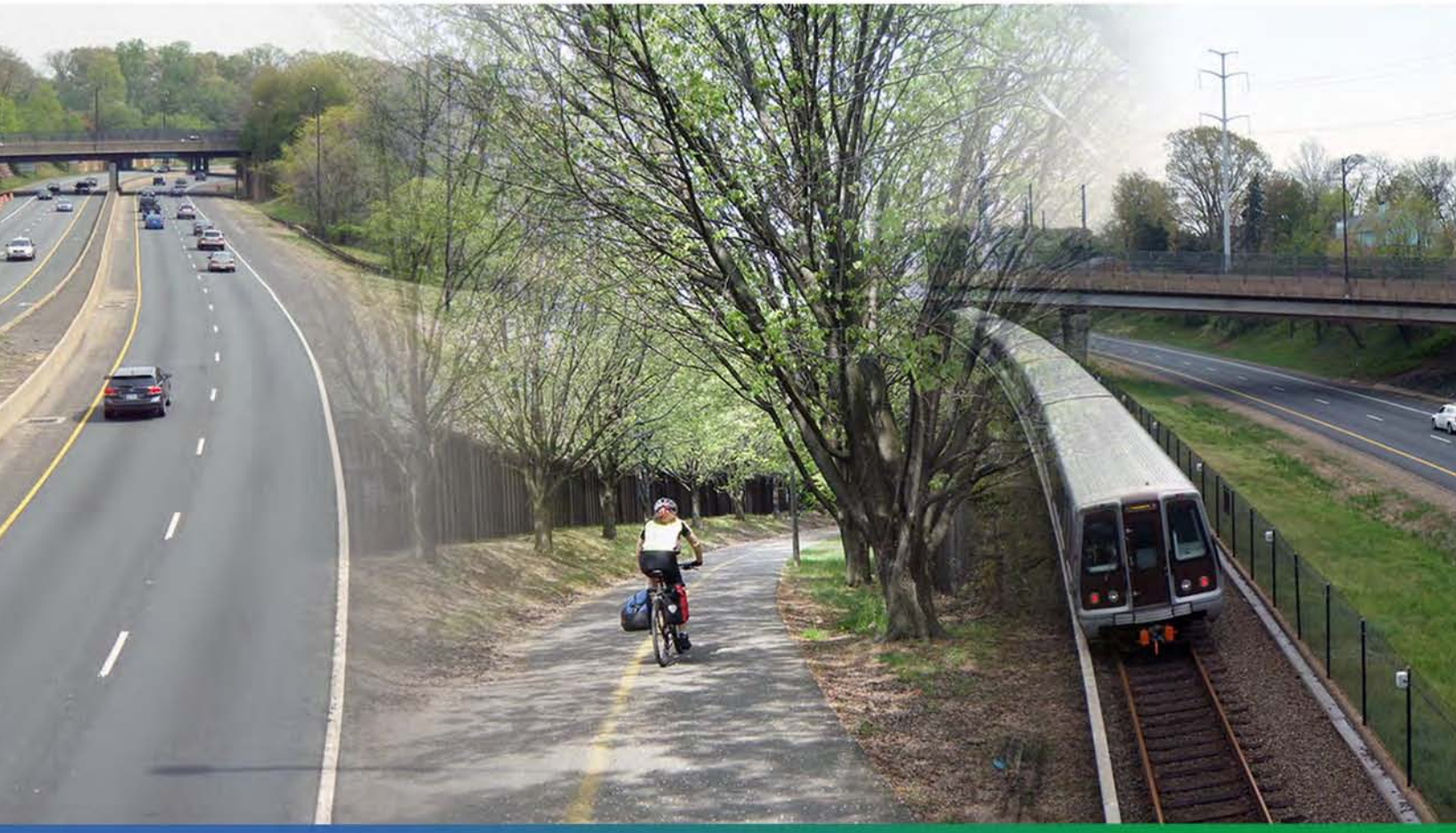
I-66 Multimodal Study

Inside the Beltway

Interim Report



prepared for

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CAMBRIDGE SYSTEMATICS

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1.0 Overview

1.1 Project Goal

The goal of the I-66 Multimodal Study is to:

Identify a range of current and visionary multimodal and corridor management solutions (operational, transit, bike, and pedestrian, in addition to highway improvements) that can be implemented to reduce highway and transit congestion and improve overall mobility within the corridor and along major arterial roadways and bus routes within the study area.

The I-66 Multimodal Study was initiated in July 2011 by the Virginia Department of Transportation (VDOT) and the Virginia Department of Rail and Public Transportation (DRPT). The study was initiated to identify and evaluate transportation options for addressing the congestion and mobility needs of the I-66 corridor between the Capital Beltway (I-495) and the Theodore Roosevelt Bridge. It considers a wide range of complementary and mutually supportive multimodal improvement options, such as public transportation, transportation demand management, high-occupancy vehicle (HOV) lanes, high-occupancy toll (HOT) lanes, congestion pricing, managed lanes, active traffic management, bicycle and pedestrian corridor access, and highway improvements. The I-66 Multimodal Study focuses on identifying and analyzing the most effective options for reducing congestion along the I-66 corridor inside the Beltway.

Corridor Description

The I-66 corridor includes a complex, comprehensive mix of transportation facilities and services, including highway (general purpose and HOV), heavy rail, local and express bus services, and a network of on and off-road bicycle facilities. The study corridor also includes parallel arterials which serve non-HOV travel during the peak periods.

The primary study focus is the I-66 corridor from the Capital Beltway east to the Virginia/District of Columbia border. Since potential mobility improvement to the I-66 corridor can impact surrounding transportation facilities, the study area is broader and extends from the Potomac River to the east, Columbia Pike (VA Route 244) to the south, I-495 to the west, and Dolley Madison Boulevard/Chain Bridge Road (VA Route 123) to the north. The nearby parallel facilities, within the study boundaries include U.S. Route 29 (Lee Highway), U.S. Route 50 (Arlington Boulevard), and Washington Boulevard (VA Route 237). Section 2 of this report discusses the refinement of the study area for this project.

Within the primary corridor, there are two lanes in each direction from the Theodore Roosevelt Bridge to the Capital Beltway, although an additional lane for entry or exit is available through selected segments. A westbound auxiliary lane currently is under construction between George Mason Drive and Sycamore Street to widen that section of road to three lanes.

Inside the Beltway all lanes of I-66 are restricted to vehicles with two or more occupants (HOV-2) on weekdays, eastbound (toward D.C.) in the morning, between 6:30 a.m.-9:00 a.m. and westbound in the evening between 4:00 p.m. and 6:30 p.m. There is an exemption for single occupancy vehicles using the airport access road to travel to and from Dulles International Airport. In addition, SOV hybrid vehicles with clean fuel plates issued before July 1, 2011 are currently allowed to travel in the HOV lanes during restricted hours, but that exemption will expire on June 30, 2012.

The Metrorail Orange Line currently serves locations in the corridor, including stations at Rosslyn, Court House, Clarendon, Virginia Square-GMU, Ballston-MU, East Falls Church, and West Falls Church-VT/UVA. Upon completion of phase one of the Metrorail Silver Line, there will be additional stops serving the corridor at Tysons Corner, including stations at Tysons East, Tysons Central 123, Tysons Central 7 and Tysons West.

Along with Metrorail, a number of local and express bus routes provide options to travel in the corridor. These include the Potomac and Rappahannock Transportation Commission's OmniRide Rosslyn/Ballston Route; Arlington Transit Route 52, Ballston – Virginia Hospital Center – East Falls Church; Arlington Transit Route 75, Shirlington – Wakefield High School – Ballston – Virginia Square; Metro Route 10B, Hunting Towers – Ballston; Metro Route 25A, Ballston – Bradlee – Pentagon; and Metro Route 25B, Landmark – Ballston.

Bicyclists and pedestrians also can travel along the I-66 corridor, using two primary off-road routes, the Washington & Old Dominion (W&OD) Trail or the Custis Trail. The (W&OD) Trail starts in Purcellville, Virginia and extends to Shirlington, Virginia. The Custis Trail intersects the W&OD Trail in Bon Air Park in western Arlington County and parallels I-66 to the eastern edge of Arlington County at the intersection of Lynn Street and Lee Highway, at the Virginia entrance to the Key Bridge. In addition to the bicycle travel facilities, there are four Capital Bike Share locations in the study area, located towards the eastern end of the Rosslyn-Ballston Corridor.

With these considerations in mind, the I-66 Multimodal Corridor Study was initiated to develop a range of potential mobility enhancements to alleviate congestion in the study area. The combination of several multimodal improvements could have a significant impact on mobility.

1.2 Relevant Projects and Corridor Studies

There have been several projects and studies in recent years that have addressed mobility challenges within the I-66 corridor. The following section highlights a number of current projects, either in development or under construction, that will improve mobility in the corridor and two of the most relevant recent studies that have been completed. In particular, recommendations from the I-66 Transit/TDM Study and the Idea-66 study will be used to inform the mobility options chosen as part of this Study.

Projects

Projects in Planning/Study Phase

I-66 Tier I Environmental Impact Study (I-495 to U.S. 15). The Tier I EIS will identify current and future transportation needs along I-66 outside the Beltway, propose solutions and identify their environmental impacts. A draft EIS is expected by June 2012 for public review and final EIS anticipated by June 2013.

DRPT Super NOVA Vision Plan. This DRPT planning study will encompass Northern Virginia, south to Caroline County and west to Culpeper and Frederick Counties and will include coordination with Maryland, Washington, D.C., and West Virginia. This study began in November 2011 to identify transit and TDM needs/strategies for the near, mid, and long term (2040) and will incorporate stakeholder and public input.

Projects in Design Phase

I-66 Vienna Metro Access Ramp (I-66 at Vaden Street). This project provides a bus-only ramp from the eastbound and westbound HOV lanes of I-66 to Vaden Street near the Vienna Metro Station.

I-66 Spot Improvement #2 (Westmoreland Drive to Haycock Road). This project involves addition of a westbound auxiliary lane by continuation of an on-ramp to an off-ramp. No right-of-way is required. A public hearing was held on October 27, 2008 and the project awaits completion of the I-66 Multimodal Study before reinitiating design.

I-66 Spot Improvement #3 (Glebe Road to Lee Highway). This project involves addition of a westbound auxiliary lane by continuation of an on-ramp to an off-ramp. No right-of-way is required. A public hearing was held on October 27, 2008 and the project awaits completion of the I-66 Multimodal Study prior to reinitiating design.

I-66 Active Traffic Management (ATM) (D.C. line to U.S. 15). This project will install an active traffic management system on I-66 through Arlington, Fairfax, and Prince William counties. The system would improve safety and incident management, which includes ramp metering inside the Beltway and a dynamic merge to assist motorists merging from the Dulles Connector Road.

Metrorail Silver Line Extension (Phase Two – Wiehle Avenue to Dulles Airport). The Metropolitan Washington Airports Authority (MWAA) is constructing, in two phases, a 23-mile extension of the existing Metrorail system, which will be operated by the Washington Metropolitan Area Transit Authority (WMATA). Phase Two will run from Wiehle Avenue to Ashburn in eastern Loudoun County. A construction date has not been set for this extension, but Preliminary Engineering (PE) is currently underway.

Projects in Construction

I-66 Spot Improvement #1 (George Mason Drive to Sycamore Street). This project involves addition of a westbound auxiliary lane by continuation of an on-ramp to an off-ramp. No right-of-way is required and no impacts outside of the immediate I-66 corridor are expected. The project is under construction and scheduled for a December 2011 completion.

Metrorail Silver Line Extension (Phase One – East Falls Church to Wiehle Avenue. The Metropolitan Washington Airports Authority (MWAA) is constructing, in two phases, a 23-mile extension of the existing Metrorail system, which will be operated by the Washington Metropolitan Area Transit Authority (WMATA). Phase One will be completed in 2013 and will run from East Falls Church to Wiehle Avenue on the eastern edge of Reston, adding five stations to the Metrorail system: Tysons East, Tysons Central 123, Tysons Central 7, Tysons West, and Wiehle Avenue.

I-66 Pavement Rehabilitation (I-495 – U.S. 50). This project is a design-build project for concrete patching and asphalt overlay on the eastbound and westbound mainline and ramps. The project also includes upgrades to corridor drainage, concrete barrier and guardrail. Construction is underway and scheduled for an October 2012 completion date.

I-66 – I-495 HOT Lanes. VDOT MEGA-Project team reconstruction of existing bridges, access ramps and construction of a new HOT lane access ramp at the I-66/I-495 interchange. Work is scheduled for completion in late 2012.

Prior Studies

The baseline condition for the I-66 Multimodal Study will include the existing transportation network and services in the study corridor, improvements that are funded in the Financially Constrained Long-Range Plan (CLRP) and the recommendations of the I-66 Transit/TDM Study, completed in 2009 by DRPT.

I-66 Transit/Transportation Demand Management Study

The goal of this study was to identify more transportation choices through transit and transportation demand management (TDM) enhancements to increase mobility in the I-66 corridor. The geographic scope of this study extended from Washington D.C. to Haymarket, including sections of U.S. 29 and U.S. 50.

Although the study area was larger than that of the current I-66 Multimodal Study, there are a number of TDM/Transit recommendations inside the Beltway that will be included in the mobility options analysis for this Study. The applicable transit recommendations include: Priority Bus on I-66, U.S. 29, and U.S. 50; Ballston Metrorail Station Improvements; and East Falls Church Metrorail Station Improvements. The applicable TDM recommendations include: Enhanced Corridor Marketing, Vanpool Driver Incentive, I-66 Corridor-Specific Startup Carpool Incentives (Expanded), Rideshare Program Operational Support, Carsharing at Priority Bus Activity Nodes, Bike Hubs/Storage at Priority Bus Activity Nodes, TDM Program Evaluation, Enhanced Virginia Vanpool Insurance Pool, Enhanced Telework!VA, Northern Virginia Ongoing Financial Incentive, Van Priority Access, Capital Assistance for Vanpools, Flexible Vanpool Network, SmartBenefits Subsidy Public Share, Mobility Centers/Mobile Commuter Stores, and Real-Time Parking Information (at Metrorail park and ride facilities).

Idea-66

VDOT in cooperation with the Virginia Division of the Federal Highway Administration (FHWA) completed a feasibility study in 2005 to identify ways to reduce congestion within the existing right-of-way on I-66 westbound from the Rosslyn Tunnel to the Dulles Airport Access

Road. This study was in response to Congressional and state concerns over growing congestion in the I-66 corridor and the impact of such congestion on the corridor's ability to serve as an evacuation route in response to a natural disaster or terrorist incident. The study recommended a roadway widening concept with various managed lane types and advanced system management techniques be advanced for further detailed evaluation. In addition to the widening concept, an evaluation of interim improvements that could occur with minimal impacts also were recommended to address spot problems and geometric deficiencies.

Conditions on the I-66 corridor have changed since the study was completed and thus the findings are not fully transferable. Methodologically, however, the Idea-66 has much in common with the current I-66 Multimodal Study.

1.3 Oversight and Coordination

The lead agencies for this study are VDOT and DRPT. The technical and administrative work conducted for this study is managed and led by Cambridge Systematics (CS) with support from a number of subconsultants. KFH Group provides transit expertise; MCV performs data collection; RK&K provides technical analysis of the highway mobility needs; Sharp & Company supports the public information activities; the Southeastern Institute of Research (SIR) leads the market research; and Toole Design Group provides bicycle and pedestrian expertise.

To ensure that the study uses a broad lens to evaluate options, VDOT has formed a Participating Agency Representative Committee (PARC). The PARC meets with VDOT, DRPT, and the project consulting team on a monthly basis to provide input on draft materials and advise the study. Over the course of the project, the PARC will meet at least 10 times to comment on and review progress. In addition, representatives serve as liaisons with their respective agencies and elected officials and help distribute study information to constituents and interested citizens. The members of the PARC committee are listed in Table 1.1.

Table 1.1 PARC Members

Agency	Representative
Arlington County	Dan Malouff
City of Alexandria	Steve Sindiong
City of Fairfax	Alex Verzosa
City of Falls Church	Wendy Block Sanford
District Department of Transportation (DDOT)	Eulois Cleckley
Fairfax County	Michael Garcia
Federal Highway Administration (FHWA)	Ivan Rucker
Federal Transit Administration (FTA)	Melissa Barlow
Loudoun County	Nancy Gourley
Metropolitan Washington Council of Governments (MWCOG)	Rich Roisman

Table 1.1 PARC Members (continued)

Agency	Representative
Northern Virginia Transportation Commission (NVTC)	Claire Gron
Potomac and Rappahannock Transportation Commission PRTC	Nick Alexandrow
Prince William County	Monica Backmon
Town of Vienna	Michael Gallagher
Virginia Department of Rail and Public Transportation (DRPT)	Lisa Dumetz
Virginia Railway Express (VRE)	Christine Hoeffner
Washington Metropolitan Area Transit Authority (WMATA)	Mark Kellogg

1.4 Overview of Work Program

The work program was designed to produce recommendations for alleviating congestion and mobility issues in the study area that stakeholders could agree on. As of the writing of this report, several activities have been completed and others are underway. This section highlights key activities in the final work program, which provides a step-by-step process for identifying future mobility solutions in the study area.

Identify Key Corridor Issues and Needs

Key indicators of study area issues and needs include forecasted changes in land use, population, households, and employment. Other inputs include travel patterns for the different modes, modal split, network gap analysis, recurrent congestion, and any other known issues within the corridor. Technical analysis, coupled with market research, stakeholder interviews, and jurisdictional input from the PARC meetings were used to organize a defined set of study area transportation system issues and needs. Section 3 of this report discusses and presents the resulting issues and needs list.

Develop Option Elements to Address Congestion, Reliability and Mobility

An early and ongoing task of the I-66 Multimodal Study has been the development of a comprehensive inventory of mobility option elements. Element types include highway, transit, bicycle/pedestrian, transportation demand management (TDM), and intelligent transportation systems (ITS). Eligible project types included improved transit facilities and/or services (e.g., priority bus, dedicated lane, new service), modifications to highway facilities and/or operating policies (e.g., high occupancy vehicle lanes, high occupancy toll lanes, arterial road widening), intelligent transportation systems (e.g., signal timing optimization and dynamic message signs), intermodal access (e.g., bus bays, bicycle parking, access to transit), ridesharing, and

bicycle and pedestrian mobility enhancements (e.g., new trail connectors, on-road facilities, and trail widening). The mobility option elements are closely related to the study area issues and needs, as many of the elements have been previously identified by agencies and jurisdictions to address known transportation deficiencies in the study area. Section 5 of this report discusses and presents the list of mobility option elements.

Formulate and Evaluate Mobility Options and Packages

A set of eight to 10 mobility options for testing will be formulated through a process of relating potential mobility option elements to the list of issues and needs. Section 4 of this report discusses the evaluation methodology to be used, including process guidance for the synthesis of the mobility option elements into mobility options. Section 4 of this report also discusses that following evaluation of the mobility options, a set of four to five multimodal mobility option packages will be developed. These multimodal packages will be evaluated using several measures of effectiveness and full runs of the adopted regional travel demand forecasting model. Benefit/cost analyses on the proposed packages and level of service maps by mode also will be prepared.

Develop Recommendations for Enhanced Mobility on I-66 inside the Beltway

Following evaluation of the multimodal mobility option packages, recommendations will be crafted. Potential ways to implement the recommendations will be explored, including identifying potential revenue sources for all components of the package. With the current fiscal environment in mind, the full range of alternative funding options, including Federal, state, local, and private, are being considered. Both conventional (e.g., program funds) and innovative sources of revenue are being identified as part of this process, with sources arrayed on a spectrum ranging from traditional user fee-based, through commercial/residential value capture, to less traditional options. The team will configure a chart documenting the advantages and disadvantages of each potential funding source.

Public Information

Communication is a key part of the I-66 Multimodal Study. The intent of the public information and outreach program is to: 1) solicit input and opinions to inform the multimodal mobility study options; 2) disseminate timely information about the study; and 3) provide effective methods and mechanisms to address stakeholder issues and ensure two-way communication. Throughout the course of the study a variety of tools are being used to either obtain appropriate input or disseminate information. These include: market research, public meetings, stakeholder interviews, a study webpage, and project factsheets.

Market Research

Market research is being used to inform the understanding of perceptions, needs, and preferences of commuters using the I-66 corridor and to inform the potential mobility options for consideration. Data tabulation along with a thorough multivariate statistical analysis of the results is being performed. The information captured from the surveys will inform the mobility options packages. The market research effort and key findings to date are discussed in Section 6 of this report.

Public Meetings

Two rounds of public meetings are being held at locations in both Arlington and Fairfax Counties, with an option of a third round if needed. The first round of public meetings in December will present information and seek input on corridor needs and conditions, mobility options for consideration and market research results illustrating preferences in the study area. The second round of public meetings in April will present information and seek input on the comprehensive study findings and level of service (LOS) maps showing network and modal performance.

Stakeholder Interviews

Stakeholder interviews will be held to accomplish several objectives. First, they will be used to engage and inform community leaders about the study and to disseminate information. Second, they will serve as an additional source of stakeholder input for the formulation of multimodal packages. Lastly, they will help the project team identify stakeholder issues. Over 50 public agency representatives and elected officials are being interviewed to discuss the corridor transportation issues that are particularly important to them and their constituents.

Study Webpage

The I-66 Multimodal Study webpage can be found on the VDOT web site at www.i66multimodalstudy.com. The web site is a repository for the factsheets and major study deliverables. It also provides a study phone number and e-mail address so individuals can comment at any time. The phone number is 855-788-3966 (855-STUDY66) and the e-mail address is info@i66multimodalstudy.com.

Project Factsheets

Four factsheets are being prepared over the course of the study, and will be released at key milestones. These factsheets are intended for public consumption and are intended to inform the public and other stakeholders about study progress and key findings. They also are available on the study webpage.

Interim and Final Report

The final report will build on the results of the interim report and is expected to include discussion of the following elements:

- Interim Report contents;
- Mobility options tested (8-10);
- Alternative packages tested (4-5);
- Highlighting of performance measures of preferred option;
- LOS Maps;
- Public Information and Participation Report;
- Recommendations; and

- Potential Funding.

The target date for publishing the final report is May 2012.

1.5 Organization of the Interim Report

The remainder of this report is organized in the following manner. Section 2, *Study Area Definition*, defines and describes the refinement of the study area, taking into account consultations with project advisors and the PARC committee. Section 3, *Issues and Needs*, identifies issues and needs, including regional factors that influence travel and key indicators. Section 4, *Evaluation Methodology*, covers the methods for identification of mobility option elements, the formulation of and assessment of mobility options and the formulation and assessment of mobility option packages. Section 5, *Mobility Options Elements*, presents the full list of mobility option elements by category. Section 6, *Market Research*, presents findings from the survey. Section 7, *Next Steps*, presents the key near-term work items to be conducted that will advance the study towards completion.

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2.0 Study Area Definition

An early task in the I-66 Multimodal Study was to refine the study area. The initial study area for the I-66 Multimodal Study was defined in the request for proposal: bounded by the Potomac River to the east, Columbia Pike (VA Route 244) to the south, I-495 to the west, and Dolley Madison Boulevard/Chain Bridge Road (VA Route 123) to the north, with a study focus on the I-66 Corridor from the Capital Beltway (I-495) east to the Virginia/District of Columbia border. Nearby parallel facilities, including U.S. Route 29 (Lee Highway), U.S. Route 50 (Arlington Boulevard), and Washington Boulevard (VA Route 237), are included within these boundaries.

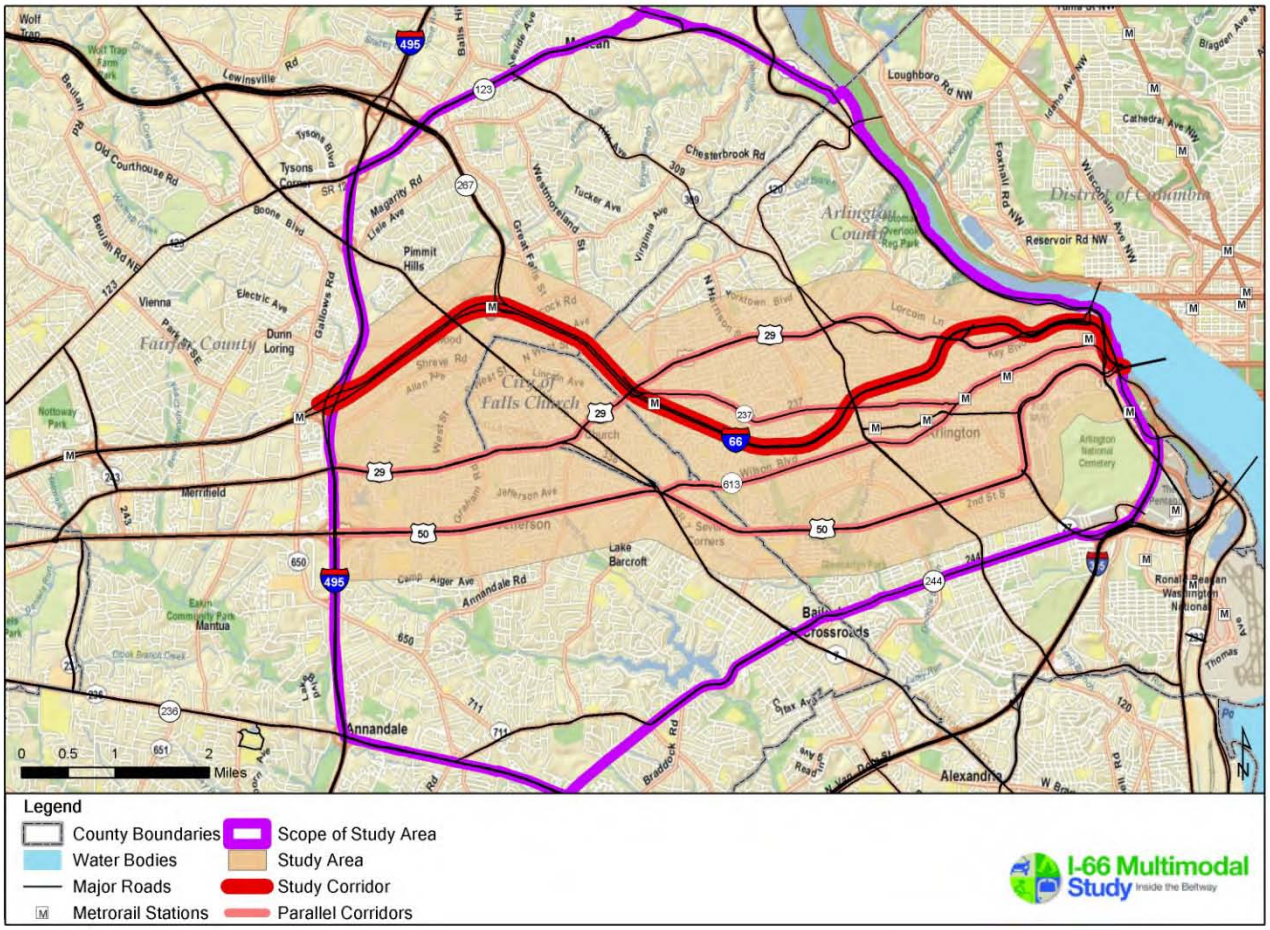
Refinement of the study area was desired to permit a focus on core issues and opportunities surrounding I-66 Corridor mobility. Information from the MWCOG Round 8 cooperative land use forecasts and the travel demand forecasting model was used to provide an understanding of growth and travel patterns in the study area and to help illustrate the area of influence for travel on I-66.

