations

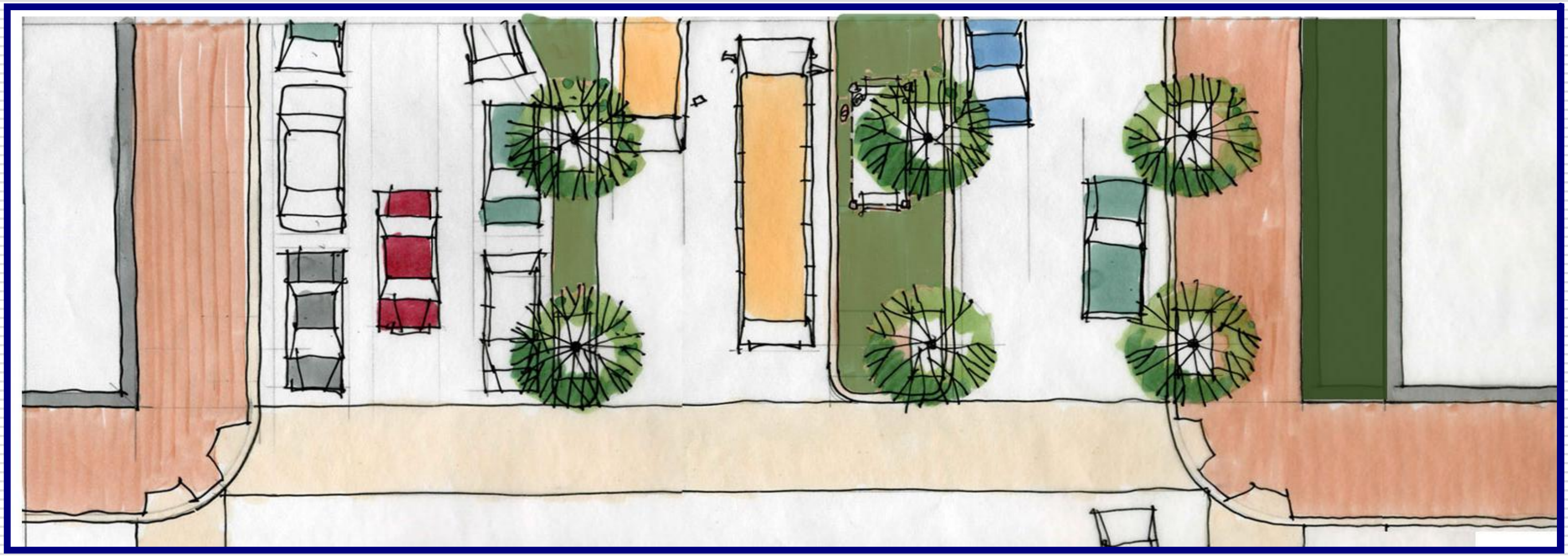
- ✓ Market area for transit services (potential ridership)
- ✓ Access to transit services
- ✓ Compatibility with adjacent land use
- ✓ Compatibility with street function
- ✓ Impacts on other modes of travel, especially pedestrian and bicycle
- ✓ Impacts on visual environment and landscaping
- ✓ Adaptability to multiple transit systems (i.e. bus rapid transit to light rail)
- ✓ Implementation barriers
- ✓ Efficiency of transit operation