In order to get an understanding of the future travel patterns in the initial study area, an application was made of the regional travel demand forecasting model. Version 2.3 of the National Capital Region Transportation Planning Board (TPB) travel demand forecasting model was used to examine the origin locations of commute trips that use I-66 inside the Beltway, as well as the trips by mode between the regional jurisdictions. A model technique known as select link analysis was used to show the origin and destination location of trips the model reports as using one or more selected links. This technique is a useful tool for understanding the travel demand market for a specific facility.

The refinement of the study area focused on the origins and destinations of commute trips that the model reports as using I-66 during the morning peak period. The morning peak period is defined in the model as the period from 6:00 a.m. to 9:00 a.m. The input transportation network reflected the infrastructure improvements and transit services that are currently planned to be in place by the year 2040 based on the Financially Constrained Long Range Plan (CLRP), including the extension of Metrorail to Dulles Airport. The input land use reflected the MWCOG Round 8.0 forecast for year 2040, which includes the redevelopment of Tysons Corner. It is important to note that in the year 2040 CLRP network the HOV restriction on I-66 is HOV 3+.

The results of this analysis indicate that a high concentration of trips forecast to use I-66 in 2040 originate inside the Beltway, with many of the origin locations in close proximity to I-66 in Arlington and Fairfax Counties. Considering the core origins and destinations of travel in the I-66 corridor and a desire to keep the study well-focused, a refined study area was designated that encompasses I-66 and several parallel arterials, including U.S. Route 29 and U.S. Route 50. This refined study area is shown in Figure 2.1. This refinement process provides a more focused area for consideration of mobility improvements and for evaluating the performance of the mobility options and packages.

Figure 2.1 Refined Study Area



3.0 Identification of Issues and Needs

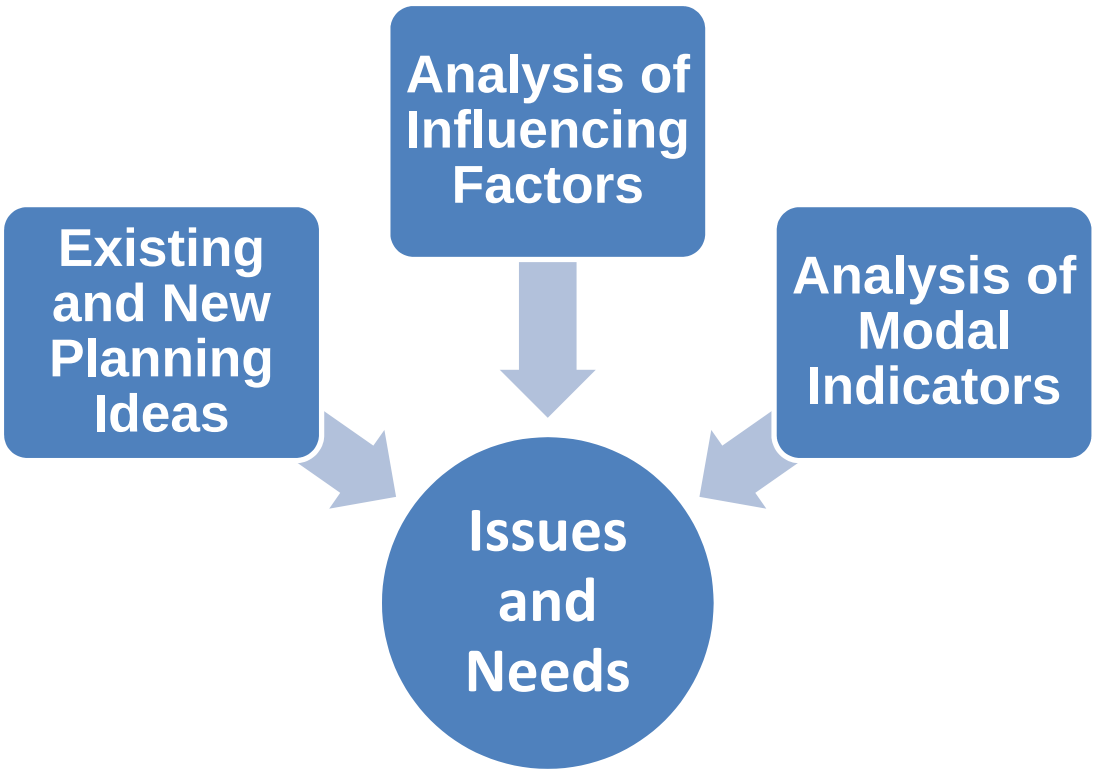
3.1 Overview

The initial set of technical activities performed for the I-66 Multimodal Study focused on providing a means to define a discrete set of issues and needs in the study area. To identify issues and needs associated with the I-66 corridor inside the Beltway, a systematic process, as depicted in Figure 3.1 was undertaken and included:

- Review of relevant studies and proposed projects for the study area (see Section 5 for a comprehensive listing of mobility option elements);
- Consideration of factors influencing travel; and
- Review of key modal indicators of issues and needs.

The defined set of transportation issues and needs provide a foundation for the remainder of the study as they serve as the basis from which all subsequent study activities flow.

Figure 3.1 Process to Identify Issues and Needs



The technical analyses supporting the identification of issues and needs considers both base year (2007) and horizon year (2040) conditions. A year 2040 travel forecast was performed using the Round 8.0 cooperative regional land use forecast and Constrained Long Range Plan (CLRP) networks as input. The forecast led to a guiding finding of the issues and needs analysis: the issues and needs within the study area that are experienced today generally continue as issues and needs into the future for a variety of reasons. The metropolitan core areas, although not experiencing as high a level of growth as in the past in terms of jobs and households, will continue to be the center of activity in the region. At the same time, growth in suburban jobs will absorb much of the growth in commuter travel from added suburban households and encourage more reverse commuting than today. The addition of the Silver Line Metrorail extension will offer new transit commuting opportunities to the Tysons Corner area at the same time that Tysons Corner's significance as a destination will grow.

The initial technical activities were focused on capturing a wide array of travel and congestion influences to gain a clear picture of the existing transportation network and impacts of the planned future network in the study area. Key indicators of study area issues and needs centered on forecasts of land use travel patterns, modal travel and system usage information, network gap analysis, congestion, and any known issues and opportunities. For example, the highway assessment illustrated temporal congestion points in each direction in the study area. The transit assessment revealed anticipated service changes for bus and rail in addition to known congestion bottlenecks and capacity needs. The bicycle and pedestrian assessment focused more on connectivity, network gaps, and constraints. The TDM review focused on programs in place. This information was supplemented by jurisdictional input from the PARC meetings. Collectively, the analyses of influencing factors and modal indicators illuminated the primary issues and needs within the study area and serve as the basis from which the mobility options are derived.

3.2 Existing and New Planning Ideas

An early and ongoing task of the I-66 Multimodal Study has been the development of a list of existing and new planning ideas, referred to as mobility option elements. Section 5 presents the list of mobility option elements. Element types include highway, transit, bicycle/pedestrian, transportation demand management (TDM), and intelligent transportation systems (ITS). Eligible project types included improved transit facilities and/or services (e.g., priority bus, dedicated lane, new service), modifications to highway facilities and/or operating policies (e.g., high occupancy vehicle lanes, high occupancy toll lanes, arterial road widening), intelligent transportation systems (e.g., signal timing optimization and dynamic message signs), intermodal access (e.g., bus bays, bicycle parking, access to transit), ridesharing, and bicycle and pedestrian mobility enhancements (e.g., new trail connectors, on-road facilities, and trail widening). The mobility option elements are closely related to the study area issues and needs, as many of the elements have been previously identified by agencies and jurisdictions to address known transportation deficiencies in the study area.

3.3 Analysis of Influencing Factors

Regional factors influencing travel demand in the study area, including growth patterns, employment and demographic data, the existing and planned highway network, existing and planned transit service, existing and planned bicycle and pedestrian trails and facilities

(excluding basic sidewalks) are described in the following sections. Regional factors are intended to provide greater context – a "big picture" view – of current and future contributing factors that influence travel, specifically in relation to the study area.

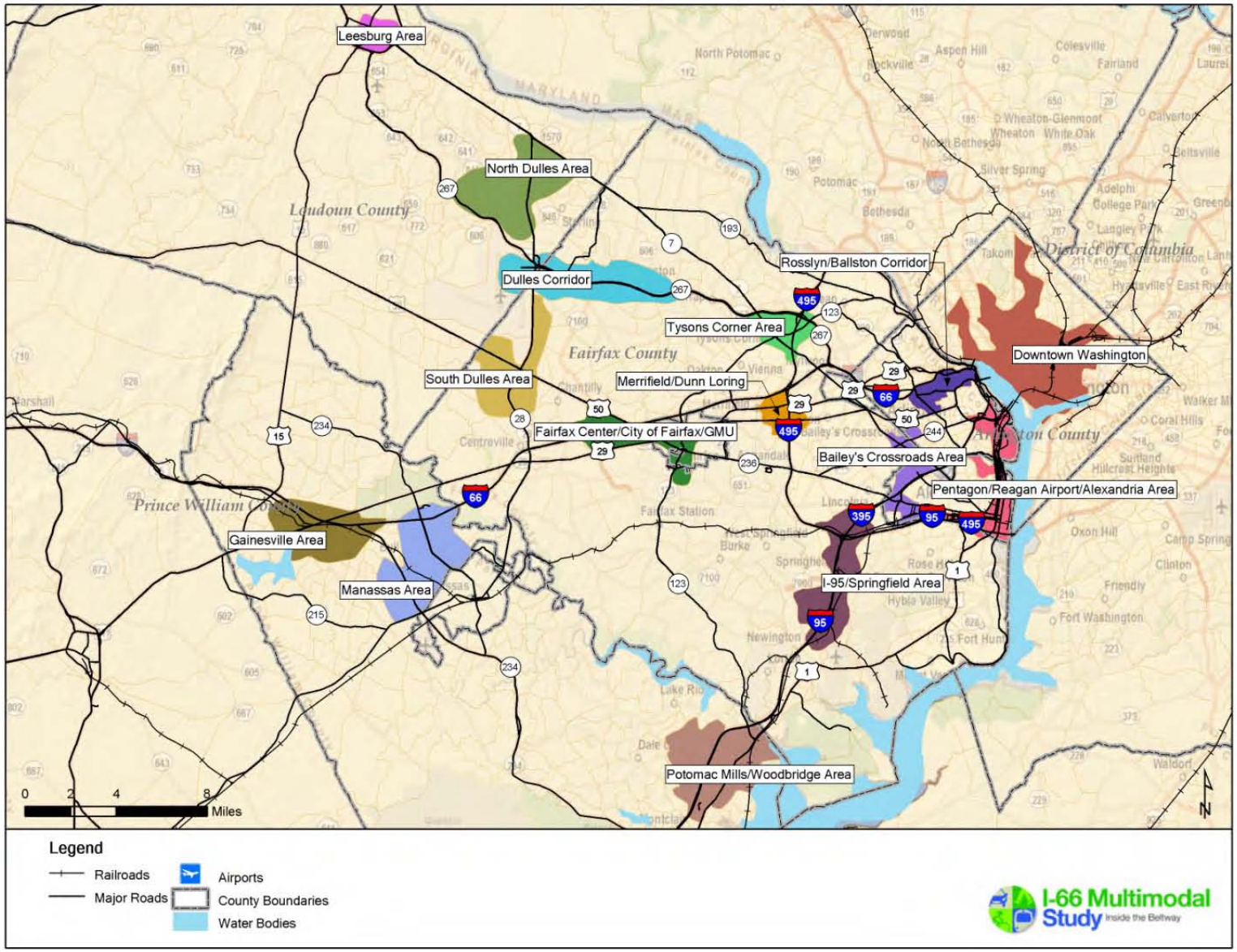
Land Use Component

Anticipated changes in land use and the transportation network and services between 2007 (the validation year for the Metropolitan Washington Council of Governments (MWCOG)/National Capital Region Transportation Planning Board (TPB) Version 2.3 Travel Demand Forecast Model) and 2040 were analyzed to assess the potential influence on travel in the study area. The adopted land use forecast, Round 8.0 Cooperative Forecast, was used as a key input. Analysis of demographic and employment data have been considered for the region as a whole (according to MWCOG regional boundaries) for northern Virginia and the refined study area.

The analysis is consistent with MWCOG's adopted regional policy to guide land use and transportation planning decisions around designated Regional Activity Centers and Clusters. MWCOG developed Regional Activity Clusters[1] (see Figure 3.2) to assist with local and regional planning to increase the amount of employment or housing at targeted locations, which makes these areas more transit-oriented and transit-friendly. For example, according to the 2010 American Community Survey (ACS), the overall mode share for bicycling and walking to work in Arlington County was 1.4 percent and 4.6 percent respectively. In contrast, Virginia's statewide mode share for bicycling and walking was 0.3 percent and 2.7 percent respectively. This increased reliance on nonmotorized transportation is a reflection of dense development patterns taking hold in certain areas of Northern Virginia in addition to a growing network of bicycle and pedestrian facilities, availability of transit opportunities, and regional support for the use of non-automobile modes of travel.

[1] Regional Activity Clusters depict groupings of Regional Activity Centers as well as the concentrations of housing and jobs immediately surrounding the Centers and along major transportation facilities.

Figure 3.2 Regional Activity Clusters as Defined by MWCOG



Growth patterns, in terms of demographic and employment data are key factors that influence travel and are shown in Table 3.1 and Table 3.2.

Currently there are 1.6 million households in the region, with the number of households expected to grow by 646,500, or 40 percent, by 2040. In northern Virginia, there are 650,800 households, representing 40 percent of the region. These households are expected to grow 312,600, or 48 percent, by 2040. All told, household growth in northern Virginia will represent 42 percent of all growth in the region by 2040. In the refined study area, 20,498 households will be added. Current and future household density are shown in Figure 3.3 and Figure 3.4 respectively, and total growth during this time period is shown in Figure 3.5.

The 2.8 million jobs in the region are expected to expand by 1.2 million, or 45 percent, to 4.0 million by 2040. In northern Virginia alone, there are currently 1.0 million jobs, representing 37 percent of jobs in the region. The number of jobs is expected to grow by 643,400, or 63 percent, by 2040. In total, employment growth in northern Virginia will represent 41 percent of all growth in the region by 2040. In the refined study area 39,400 jobs will be added. Current and future employment density are shown in Figure 3.6 and Figure 3.7 respectively, and total growth during this time period is shown in Figure 3.8.

Table 3.1 Current Land Use (2007)

	Households	Employment
Region	1,626,600	2,768,200
Northern Virginia	650,800	1,018,500
Refined Study Area	75,400	151,900

Table 3.2 Future Land Use (2040)

	Households	Percent Growth	Employment	Percent Growth
Region	2,273,100	40%	4,011,800	45%
Northern Virginia	963,500	48%	1,661,900	63%
Refined Study Area	95,700	27%	206,700	36%

Figure 3.3 Current Household Density (2007)

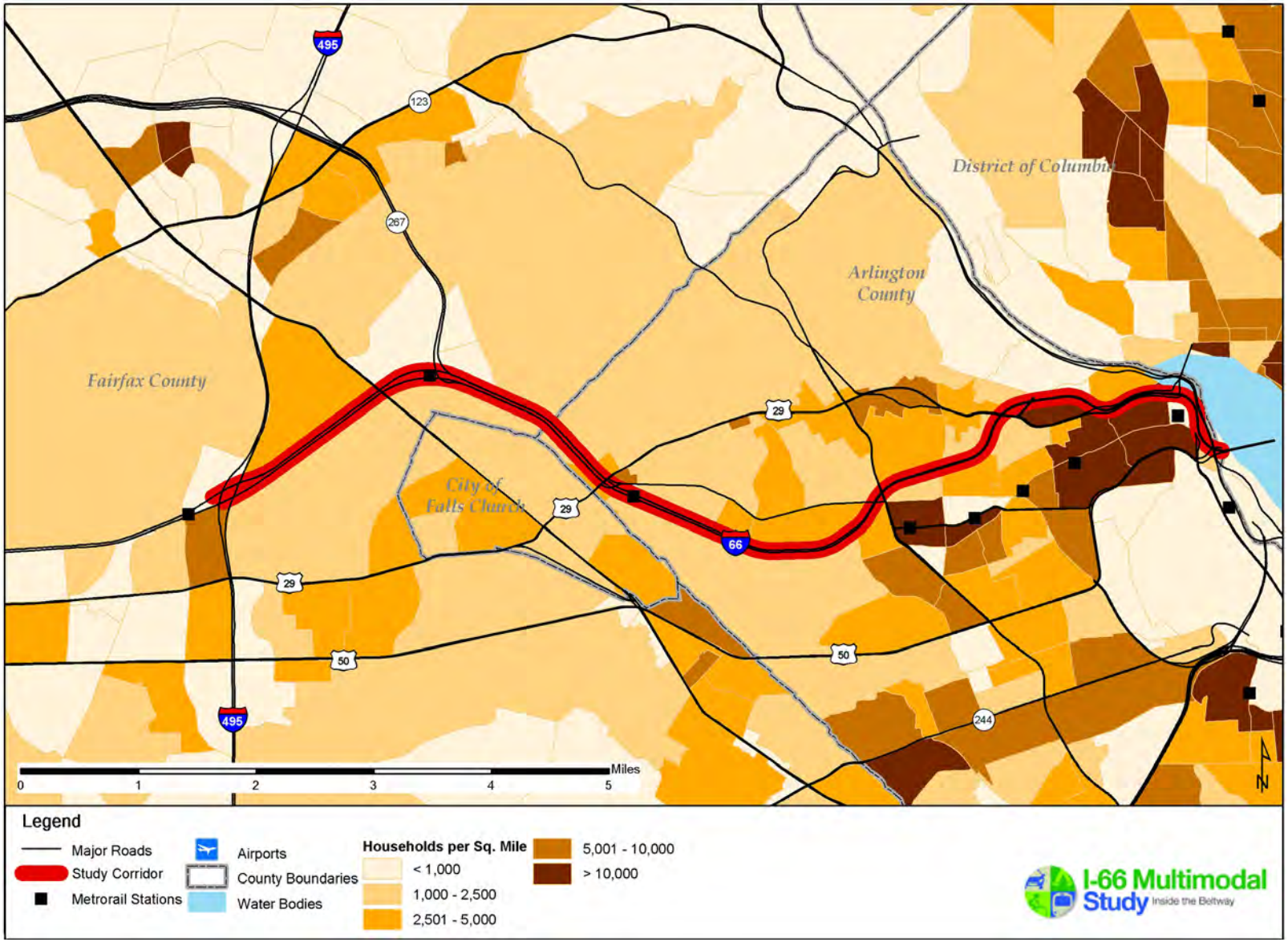


Figure 3.4 Future Household Density (2040)

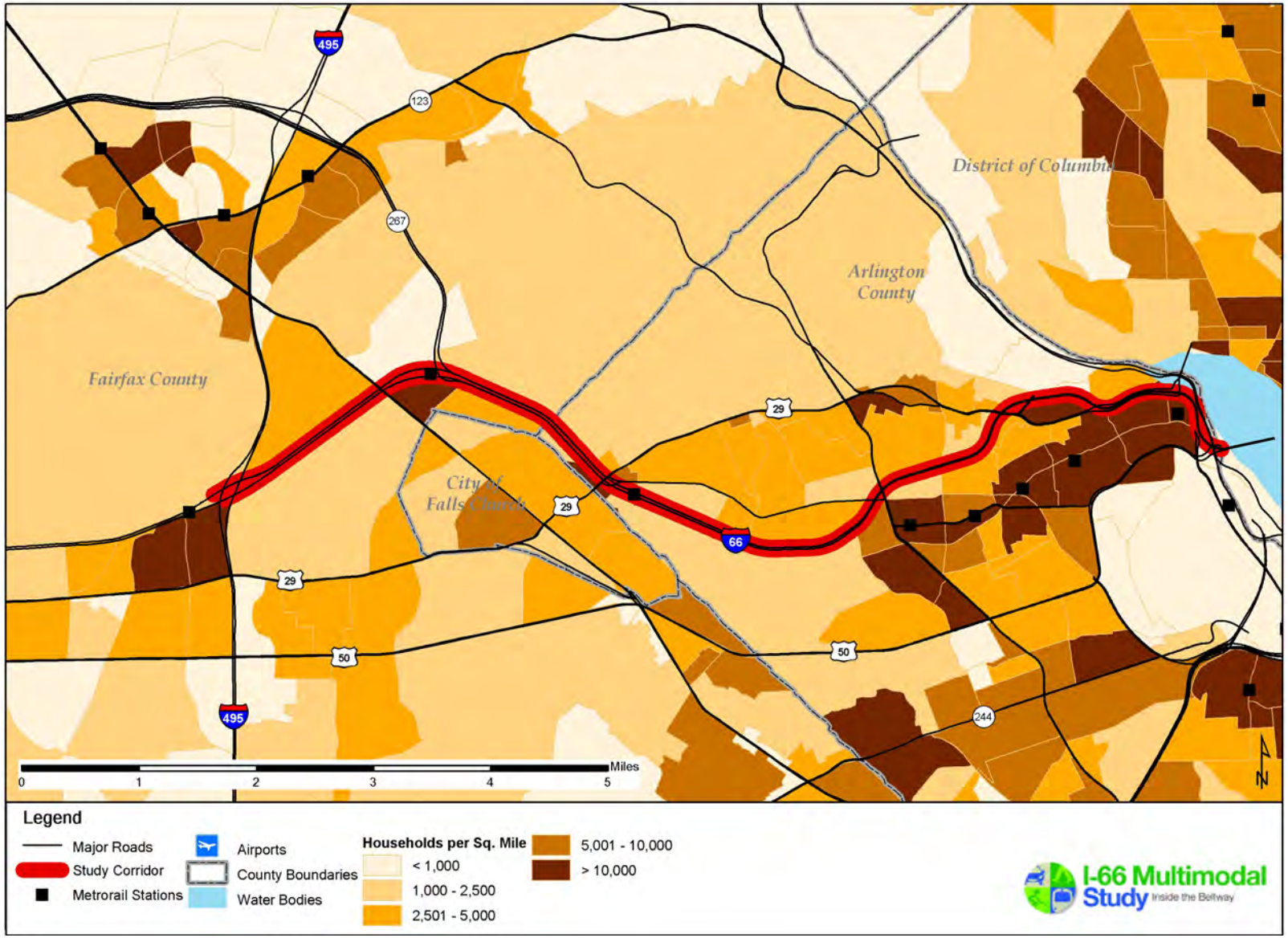


Figure 3.5 Change in Household Density (2007-2040)

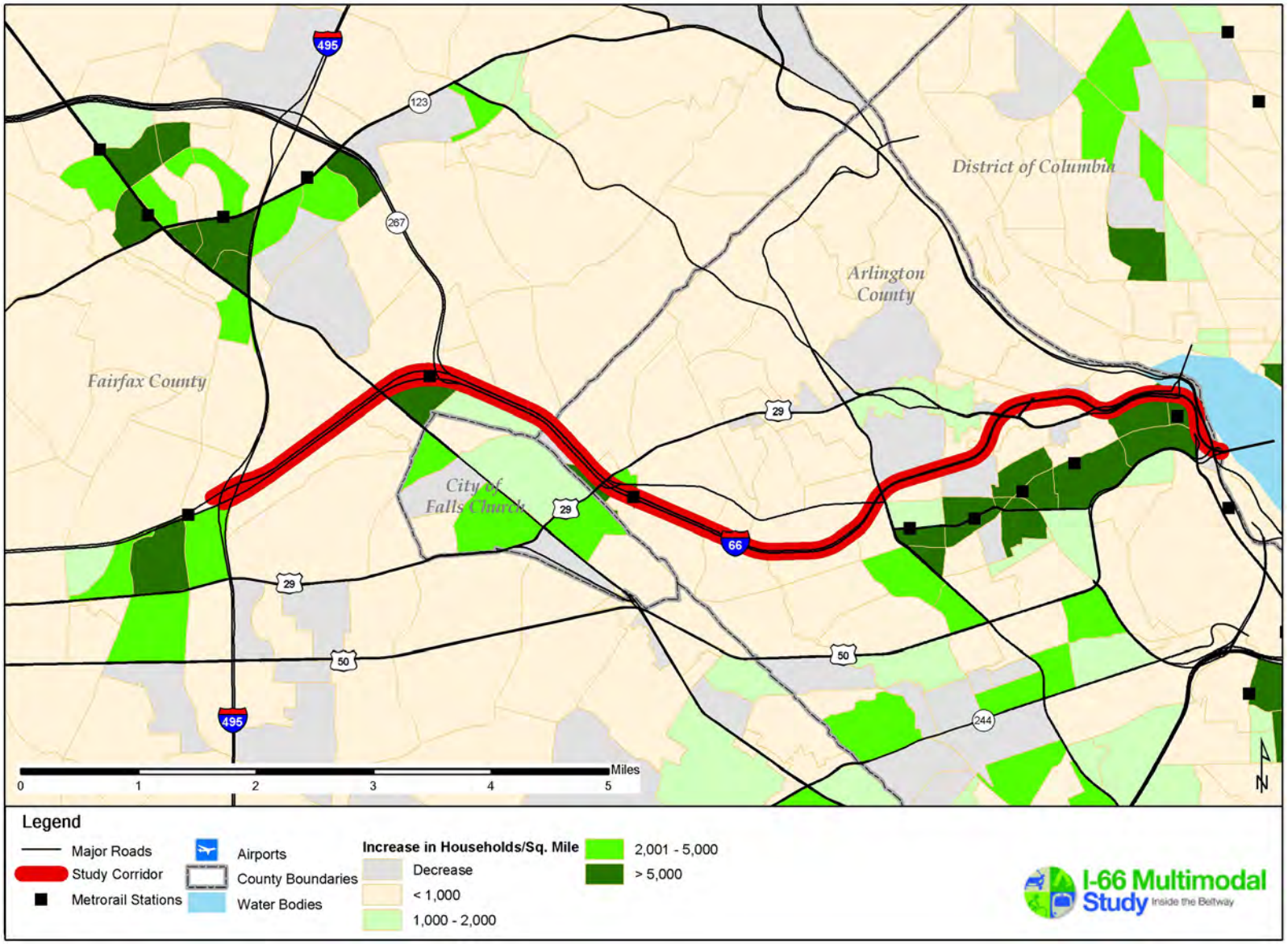


Figure 3.6 Current Employment Density (2007)