Route 1 Design Guidelines

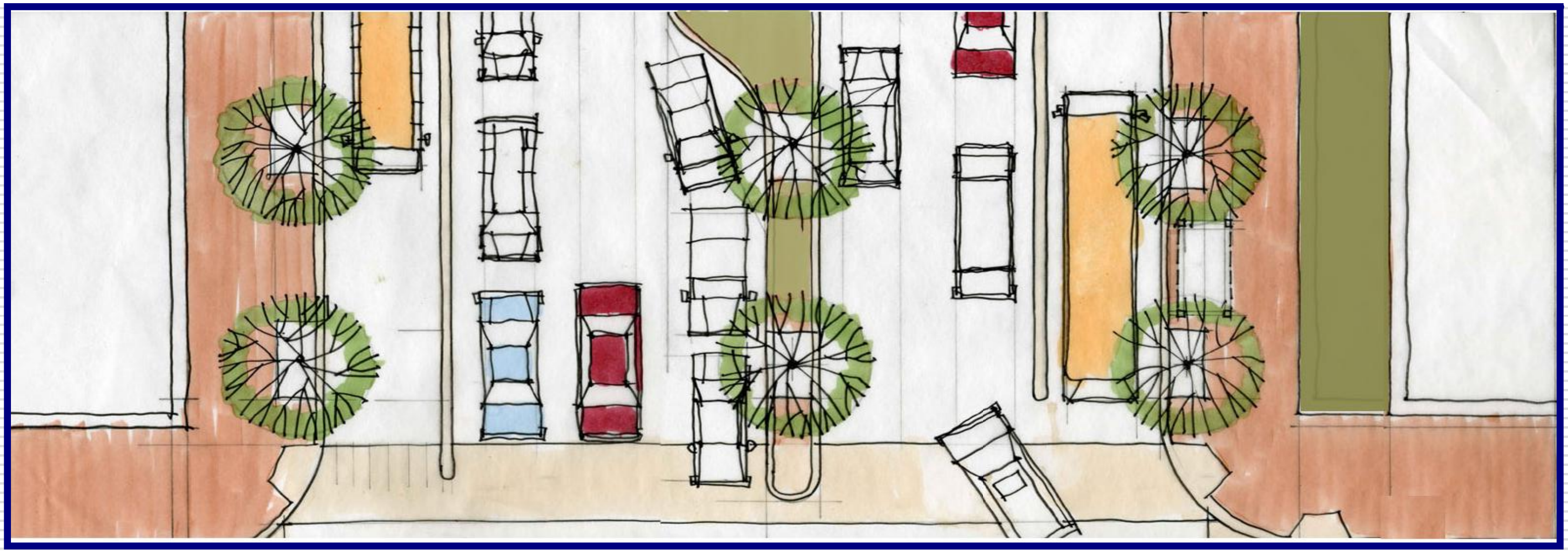
Curb to curb width – 82 feet ±

Centerline to Building Line – 85 feet





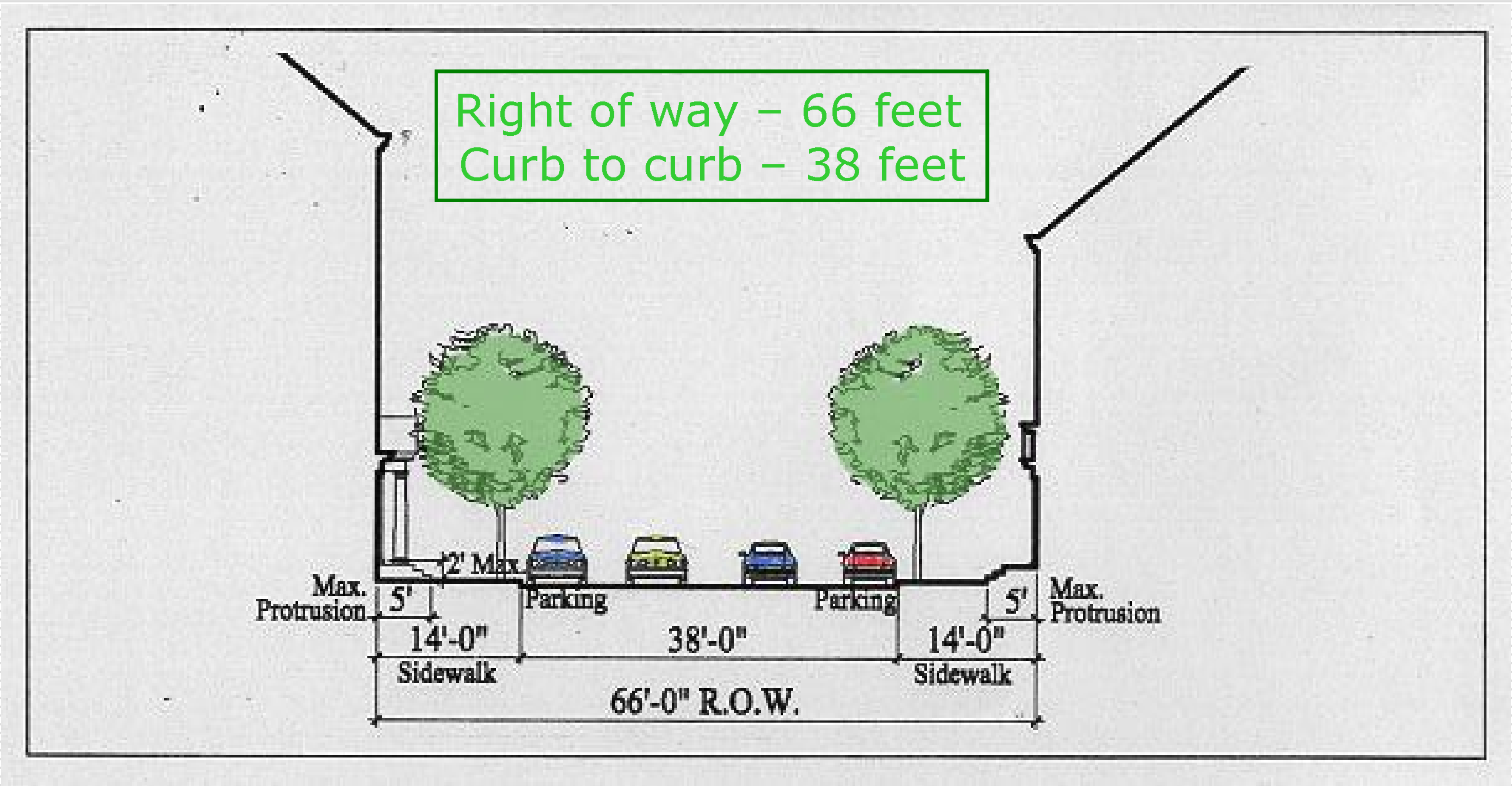
Median Transit Corridor – Route 1

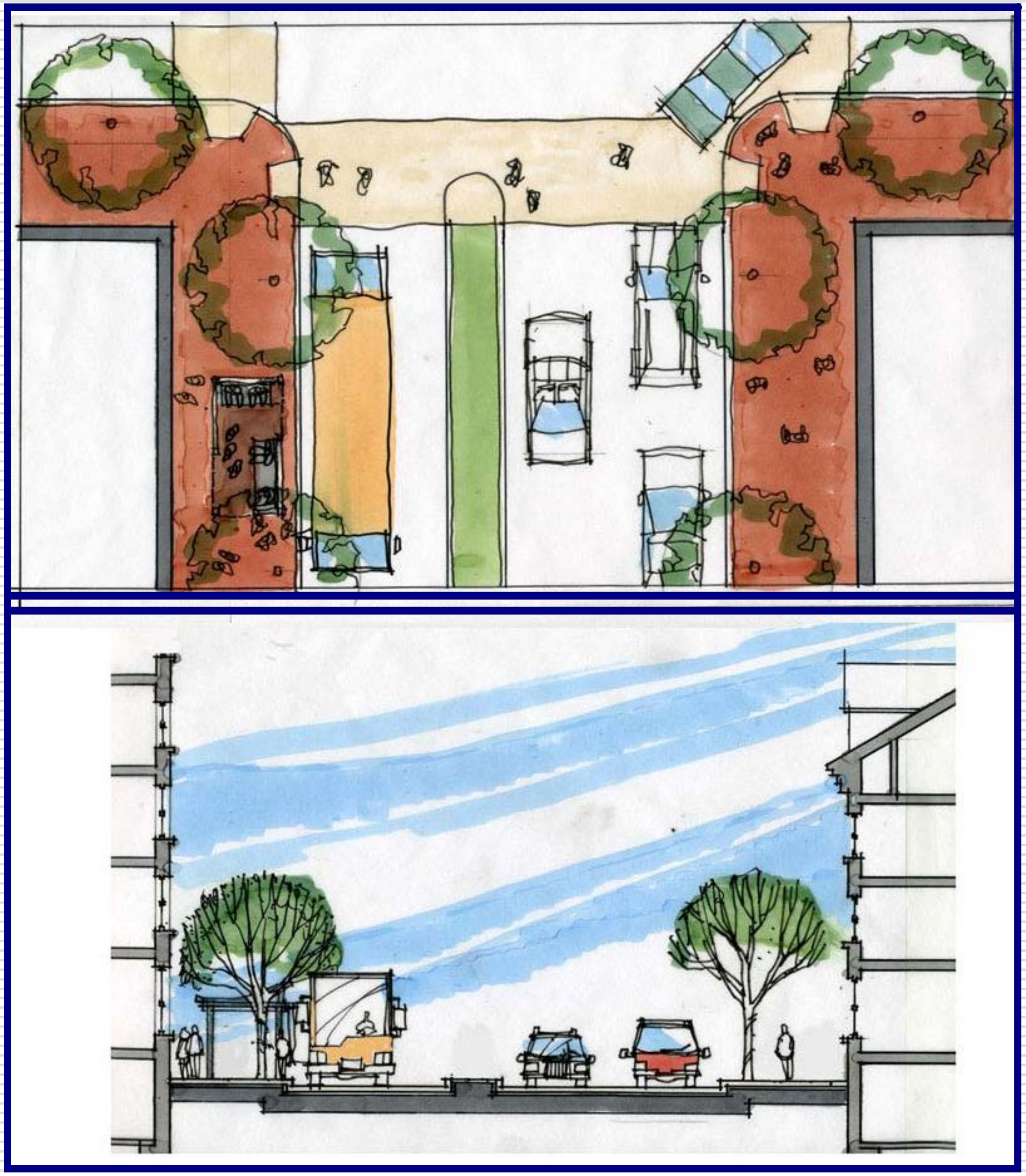


Curbside Transit Corridor (Two-Way) – Route 1

Main Street Design Guidelines

Intended to be a traditional main street



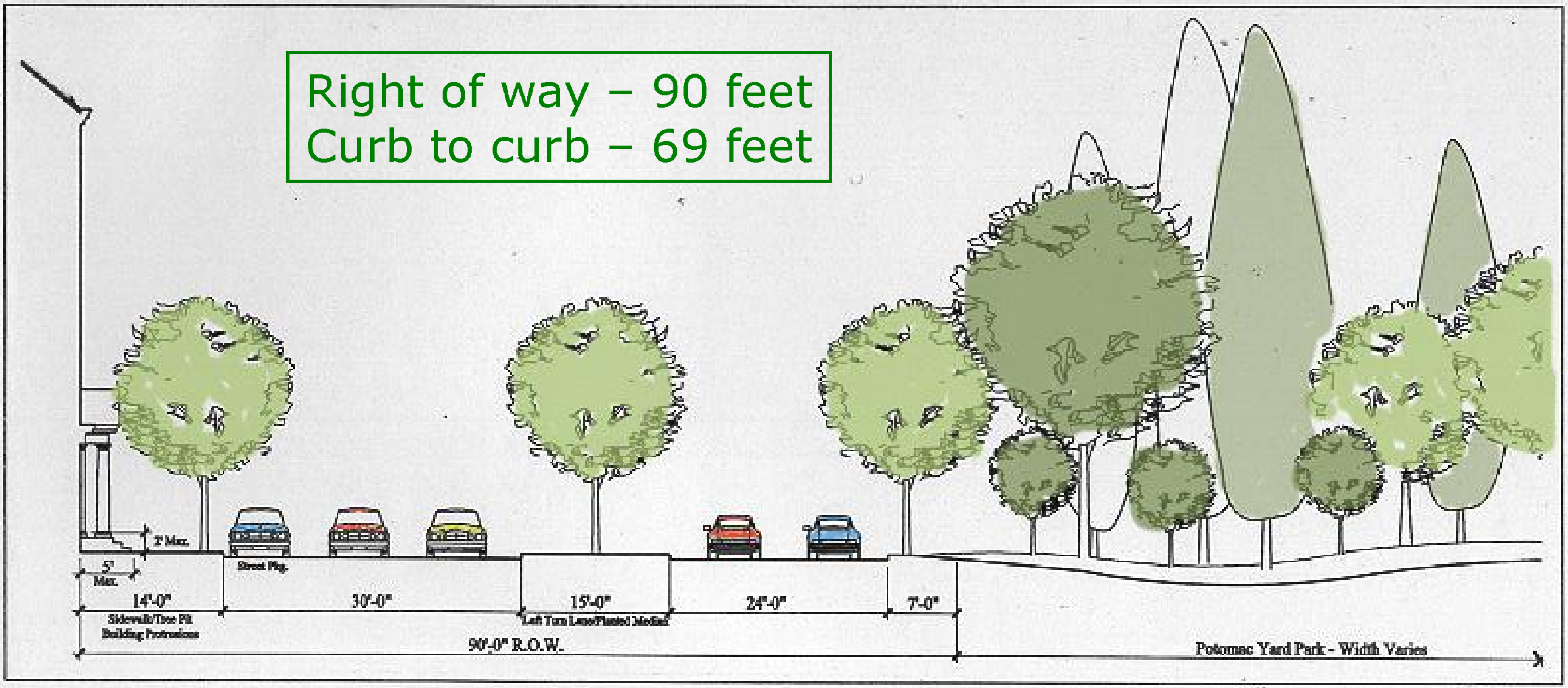


Curbside Transit Corridor (One-Way) – Main Street

Potomac Avenue Design Guidelines

Curvilinear in alignment and park-like in character."

Right of way – 90 feet
Curb to curb – 69 feet



Public Comment Summary

Crystal City/Potomac Yard Transit Corridor Community Workshop

March 2, 2006

7:00 to 9:00 PM

George Washington Middle School

Advantages, Disadvantages and Ranking of Alternatives

	Alt 1: 2-Way in Median of Route 1	Alt 2: 2-Way on East Side Route 1	Alt 3: Curbside on Route 1	Alt 4: Split Route 1 & Main Street
Advantages	Creates more green space breaks in the roadway Serves both Potomac Yard & Del Ray Larger sidewalks Better curbside visibility & accessibility Access to Potomac Yard & Del Ray One wide median Most accessible to Potomac Yard & Del Ray Facilitates pedestrian access Consolidate infrastructure & amenities Best route to extend to Braddock Metro Convey & promote service Dedicated right of way Convey & promote service Shortest distance for wheelchair, and everyone else, to cross car traffic Pedestrian crosses only 2 lanes at a time	Advantageous for Potomac Yard residents Better designed for shoppers None Put BRT on curb lanes Reduces pedestrian & turning vehicles conflicts Easy to promote & communicate More sidewalk/median for pedestrians Buses away from cars Locate closest to most potential development Pedestrians more sheltered from vehicles	Easier pedestrian access/safer pedestrian access BRT lanes could be used off hours to accommodate additional HOV capacity or other buses Easiest to implement Serves both Potomac Yard & Del Ray communities Can accommodate <u>CYCLISTS</u> Pedestrian access to transit Easier access for handicap Sidewalk access to BRT Relocate west curb to widen curb Easy to communicate & promote Only if west curb are widened & dedicated <u>lanes</u> Best pedestrian access to buses Largest sidewalks Easiest access to Monroe bridge Only have to cross street once/day Trigger more development on west side Not in middle of street	No one street becomes excessively large Wider sidewalks Who thought of this one? Most accessible for pedestrians Easier to impact Main St. as it hasn't been constructed yet Buses move faster, do not stop across path Gives improved access to businesses, less people on Potomac Ave side Street at more pedestrian scale
Disadvantages	Pedestrian access is difficult/unsafe Widens Route 1 too much (6 lanes) Incongruous with northern connections in Arlington Only stretch in Metro area with this configuration Pedestrian safety in median Awkward return to standard configuration on south side of PY Passenger accessibility Passengers crossing in front traffic Traffic conflict w/ pedestrian movement User discomfort Vehicular conflict w/turns Slows down Route 1 traffic People uncomfortable standing in middle of Route 1 Curb cuts everywhere Left turn lane into Potomac Yard - Does bus override car traffic at lights? Wider street to cross for pedestrians	Disadvantageous for Del Ray residents Widens Route 1 to 6 lanes Awkward turn from Potomac Yard side onto NB Route 1 Awkward return to standard configuration on south side of Potomac Yard Dangerous traffic flow with headlights Smaller sidewalks Median divided into narrow stripes Disorientated drivers Can't easily cross the bridge May not be able to cross at all One side has easy access, one site crosses all of Route 1 twice a day Wider street to cross 2 lanes to cross on east side	Widens Route 1 to 6 lanes Auto/taxi access to curb Lack of visibility for retail business Closer to Del Ray accessibility Power line conflict None that we can think of If curb cuts & widening west curb does not happen – bad plan Everyone crosses all of Route 1 once a day Wider street to cross Limiting access to businesses i.e. gas stations, carry out Traffic crossing lanes how do they deal with this in other cities	Del Ray residents disincentive to use NB route Too "unusual" of a concept for most bus riders Transit divided Main St constrained Takes parking from Main St Significant change to planned character of Main St Less of parking on one side of Main St Less intuitive
Table Preference	0, 50%, 2, #2, 1, No way	2, Least favorable, 3, No, No way	1, 50%, 1, 4 for #1, 3, 3	Tie 3 & 4, Not favorable, 1(2), 2 – favor 5 or 4

Additional Comments

	Alt 1: 2-Way in Median of Route 1	Alt 2: 2-Way on East Side Route 1	Alt 3: Curbside on Route 1	Alt 4: Split Route 1 & Main Street
Comments	Too much death potential	Unrealistic	Move road to make west sidewalk as wide as east sidewalk	Need more information
	Preference for busses to stay on Route 1 from South Glebe to Clifford Ave rather than divert to Potomac Ave and extend BRT the entire length Concern over accessibility for wheelchair patrons on all alternatives Each alternative favors Arlington commutation BRT will not run 24 hrs/day Go back to square 1 and design BRT & dedicated transit way before finalizing plans! "Transit Access by Design" Alternative fuels – hybrids/electric Alt 5: Split Route 1 & Potomac Avenue Closer to Potomac Greens, bridges & Route 1 More scenic Closer access to park Look at transit way on Main Street (Alt 6) Environmentally safe buses			

Community Meeting Flyer

Route 1 Transit Improvements

Thursday, March 8, 2007 7:00-9:00 p.m.

George Washington Middle School Auditorium

1005 Mount Vernon Avenue

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The City of Alexandria invites you to a

Community Meeting

to discuss

Route 1 Transit Improvements

Thursday, March 8, 2007 7:00-9:00 p.m.

George Washington Middle School Auditorium

1005 Mount Vernon Avenue

The City of Alexandria invites you to participate in a meeting to discuss the potential configuration of dedicated transit on Route 1 that is being developed with Arlington County to serve the Crystal City/Potomac Yard corridor.

The proposal is to provide dedicated travel lanes for high-quality transit services in the Potomac Yard-Route 1 corridor in a manner consistent with the pedestrian-oriented urban nature planned for Potomac Yard and the Route 1 corridor.

Please join us on March 8 to discuss the options and provide input regarding the configuration of future dedicated transit lanes on Route 1. For more information, please contact Tom Culpepper, Department of Transportation and Environmental Services at 703-838-4966, or email tom.culpepper@alexandriava.gov or Jeffrey Farner, Department of Planning and Zoning, at 703-838-4666 or email jeffrey.farner@alexandriva.gov. with questions or comments. Thank you for participating in this important transit and urban design discussion for the Route 1 corridor adjacent to Potomac Yard.

***Accessibility**: GW Middle School is served by Metrobus 10 A,E,B, and is within a short walking distance of the Braddock Road Metro Station. For Metrorail/bus schedule information, call 202-637-7000 or visit www.wmata.com.*

To request materials in an alternative format or a disability accommodation, please contact Mary Christesen at 703-838-4666 or mary.christesen@alexandriava.gov. The City of Alexandria is committed to compliance with the City's Human Rights Code and the Americans with Disabilities Act.

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Community Meeting Presentation

Route 1 Transit Improvements

Thursday, March 8, 2007 7:00 - 9:00 p.m.

George Washington Middle School Auditorium

1005 Mount Vernon Avenue

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Crystal City/Potomac Yard
Transit Corridor
Community Workshop
March 8, 2007
7:00pm – 9:00pm

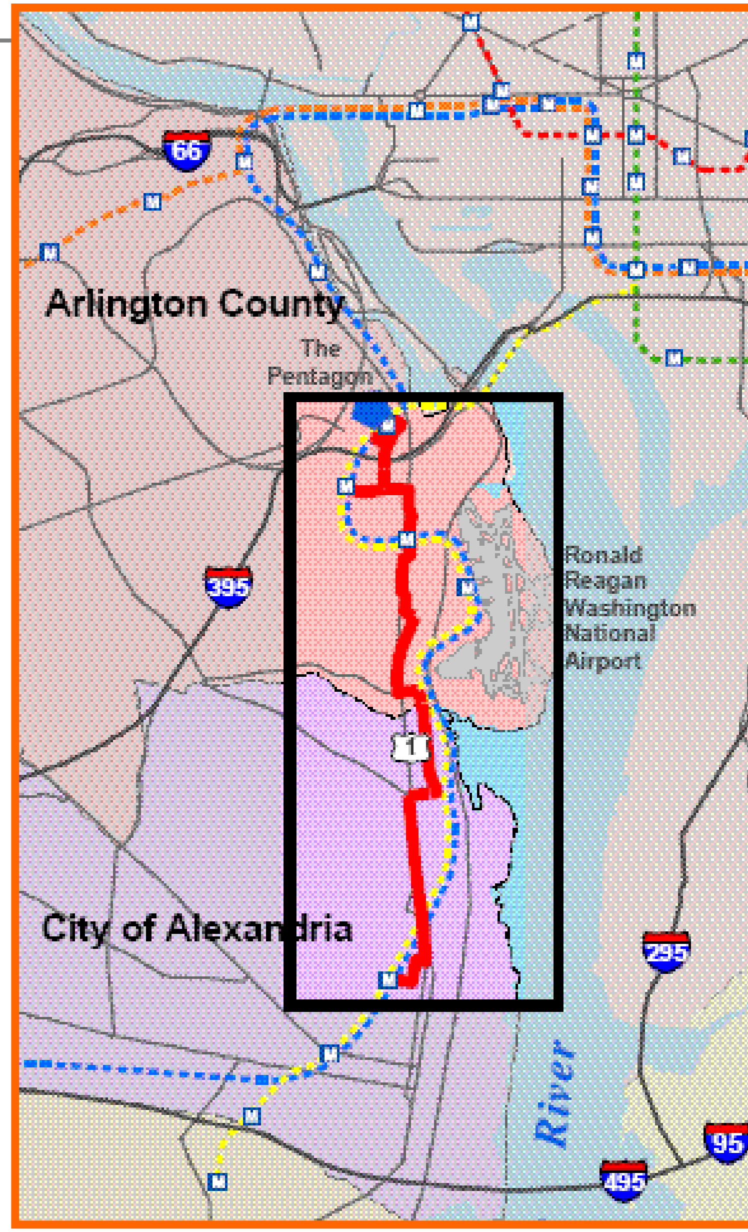
Tonight's Workshop

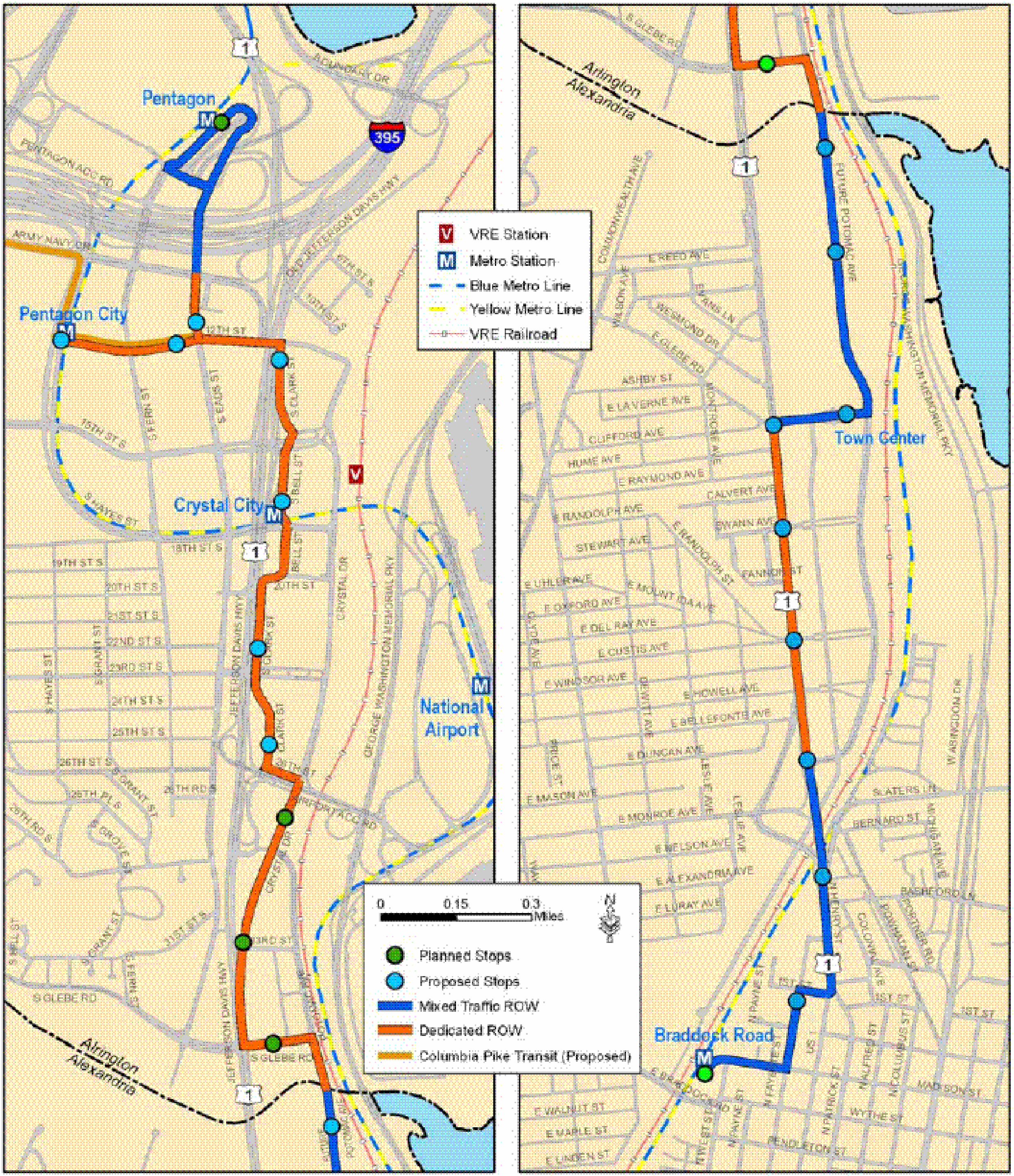
- Project Overview and Status
- Issue at Hand
- Key Considerations
- Q&A
- Next Steps

Project Overview

Goal:

Develop a high-quality, high-capacity transit alternative for travel in the Crystal City/ Potomac Yard area




Pentagon
Pentagon City
Crystal City
National Airport
Town Center
Braddock Road
Arlington
Alexandria
VRE Station
Metro Station
Blue Metro Line
Yellow Metro Line
VRE Railroad
0
0.15
0.3
Miles
Planned Stops
Proposed Stops
Mixed Traffic ROW
Dedicated ROW
Columbia Pike Transit (Proposed)

Project Overview

Dedicated transit corridor that is functional, attractive and compatible with the environment

High-quality transit service with attractive, accessible stations offering passenger amenities and support services

Project Development

Crystal City/Potomac Yard Area Transportation Study (SJR 406, HJR 567), October 1999

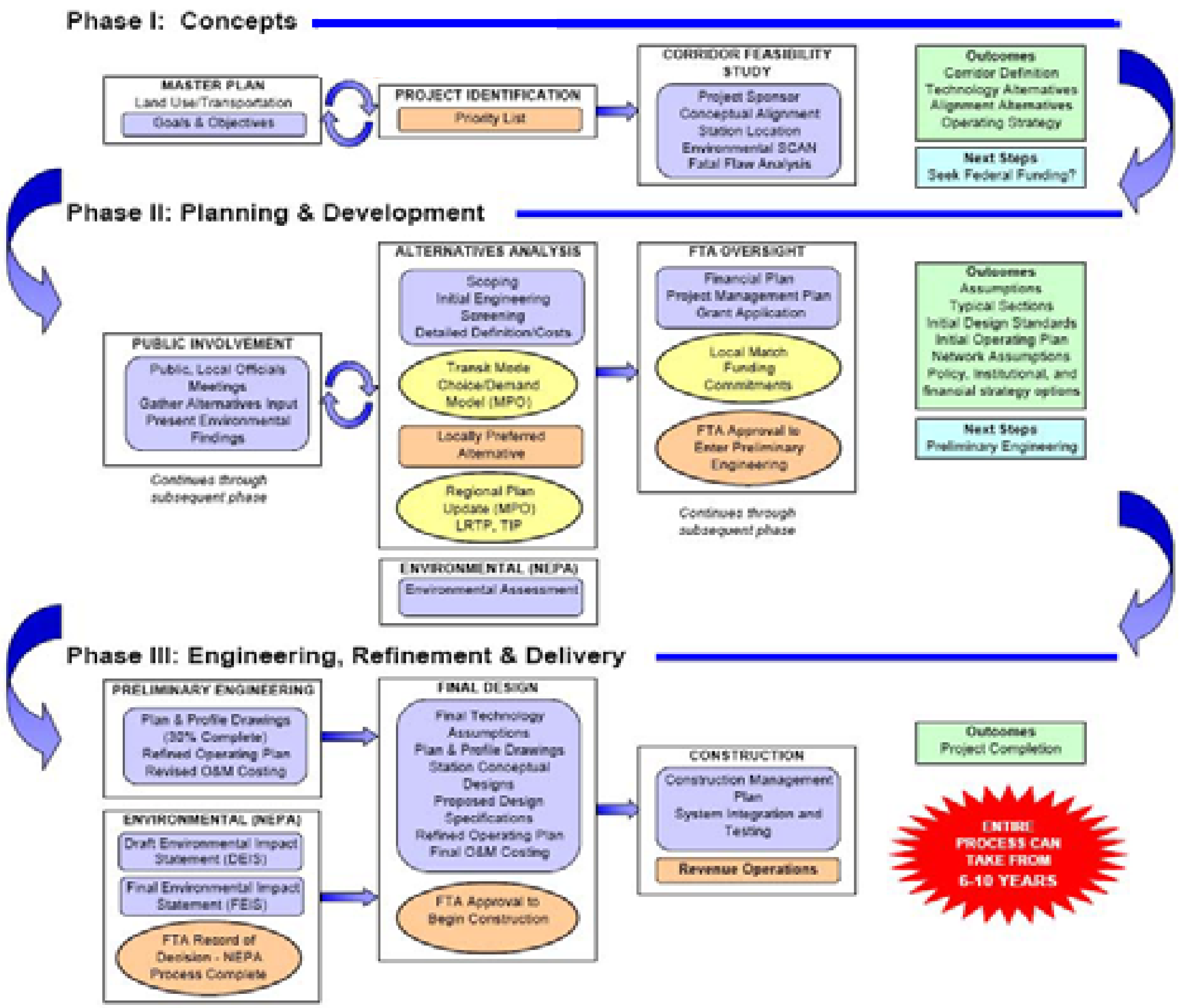
Crystal City/Potomac Yard Corridor Transit Alternatives Analysis, March 2003

Crystal City/Potomac Yard Corridor Interim Improvement Project, December 2005

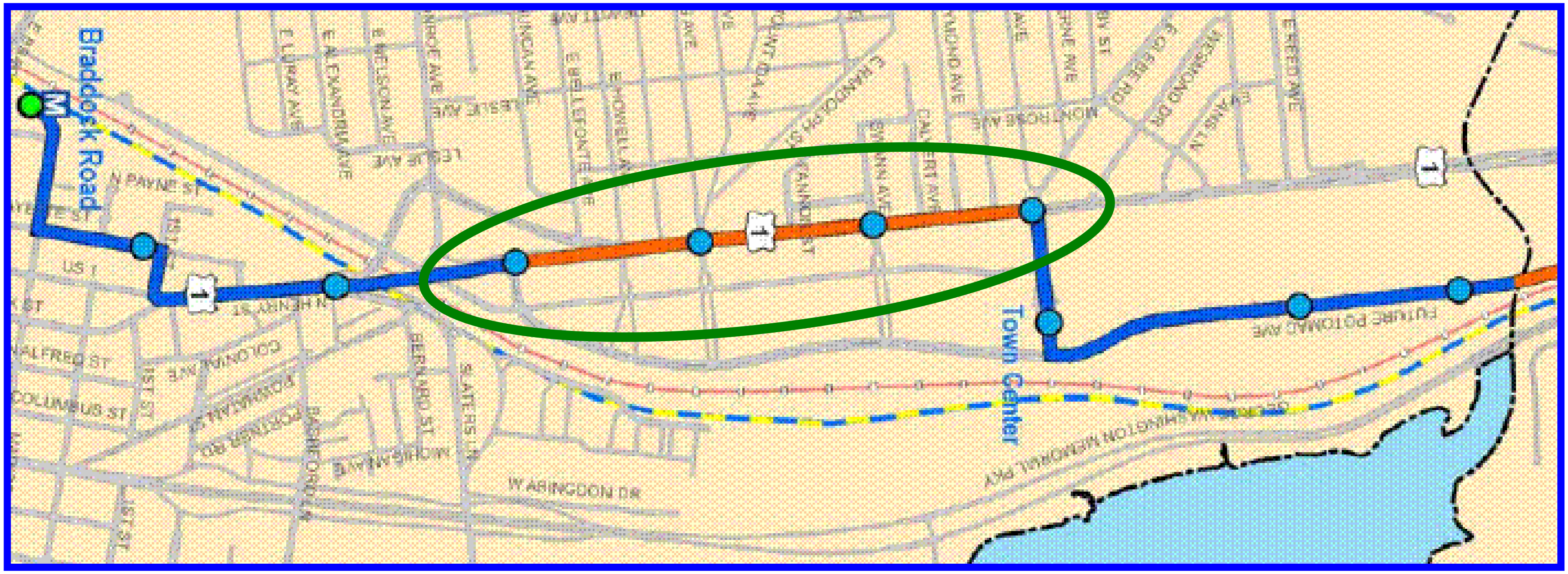
Crystal City/Potomac Yard Transit Improvements Environmental Review, January 2007