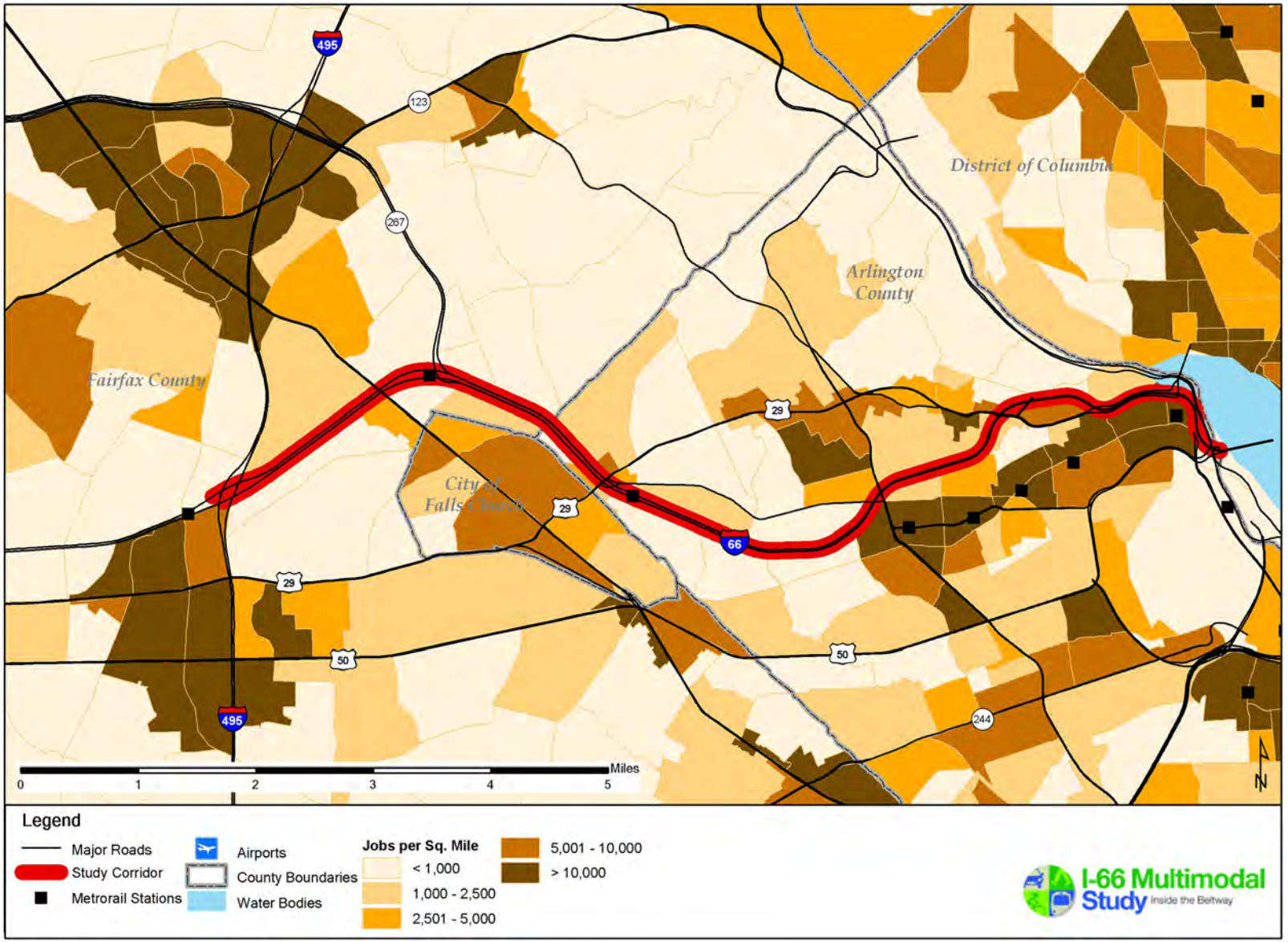


Figure 3.7 Future Employment Density (2040)

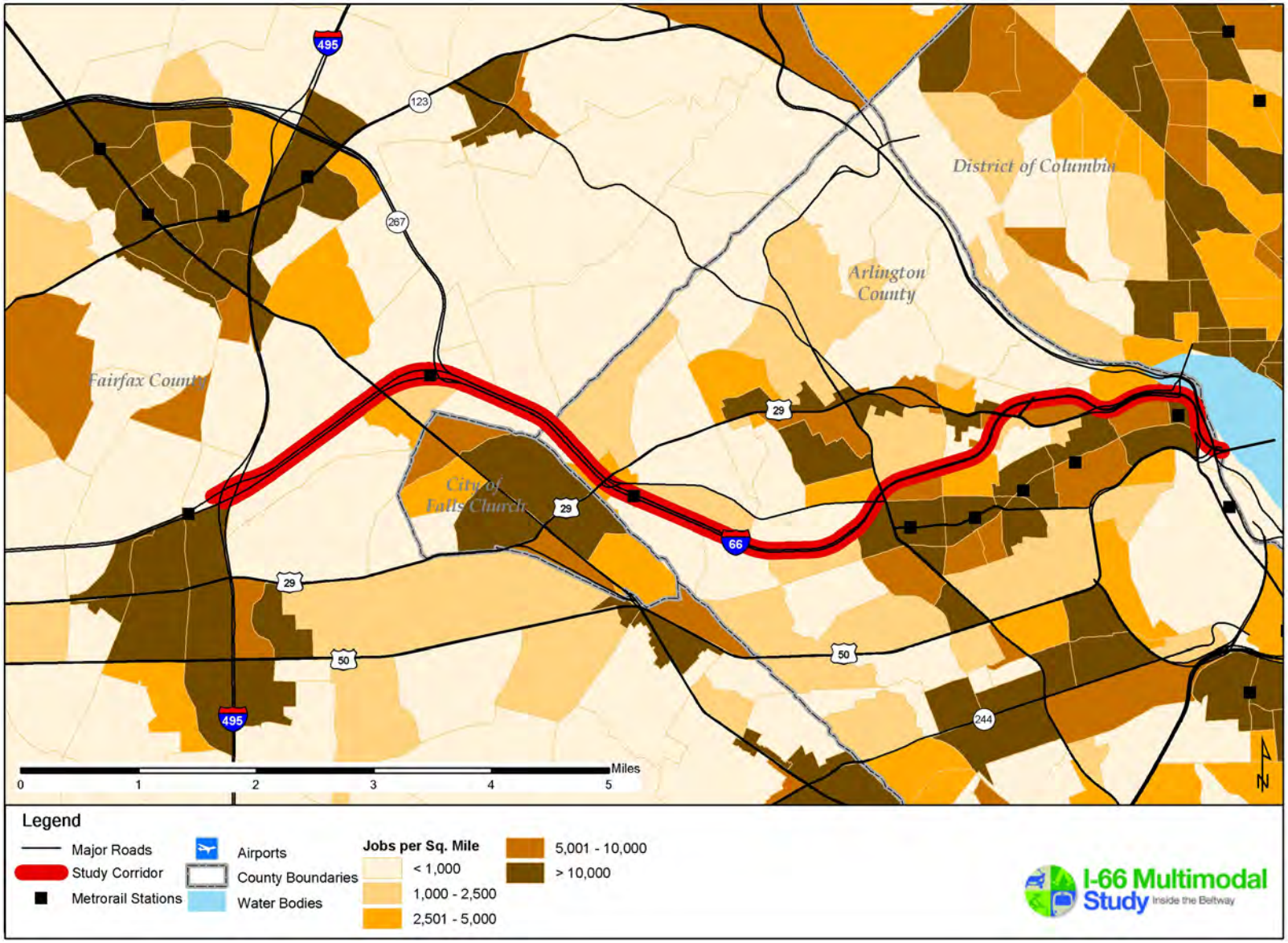
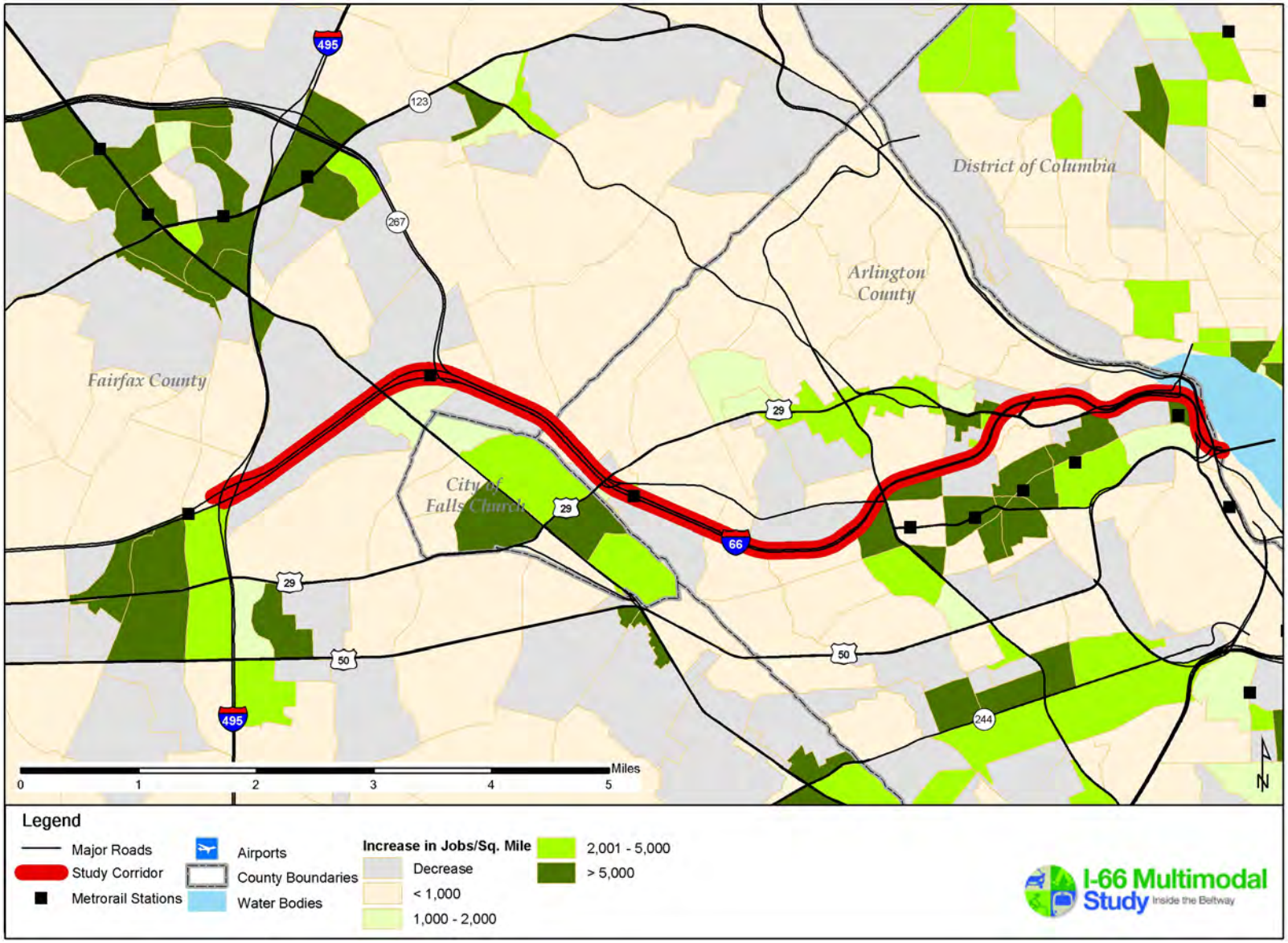


Figure 3.8 Change in Employment Density (2007-2040)



Roadway Component

The roadway component of the analysis focused on expected changes to the existing roadway transportation network. This analysis drew from the compilation of roadway mobility option elements (detailed further in Section 5). Planned roadway projects were grouped as follows:

- Highway widening/ Reconstruction;
- Traffic operations/ Safety/ Transportation Systems Management (TSM);
- Other (e.g., lighting); and
- Intelligent Transportation Systems (ITS).

Other major roadway network changes, principally the Capital Beltway High Occupancy Toll (HOT) Lanes, were also considered. In addition, consideration was given to potential operational policy changes such as changes to High Occupancy Vehicle (HOV) hours, occupancy requirements, and lane restrictions as well as the current hybrid exemption to HOV requirements in terms of the potential impact on roadway travel in the study area.

Roadway Network Changes

Figure 3.9 depicts projects under construction, funded, or planned that are located inside the Beltway. This analysis was developed to highlight the planned roadway network changes. Continuous projects that cross the Beltway are also shown. A key to identifying the projects in Figure 3.9 is shown in Table 3.3.

Figure 3.9 Potential Future Roadway Network Changes

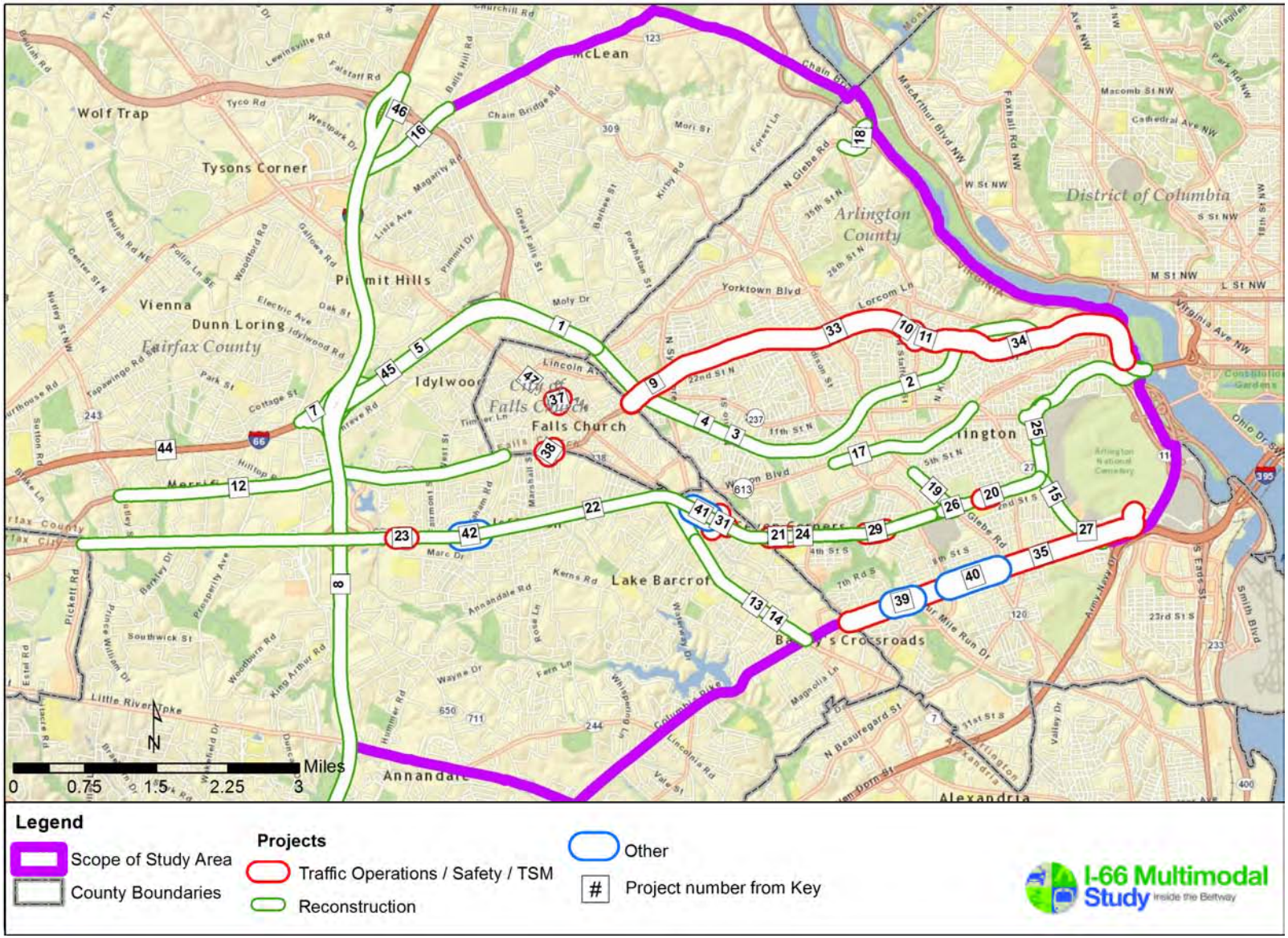


Table 3.3 Key to Figure 3.9

		PROJECT OVERVIEW			LOCATION			PROJECT DETAILS			
		Project Name	Description	Type of Improvement	Location	From/At (Starting Point of Facility Location)	To Ending Point of Facility Location)	# of Lanes (From)	# of Lanes (To)	Is Element in CLRP?	Source Plan
HIGHWAY WIDENING/RECONSTRUCTION	1	I-66 WB Spot Improvements	Construction of WB Auxiliary Lane on I-66 in Arlington County at three different locations	Widening/ New Construction	I-66	0.111 Mi. E. of Westmoreland St (Rt 693)	0.211 Mi. W. of Haycock Rd (Rt 703)	2	3	Yes	VDOT Six Year Improvement Plan
	2					0.095 Mi. W. of Lee Highway (Rt. 29)	0.045 Mi. E. of Glebe Rd (Rt. 120)	2	3	Yes	
	3					0.0692 Mi. E. of Gorge Mason Drive	0.097 Mi. E. of Sycamore Street	3	4	Yes	
	4	I-66 Widening	Part of the 2035 Virginia Surface Transportation Plan's recommendations to existing facilities identified for further study	Widen	I-66	Fairfax Arlington County Line	DC District Line	4	4	No	2035 Virginia Surface Transportation Plan
	5			Widen	I-66	I-495	Fairfax Arlington County Line	4	6	No	
	7	1-66/1-495 Interchange HOT Lanes	Reconstruction of I-66's Interchange with the Capital Beltway (I-495); Access Improvements & Flyover	Reconstruction - Widening and Expansion	I-66	East of I-66/495 Interchange	West of I-66/495 Interchange	4/6	4/6	Yes	VDOT Six Year Improvement Plan

Table 3.3 Key to Figure 3.9 (continued)

		PROJECT OVERVIEW			LOCATION			PROJECT DETAILS			
		Project Name	Description	Type of Improvement	Location	From/At (Starting Point of Facility Location)	To Ending Point of Facility Location)	# of Lanes (From)	# of Lanes (To)	Is Element in CLRP?	Source Plan
HIGHWAY WIDENING/RECONSTRUCTION	8	I-495 HOT Lanes	Fourteen miles of new HOT lanes (two in each direction) on I-495 between the Springfield Interchange and just north of the Dulles Toll Road.	Widening	I-495	I-395/ Springfield Interchange	North of VA-267/ Georgetown Pike (Rt. 193)	10	14	Yes	VA Mega Projects
	9	Lee Highway Widening	Widen Lee Hwy at various locations	Widening	US 29	ECL Falls church CL	Sycamore Street	4	4	No	2035 Virginia Surface Transportation Plan
	10			Widening	US 29	Rt 309 N	Rt 309 S	4	6	No	
	11			Widening	US 29	Rt 309 S	Kenmore St	6	6	No	
	12			Widening	US-29	Rt 243	WCL Falls Church	4	6	No	
	13/ 14	Leesburg Pike Widening	Widen the existing Leesburg Pike between Seven Corners and Bailey's Crossroads	Widening	Rt 7	Seven Corners	Bailey's Crossroads	4	6	Yes	
	15	Washington Boulevard Widening	Widen the existing Washington Boulevard between Rt 50 and Columbia Pike (South)	Widening	Rt 27	Rt 50	Rt 244 South	4	6	No	

Table 3.3 Key to Figure 3.9 (continued)

		PROJECT OVERVIEW			LOCATION			PROJECT DETAILS			
		Project Name	Description	Type of Improvement	Location	From/At (Starting Point of Facility Location)	To Ending Point of Facility Location)	# of Lanes (From)	# of Lanes (To)	Is Element in CLRP?	Source Plan
HIGHWAY WIDENING/RECONSTRUCTION	16	VA 123 (Dolley Madison Blvd.) Widening	Widen existing Dolley Madison Blvd. from 4-lane roadway to a 6/8-lane roadway, between I-495 & Great Falls St; and implement safety and operational improvements, as necessary.	Widening/ Reconstruction	Rt 123	I-495	VA 694 (Great Falls St.)	4	6	No	TransAction 2030
	17	Wilson Blvd. Improvements	Construct any additional through lanes, turning lanes, and pedestrian facilities to improve safety along Wilson Blvd between Frederick Street & Washington Blvd.	Widening/ Reconstruction	Wilson Blvd	N. Frederick	Washington Blvd.	4/6	6	Yes	
	18	North Glebe Road Widening	Widen the existing North Glebe Road between Rt 123 and Military Road (lane width, etc.)	Widening	Rt 120	Rt 123	Military Rd	4	4	No	2035 Virginia Surface Transportation Plan
	19		Widen the existing North Glebe Road between Henderson Road and Rt 50	Widening	Rt 120	Henderson	Rt 50	4	6	No	
	20	Arlington Boulevard (US 50) Improvements	Widen the existing Arlington Boulevard between Rt 120 and Rt 27	Widening	US 50	Rt 120	Rt 27	6	6	No	
	21		Widen the existing Arlington Boulevard between East of Fairfax County Line and Rt 27		US 50	ECL Fairfax	Rt 27	6	6	No	

Table 3.3 Key to Figure 3.9 (continued)

		PROJECT OVERVIEW			LOCATION			PROJECT DETAILS			
		Project Name	Description	Type of Improvement	Location	From/At (Starting Point of Facility Location)	To Ending Point of Facility Location)	# of Lanes (From)	# of Lanes (To)	Is Element in CLRP?	Source Plan
HIGHWAY WIDENING/RECONSTRUCTION	22	Arlington Boulevard (US 50) Improvements	Widen Rt 50 between ECL City of Fairfax and Arlington County Line; Extend Left Turn Lane and Implement safety improvements as needed at the intersection of Jaguar Trail:	Widening	US 50	ECL City of Fairfax	Arlington County Line	4	6	Yes	2035 Virginia Surface Transportation Plan
	23			Reconstruction		At VA 2338 Jaguar Trail	-	-	-		VDOT Six Year Improvement Plan
	24	US 50 Limited Access	Improve safety of US 50 in Arlington County by upgrading it to a limited access highway via proposed interchange and intersection improvements.	Reconstruction	US 50	Fairfax County Line	The District of Columbia	6	6	Yes	TransAction 2030
	25	Reconstruction of the interchanges around Courthouse Road and 10th Street North	Address some of the existing concerns about vehicular safety, discontinuity of the parallel bicycle/pedestrian trail and motor vehicle access at Rt 50, 10th St & Courthouse Rd interchanges	Reconstruction : Safety/Traffic Operations/TSM	US 50	0.223 Mi. E of Int. Rt 50 & Rt 237	0.424 Mi. W of int. Rt. 237 (10th St.)	5	6	Yes	VDOT Six Year Improvement Plan
	26	Glebe Road/Rt 120 & Rt 50 Bridge Interchange Improvement and Replacement	Replace and widen Glebe Road Bridge over Route 50 with a new span which is about 27 feet wider than the current bridge.	Reconstruction /Widening	Rt 120	US-50	Rt. 120 & Rt. 50	4	4	Yes	
			Glebe Road/Rt 120 & Rt 50 Bridge Interchange Improvement			0.14 Mi. S of Rt 50	0.8 Mi. N of Rt 50				

Table 3.3 Key to Figure 3.9 (continued)

		PROJECT OVERVIEW			LOCATION			PROJECT DETAILS			
		Project Name	Description	Type of Improvement	Location	From/At (Starting Point of Facility Location)	To Ending Point of Facility Location)	# of Lanes (From)	# of Lanes (To)	Is Element in CLRP?	Source Plan
	27	Washington Boulevard & Columbia Pike Intersection Improvements	Reconstruct interchange at Columbia Pike.	Reconstruction	Rt 27	North of I 395	North of VA 244	6	6	Yes	TransAction 2030
TRAFFIC OPERATIONS/ SAFETY/TSM	28	Install Curb & Gutter, Sidewalk & Upgrade Signal on US 50	Install Curb & Gutter, Sidewalk & Upgrade Signal at US 50 & Irving St. intersection; and US 50 & Park Dr intersection	Safety/Traffic Operations/ TSM	US 50	Irving St.	500' away from intersection	6	6	No	VDOT Six Year Improvement Plan
	29					Park Dr	500' away from intersection	6	6	No	
	30	Intersection Redesign Rt 50 & Manchester St	Redesign Intersection at Rt 50 & Manchester St	Safety/Traffic Operations/ TSM	US 50	Rt 50 & Manchester	-	6	6	No	
	31	Intersection Improvements at Rt 50 & Patrick Henry Dr	Implement Intersection Improvements at Rt 50 & Patrick Henry Dr	Safety/Traffic Operations/ TSM	US 50	0.2 Mil W of Patrick Henry Dr	0.04 Mi. E of Patrick Henry Dr.	6	6	No	
	32	Five Points Intersection Improvements	Implement safety improvements at five points intersection in Arlington County	Safety	US 29	At Old Dominion (Rt 309) and Lee Hwy (Rt 29)	-	4	4	No	
	33	Sign, Markings, Crosswalks and Signal Upgrade on Lee Hwy	Upgrade Signs, Markings, Crosswalks and Signals on Lee hwy	Safety/Traffic Operations/ TSM	Rt 29	-	-	4/6	4/6	No	
	34	Rt 29 Signal Pre-Emption Emergency Vehicles	Pre-Empt Signal for Emergency Vehicles from Falls Church to Rosslyn	Safety/Traffic Operations/ TSM	US 29	Falls Church Corp.	Rosslyn Metro Station	4/6	4/6	No	

Table 3.3 Key to Figure 3.9 (continued)

		PROJECT OVERVIEW			LOCATION			PROJECT DETAILS			
		Project Name	Description	Type of Improvement	Location	From/At (Starting Point of Facility Location)	To Ending Point of Facility Location)	# of Lanes (From)	# of Lanes (To)	Is Element in CLRP?	Source Plan
TRAFFIC OPERATIONS/ SAFETY/TSM	35	VA 244 (Columbia Pike) Signal Prioritization	Provide safety improvements and signal prioritization with SCOOT technology for buses and emergency vehicles, along the Columbia Pike Corridor	Operations	Rt 244	Fairfax County Line	Southgate Rd.	4	4	Yes	TransAction 2030
	36	Signal Upgrade at 5 Major Arterials in Arlington	Upgrade signals at 5 Major Arterials in Arlington along Wilson Blvd & Clarendon Blvd	Safety/Traffic Operations/ TSM	Wilson Blvd, Clarendon Blvd	Various locations	-	-	-	No	
	37	Signal Installation: City of Falls Church	Install a traffic signal for vehicular and pedestrian circulation at the West Broad Street and Pennsylvania Avenue	Traffic Management	City of Falls Church	West Broad Street & Pennsylvania St	-	-	-	No	City of Falls Church Capital Improvement Program
	38		Install Traffic Signal for vehicular and pedestrian circulation at the Washington Street/Maple Avenue intersections and will construct associated roadway improvements	Traffic Management	City of Falls Church	Washington St & Maple Ave	-	-	-	No	
OTHER	39	Columbia Pike Roadway Lighting	Install Roadway lighting along Columbia Pike	Safety/Traffic Operations/ TSM	Rt 244	S Dinwiddie St	S Buchanan St	4	4	No	VDOT Six Year Improvement Plan
	40			Safety/Traffic Operations/ TSM	Rt 244	George Mason Drive	Glebe Road	4	4	No	
	41	Roadway Lighting On Rt 50	Install roadway lighting along Arlington Blvd	Safety/Traffic Operations/ TSM	US 50	0.25 Mi. W of Patrick Henry Dr	0.1 Mi. W of Patrick Henry Dr	6	6	No	

Table 3.3 Key to Figure 3.9 (continued)

		PROJECT OVERVIEW			LOCATION			PROJECT DETAILS			
		Project Name	Description	Type of Improvement	Location	From/At (Starting Point of Facility Location)	To Ending Point of Facility Location)	# of Lanes (From)	# of Lanes (To)	Is Element in CLRP?	Implementing Agency
ITS	42	Roadway Lighting On Rt 50				At Graham Rd	-	4	4	No	VDOT Six Year Improvement Plan
	43	Roadbed Assessment and Reconstruction;	Roadbed reconstruction program / comprehensive survey to core sampling of City streets to identify deficiencies	Reconstruction	City of Falls Church	Various locations across the city	-	-	-	No	City of Falls Church Capital Improvement Program
	44	I-66 Active Traffic Management (ATM)	Provide Enhanced Mobility and Safety along I66 between US 15 and DC Line	Lane / Shoulder Controls, CCTV, Ramp Metering, Incident Management /Emergency Pulloff Areas	I-66	DC Line	US 15	4/6	Variable	No	VDOT Six Year Improvement Plan
	45	VDOT NRO DMS Upgrades (Phase IA)	Safety, Traffic Operations, and Transportation Systems Management	Operations	I-66	Arlington County Line	I-495	4/6	4/6	No	
	46	VA 267 (Dulles Toll Road) Safety, Operational, and Toll Collection Improvements	Implement safety, operational, and toll collection improvements, as necessary. Ongoing upgrade of ITS transportation management system technology;	Widening and Operations	VA-267	I-66	Route 28	6	8	No	TransAction 2030
	47	VA 7 Signal Optimization	Signal Timing Optimization along VA 7	-	-	-	-	-	-	No	2035 Virginia Surface Transportation Plan

Capital Beltway High Occupancy Toll Lanes

The I-495/Capital Beltway HOT lanes project will build 14 miles of HOT lanes (two in each direction) on I-495 between the Springfield Interchange and north of the Dulles Toll Road. When completed, buses, carpools, and vanpools with three or more people can use the lanes for free; non-HOV vehicles can choose to pay a toll or use the general purpose lanes on I-495. The tolls will change as traffic conditions change, keeping the HOT lanes congestion free.