http://alexandriava.gov/tes/development_studies.html

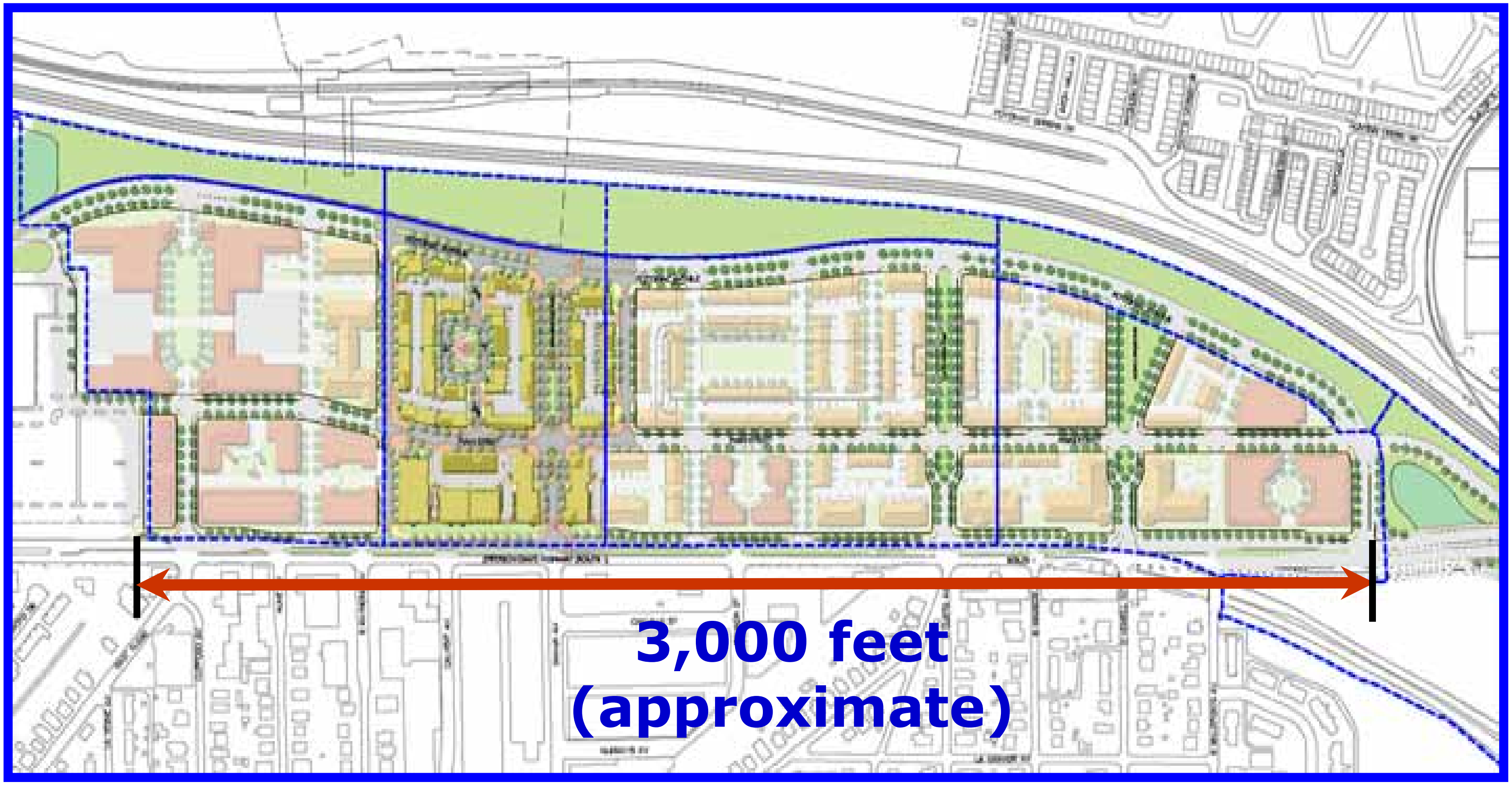
Project Development Process



●●● Tonight's Discussion

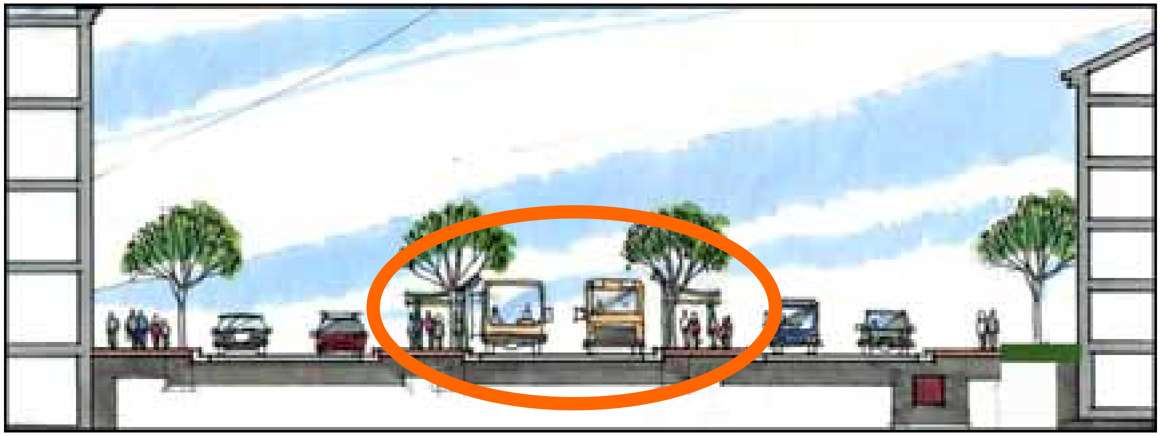


Tonight's Discussion



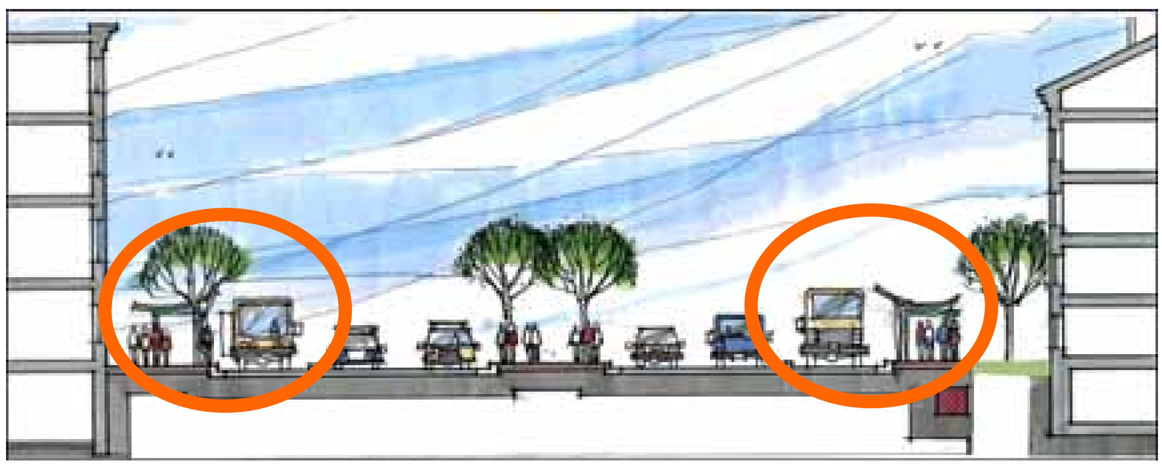
Tonight's Discussion

Configuration of the transit lanes on Route 1



Median

Curbside



BUS RAPID TRANSIT – Median

Vancouver, British Columbia

BUS RAPID TRANSIT – Curbside

Los Angeles, California

Key Considerations

- Operations
  - Transit service
  - Traffic flow
  - Implementation
  - Corridor width
- Urban Design
  - Right-of-Way
  - Streetscape
- Pedestrians
  - Station access
  - Crossing Route 1

Corridor Operations

Median Configuration

Curbside Configuration

Reduces transit travel time

- 2 to 4 minute reduction
- No special signal phasing

Less impact on traffic flow

- Same or better levels of service
- No conflicts with turning vehicles

Increases transit travel time

- Reduced “green time”
- Special signal phasing required

More impact on traffic flow

- Increases delay
- Conflicts with right-turn vehicles

Implementation

Median Configuration

Curbside Configuration

- Needed ROW available
- Can be constructed sooner
- Less costly
- “Fixed guideway” for FTA

- West-side ROW limited
- Delayed construction
- More costly
- Mid-block access points

Corridor Requirements

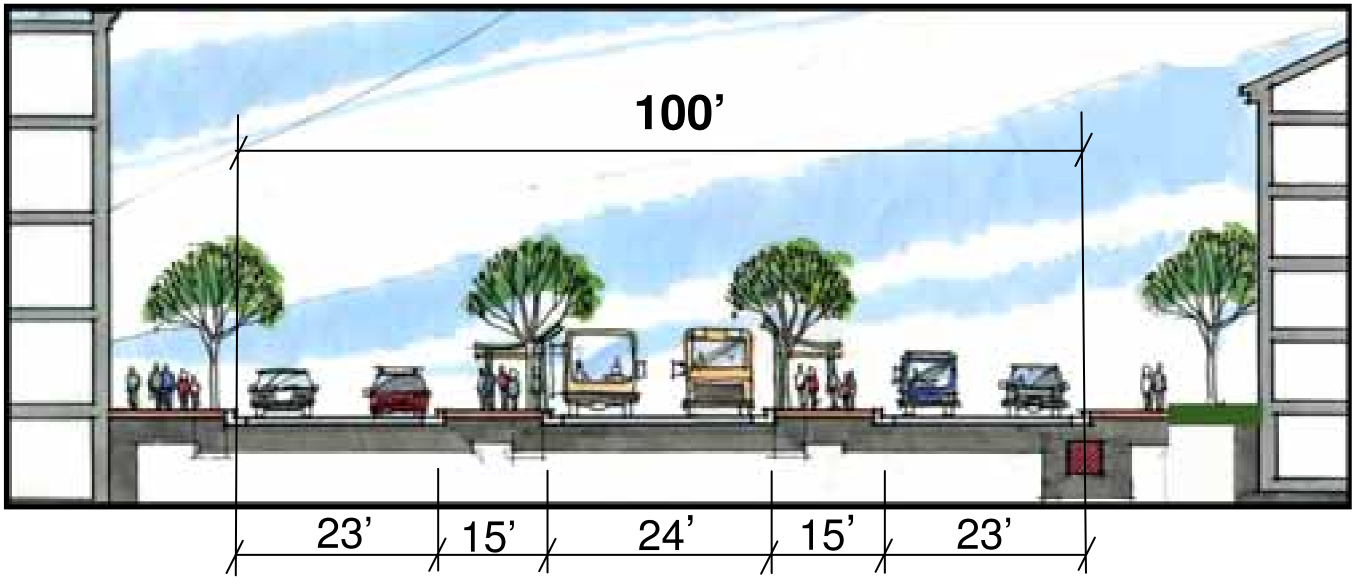
Reduced roadway width

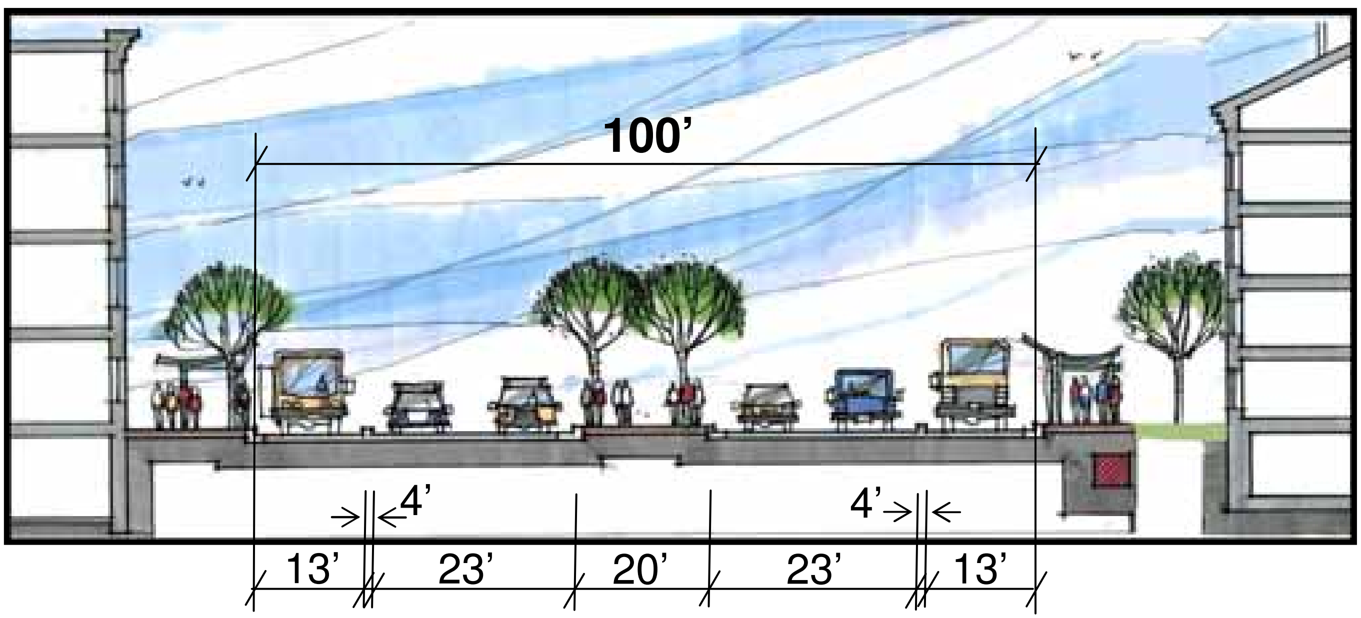
- Right turn lanes
- Travel lane widths
- Drainage

Field tests

- Real vehicles and operators
- Turning requirements
- Passing maneuvers

Curb-to-Curb Street Width



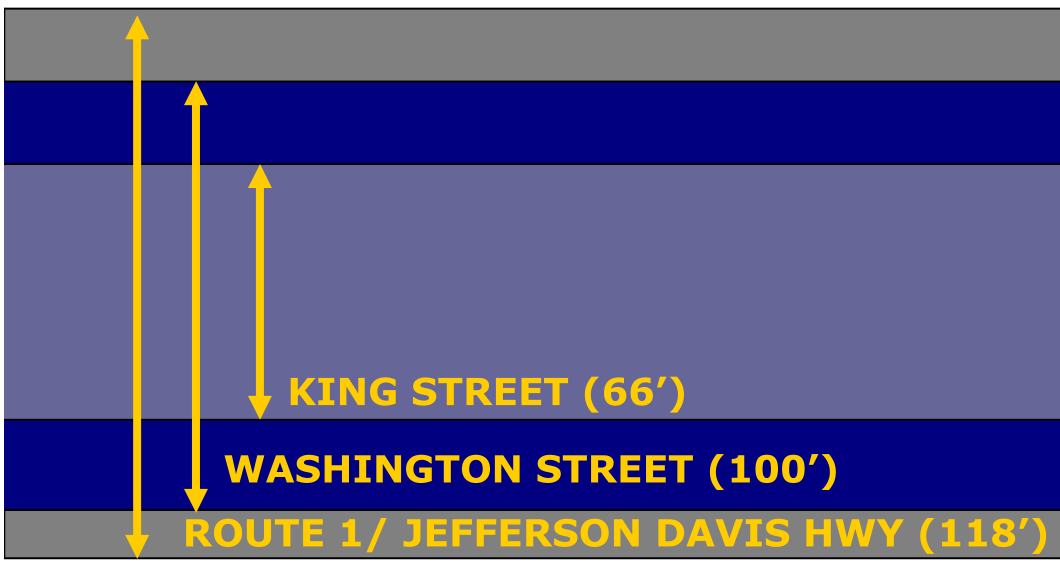


What makes a great urban street?

<u>SCALE</u> – <u>CHARACTER</u>

- Street Width
- Street Wall
- Sidewalk Width
- Building Heights
- Landscaped Median
- Pedestrian Orientation
- Access to Transit
- Streetscape

Right-of-Way

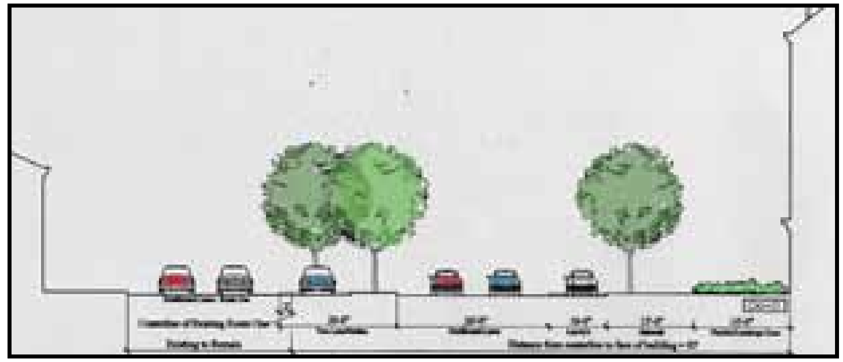

KING STREET (66’)
WASHINGTON STREET (100’)
ROUTE 1/ JEFFERSON DAVIS HWY (118’)

Street Wall

Sidewalk Width – East Side

Sidewalk Width – West Side

Landscaped Median - Examples



Center median and larger right-of-way

Landscaped Medians

Pennsylvania Ave (50')

Commonwealth Ave (30')

Washington St (8')

Route 1 (2 x 15')

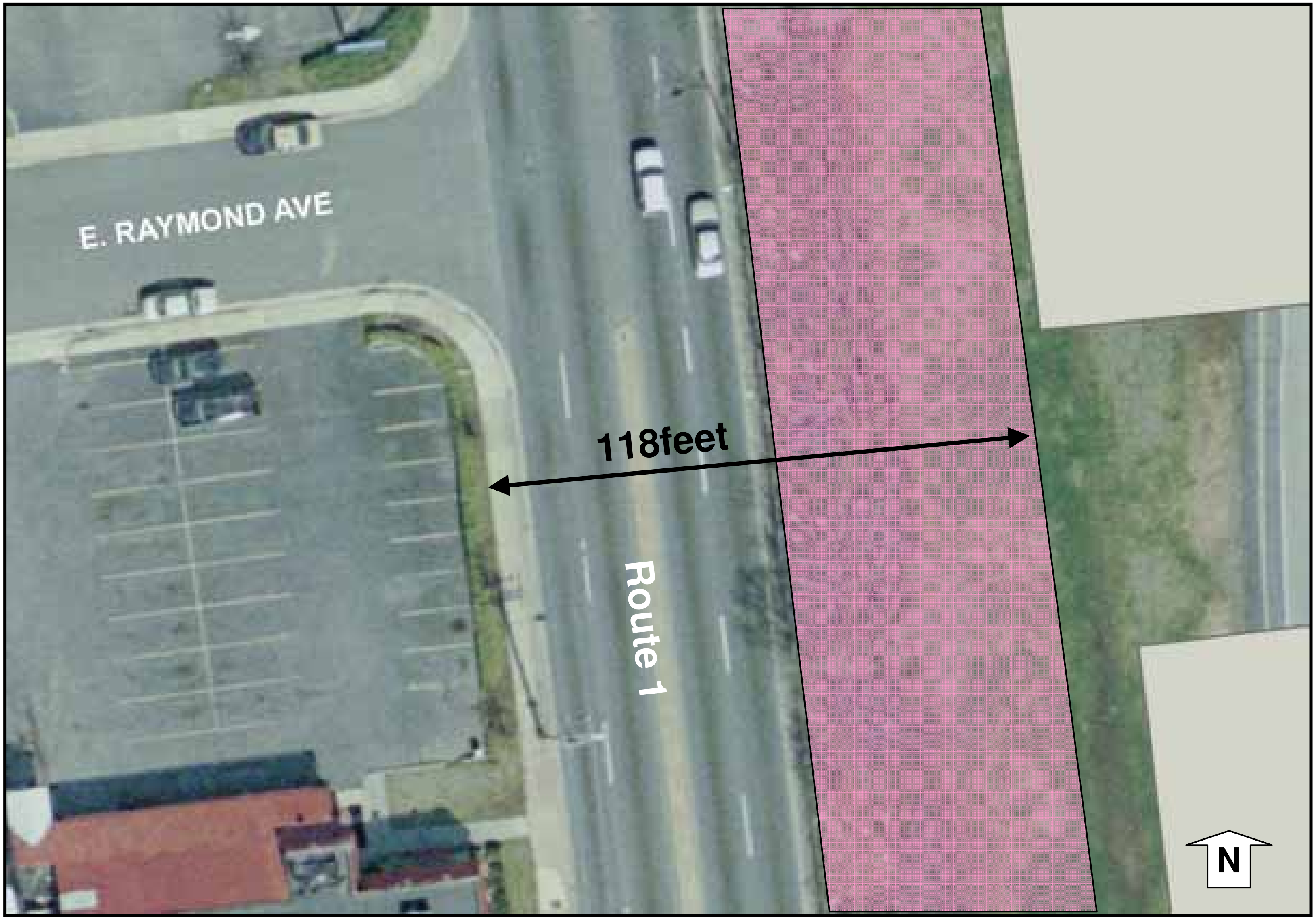
Illustrative Rendering

Challenges

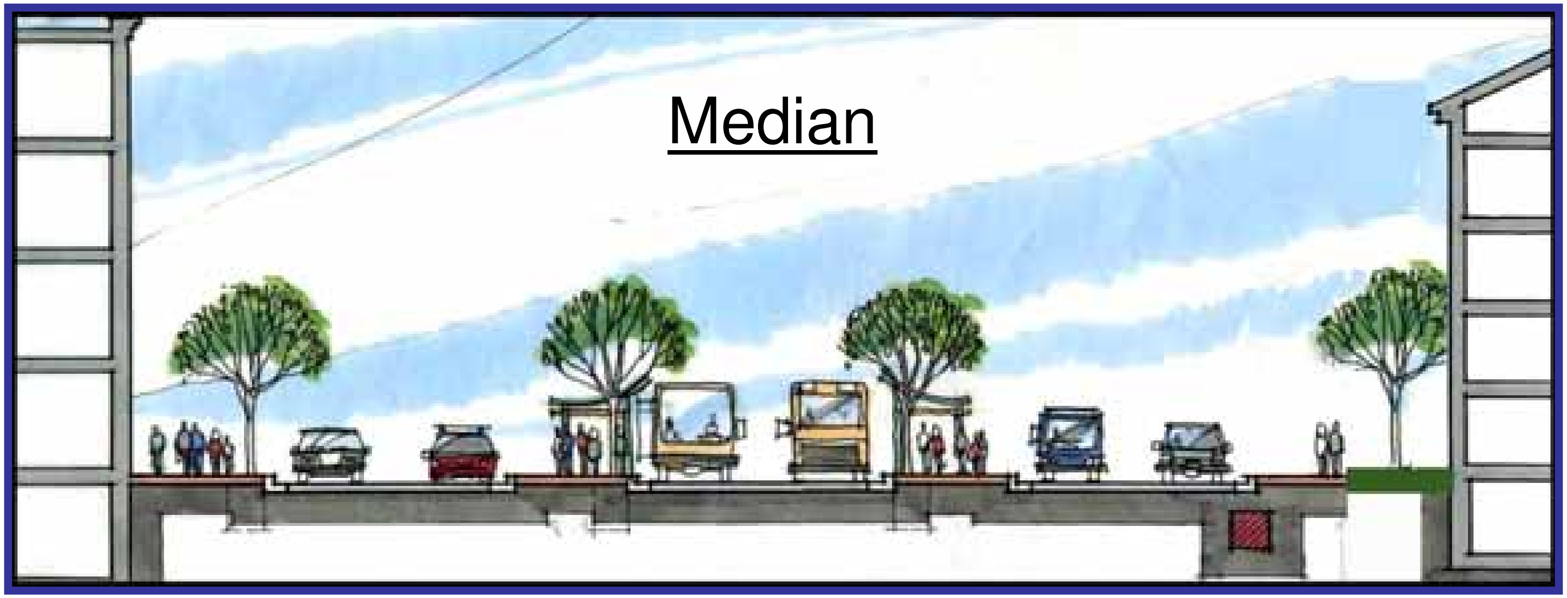
- Building 10 City Blocks
- Integrating East side of Route 1 into fabric of existing neighborhoods
- Define Character of Future Route 1 Corridor

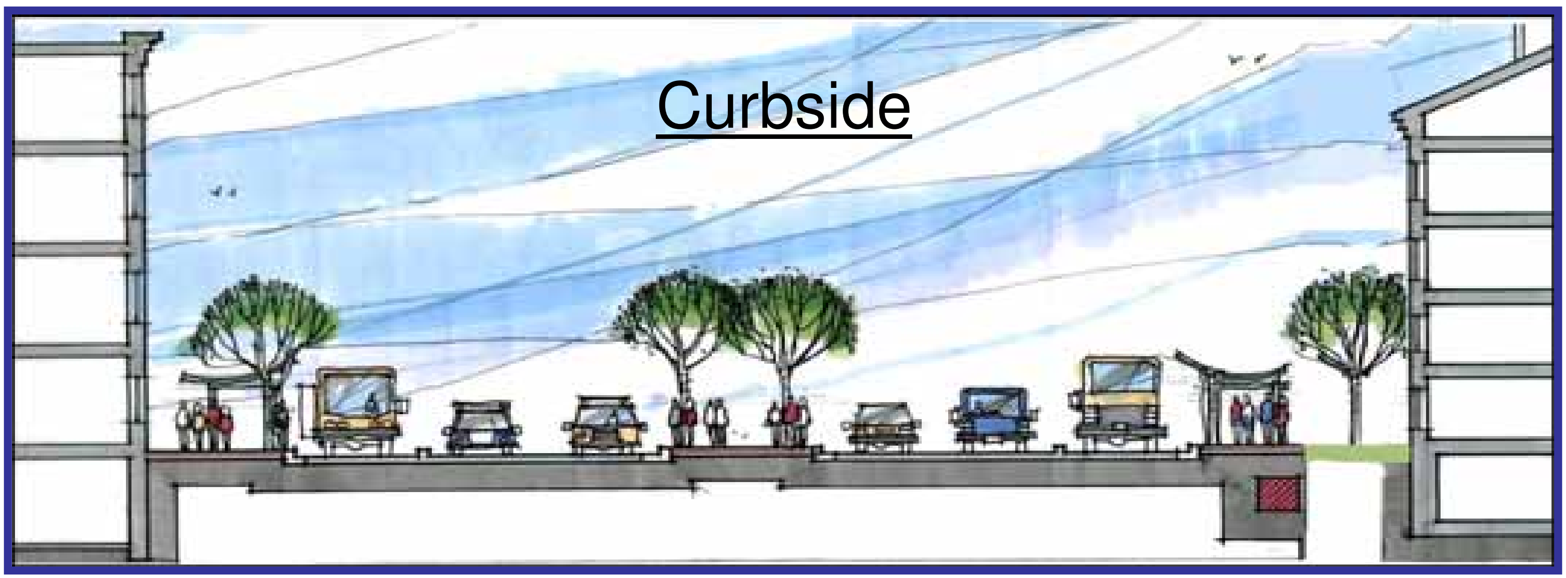
Existing Conditions

Proposed Right-of-Way



Streetscape

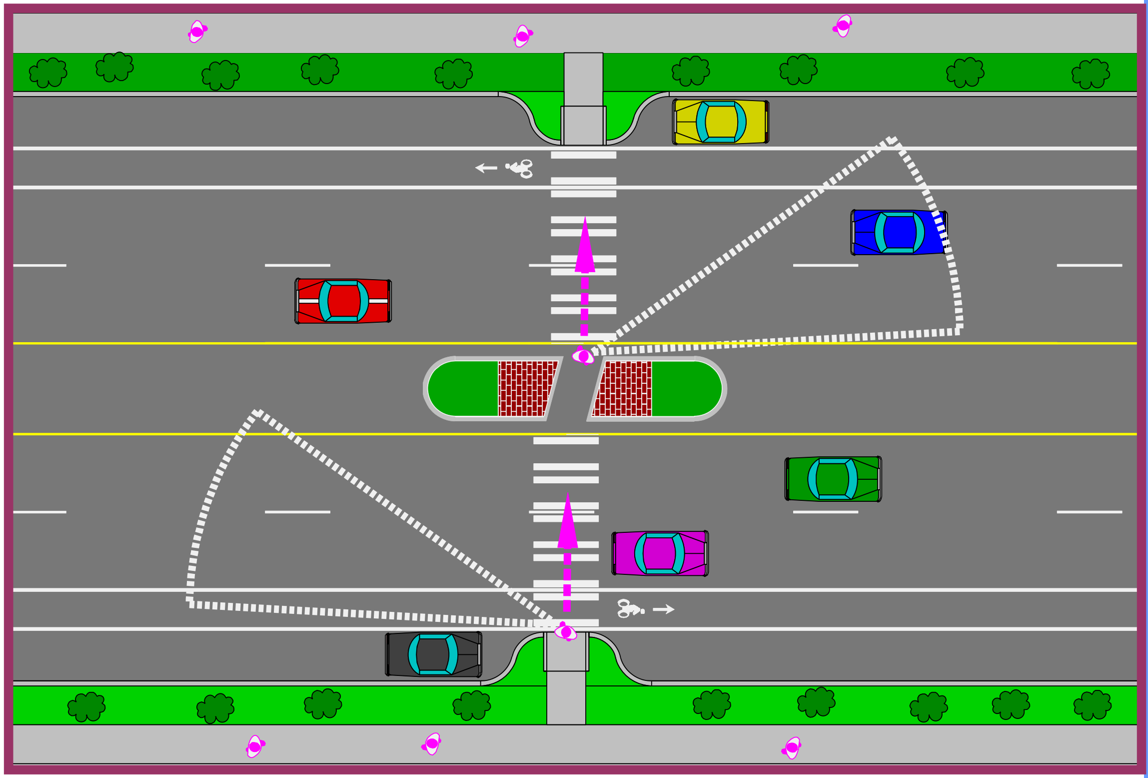




Fundamentals of Street Crossings

What We Know

- People seek frequent crossing points
- Most people will walk 150 feet to get to locations rewarding their travel
- Break crossings into separate stages with medians & refuges – a must on multi-lane roads
- Encourage people to look at oncoming traffic
- Enhanced signing & lights should be used selectively



Pedestrian Considerations

Improvements on Route 1

- Wide sidewalks
- ADA: Curb ramps, audible indicators
- Countdown timers
- Well-marked crosswalks at signalized intersections & leading pedestrian intervals
- Median refuges with extended noses
- Well-lit sidewalks and crossings

Pedestrian Considerations

High-Visibility Crosswalks

Stamped & Textured Crosswalks

Pedestrian Considerations

Pedestrian Countdown Signals with Leading Pedestrian Intervals & audible pushbuttons for ADA compliance

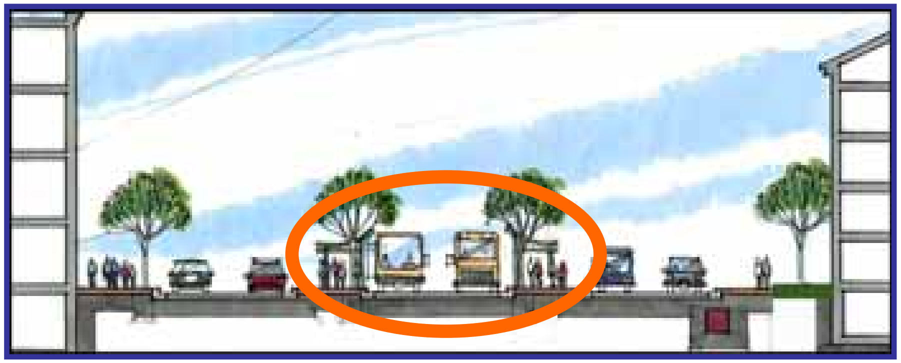
Pedestrian Considerations - Median

- Full Route 1 crossing = 100'
- "Stages" are different
- PRO: Access to transit is either 23' or 62' – good access from both sides of street
- CON: Requires crossing for all trips

Pedestrian Considerations - Curbside

- Full Route 1 crossing = 100’
- “Stages” are different
- PRO: Easy access on one side of street
- CON: Extremely long crossing for opposite trip

Median vs. Curbside



✓	Transit service and performance	
✓	Impact on vehicular traffic	
✓	Pedestrian access and crossings	
✓	Right-of-way / Width of street	✓
✓	Implementation and Cost	
✓	Streetscape	

Illustrative Rendering

CRYSTAL CITY/POTOMAC YARD TRANSIT CORRIDOR
ROUTE 1 TRANSITWAY CONFIGURATION ALTERNATIVES

CONSIDERATION	MEDIAN	CURBSIDE
Overall transit performance	Better overall performance	Reduced, even with barriers between transit & vehicular lanes
Transit travel delay	Lower due to increased "green time" at signals (shares Rte 1 phase)	Higher due to reduced "green time" at signals (special phase)
Conflicts between transit and vehicular traffic	• Less potential for conflict with vehicles • Left-turns from Rte 1 limited to protected movement only • Left turns from side streets not restricted • Right turns from Rte 1 not restricted • Right turns from side streets not restricted	• More potential for conflicts with vehicles • Could allow permissive left turns from Rte 1 with restricted transit green time • Left turns from side streets not restricted • Right turns from Rte 1 permitted only with exclusive transit phasing on both sides • No Right Turn on Red (both sides)
General vehicular traffic flow	• Minimal impact • No conflicts with left or right turning traffic (transit vehicles move with Rte 1 through traffic)	• Reduces level of service at some intersections • Additional phase or Intelligent Traffic System (ITS) required • Conflicts between through transit movements and general traffic (right turns at intersections and mid-block curb cuts)
Use of transit lanes by vehicular traffic	General traffic less likely to use transit lanes	Significant enforcement required to control use by general traffic
Implementation & Cost	• Can be constructed concurrent with Rte 1 improvements • Required ROW available	• Requires reconstructing northbound lanes/sidewalk on west side of Rte 1 • ROW needed on west side of Rte 1
FTA funding implications	Supports New Starts/Small Starts eligibility as "fixed guideway"	Not considered "fixed guideway" without physical barrier separation
Roadway width	100 feet curb-to-curb	100 feet curb-to-curb
Landscaping	• Increases landscape area in median • Reduces or eliminates landscape area between sidewalk and building line on east side of Rte 1	• No effect on median landscaping area based on design guidelines • Stations encroach on pedestrian and landscape area
Pedestrians crossings Rte 1	• Full crossing = 3 lanes + median + transitways + median + 2 lanes (equal distance to curbside, stage lengths are different) • Crossing is broken into three 23' to 33' stages • Crossings at intersections only (well-lit & signalized with crosswalks, countdown timers, leading ped intervals, etc…)	• Full crossing = transitway + 3 lanes + median + 2 lanes + transitway (equal distance to median, stage lengths are different) • Crossing is broken into two 40' to 50' stages • Crossings at intersections only (well-lit & signalized with crosswalks, countdown timers, leading ped intervals, etc…)
Pedestrian accessing transit	• In one direction, peds cross only one direction of vehicular travel lanes to median (23' to 33') • In other direction, peds cross transitways & buffer in addition to one direction of vehicular travel lanes (62')	• In one direction, peds board/ disembark curbside (0') • In other direction, peds cross all lanes, median refuge & transitways on Rte 1 (both directions of travel) (100')
Passenger Comfort	Amenities in median can increase passenger comfort	Perception of increased comfort waiting at curb