Operational Policy Changes

There are a number of potential operational policy changes that need to be considered when exploring future travel in the corridor, including changes to the existing HOV hours, occupancy requirements, and lane restrictions (shown in Table 3.4). For example, a policy change to HOV 3+ inside the Beltway would restrict travel on I-66 to vehicles with three occupants. The hybrid exemption allows hybrid vehicles with clean fuel plates issued before July 1, 2011 to travel in the HOV lanes on I-66 during rush hour with one occupant. This exemption is not guaranteed in the future, but may be renewed as it is set to expire June 30, 2012.

Table 3.4 Northern Virginia HOV Lane Policies – Current HOV Restrictions

Facility	Restrictions	Limits	Hours of Operation	
I-66 Inside the Beltway	HOV 2+	Capital Beltway (I-495) to Rosslyn (Lynn Street)	Eastbound	6:30 AM to 9:00 AM
			Westbound	4:00 PM to 6:30 PM
I-66 Outside the Beltway	HOV 2+	U.S. Route 29 in Prince William County to Capital Beltway (I-495)	Eastbound	5:30 AM to 9:30 AM
			Westbound	3:00 PM to 7:00 PM
I-395/I-95	HOV 3+	Pentagon (Eads Street) to Dumfries	Northbound	6:00 AM to 9:00 PM
			Southbound	3:30 PM to 6:00 PM
Dulles Toll Road	HOV 2+	Route 28 to Spring Hill Road	Eastbound	6:30 AM to 9:00 AM
			Westbound	4:00 PM to 6:30 PM

Planned changes to HOV restrictions identified in the 2010 CLRP for the year 2040 are:

- HOT Lanes on I-95;
- HOV 3+ for I-66 and Dulles Toll Road; and
- I-495 Capital Beltway HOT Lanes.

HOV enforcement is an issue that many state DOTs and law enforcement agencies are working to address. Enforcement of HOV violators is handled by the Virginia State Police (VSP). VDOT and the VSP have been working together to increase enforcement in the I-66 corridor since 2003, when a task force was established to address the high violation rates on the facility. The task force released a report that specifically addressed the issue related to HOV enforcement on the I-66 corridor, I-95 and I-395. Many issues identified by the task force have been resolved, but there continues to be a significant number of non-HOV users on the facility on a daily basis.

A recent empirical study was performed by Smith and Yook[2] about the impact of enforcement on HOV occupancy violation. This study, in addition to evaluating the impacts of saturation enforcement, compared the rate of HOV violation as observed by the study team and actual citations issued by the VSP for HOV violations. Saturation enforcement is defined as a concerted effort in which a large number of enforcement personnel are dedicated to HOV enforcement. The study findings concluded that there is a low chance for a violator to be issued a citation, even on days when saturation enforcement was in effect. The study also concluded that there is no technology available today that completely supports automated occupancy enforcement and VDOT should continue to use manual enforcement. For the I-66 corridor this is especially relevant because most of the enforcement along I-66 inside the beltway is performed manually at off ramps from I-66.

It is important to protect the timesaving benefits HOV lanes provide as increasing HOV violations result in lanes becoming congested, slowing legitimate HOV users and transit vehicles in the corridor. Given the critical role that Northern Virginia's HOV network serves, *use of I-66 by non-HOV users during HOV operation hours* has been identified as one of the issues and needs as part of the I-66 Multimodal Study.

Transit Component

The transit component of the analysis of regional factors influencing travel demand within the study corridor examined existing and planned transit service frequencies. The purpose of the transit service frequency analysis was two-fold: 1) to inventory existing service frequencies; and 2) to determine any notable changes between 2007 and 2040 that may influence travel in the study area. This analysis primarily utilized the 2040 CLRP model inputs associated with the MWCOG/TPB Version 2.3 travel demand forecast model to examine changes in transit service frequencies between 2007 and 2040. The 2007 and 2040 data for service frequency included the number of buses or trains per hour during the morning peak period. Transit service was broken out for inbound and outbound bus and rail services to examine changes in service frequencies by submode.[3]

Since the data represents service frequencies during the morning peak period, transit vehicles traveling in the inbound direction capture travel in the peak direction, while those traveling in the outbound direction capture the "reverse commute." With regard to the methodology of displaying service frequency data in the maps, the model inputs include multiple transit routes that overlap for parts of the road segments. Thus, the numbers of vehicles per hour represent the sum of all the routes that travel on the particular segments.

Figures 3.10 and 3.11 show the service frequencies of express or commuter buses traveling in the peak direction during the morning peak period in 2007 and 2040, respectively. In 2007, the frequency of inbound express buses on the Dulles Connector Road to West Falls Church is

[2] Brian Smith and Donghyung Yook, "Investigation of Enforcement Techniques and Technologies to Support High-Occupancy Vehicle and High-Occupancy Toll Operations", VTRC Report, VTRC 10-CR1, September 2009.

[3] The model provided rail data for Metrorail, commuter trains, and light rail transit (only applicable in 2040). The rail data was grouped together since the majority of it represented Metrorail service, which is the primary type of rail service within the study area.

more than twice that of buses traveling on I-66 inside the Beltway. Frequencies are more comparable in 2040 when the number of express buses decreases as a result of the Silver Metrorail Line providing service. Another notable change is the increase of express buses to Tysons Corner from the south, much of which is new service to Tysons along the Beltway HOT lanes.

Figure 3.10 Express Bus Inbound (2007)

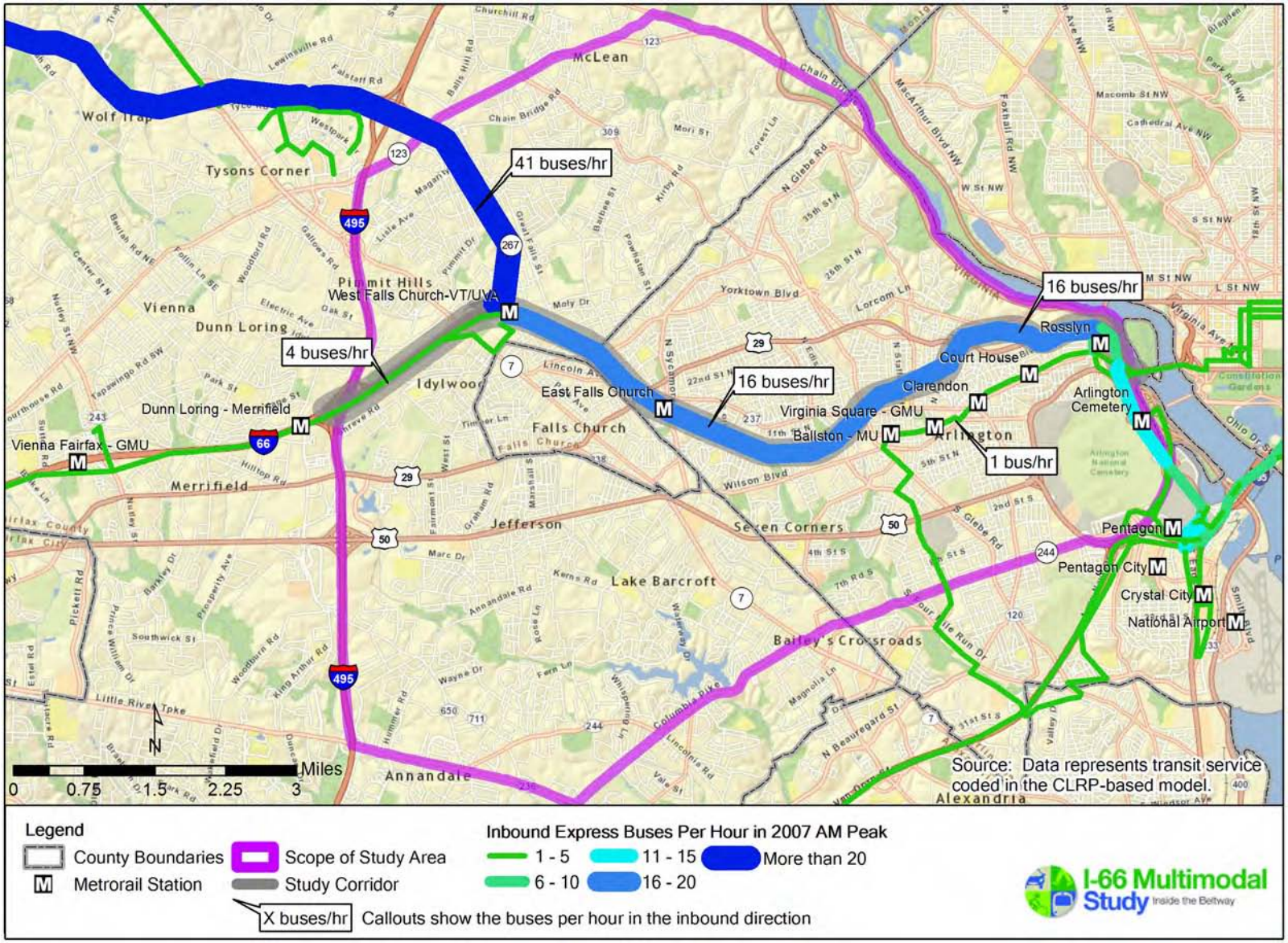
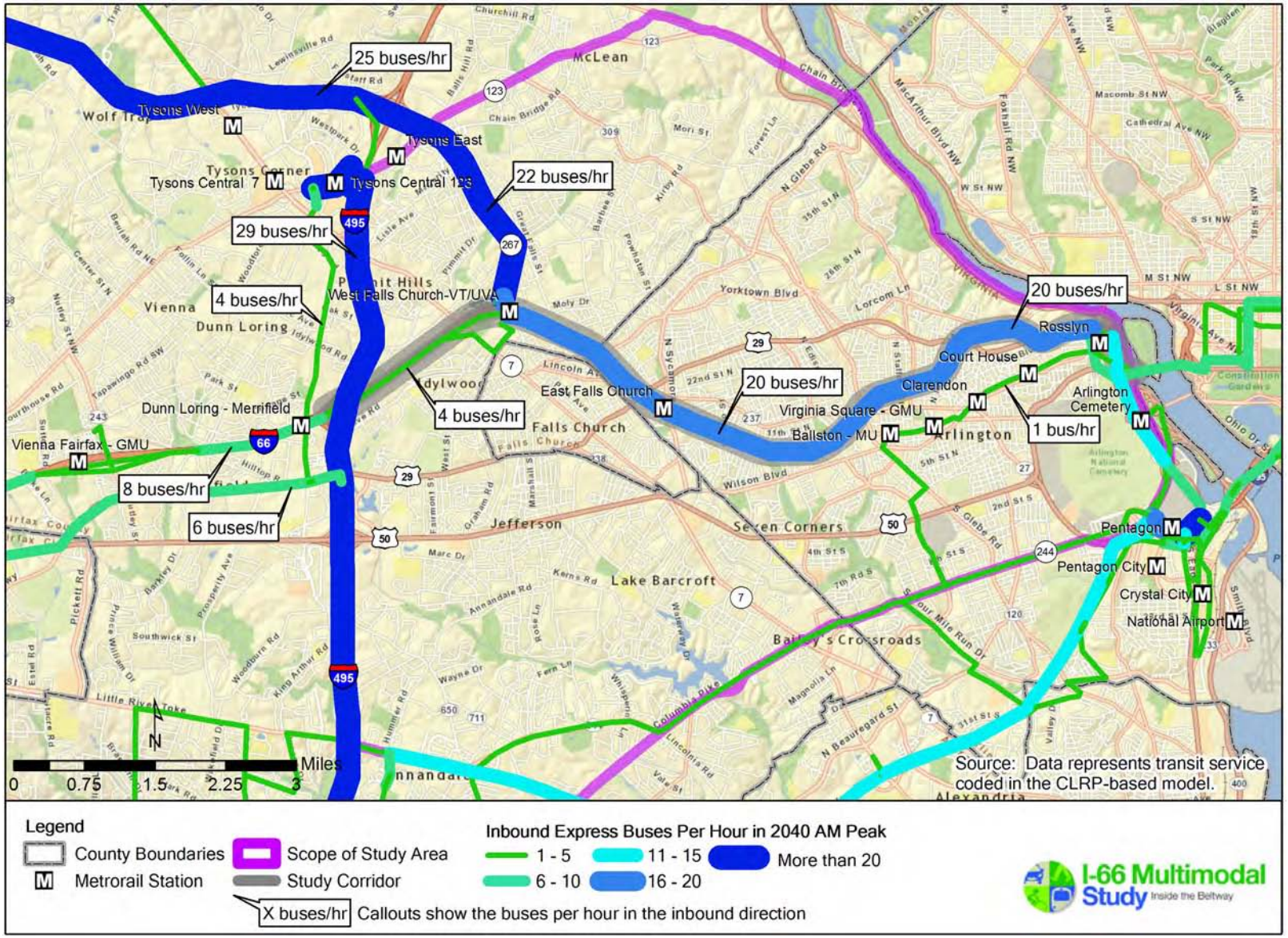


Figure 3.11 Express Bus Inbound (2040)



Figures 3.12 and 3.13 display the service frequencies of express buses providing the reverse commute during the morning peak period in 2007 and 2040, respectively. As would be expected, in both 2007 and 2040, the frequencies of outbound express buses are significantly lower than in the inbound direction, indicating that little outbound express service is operated in the morning peak period. Figure 3.13 indicates that the frequency of outbound express buses also decreases significantly along the Dulles Connector Road in 2040, due to the availability of the Silver Line, while the frequencies along I-66 inside the Beltway increase minimally.

Figure 3.12 Express Bus Outbound (2007)

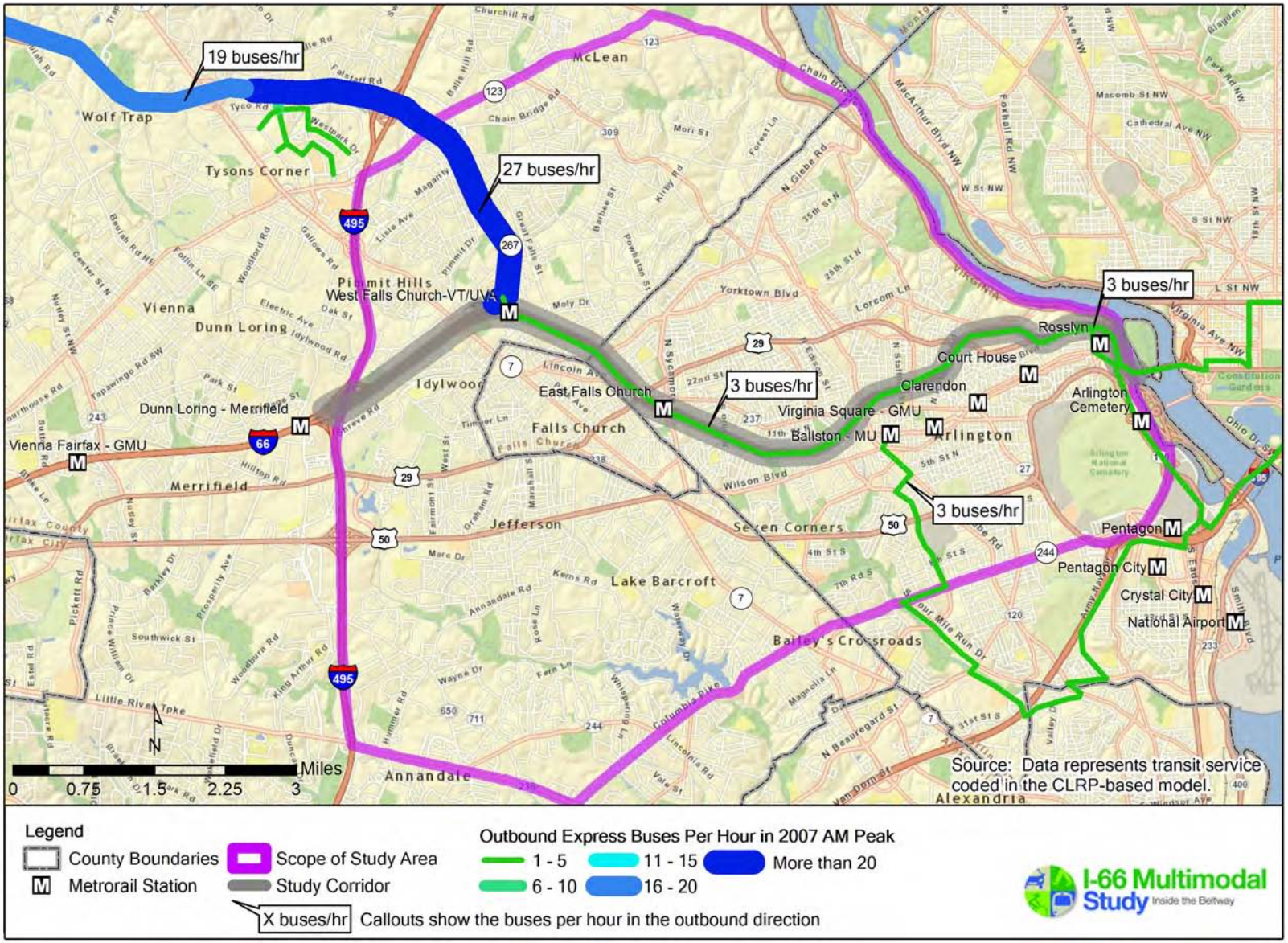
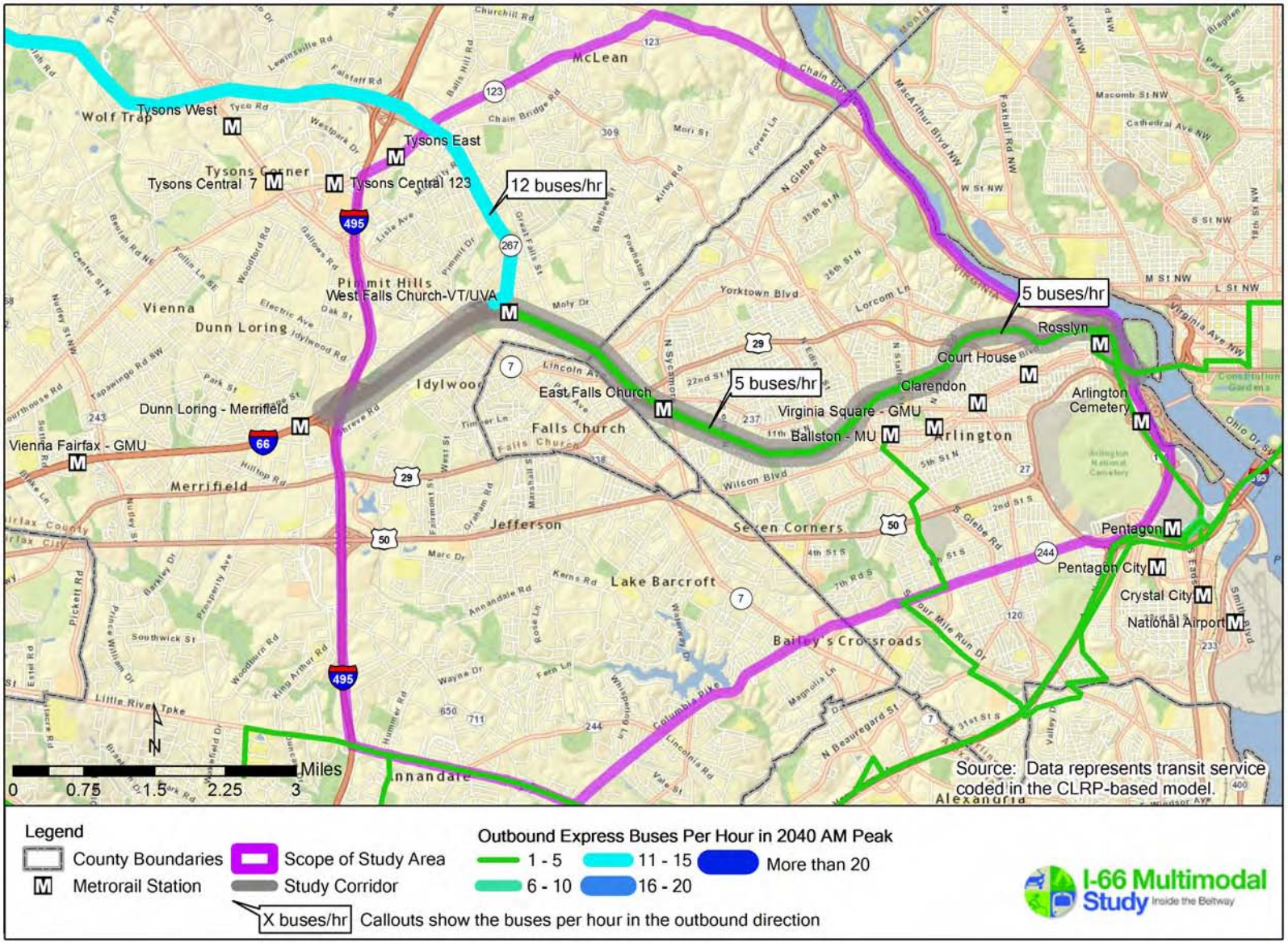


Figure 3.13 Express Bus Outbound (2040)



The number of inbound local buses per hour in 2007 and 2040 is portrayed in Figures 3.14 and 3.15, respectively. Both maps indicate that the highest frequencies of inbound local buses are found near Metrorail stations, including East Falls Church and Ballston – MU, and along U.S. 29 near the Rosslyn – Ballston Corridor. In 2040, the frequencies of local inbound buses generally do not change significantly. The exceptions are in the Rosslyn – Ballston Corridor (Wilson Boulevard) and along Glebe Road, where the frequencies more than double, and a modest increase in frequencies at the Westpark Transit Center and the new Tysons Central 123 Metrorail Station in Tysons Corner. Figure 3.15 also indicates new local bus service inbound to Tysons Corner that mirrors the new express bus service, discussed previously, and reflects the future growth of Tysons Corner as a regional destination. The frequencies of outbound local bus services in 2007 and 2040 are similar to those of inbound local bus services. The frequencies of outbound local buses do not change considerably between 2007 and 2040, with similar exceptions of increased frequencies in 2040 along the Rosslyn – Ballston Corridor and along Glebe Road.

Figure 3.14 Local Bus Inbound (2007)

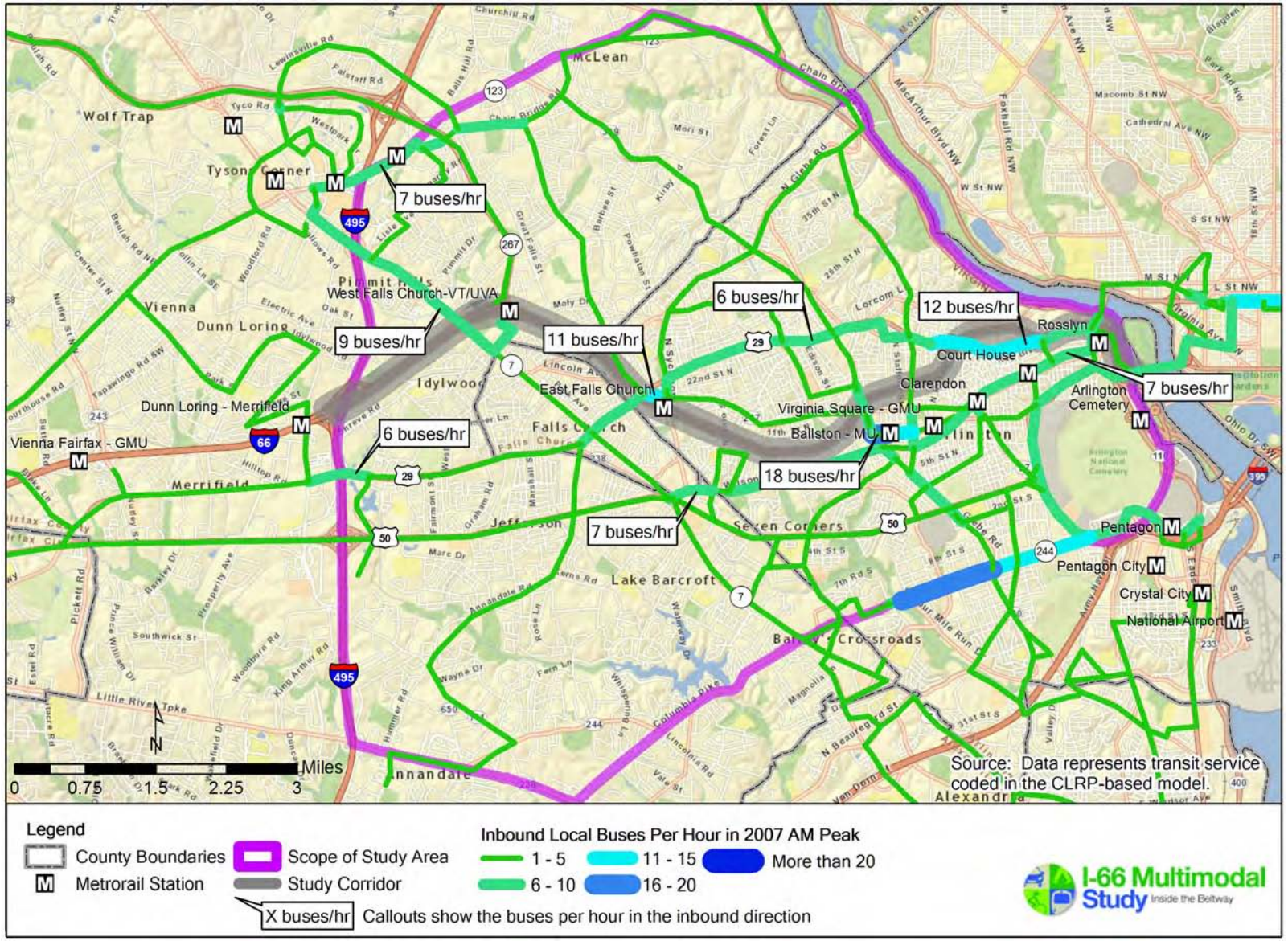
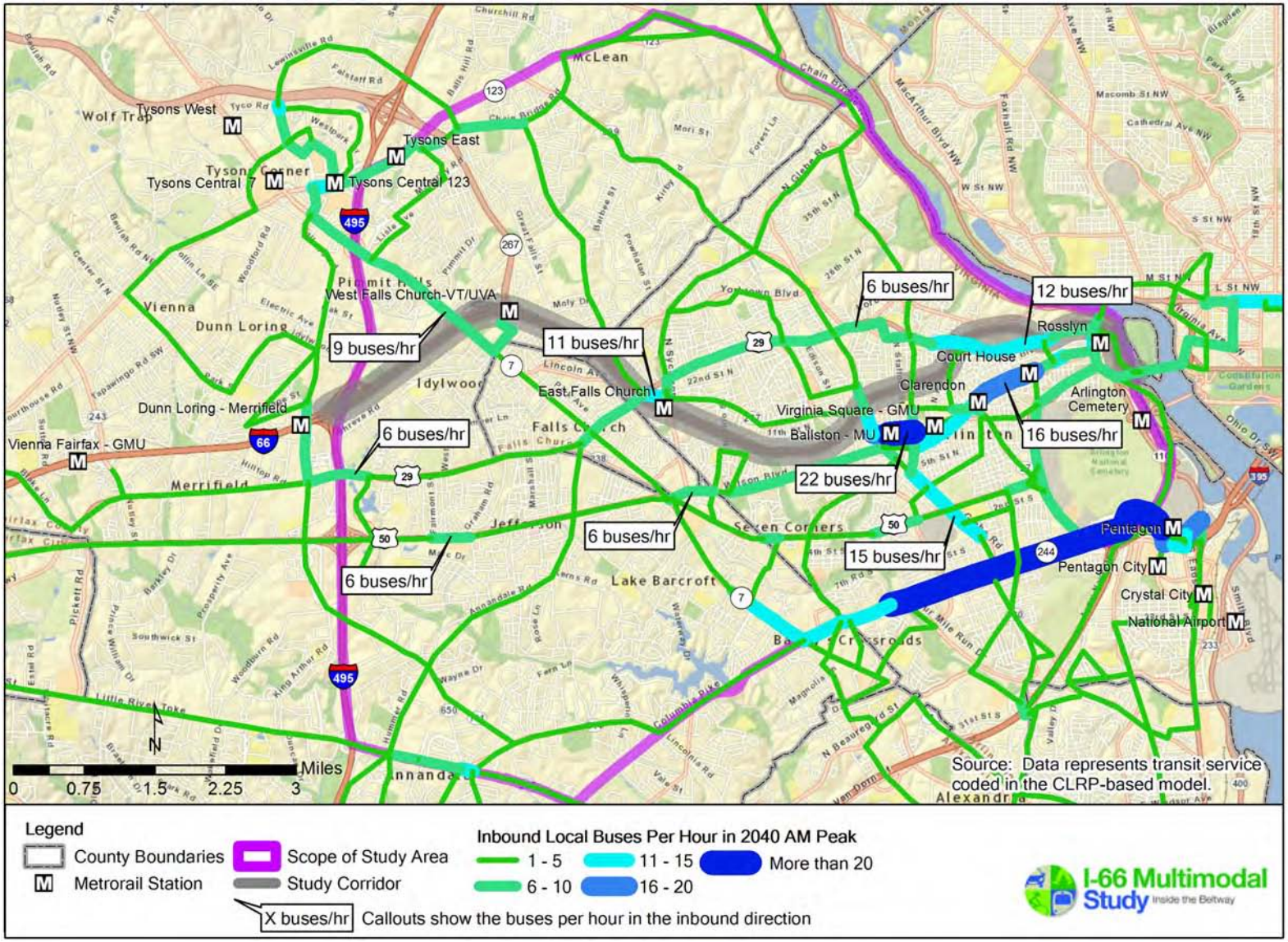


Figure 3.15 Local Bus Inbound (2040)



Figures 3.16 and 3.17 display the frequencies of inbound Metrorail trains during the morning peak period in 2007 and 2040, respectively. The service frequencies are the same in the outbound direction. The service frequencies shown are based on the CLRP network model inputs which do not include trippers, which are additional trains put into service to provide additional capacity during the "peak of the peak." [4] The primary changes in rail frequencies in 2040 are a result of adding the new Silver Line to Dulles Airport. With the frequency of Orange Line trains also increasing in 2040[5], the number of trains per hour from the West Falls Church Station to points east more than doubles from 2007 levels. The service frequency of the Blue Line through the Rosslyn tunnel decreases in 2040, reflecting adjustments that Metro has planned to accommodate Silver Line service[6].

[4] Metro currently operates 7 tripper trains per peak hour on the Orange line – Vienna to New Carrollton.

[5] Metro is adjusting frequencies on the Orange line as part of its re-alignment to accommodate crowding and service reliability at the Rosslyn portal and to address the requirements of the Silver Line. In June 2012, Metro anticipates adding 3 trains per peak hour to the Orange line from West Falls Church to Largo Town Center, in addition to 6 tripper trains per peak hour.

[6] In addition, in June 2012 Metro anticipates shifting 1/3 of the Blue Line trains (or three trains per peak hour) from Franconia-Springfield to operate via the Yellow Line to Greenbelt.

Figure 3.16 Metrorail Inbound (2007)

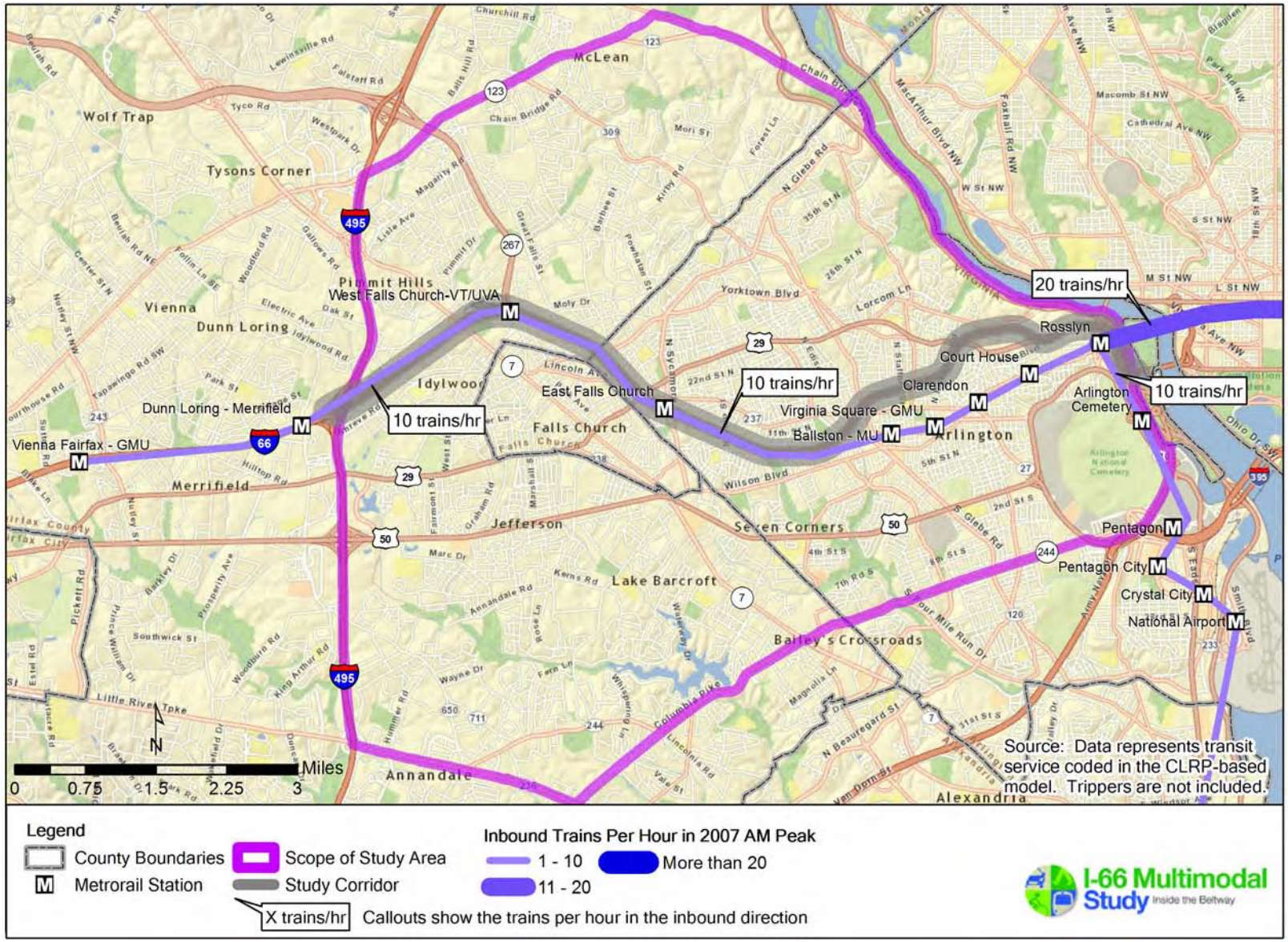


Figure 3.17 Metrorail Inbound (2040)

Overall, the transit assessment revealed service changes that are already planned for bus and rail. The changes highlighted between 2007 and 2040 indicate that the Silver Line Metrorail will provide an important transit alternative in the future to relieve congestion along the Dulles Connector Road and I-66 and to help accommodate the increased travel to Tysons Corner. At the same time, when the Silver Line is operational, WMATA will make adjustments and realignments to services on the Blue and Orange lines both lines utilize the Rosslyn portal, which is currently at throughput capacity of 26 trips per hour. Increased frequencies of local bus services in the Rosslyn – Ballston Corridor in the future may help relieve congestion on the Orange Line Metrorail, though capacity issues inside the stations, particularly at the Rosslyn and Ballston – MU Stations, will still need to be addressed. While the frequency of express buses decreases significantly with the completion of the Silver Line, local bus frequencies and geographic coverage within the service area remains comparable to the 2007 levels.

Intermodal Connections

Improved facilitation of transfers between modes of travel (bus, rail, car, and bike/walk) was identified as a corridor issue and need. Aspects include kiss and ride, park and ride, bus interfaces, and pedestrian and bicycle interfaces with Metrorail or other premium transit services. Associated mobility option elements were included on the inventory list that is described in Section 5 of this report.

Bicycle and Pedestrian Component

The analysis of bicycle and pedestrian conditions examined the presence of existing facilities as well as major planned investments. Existing information was adapted from resources obtained from Arlington County, the City of Falls Church, Fairfax County, VDOT, WMATA, and MWCOG. Data sources include the Arlington County Master Transportation Plan, Fairfax County Bicycle Level of Service Analysis, Tysons Corner Bicycle Plan, WMATA Bicycle and Pedestrian Capital Needs Inventory, and the MWCOG Regional Bicycle and Pedestrian Master Plan. This information is supplemented by professional knowledge of existing conditions and planned improvements for bicycling and walking in the project study area, as well as local and regional trends related to walking and bicycling. The analysis also includes a review of bicycle commuting volumes and mode share using recent bicycle count data obtained from Arlington County. Together these analyses are intended to offer a broad picture of the bicycle and pedestrian conditions in the study area.

Existing Facilities

Bicycle commuters traveling along the I-66 corridor inside the Beltway have two primary travel routes to choose from, depending on their ultimate destination and facility preference. The off-road route consists of the Washington & Old Dominion (W&OD) Trail that starts in Purcellville, Virginia and extends to Shirlington, Virginia, and the Custis Trail that intersects the W&OD Trail in Bon Air Park in western Arlington County and parallels I-66 to the eastern edge of Arlington County at the intersection of Lynn Street and Lee Highway, at the Virginia entrance to the Key Bridge. This route is appropriate for commuters traveling east into the District of Columbia core or those who prefer off-road facilities. These off-road routes generally parallel I-66 and are shown in the west to east direction in green on Figures 3.18 through 3.20.

The W&OD Trail is owned and operated by the Northern Virginia Regional Park Authority (NVRPA). The trail is built on an old rail bed. As a result, it has fairly gentle grades and good sight lines. In the study area, the W&OD Trail is asphalt surfaced, and is approximately 10 feet wide. The trail surface is generally in good condition. The trail is currently unlit, with the exception of spillover lighting from street lights. However, the NVRPA is currently assessing the feasibility of installing lighting on portions of the W&OD Trail to improve the safety and comfort of nighttime users. There are several at-grade crossings of roadways in Falls Church, most notably the signalized trail/road intersection at North Washington Street near the on-ramp to eastbound I-66.

The Custis Trail was built by the VDOT as part of the I-66 corridor. The Custis follows the terrain abutting I-66 and has steep slopes in many sections. There are tight turns in some sections (e.g., the switchback behind Lyon Village Shopping Center), and several locations where sound walls, vegetation, or other natural or structural barriers create blind spots. The trail is asphalt surfaced and is approximately 10 feet wide. The trail surface has deteriorated in some sections, and there are places where tree roots, erosion, and other natural causes create bumps and heaves in the trail. There is some lighting on the trail, especially at underpasses where the trail crosses under I-66 or other major roadways. There are few at-grade crossings of roadways until the eastern extents of the trail. Arlington County has installed bicycle signals at two of these at-grade crossings to evaluate the device's effectiveness at improving bicyclist safety and comfort.

While the Custis Trail provides good connectivity into the District of Columbia core from points west, many bicycle commuters traveling into the Rosslyn-Ballston Corridor from the west transition from the Custis Trail to an on-road route near the intersection of Fairfax Drive and Glebe Road. This route is comprised primarily of striped bicycle lanes and runs east along Fairfax Drive, to Wilson Boulevard/Clarendon Boulevard. At this intersection, the route follows the one-way pair of Clarendon Boulevard (eastbound) and Wilson Boulevard (westbound). This on-road route is shown in blue on Figure 3.20. This primary on-road route is complimented by several connecting routes, including striped bike lanes that connect to the Custis Trail along North Kirkwood Road and Veitch Street, and signed bicycle routes on several local streets in Arlington County. The ultimate destination for bicyclists electing the on-road route is assumed to be somewhere in the vicinity of the Rosslyn-Ballston Corridor, or at one of the Metrorail stations on the Orange Line.

Figure 3.18 Existing Bicycle Facilities (West)

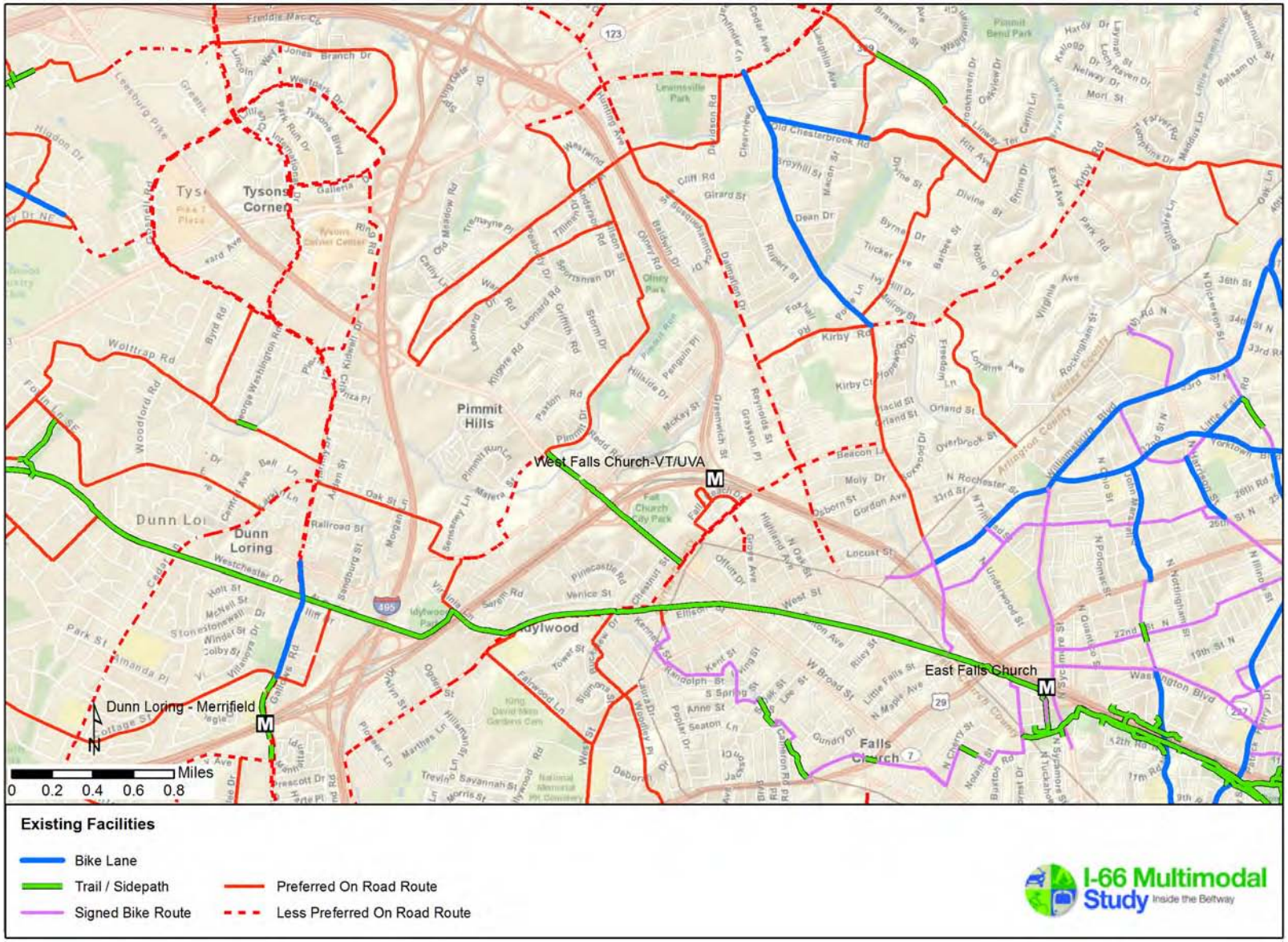


Figure 3.19 Existing Bicycle Facilities (Central)

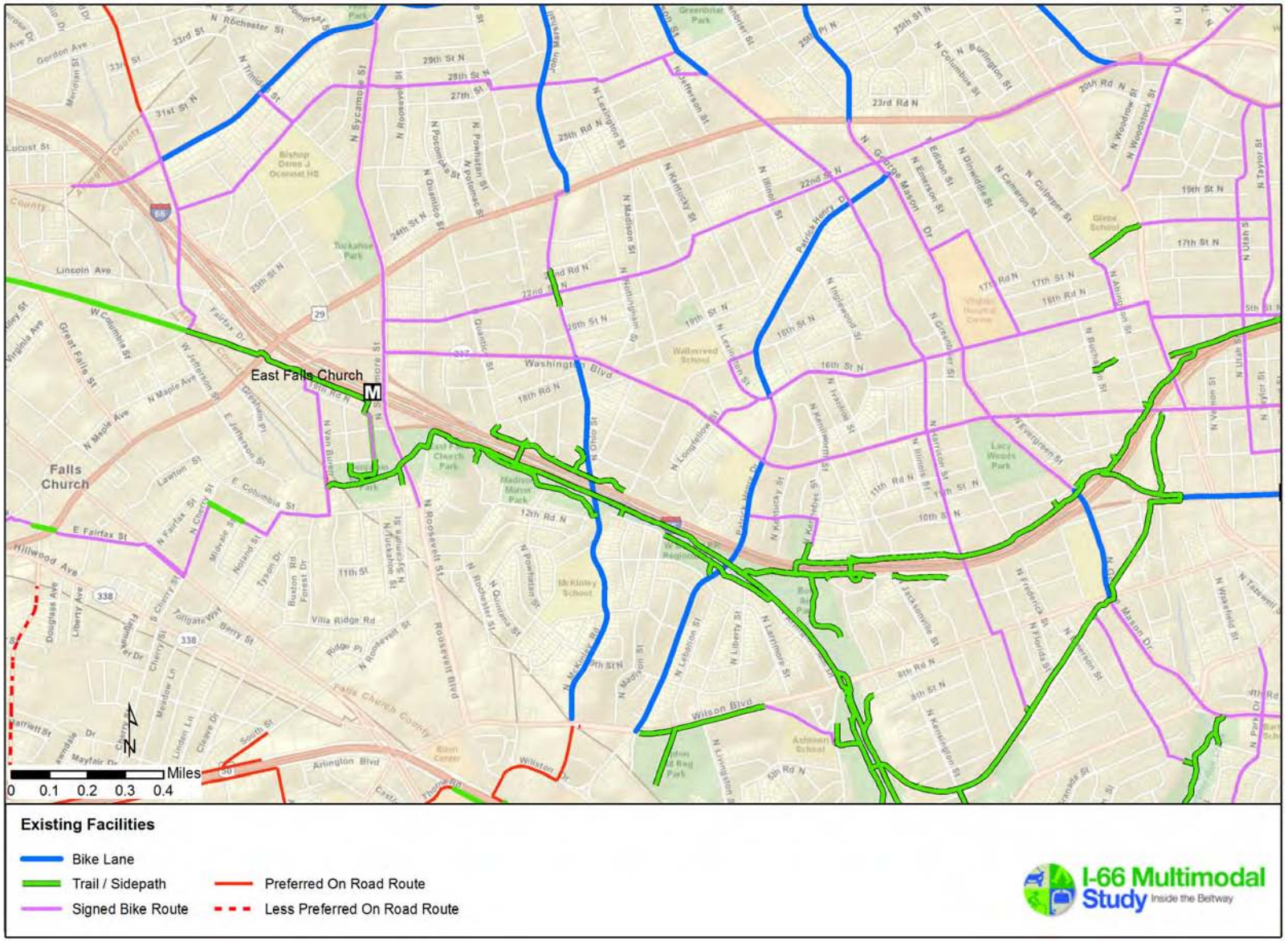
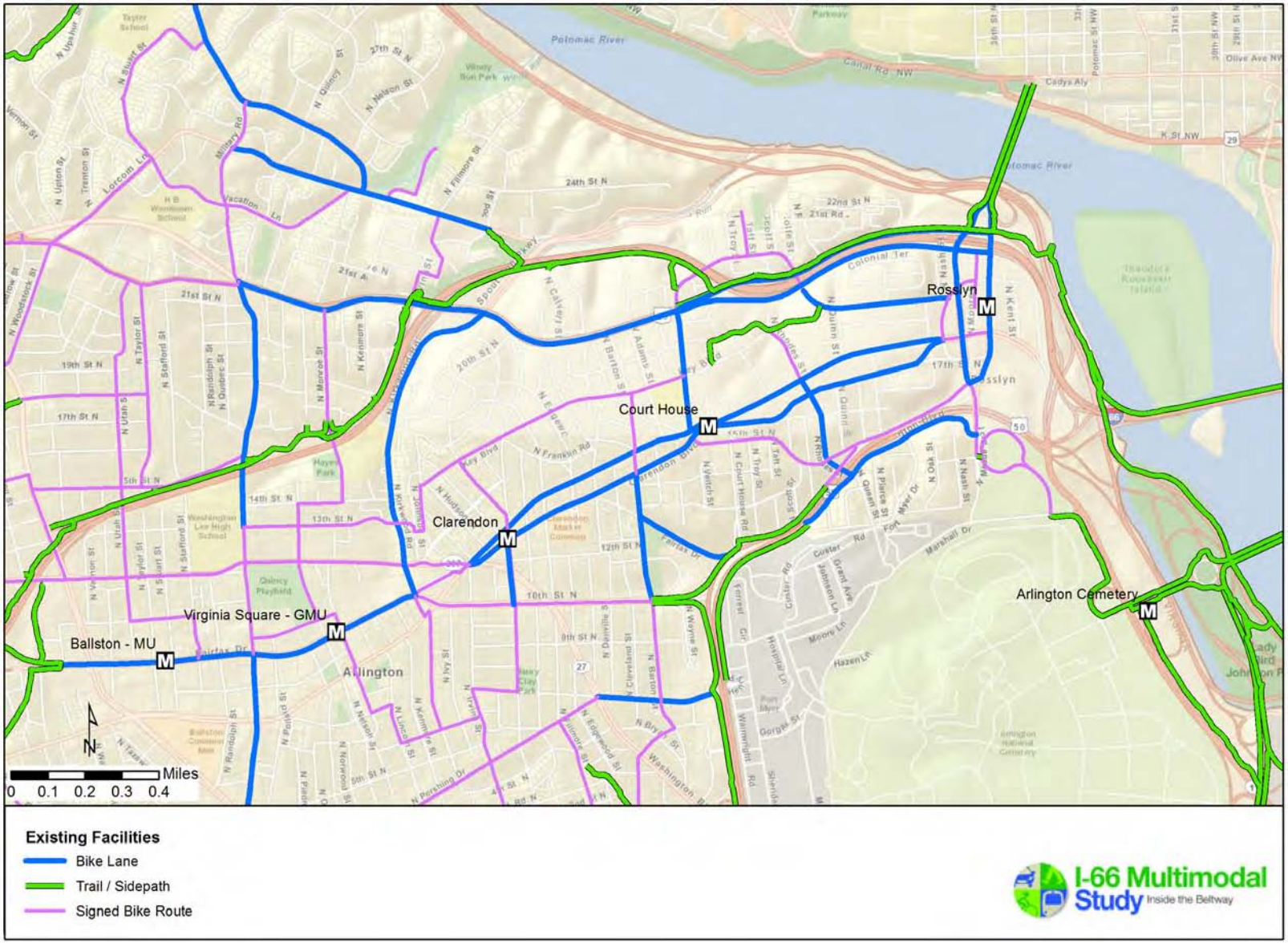


Figure 3.20 Existing Bicycle Facilities (East)



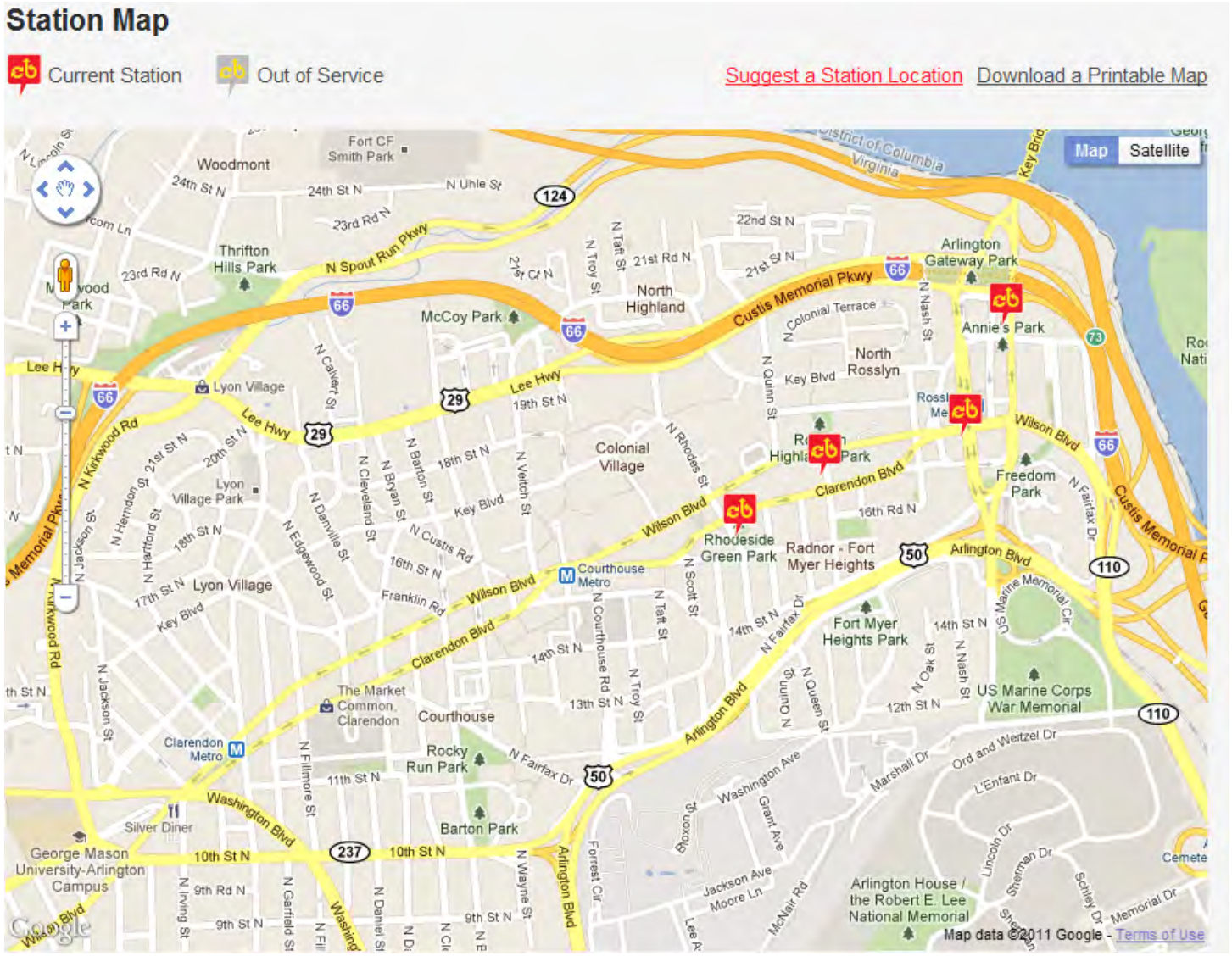
Transit Connections

The quality of bicycle and pedestrian connectivity to transit stops varies throughout the I-66 corridor. For example, a relatively good bicycle and pedestrian network connects to Metrorail stations in the Rosslyn-Ballston corridor, while certain stations further west (e.g., West Falls Church) are accessed via challenging crossings and discontinuous bicycle and pedestrian networks. In addition, bicyclists have indicated that lack of secure, covered bike parking at Metrorail stations can be a deterrent to access by bicycle. WMATA is currently increasing the volume and security of bicycle parking across the system, including several stations in the study corridor.