Technical Memorandum Update

Appendix 11

General Plans

Technical Memorandum Update

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Crystal City/Potomac Yard Transit Improvements Project – Section B

Appendix 11

GENERAL PLANS:

Alignment Layout & Typical Sections

(for Documented Categorical Exclusion)

March 2011

SHEET INDEX & KEY MAP

Alignment Layout:

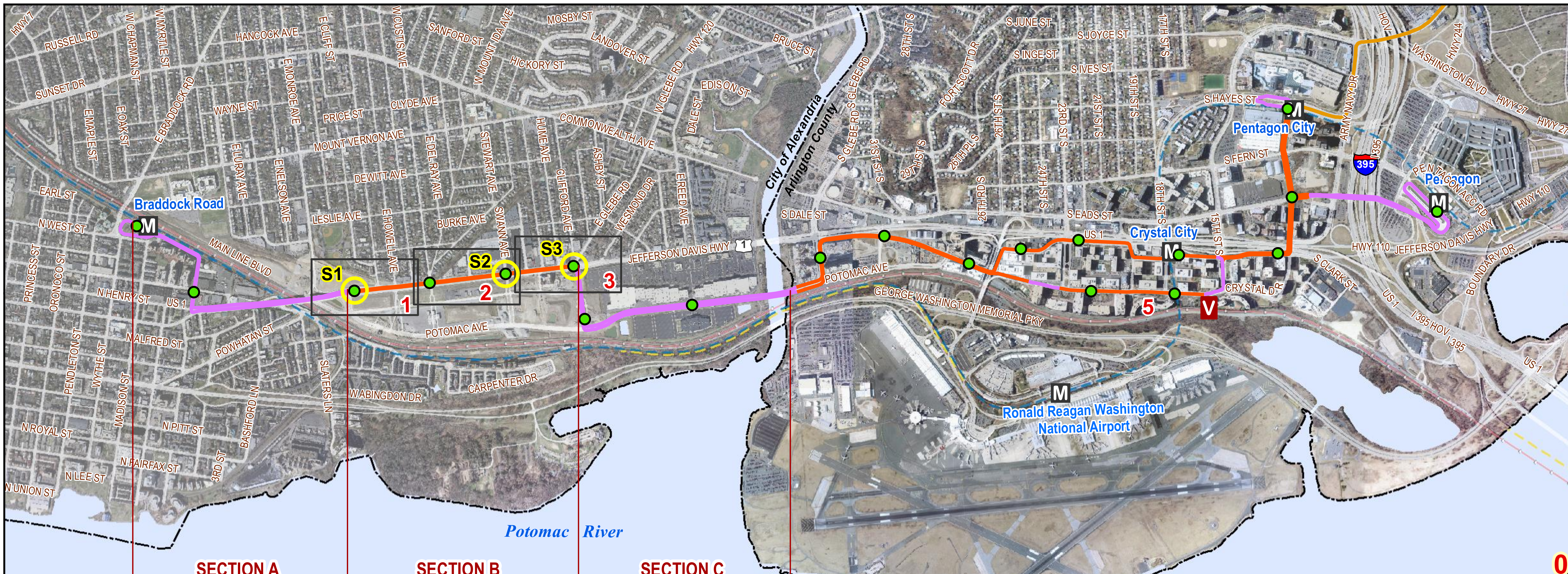
0. Sheet Index & Key Map
1. Section B (Route 1 at Potomac Avenue and Howell Avenue)
2. Section B (Route 1 at E Custis Avenue and Swann Avenue)
3. Section B (Route 1 at Calvert Avenue and E Glebe Road)

Intersection Plans and Typical Sections:

S1. Route 1 and Potomac Avenue: Section B
S2. Route 1 and Swann Avenue: Section B
S3. Route 1 and E Glebe Road: Section B
S4: Typical Station Stop Plan: Section B
S5: Typical Station Stop Perspective View: Section B

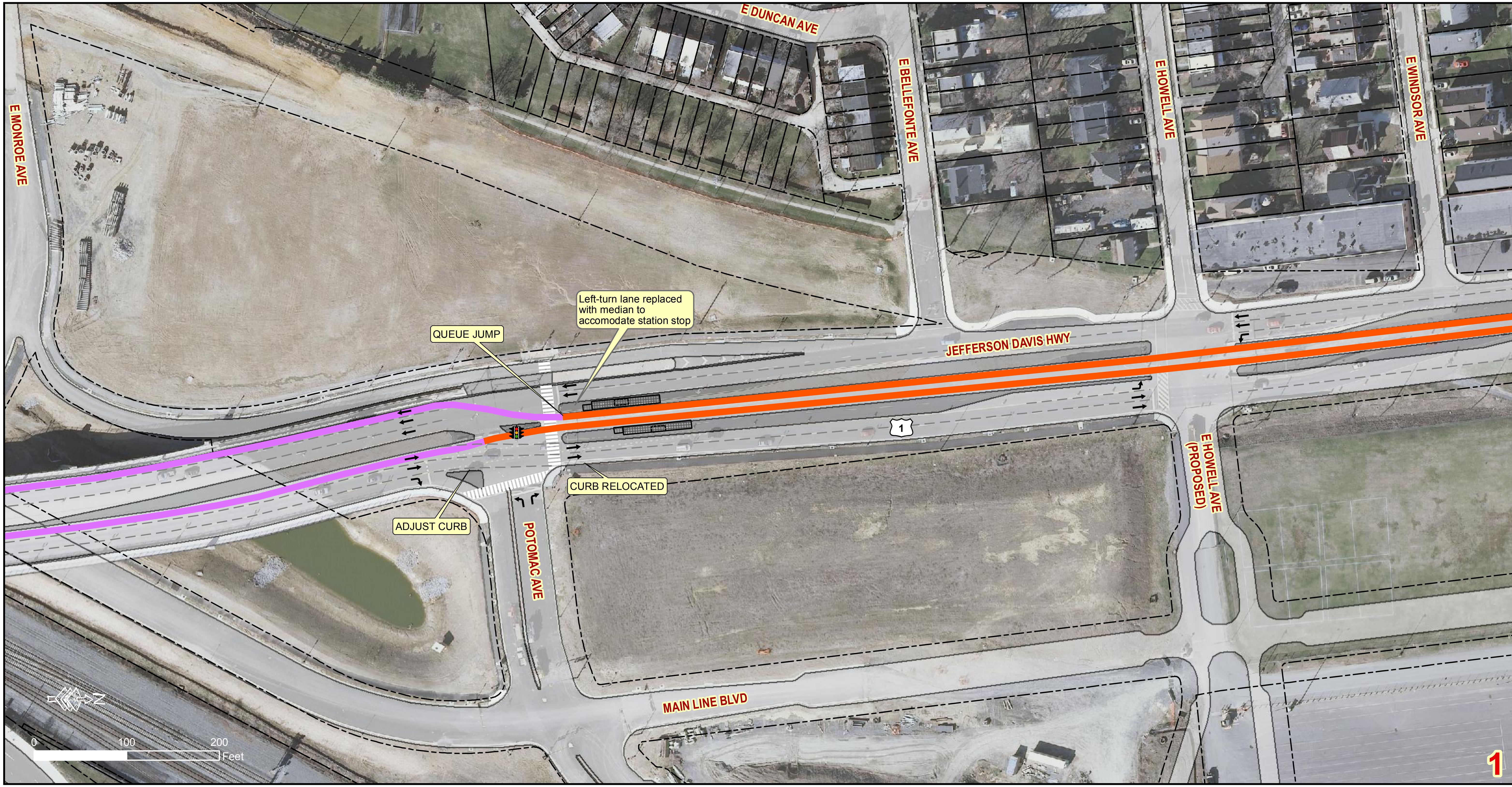
LEGEND

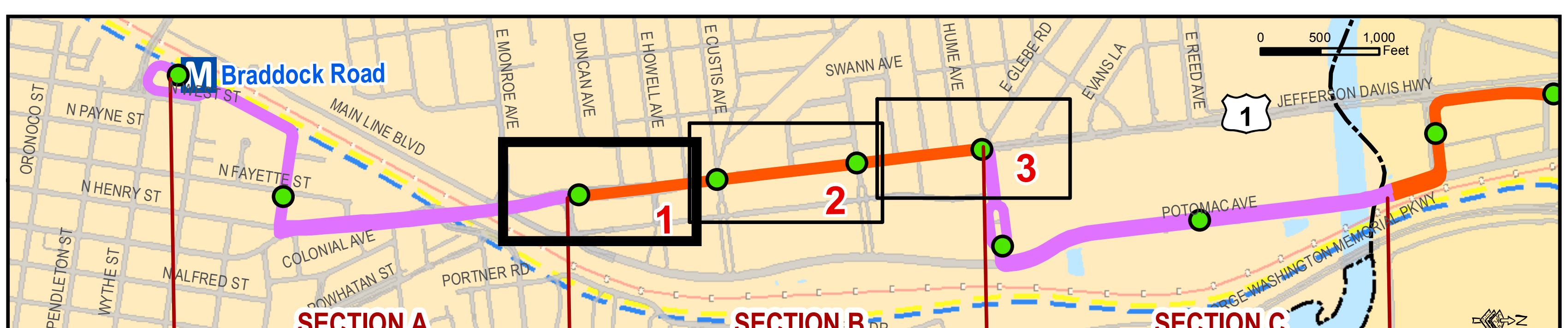
- Proposed Station Stop
- **Proposed Alignment**
- Exclusive Bus Lanes
- Transit Vehicles in Mixed Traffic
- Columbia Pike Transit (Proposed)
- 2 Alignment Layout Sheet Index
- S1 Intersection Plans & Typical Sections Sheet Index
- M Metro Station
- Metrorail Blue Line
- Metrorail Yellow Line
- V VRE Station
- CSX Railroad



0 1,000 2,000 Feet

Crystal City/Potomac Yard Transit Improvements Project - Section B



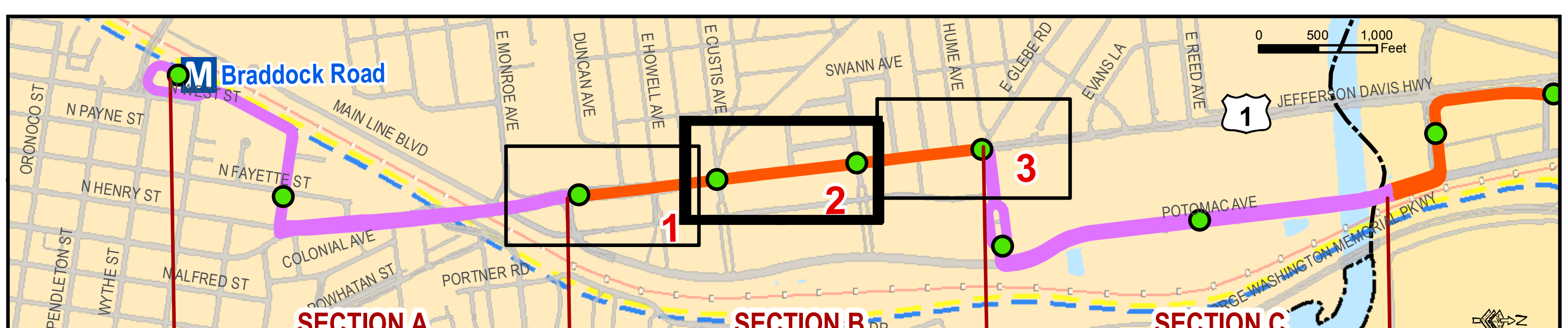


- Metro Station
- Metrorail Blue Line
- Metrorail Yellow Line
- CSX Railroad
- Signalized Intersection
- Parcel
- Proposed Station Stop (Key Map)
- Proposed Station Stop

Proposed Alignment

- Dedicated Lanes for Transit
- Transit Vehicles in Mixed Traffic

Crystal City/Potomac Yard Transit Improvements Project - Section B



Metro Station

Metrorail Blue Line

Metrorail Yellow Line

CSX Railroad

Signalized Intersection

Parcel

Proposed Station Stop (Key Map)