Bikeshare Locations

In addition to bicycle travel facilities, there are four Capital Bikeshare locations in the study area, located towards the eastern end of the Rosslyn-Ballston Corridor. The location of the stations is indicated in Figure 3.21. There are six additional bikeshare stations in the southern portion of the County in the Pentagon City and Crystal City neighborhoods. Each of the Rosslyn-Ballston Corridor stations holds between 11 and 20 bicycles. In aggregate, these four stations generated almost 16,000 bicycle trips (8,229 departures/ 7,664 arrivals) in the six month period between March and August of 2011. This represents approximately 23 percent of all bikeshare trips in Arlington County (70,144 total trips), but just over 1 percent of all bikeshare trips across the Capital Bikeshare system (1,419,473 total trips).

Figure 3.21 Rosslyn-Ballston Corridor Bikeshare Stations

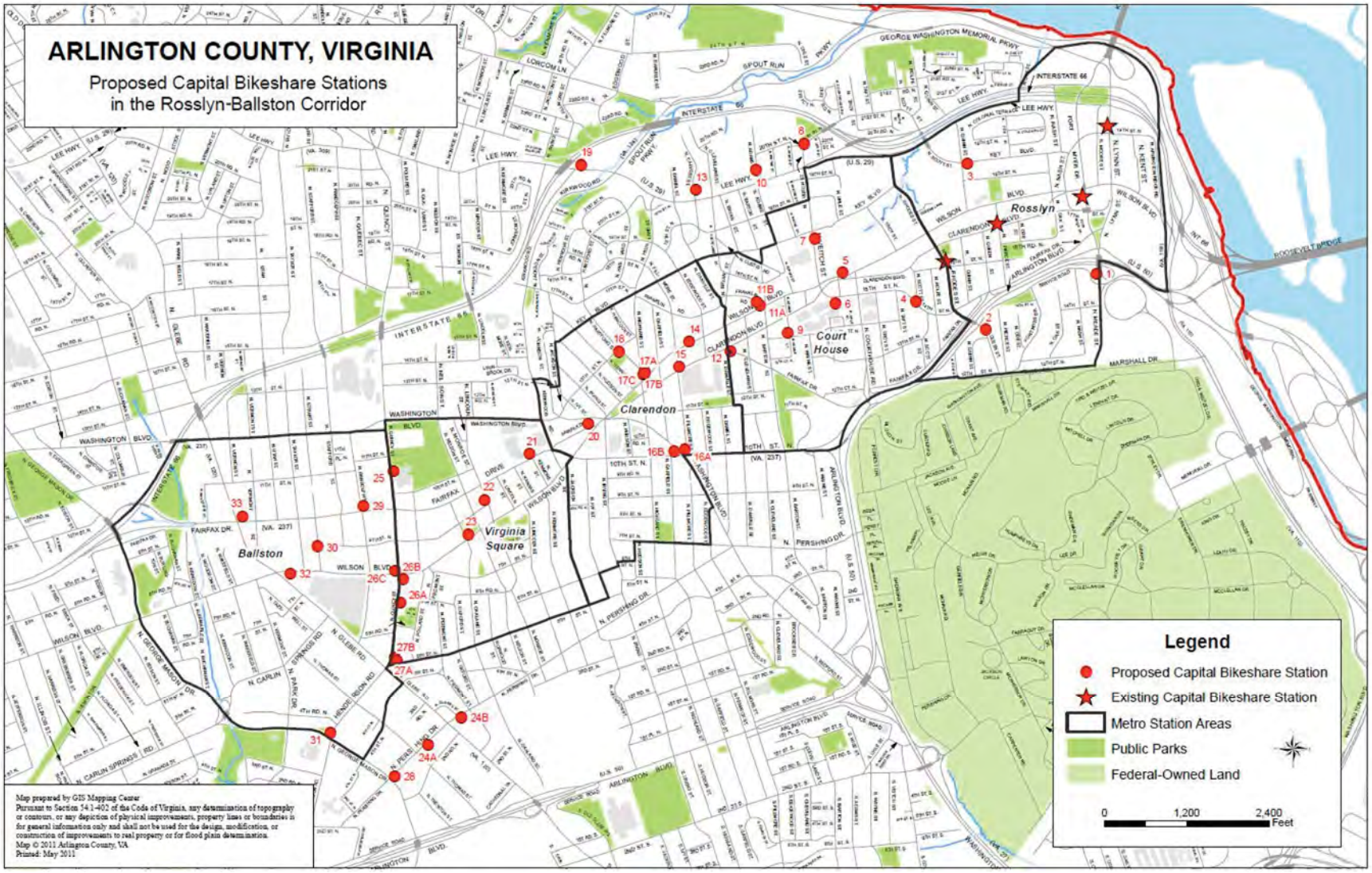


Source: Capital Bikeshare http://www.capitalbikeshare.com/station_map.

Arlington County and Capital Bikeshare have announced plans to add an additional 30 bikeshare stations in the Rosslyn-Ballston Corridor within the next year.[7] Planners have been conducting GIS analysis to identify appropriate locations, and have engaged the public through meetings and online maps to solicit input on desired locations for the new stations. Figure 3.22 shows the proposed locations of new stations. The red stars indicate existing stations and the red circles indicate proposed locations.

[7] Source: BikeArlington. http://www.bikearlington.com/pages/bikesharing/public-meeting-to-discuss-arlington-expansion-of-capital-bikeshare/

Figure 3.22 Proposed Capital Bikeshare Locations

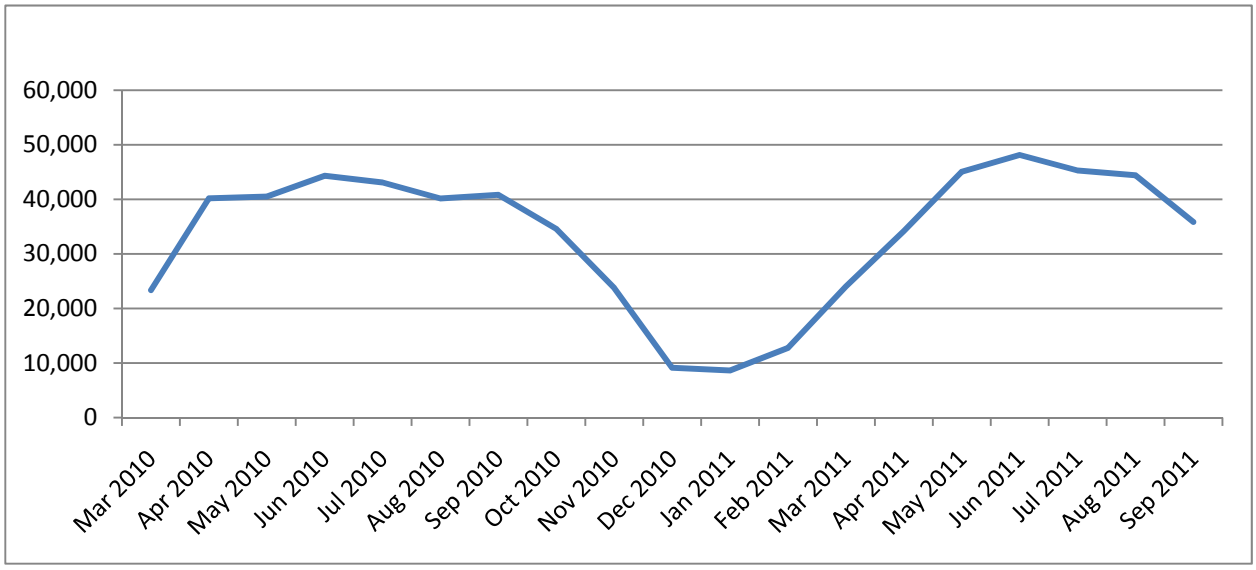


Source: BikeArlington: http://www.bikearlington.com/tasks/sites/bike/assets/File/Map-list5.pdf

Bicycle Commuting Volumes and Mode Share

Between 2000 and 2010, the Arlington County mode share of bicyclists commute to work has doubled from 0.7 percent to 1.4 percent.[8] The Custis Trail carried over 350,000 bicycle trips in 2010, with a peak of almost 50,000 bicyclists in June of 2011. As Figure 3.23 shows, ridership is consistently high from March through October, with a decline in usage not occurring until the colder months of November through February.

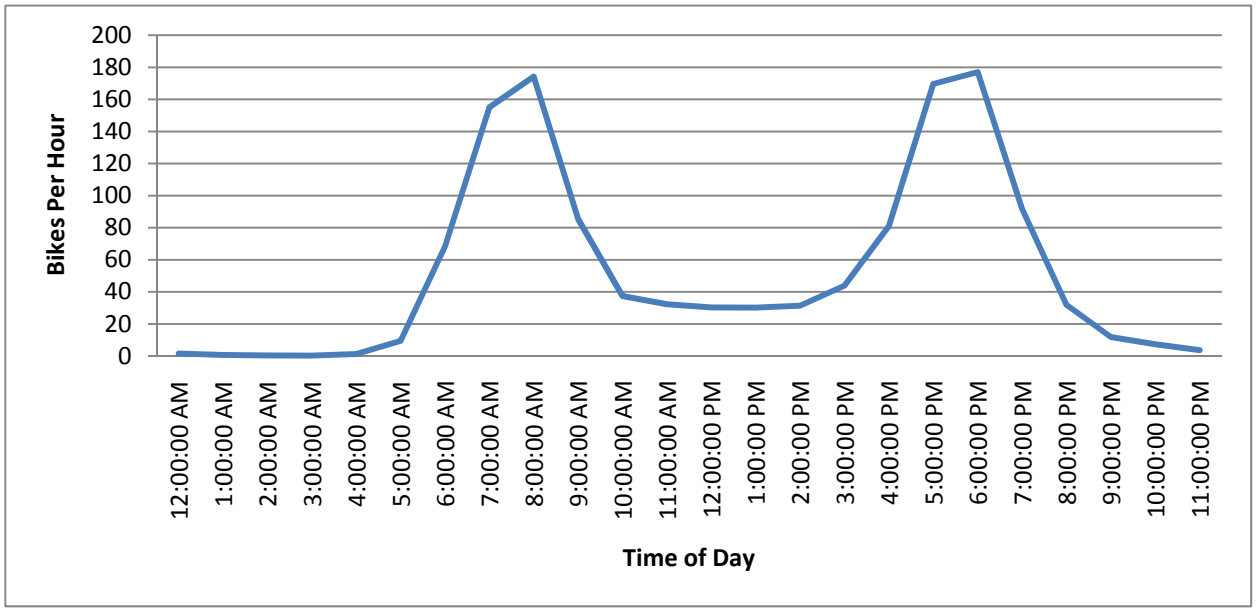
Figure 3.23 Custis Trail at Bonair Park Monthly Bicycle Counts (March 2010 – September 2011)



Daily ridership patterns illustrate the strong flow of commuting bicyclists in the morning and in the evening. As Figure 3.24 shows, average weekday ridership is distributed over the course of a day. There are peaks of almost 180 bicyclists per hour at 8:00 a.m. and almost 180 riders per hour at 6:00 p.m. This equates to approximately three bicyclists per minute during peak travel times. Observations by the project team confirm that the majority of morning bicyclists are heading east on the Custis Trail, with a reverse of this travel pattern in the evening.

[8] Source: American Community Survey 2000, 2010.

Figure 3.24 Custis Trail Average Weekday Bicycles Per Hour (March 2010 – November 2011)



Anecdotal comments from regular bicycle commuters on the W&OD Trail suggests that these relatively high volumes of riders occurring during the compressed morning and evening peak hour periods result in congested conditions on the trails. During peak commute times, bicyclists on the Custis Trail also experience congestion. Bicycle travel time and speed data collection was conducted as part of the I-66 Multimodal Study to establish and confirm field conditions. Bottlenecks on W&OD and Custis Trails was identified as an issue or need.

The trails in the corridor have relatively good connectivity to surrounding neighborhoods. However, wayfinding and signage alerting trail users where they are tends to be inconsistent or missing. Furthermore, enhanced wayfinding is needed at various decision points along the trails to assist riders in navigating to their destinations.

TDM Component

Transportation Demand Management (TDM) programs reduce the total demand for vehicular transportation in ways that do not diminish the overall utility of the transportation system. The TDM strategies that are adopted by a region must be specifically tailored to the conditions of the region with regard to factors such as demographics, infrastructure and transit accessibly.

There are an extensive number of TDM strategies that have been developed in Northern Virginia. Arlington and Fairfax Counties have instituted programs tailored to their demographic and employment levels as part of their current and long range plans. These counties serve both regional employment centers and residential corridors, and design their programs to accommodate residents as well as employees in the county. A table listing of regional TDM programs is included as Appendix A.

ITS (Multimodal) Component

VDOT is implementing an Active Traffic Management program in the I-66 corridor, between Haymarket and the Theodore Roosevelt bridge. This project will install an active traffic management system on I-66 through Arlington, Fairfax, and Prince William counties. The system would improve safety and incident management, which includes ramp metering and dynamic merge signals inside the Beltway to assist motorists merging from the Dulles Connector Road. While the bulk of the program elements will be implemented outside the Beltway, the dynamic merge treatment will be applied at the merge of I-66 with the Dulles Airport Access Road, and adaptive ramp metering will meter, activate, and deactivate individual on-ramps in response to real-time traffic conditions along I-66. This improved ramp metering strategy is expected to improve the travel along the I-66 mainline.

WMATA and local bus operators are on Google maps, have a regional trip planner (on the WMATA website), and use other ITS applications that improve operation of their systems. However, there may be other ITS technologies that could help move traffic and facilitate intermodal transfers in the corridor. These will be explored in the future analysis of mobility options.

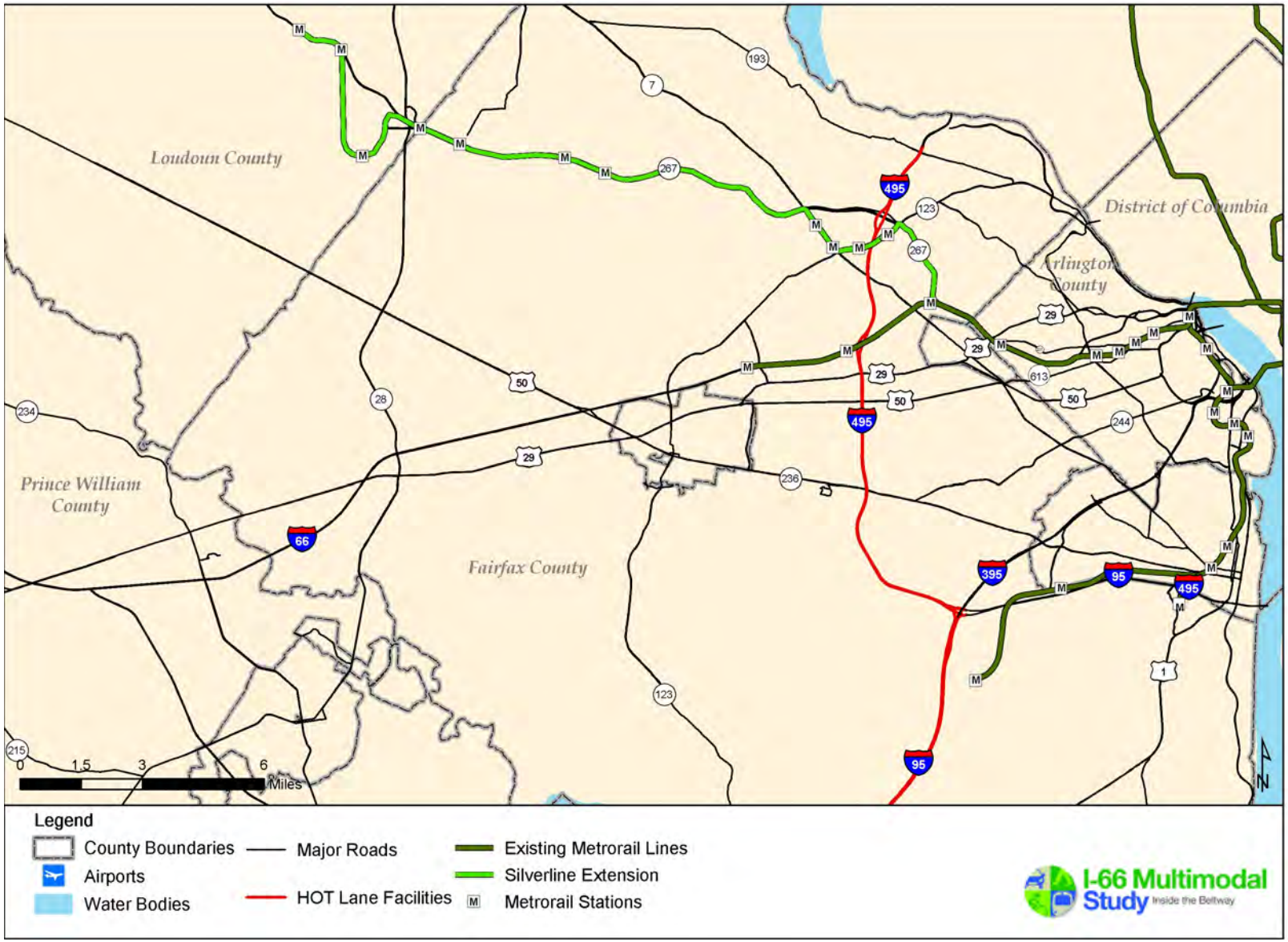
3.4 Analysis of Modal Indicators

Travel Patterns

A top level analysis of year 2040 travel patterns was conducted using the MWCOG/TPB Version 2.3 Travel Demand Forecast Model. The model output was used to look at mode shares by jurisdiction and travel from and to key activity centers along the I-66 Corridor. Major commuter origins and destinations were reviewed to understand the issues and needs associated with the travel patterns. As part of understanding the future travel patterns, a select link analysis focusing on I-66 inside the Capital Beltway was also performed to better understand the origin locations for vehicles using the facility during the morning commute in year 2040.

While travel in the corridor will continue to be dominated by travel into the regional core, large percentage changes in future travel demand and growth are likely to occur in areas that are well positioned to absorb new housing and employment. Therefore, changes to land use and the transportation network represent important components to understanding the impacts on travel patterns. There are a number of major transportation network changes that impact future travel in the corridor. These major network improvements include the completion of the Metrorail Silver Line and the Capital Beltway HOT Lanes. These facilities are shown in Figure 3.25.

Figure 3.25 Major Transportation Network Changes



Total motorized (automobile and transit) work trips in Northern Virginia will grow significantly between 2007 and 2040. Growth in employment opportunities in outer jurisdiction will attract reverse commute travel. Although the travel demand in the outer jurisdictions will grow significantly on a percentage basis, the absolute number of trips remains much smaller than in the inner jurisdictions and the District of Columbia. The core employment areas including downtown D.C., and the Arlington Core will continue to attract the majority of commuter trips, although overall growth in this movement will be modest.

Figure 3.26 and Figure 3.27 illustrate jurisdictional total of travel activity through depiction of model "productions" and "attractions" for work trips and all trip purposes, respectively. Production is a term used to describe a trip that starts or ends at the home. Attraction is a term used to describe a trip that starts or ends at a non-home, such as an office, store, or other typical destinations. For commuter trips, productions are commonly conceived to be origins and attractions are thought of as destinations.

Similar to the current conditions, the I-66 corridor is anticipated to continue to have high commuting demand attracted to jobs in jurisdictions with more jobs (attractions) than workers (productions), such as Arlington County. Currently Fairfax County has more workers than jobs, but by 2040 it is expected to have slightly more jobs than workers. Regionally, Fairfax County continues to generate the greatest amount of work trips into 2040. Loudoun and Prince William Counties both have more workers than jobs and that imbalance will continue into year 2040. Commuting patterns will continue to be radial and towards the core given the higher growth in jobs than households in Arlington County and the District of Columbia. The District of Columbia will continue to attract workers from Northern Virginia even though the forecasted growth is modest, at less than one percent per year. The bulk of the employment in the region is still forecasted to be in the core areas.

When looking at all trip purposes (including shopping, recreational, and other similar non-work trips) a similar picture is presented. Arlington County continues to have more attraction trip ends than productions into 2040. Fairfax County continues to generate the most amount of travel of the jurisdictions in Northern Virginia.

Figure 3.26 Total Motorized Trips (Auto and Transit) Home Based Work Purposes by Jurisdiction (2007 and 2040)

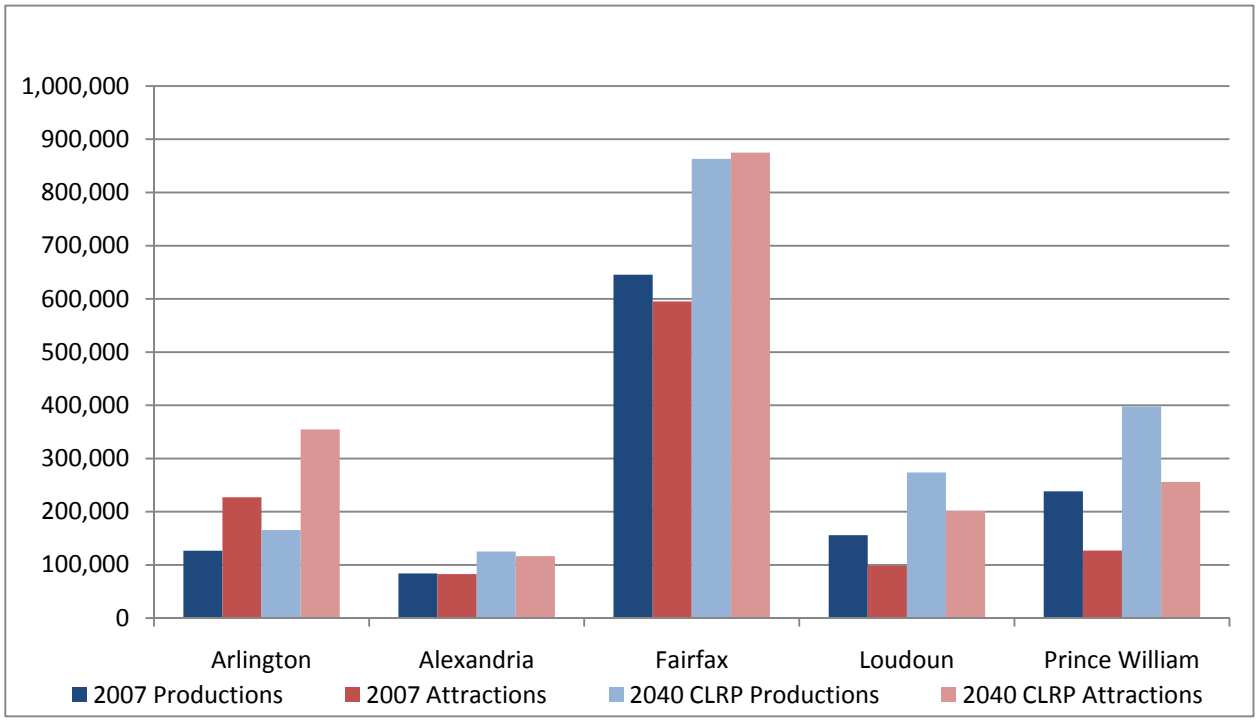
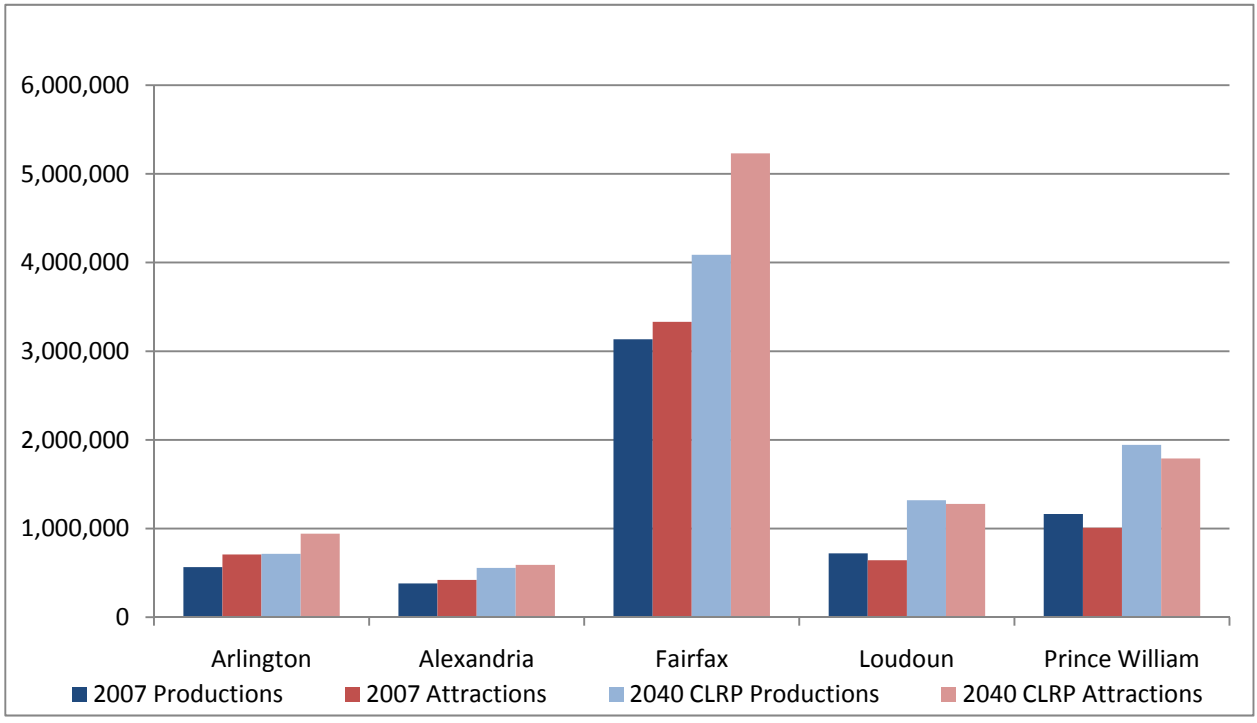


Figure 3.27 Total Motorized Trips (Auto and Transit) All Purposes by Jurisdiction (2007 and 2040)



Figures 3.28 and 3.29 show the density of auto and transit work trip productions in Year 2040 for North Arlington and Arlington Core, respectively. Productions associated with the District of Columbia core exhibit a similar pattern. Trip productions associated with specific destinations do not themselves represent trips that are using the I-66 corridor, but these plots provide a view to key trip patterns.