Proposed Station Stop

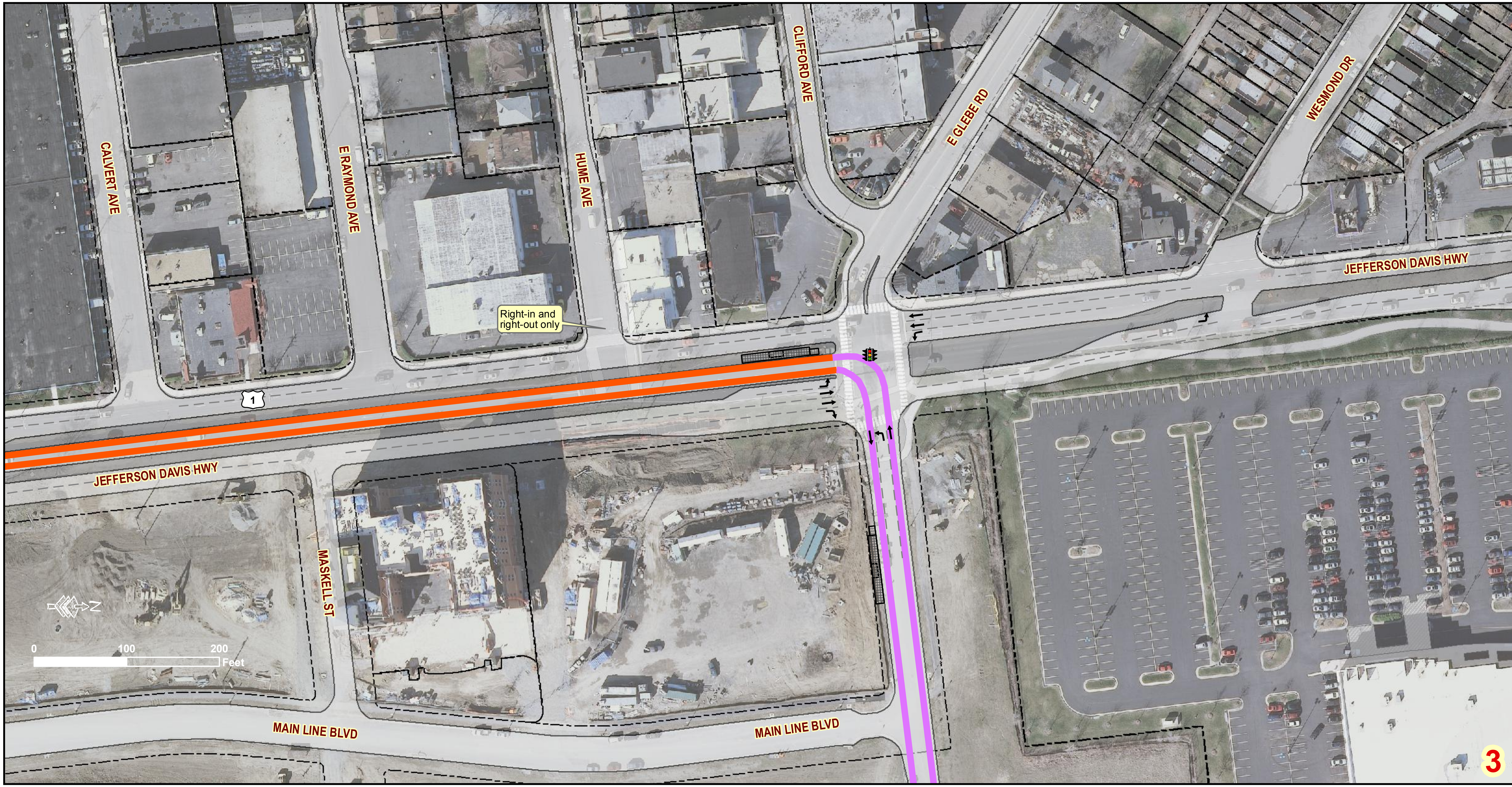
Proposed Alignment

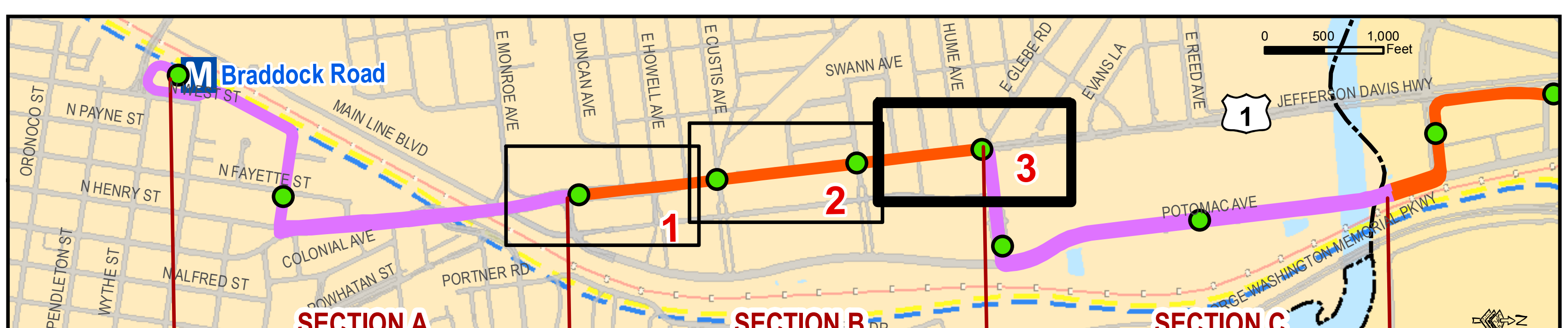
Dedicated Lanes for Transit

Transit Vehicles in Mixed Traffic

metro

Crystal City/Potomac Yard Transit Improvements Project - Section B





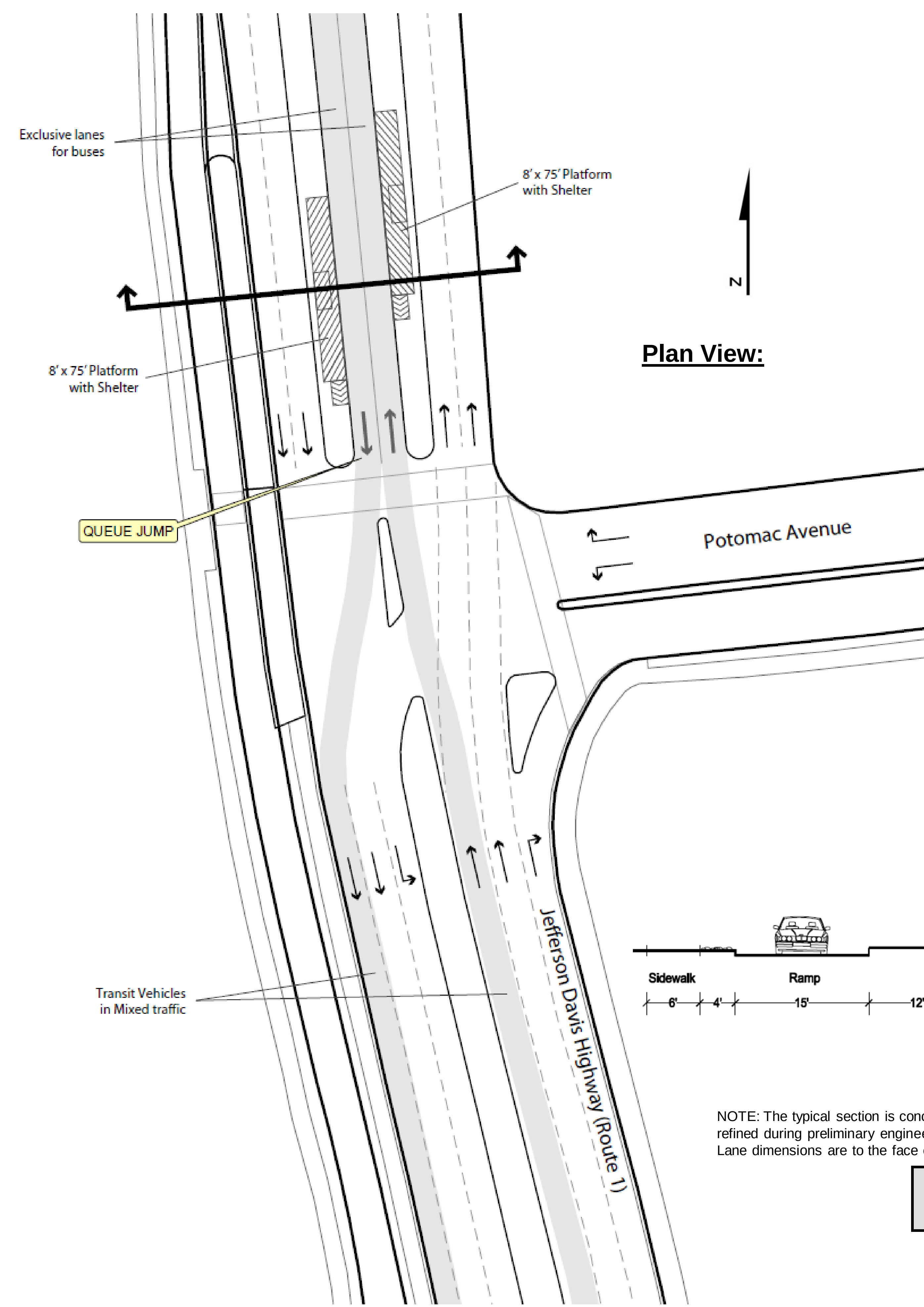
Metro Station
Metrorail Blue Line
Metrorail Yellow Line
VRE Railroad
Signalized Intersection
Parcel
Proposed Station Stop (Key Map)
Proposed Station Stop

Proposed Alignment

Dedicated Lanes for Transit
Transit Vehicles in Mixed Traffic

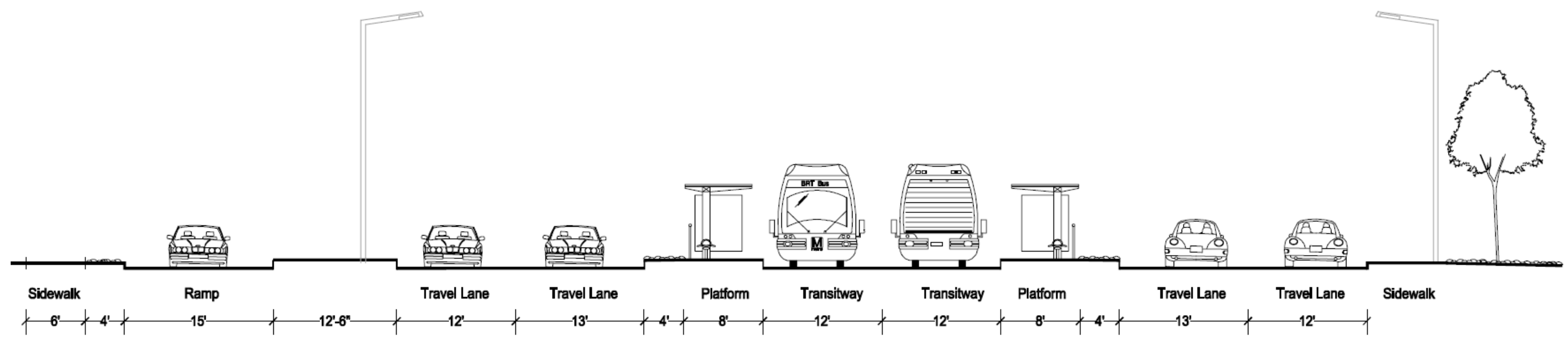
Crystal City/Potomac Yard Transit Improvements Project - Section B

Plan View:



Notes:

1. A median busway along Route 1 (Jefferson Davis Hwy) would include two lanes dedicated for bus use and separated from vehicular traffic by landscaped median areas.
2. Passenger boarding areas would be located along the landscaped median, which would also provide pedestrian refuge areas at street crossings.



Section: **Route 1 (Jefferson Davis Highway) at Potomac Avenue**

(Not to Scale)

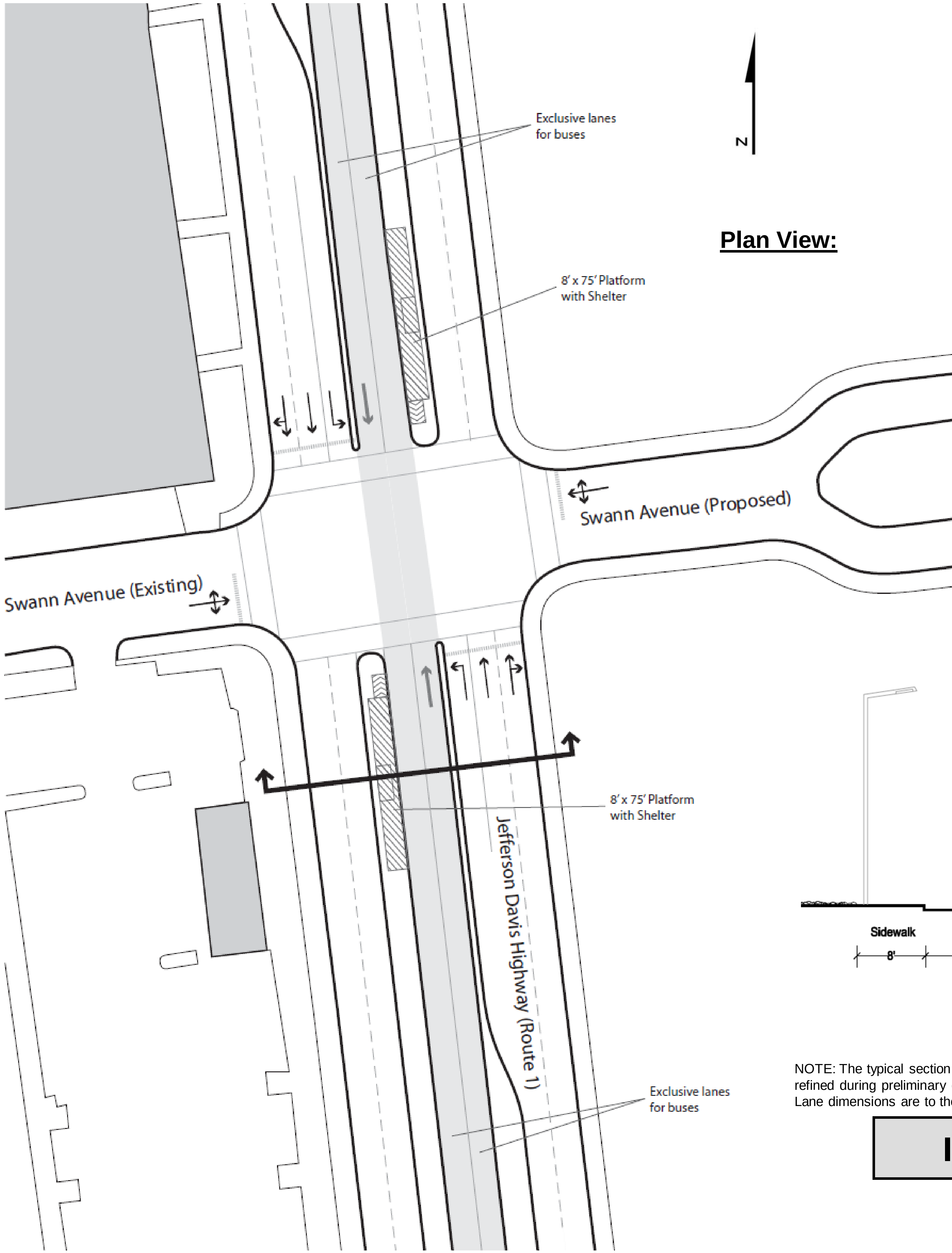
NOTE: The typical section is conceptual and will be refined during preliminary engineering and final design; Lane dimensions are to the face of curb .