Figure 3.28 Work Trip Productions to North Arlington (2040)

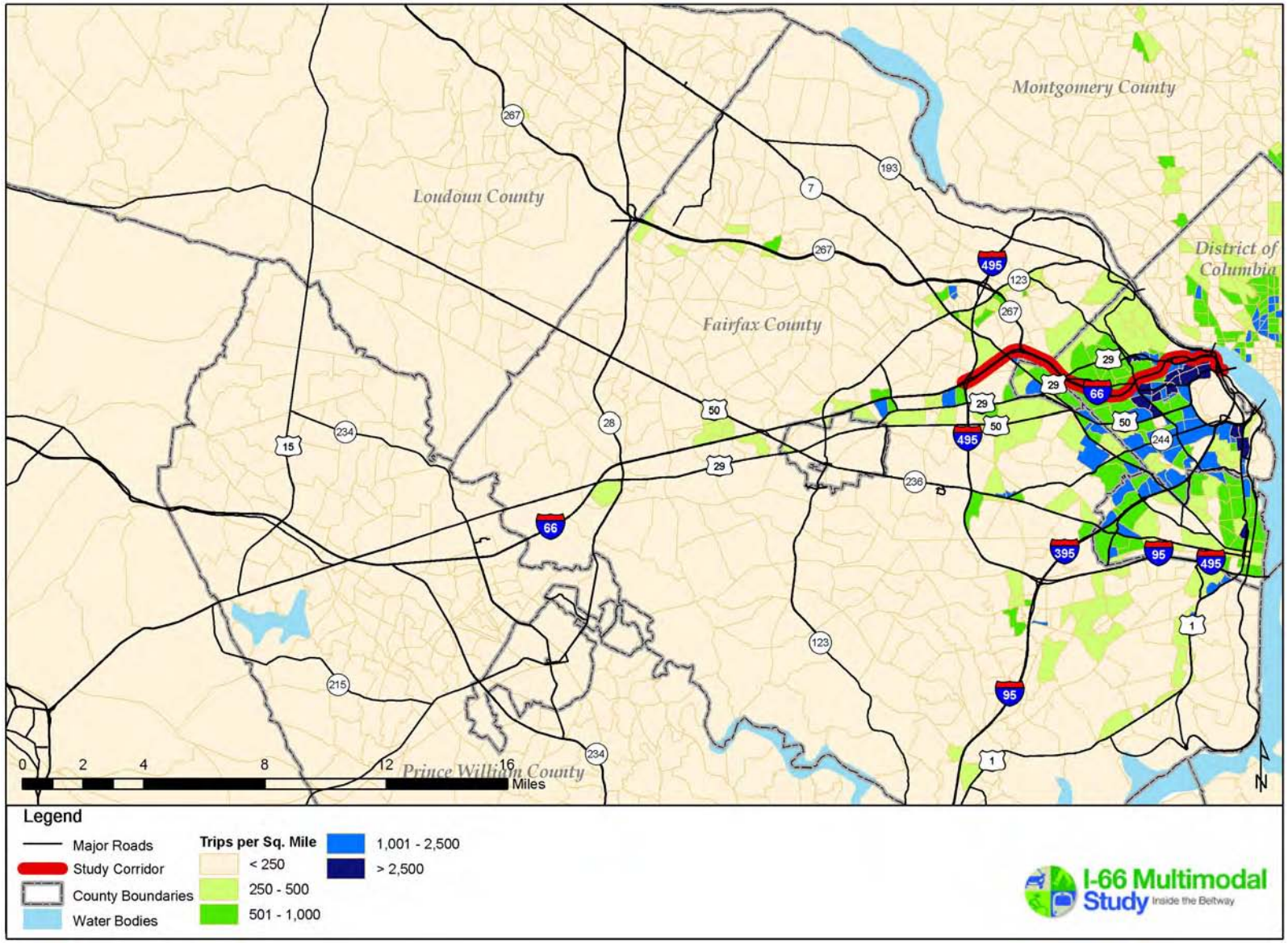
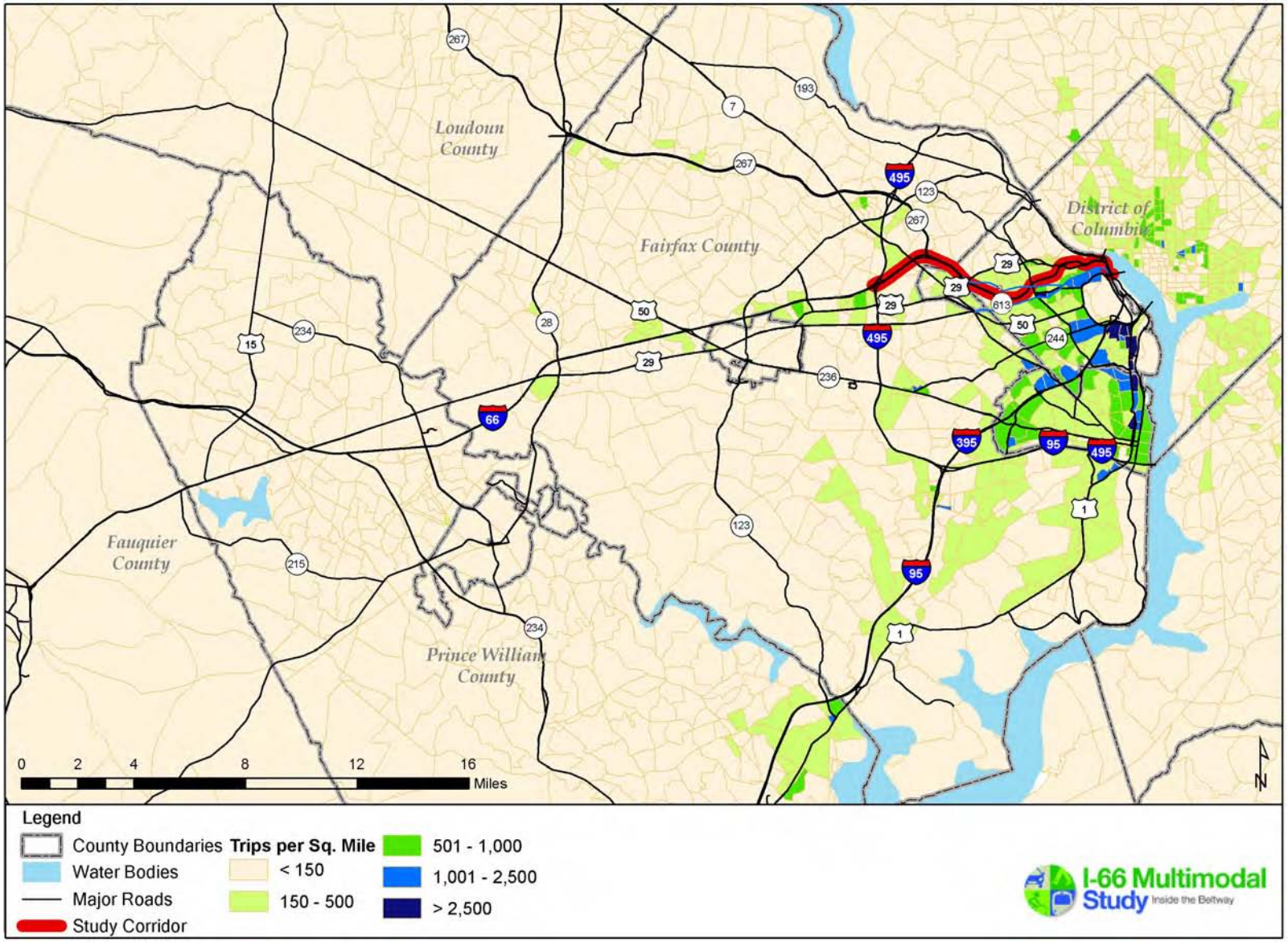


Figure 3.29 Work Trip Productions to Arlington Core (2040)



Roadway Component

Roadway Hot Spots

To facilitate the determination of roadway capacity issues in the study area, several analyses were conducted to illustrate capacity constraints based on existing and projected roadway conditions. Projects identified in planning documents as part of development of the list of mobility option elements were included in this evaluation. Including these projects helped to cross reference whether the hot spots identified as part of the analysis would be addressed by the mobility options elements listed in Section 5. The primary roadways examined for this analysis included I-66 and all major arterials inside the Beltway as follows:

- U.S. Route 29 (Lee Highway): From the Capital Beltway (I-495) in the west to the Virginia/District of Columbia border in the east
- U.S. Route 50 (Arlington Boulevard): From the Capital Beltway (I-495) in the west to the Virginia/District of Columbia border in the east
- U.S. Route 7 (Leesburg Pike): From the Capital Beltway (I-495) in the north to the Columbia Pike (VA Route 244) in the south
- VA 613 (Wilson Boulevard): From City of Falls Church or Seven Corners in the west to Arlington National Cemetery in the east
- VA 237 (Washington Boulevard): From I-66 in the West to Wilson Boulevard in the East

A variety of data sources were reviewed to support the conduct of the hot spot analysis. Different data sources were investigated to determine appropriate data to analyze I-66 and the study area arterials.

- I-66
  - Speed data from RITIS (Regional Integrated Transportation Information System)
  - Congestion hot spots from the STARS program
  - Speed and volume data from VDOT Northern Region Operations
  - Traffic data from the I-66 Spot Improvement Project
  - AADT provided by VDOT
- Major and minor arterials
  - Synchro files provided by VDOT Northern Region Operations (NRO).

After a thorough investigation of the available data and its applicability to present hot spot data in a quantitative fashion on a major link basis, the *Traffic Quality on the Metropolitan Washington*

Area Freeway System[9] report published by MWCOG/TPB, as well as hourly data from RITIS and the I-66 Spot Improvement studies (i.e., 2005 year data) hourly were determined to be the most appropriate data sources for roadways in the study area.

Hourly traffic volumes were derived for all major links along I-66 in both eastbound and westbound directions. Maps were produced for the morning peak (eastbound) and non-HOV peak period (hour immediately past the end of HOV restrictions) using a color coded scheme for Level of Service.

In the case of arterials, a similar methodology was adopted to determine the link based LOS, but using the detailed network in Synchro.[10] Arterial Level of Service (LOS) was calculated to define hot spots based on the Highway Capacity Manual methodology, which uses speed as the main input for determining arterial LOS. The volume to capacity ratios were evaluated, but lane capacities differed based on the roadway facility type and surrounding land use (i.e., area type).

Figure 3.30 presents the AADT map for the study area. As expected I-66 is the major roadway for travel inside the Beltway. U.S. Route 50 is the primary alternative for travel inside the Beltway. U.S. Route 29 is the next major contributing arterial for travel inside the Beltway. Route 7 is the primary North-South arterial within the study area.

Figure 3.31 shows the portions of I-66 eastbound (HOV direction) within the study area currently operating at congested levels. Figure 3.32 shows the westbound morning peak conditions (non HOV) are congested after Fairfax Drive.

[9] *Traffic Quality on the Metropolitan Washington Area Freeway System Spring 2011 Report*, National Capital Region Transportation Planning Board, October 4, 2011.

[10] Arlington County Synchro data was not available at the time of publishing.

Figure 3.30 Annual Average Daily Traffic (AADT) in the Study Area (2010)

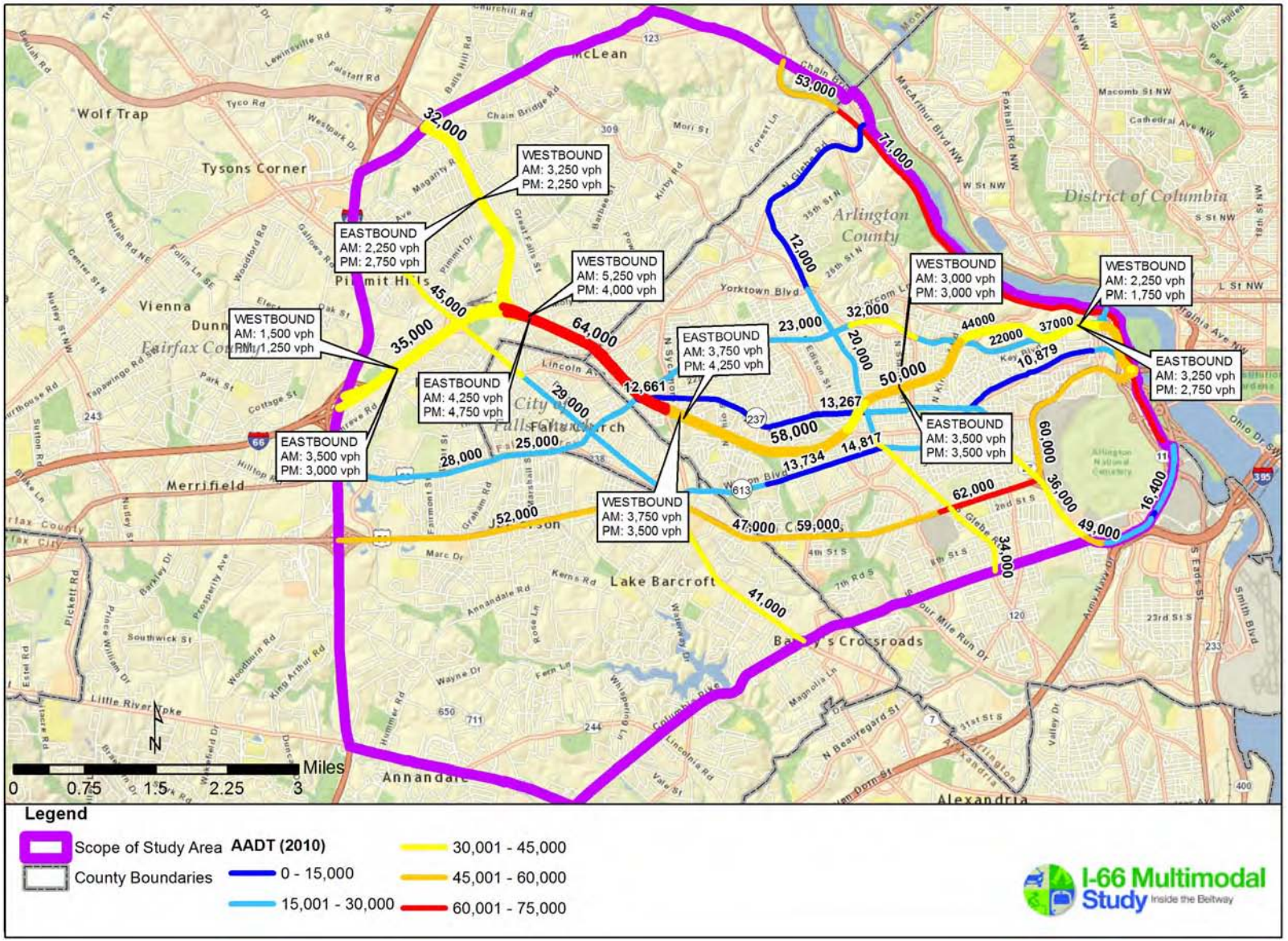


Figure 3.31 I-66 Level of Service – Eastbound Morning Peak Period

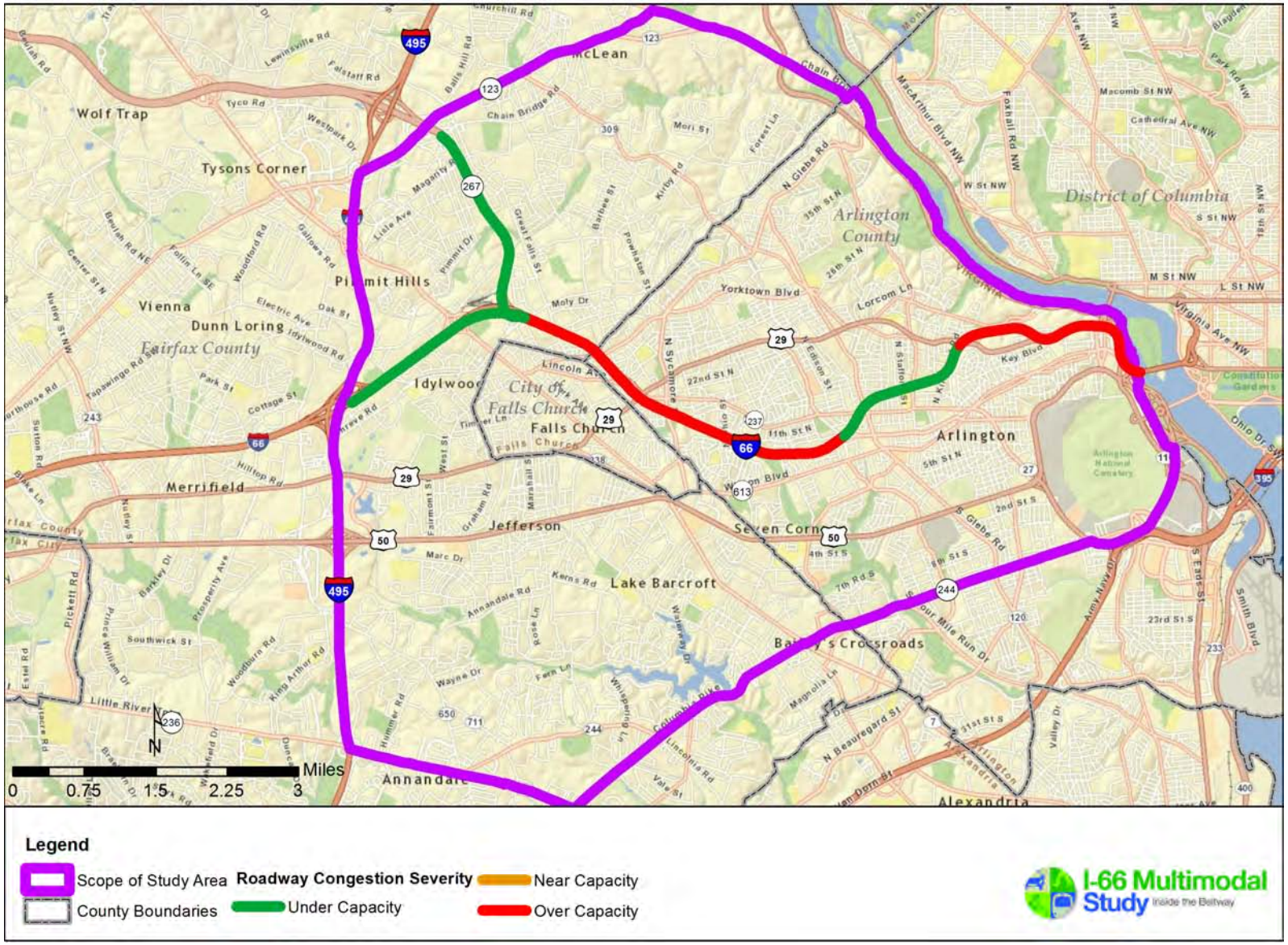


Figure 3.32 I-66 Level of Service – Westbound Morning Peak Period

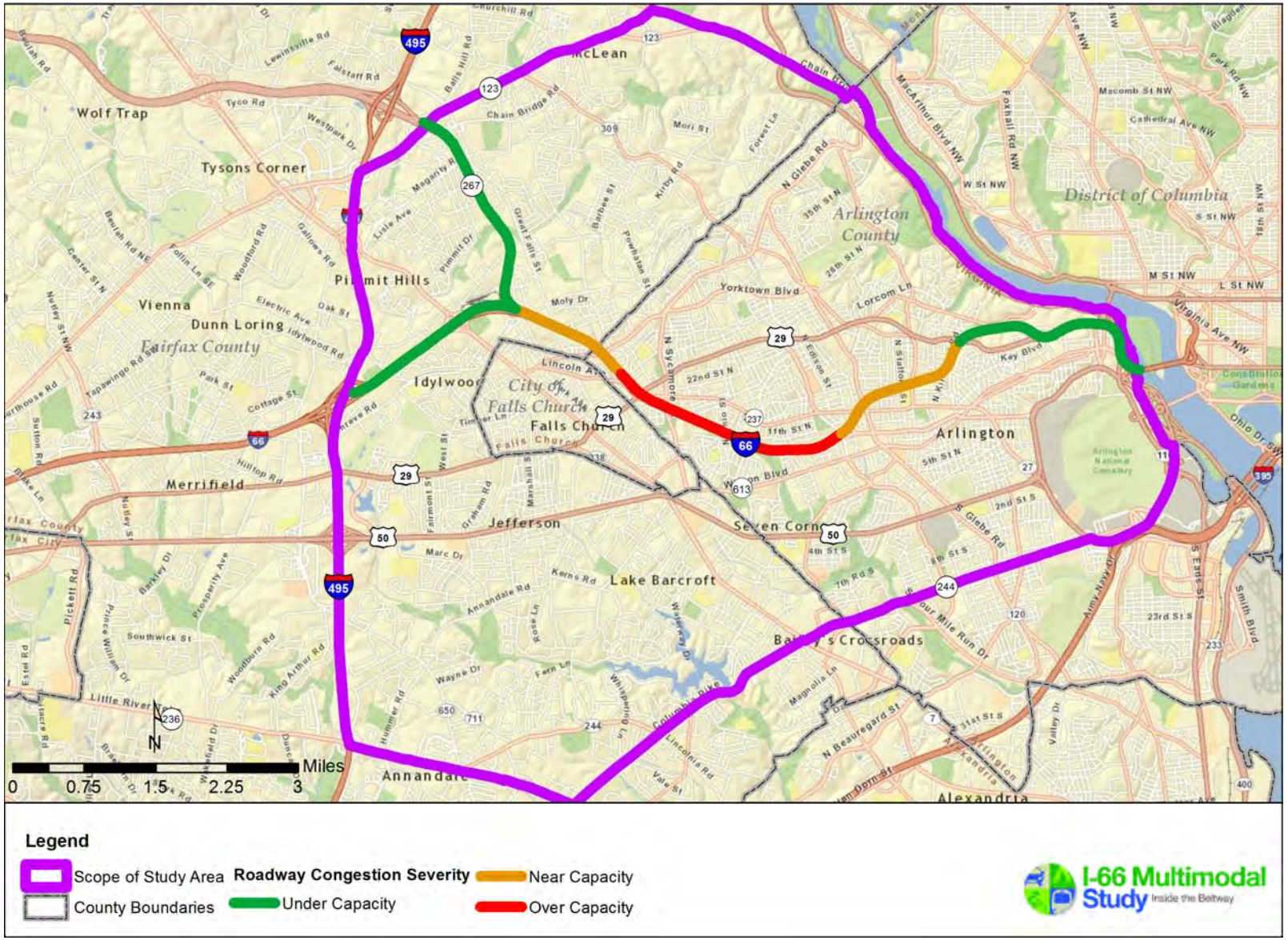
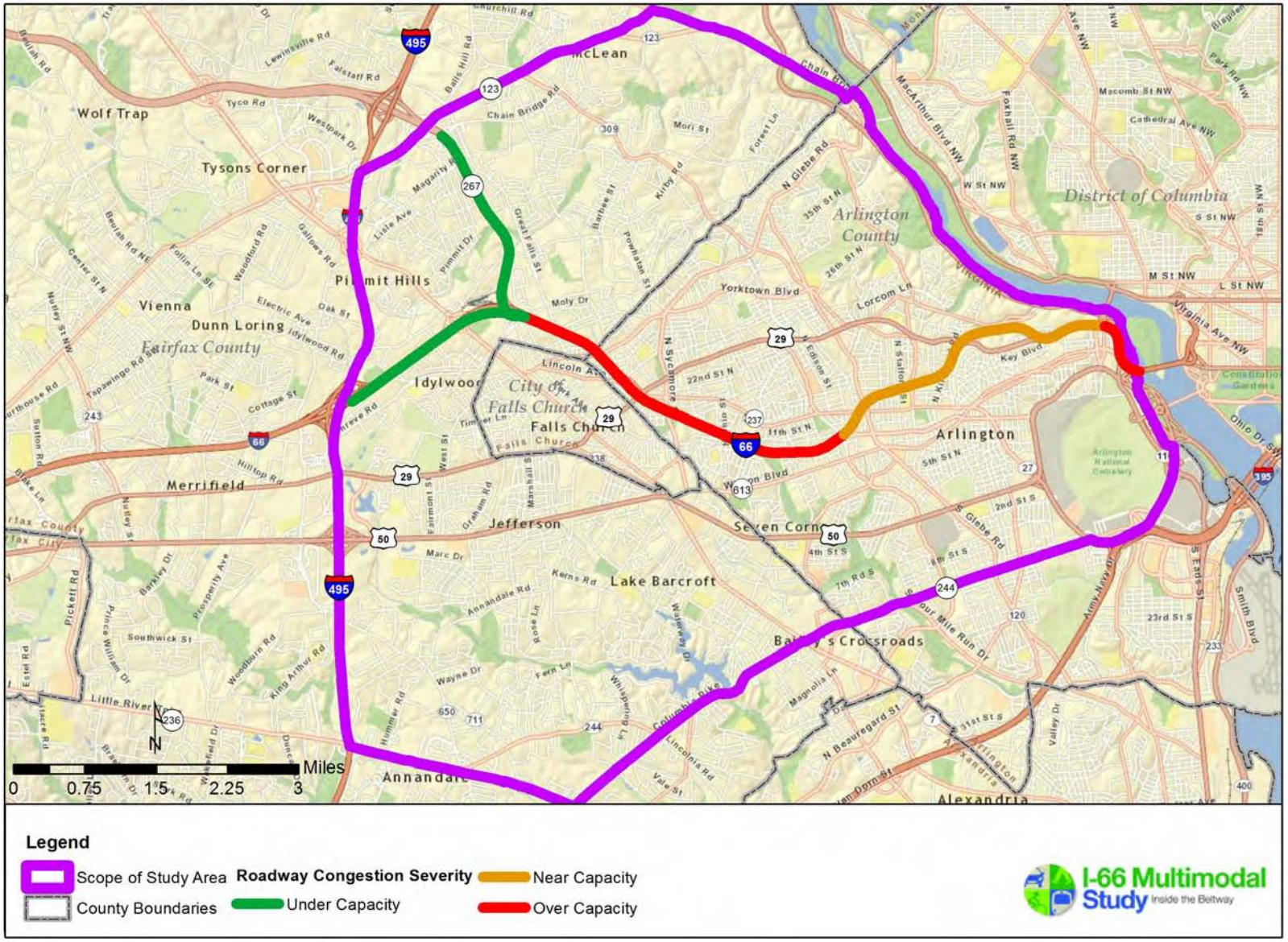


Figure 3.33 illustrates the non-HOV traffic conditions immediately following the ending of HOV restriction hours in the eastbound direction. For the eastbound non-HOV restriction time period, there is no evidence of latent demand that results in capacity constraints immediately past the HOV restriction hours. However, there is evidence of improvements in LOS at some segments in the eastbound direction in the non-HOV restriction hour as compared to the HOV restricted hours. Results suggest that latent demand also exists in the westbound direction in the evening.