S1

Intersection Plan and Typical Section: Route 1 at Potomac Avenue

Crystal City/Potomac Yard Transit Improvements Project – Section B

Plan View:



Notes:

1. A median busway along Route 1 (Jefferson Davis Hwy) would include two lanes dedicated for bus use and separated from vehicular traffic by landscaped median areas.
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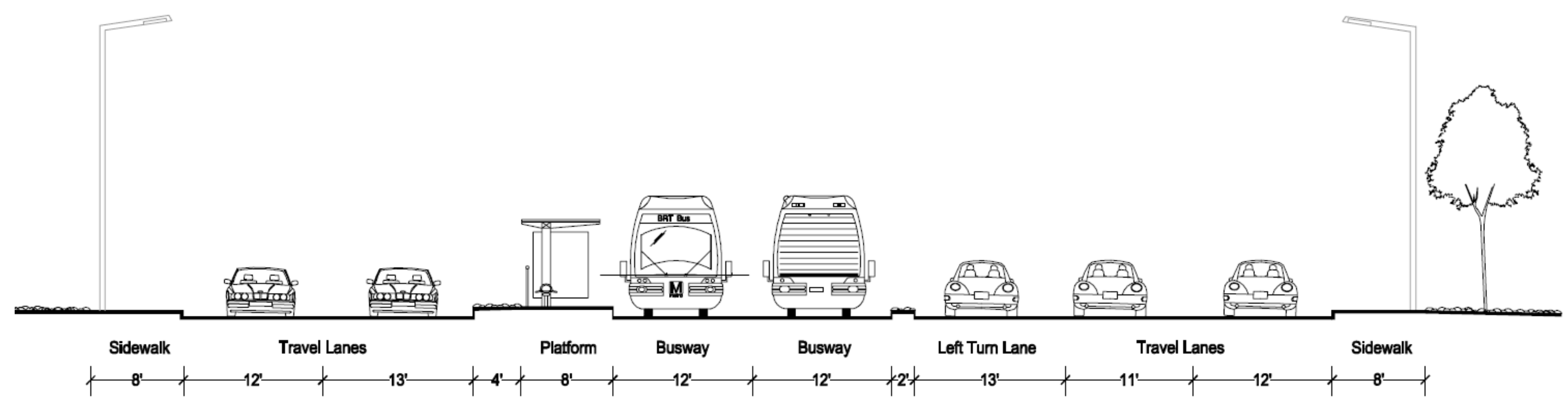


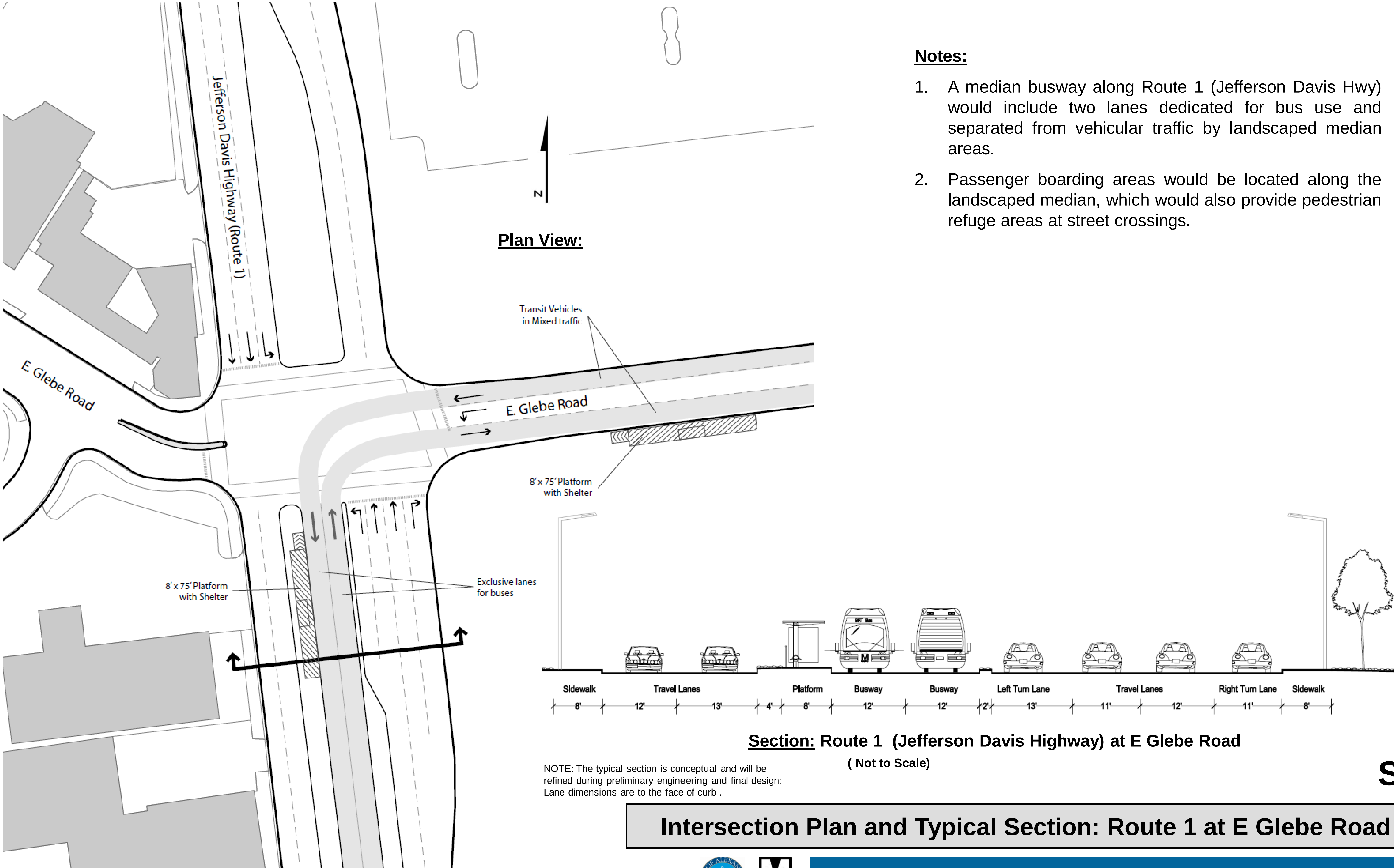
Section: Route 1 (Jefferson Davis Highway) at Swann Avenue

(Not to Scale)

NOTE: The typical section is conceptual and will be refined during preliminary engineering and final design; Lane dimensions are to the face of curb .

S2

Intersection Plan and Typical Section: Route 1 at Swann Ave



Notes:

1. A median busway along Route 1 (Jefferson Davis Hwy) would include two lanes dedicated for bus use and separated from vehicular traffic by landscaped median areas.
2. Passenger boarding areas would be located along the landscaped median, which would also provide pedestrian refuge areas at street crossings.

Section: Route 1 (Jefferson Davis Highway) at E Glebe Road

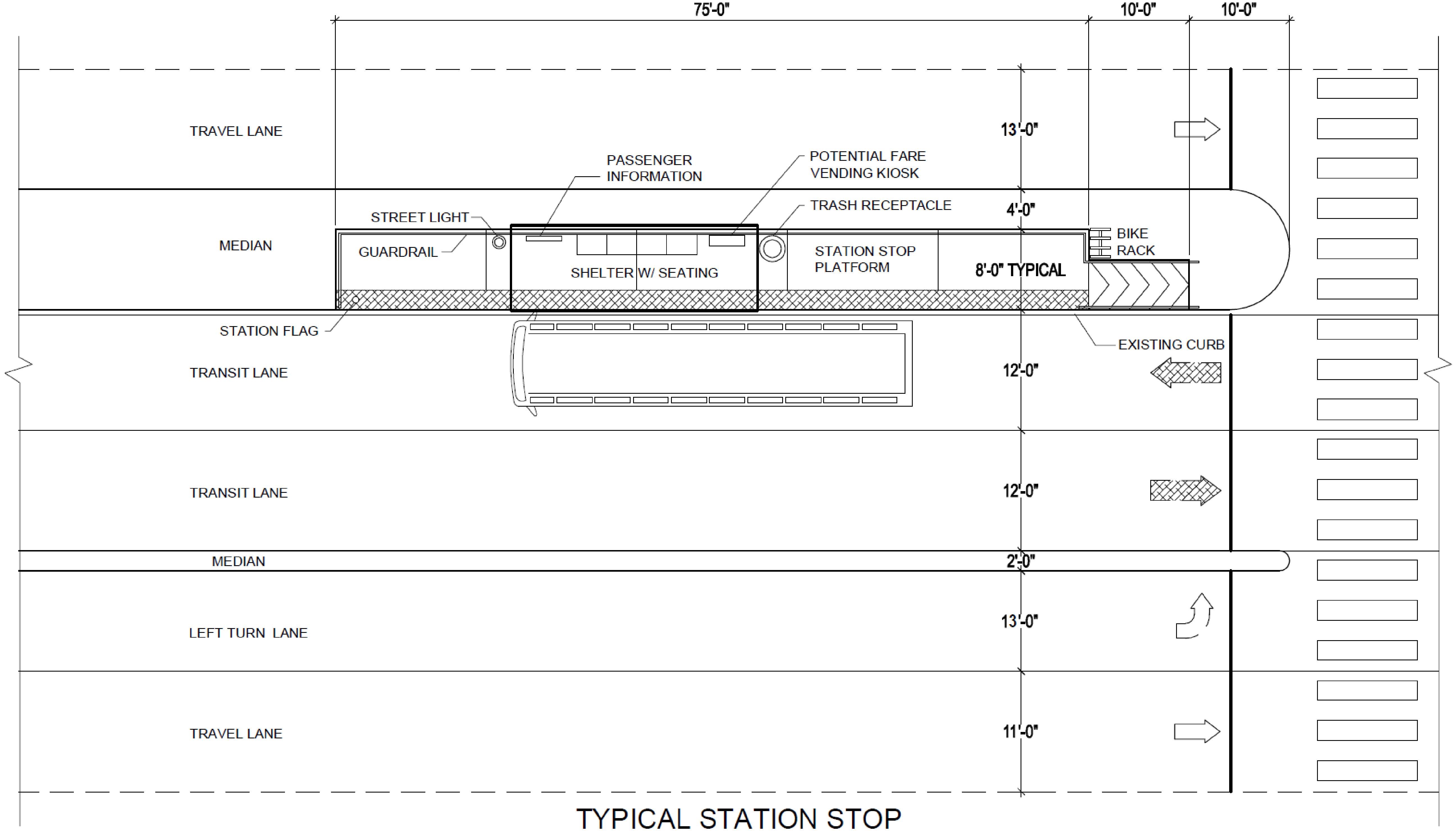
(Not to Scale)

NOTE: The typical section is conceptual and will be refined during preliminary engineering and final design; Lane dimensions are to the face of curb .

S3

Intersection Plan and Typical Section: Route 1 at E Glebe Road

Crystal City/Potomac Yard Transit Improvements Project – Section B



TYPICAL STATION STOP CONFIGURATION

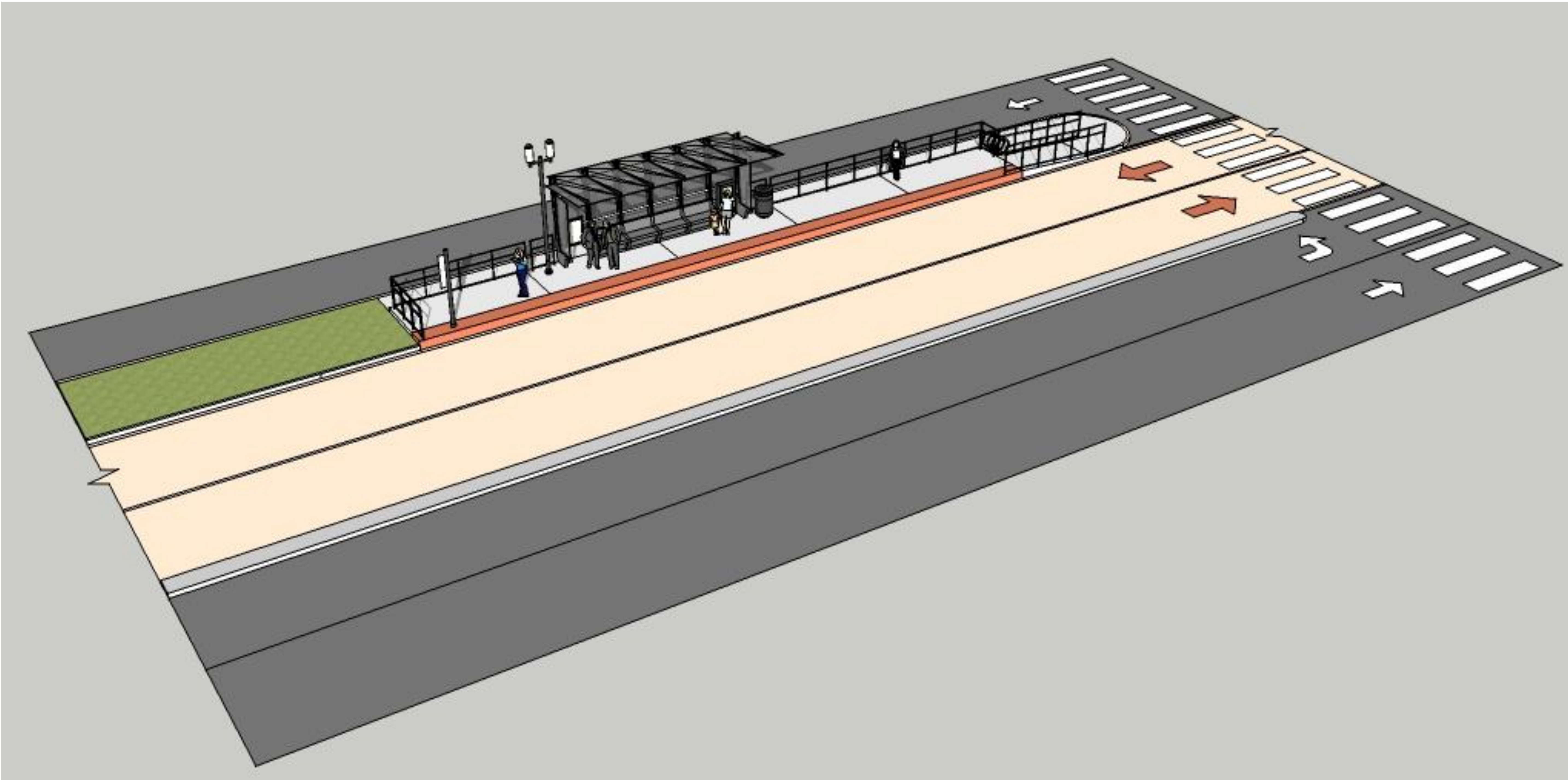
Not to Scale

S4

NOTE: The station stop site plan is conceptual and will be refined during preliminary engineering and final design ;
Lane dimensions are to the face of curb .

Typical Station Stop: PLAN

Crystal City/Potomac Yard Transit Improvements Project – Section B



S5

NOTE: The perspective view is conceptual and will be refined during preliminary engineering and final design

Typical Station Stop: PERSPECTIVE VIEW