Figure 3.33 I-66 Level of Service – Eastbound Non-HOV Period



U.S. Route 29 and U.S. Route 50 are the principal parallel arterials in the study area that are typically accessed by motorists as an alternative to I-66. As seen in Figure 3.34, capacity constraints are evident along U.S. Route 29 between Shreve Road and Fairwood Lane in the morning peak in the eastbound direction. On eastbound U.S. Route 50, capacity constraints are apparent from the I-495 interchange to Seven Corners. Figure 3.35 shows the traffic conditions in the westbound direction for the morning peak period. These maps show the majority of arterials in the study area are not over capacity in the morning westbound direction, although there are some capacity constraints in the Seven Corners area as well as some intersections where motorists experience long delays. Overall in the westbound direction the traffic conditions are near or above capacity

Figure 3.34 Arterial Level of Service – Eastbound Morning Peak Period

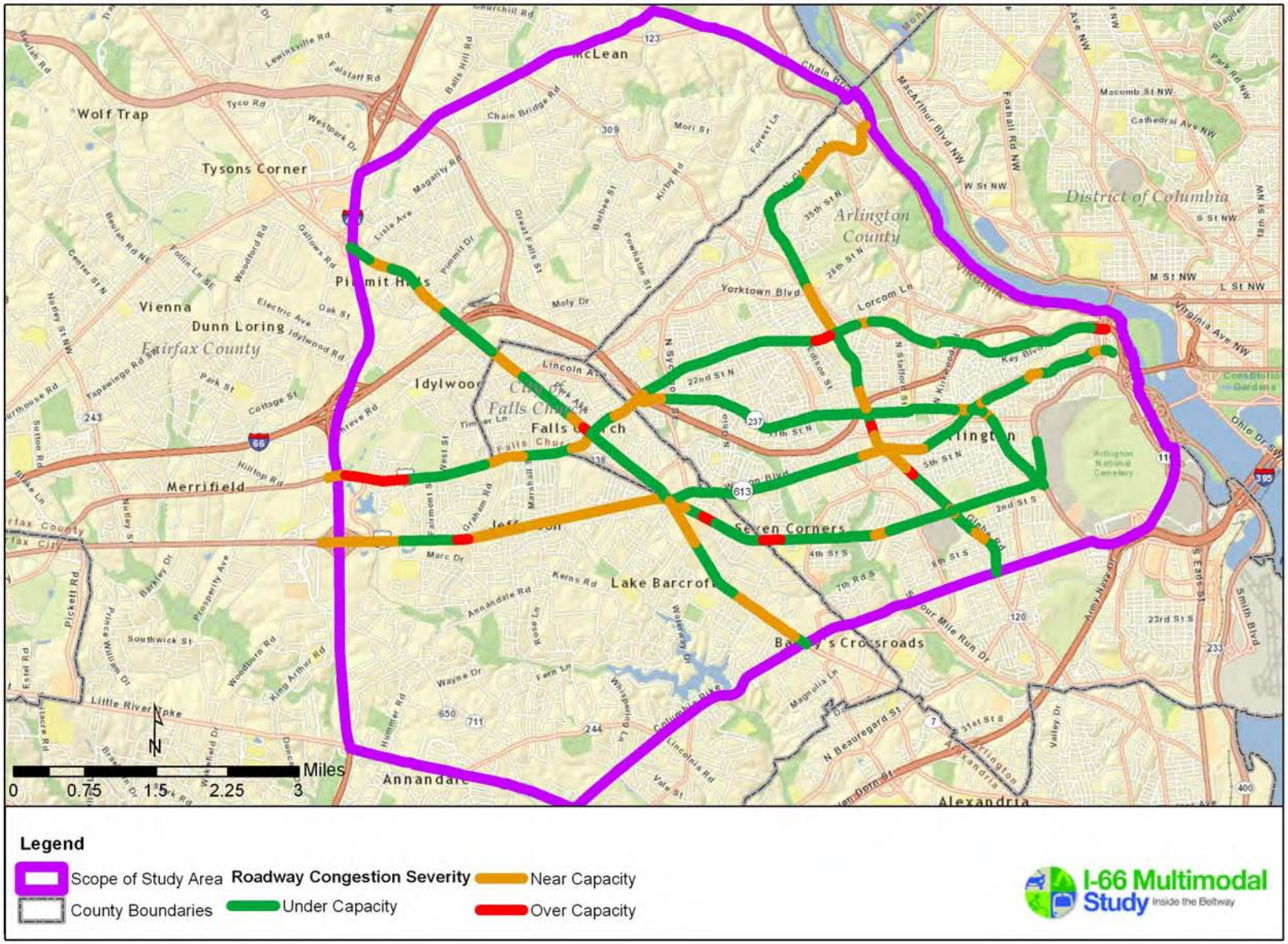
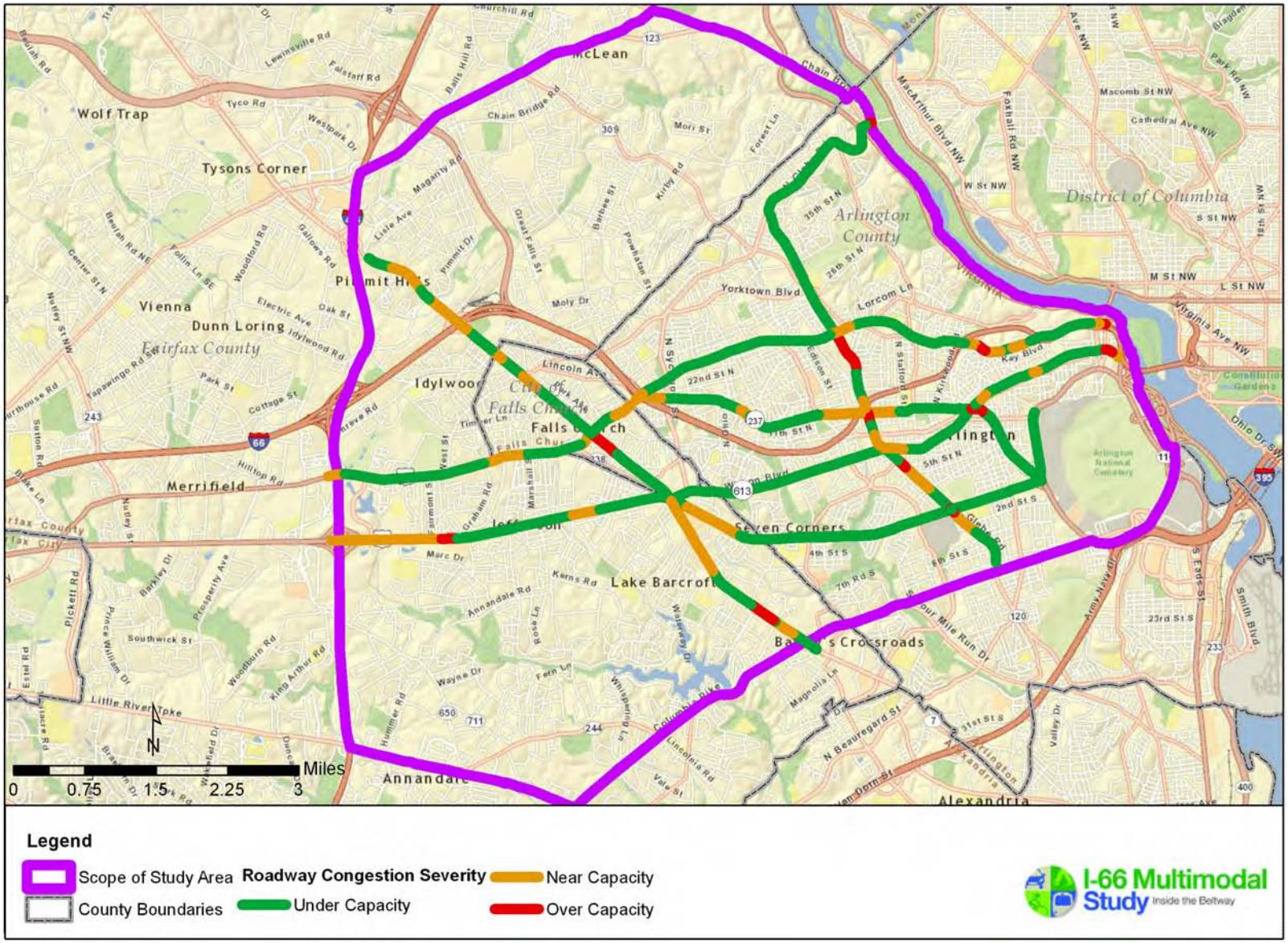


Figure 3.35 Arterial Level of Service – Westbound Morning Peak Period



Analysis of AADT, V/C ratios, and LOS show that roadway congestion is an issue in the study area. The following specific issues and needs were identified:

- Eastbound roadway congestion (include interchange capacity constraints at the Dulles Connector Road)
- Westbound roadway congestion
- Capacity issues at I-66/arterial interchanges

Transit

Transit Load Factors

Analysis of transit load factors utilized model outputs based on a run of the MWCOG/TPB Version 2.3 travel demand forecast model using the CLRP as the network input. Locations within the study area were identified where capacity issues currently exist (2007) and are projected to occur in the future (2040). Load factors were calculated as a ratio of ridership to capacity (the number of seats available on transit vehicles) during the morning peak period in the peak direction (inbound toward the District of Columbia). The model provided ridership data in riders per peak hour for all bus services combined, and the data for all rail services (Metrorail, commuter trains, and light rail transit) were grouped together.

Transit capacity was estimated using the service frequency data from the previous analysis conducted and described above. Frequency data included number of transit vehicles per hour and an average of 40 seats per bus or 800 persons per train. The average of 40 seats per bus was based on passenger seat information from the American Public Transportation Association's Transit Vehicle Database[11]. The assumption of 800 persons per train was based on WMATA's planning guideline of 100 persons per car and assuming eight cars per train.

A limitation of the bus load factors analysis relates to the bus services overlapping on certain physical segments. Because ridership data was sorted by individual routes, and the "inbound" direction of some routes was the opposite of other routes, the load factors displayed in the maps highlight the routes that are over capacity, though other routes traveling on the same segment may be under capacity. Given this limitation, the analysis remained helpful in determining specific locations and services within the study area that may be "choke points" in the bus network – places where peak ridership exceeds the available capacity on buses.

Figures 3.36 and 3.37 show the load factors on bus services, including express and local services, in 2007 and 2040, respectively. Both figures indicate that buses generally have capacity available now and in the future. The highest bus load factors in 2007 and 2040 occur on Wilson Boulevard between the Rosslyn and Clarendon Metrorail Stations and on Glebe Road near the Ballston – MU Metrorail Station. The highest load factors can be attributed to

[11] U.S. Department of Transportation Federal Transit Administration. *Transit Bus Life Cycle Cost and Year 2007 Emissions Estimation.* Washington, D.C.: National Technical Information Service, 2007, http://www.fta.dot.gov/documents/WVU_FTA_LCC_Final_Report_07-23-2007.pdf.

specific routes that have high peak ridership, but only operate one or two vehicles per hour (in both 2007 and 2040, with the exception of Metro Route 25A, which was only modeled in 2040):

- Potomac and Rappahannock Transportation Commission's OmniRide Rosslyn/Ballston Route: Commuter bus from Dale City and Woodbridge to Pentagon, Rosslyn, and Ballston

- Arlington Transit Route 52, Ballston – Virginia Hospital Center – East Falls Church: Local bus operates between the East Falls Church and Ballston Metrorail Stations, serving the Virginia Hospital Center

- Arlington Transit Route 75, Shirlington – Wakefield High School – Ballston – Virginia Square: Local bus operates from Shirlington Station to Ballston – MU and Virginia Square Metrorail Stations, serving several neighborhoods

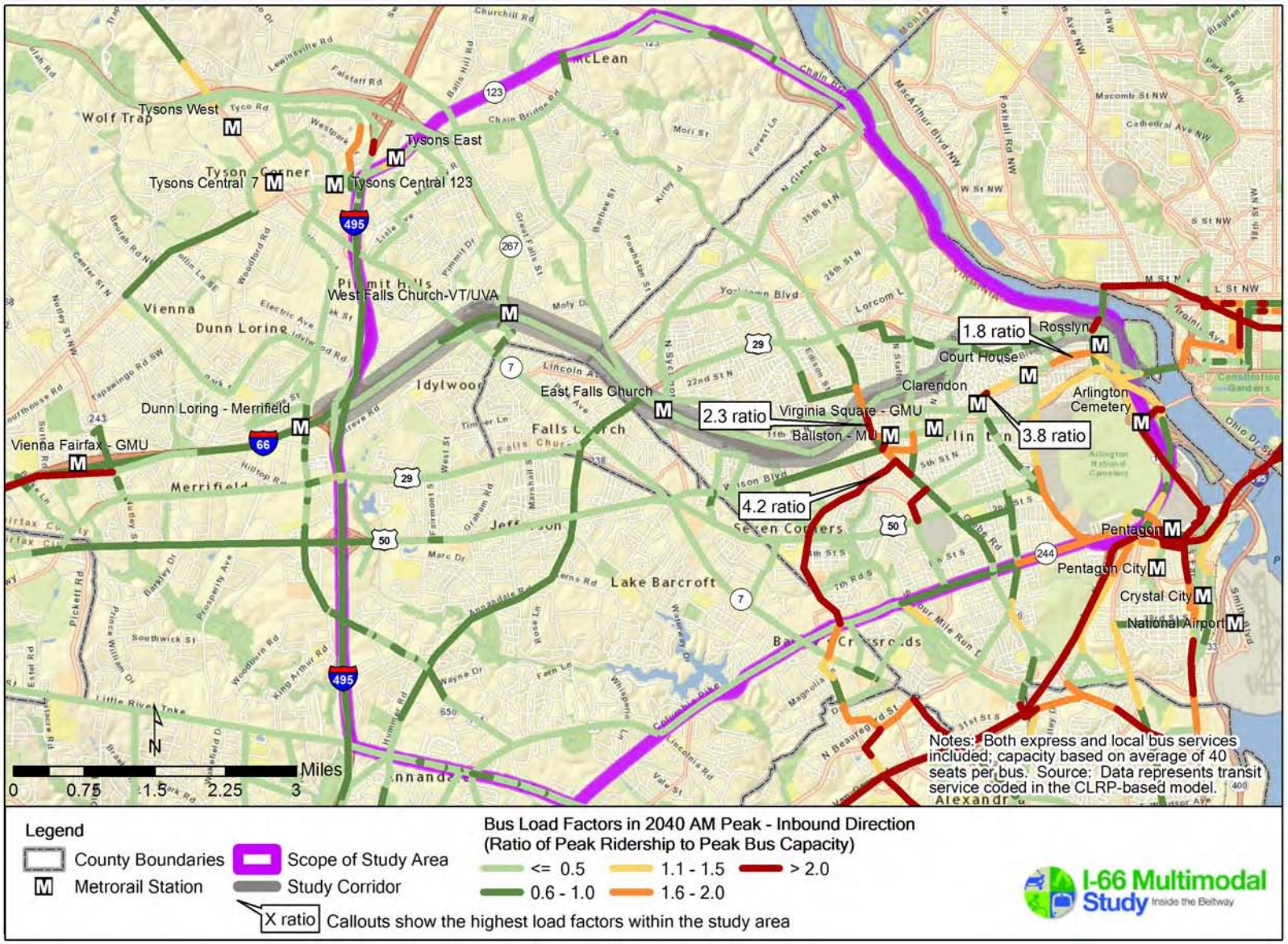
- Metro Route 10B, Hunting Towers – Ballston: Local bus operates between Alexandria and the Ballston – MU Metrorail Station, serving the Braddock Road Station and Shirlington

- Metro Route 25A, Ballston – Bradlee – Pentagon: Local Bus Service operates between the Ballston – MU and Pentagon Metrorail Stations, serving Northern Virginia Community College and Shirlington

- Metro Route 25B, Landmark – Ballston: Local bus operates between the Van Dorn Street and Ballston – MU Metrorail Stations, serving Landmark Center, Inova Alexandria Hospital, and Northern Virginia Community College

Figure 3.36 Bus Load Factor (2007)

Figure 3.37 Bus Load Factor (2040)



Figures 3.38 and 3.39 display the load factors on rail services in 2007 and 2040, respectively. The figures indicate that rail services generally have capacity available, though several segments are very near or just above capacity. The load factors are highest in the Rosslyn – Ballston Corridor. In 2007, Metrorail services from the Court House Station to the Rosslyn Station were above capacity, with the segments from Virginia Square – GMU Station to Court House Station at capacity. In 2040, none of the rail services are quite at capacity, though the segment from Tysons East to West Falls Church and again the Rosslyn – Ballston Corridor are very near capacity.

Figure 3.38 Metrorail Load Factor (2007)

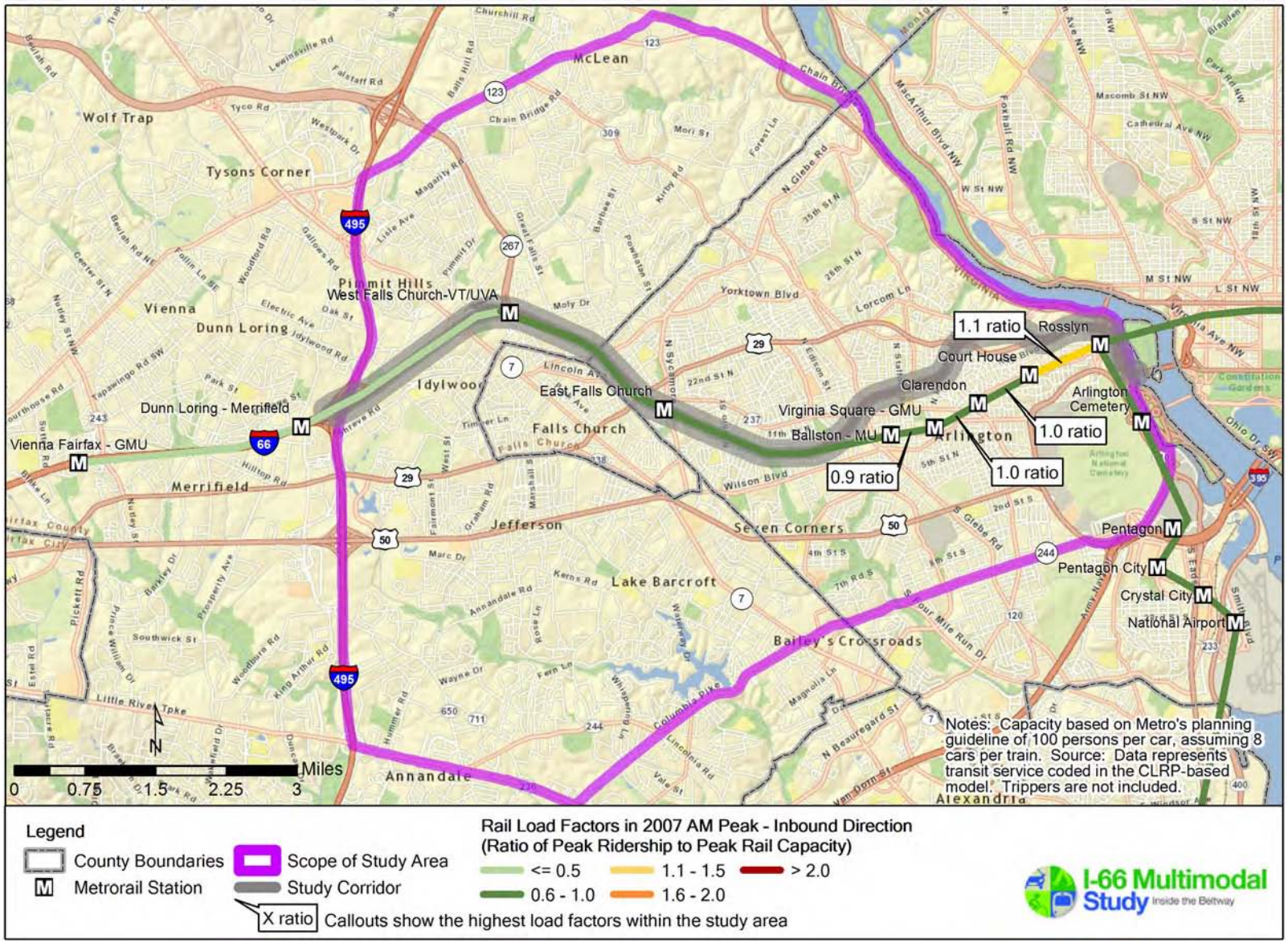


Figure 3.39 Metrorail Load Factor (2040)

Network Constraints and Opportunities

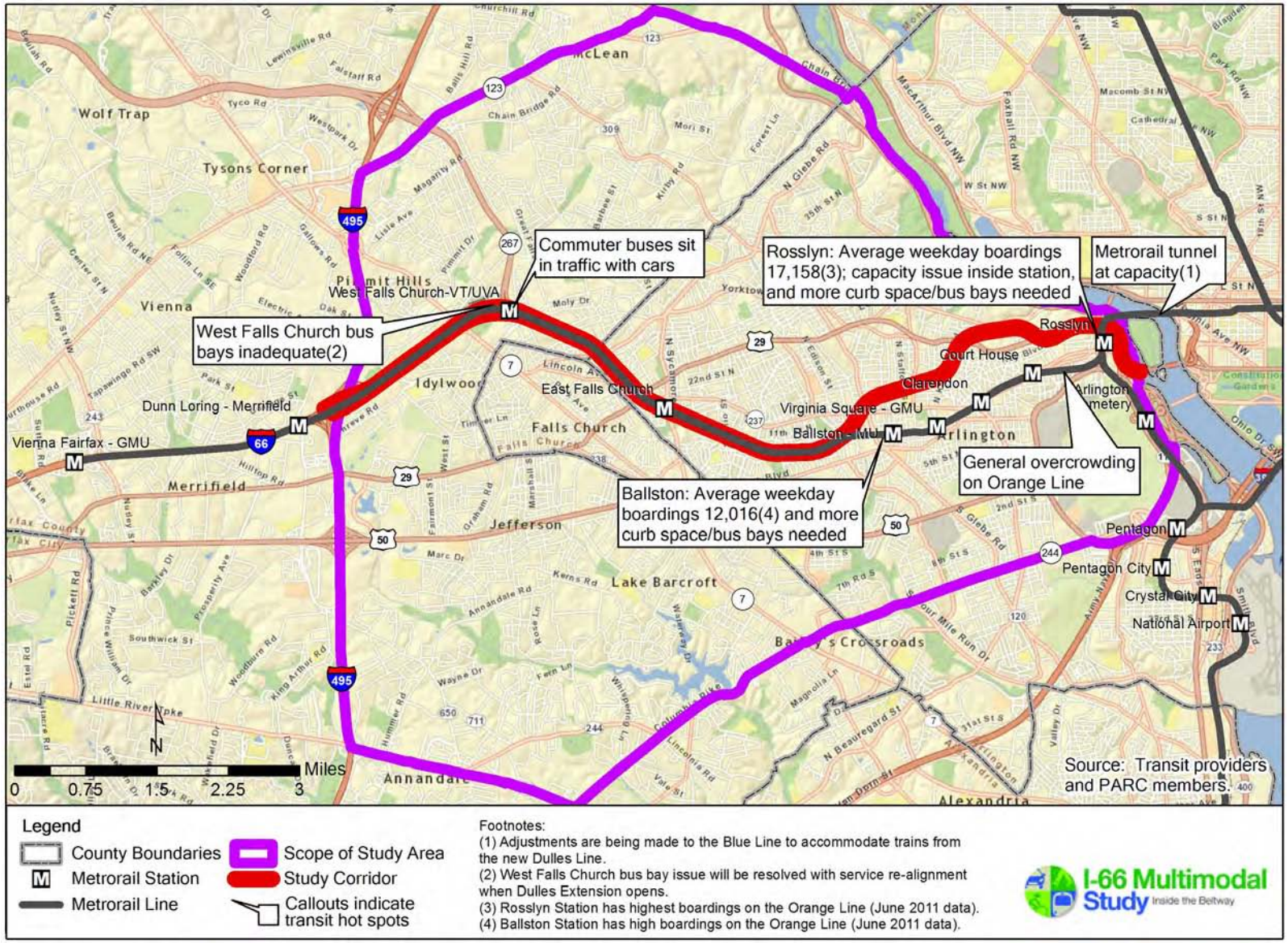
Another component of identifying transit needs and issues within the study area involved obtaining input from the service providers directly on the capacity constraints and problem areas they face today pertaining to their services, some of which are expected to continue in the future.

As a result of direct communications with transit providers in the study area, the following were identified as transit network constraints and opportunities:

- Transit capacity on Orange Line Metrorail – Orange Line trains are overcrowded, and do not have the capacity to carry the current level of riders and may not be able to carry the level of ridership anticipated in the future.
  - Metro measures load factor at the max load point (between Courthouse and Rosslyn) and has a planning standard of 100 persons per car (ppc) in the peak hour. Currently, the Orange Line is operating at 106 ppc. With its plan to re-align the Blue/Yellow Lines, Metro anticipates adding trains to the Orange Line from West Falls Church which could reduce Orange Line loads to under 100 ppc.
  - The Rosslyn portal is currently operating at its 26 trains per hour throughput capacity and cannot accommodate additional trains. Adjustments are planned to re-align some Yellow/Blue Line trains to accommodate the Silver Line trains at the Rosslyn tunnel.
  - Some Metrorail stations inside the Beltway lack passenger capacity on the platform or bus capacity for connections (street and bus bays).
- Transit bus in shared-use lanes – Buses (particularly commuter buses) sit in HOV traffic because there are no dedicated lanes for buses along the corridors. In addition to any HOV "hot spots", there is a perception that the buses have difficulty merging from the Dulles Connector Road/VA 267 onto I-66 in the morning.
- Transit connectivity (particularly with respect to bicyclists and pedestrians) – Transit passengers need to move from rail and major bus facilities to their final destinations safely and conveniently. More local circulators are a possibility, but pedestrian and bicycle access will need to be addressed.

Figure 3.40 provides a visual representation of the network constraints and opportunities noted above.

Figure 3.40 Transit Network Constraints and Opportunities



Findings

The transit assessment revealed congestion bottlenecks and capacity needs. The analysis of bus load factors indicated that the routes with capacity issues today will continue to have them without service improvements (e.g., higher frequencies). Transit connectivity also emerged in terms of adding curb space or bus bays for buses to better serve Metrorail stations, as well as improving nonmotorized access to major transit facilities. As mentioned previously, connecting transit to other modes is critical for riders to be able to access their final destinations safely and conveniently. The resulting issues and needs illuminated through these analyses include:

- Orange Line Metrorail congestion
- Adverse impact of roadway congestion on bus service
- Challenges to intermodal transfers (rail, bus, bike, car).

Bicycle/Pedestrian Component

Changes to non-motorized commuting travel on the trails and on-road routes paralleling I-66 was the focus of the bicycle and pedestrian analysis. In the study area, due to the length of anticipated trips -generally over two miles- there is greater emphasis on bicycle travel. Pedestrian circulation is addressed as it pertains to transit access, but is not deemed to be a frequently used commute mode for longer distances.

The analysis focused on existing conditions for bicycling and walking planned improvements by 2040, with a focus on known network gaps or constraints. Information was adapted from resources obtained from Arlington County, the City of Falls Church, Fairfax County, VDOT, WMATA, and MWCOG. Data sources include the Arlington County Master Transportation Plan, Fairfax County Bicycle Level of Service Analysis, Tysons Corner Bicycle Plan, WMATA Bicycle and Pedestrian Capital Needs Inventory, and the MWCOG Regional Bicycle and Pedestrian Master Plan. Each of the jurisdictions in the study area is at a different point in the development of its bicycle system which impacts the type of information that can be shown on the maps. For example, Arlington County has developed a detailed bicycle route system with signed routes, bicycle lanes, etc. On the other hand, Fairfax County has a county-wide assessment of the suitability of its roads for bicycling, and has not identified designated bicycle routes. This information is supplemented by professional knowledge of existing conditions and planned improvements for bicycling and walking in the project study area, as well as local and regional trends related to walking and bicycling.

Network Gaps and Constraints

Several improvements are needed to improve the safety and comfort of current system users and increase capacity to accommodate additional bicyclists. Arlington County has identified several bicycle facility improvements in the County's Master Transportation Plan. Fairfax County has identified several improvements for bicycling in the Tysons Corner area through the recent Tysons Corner Bicycle Plan. The City of Falls Church is wrapping up the development of a bicycle and pedestrian master plan that will include several

recommendations for improvements within the City. Many of these facility recommendations have been included as a mobility option element (see Section 5).

The analysis focused on a subset of those elements that address many of the gaps and barriers found in the on- and off-road bicycle network in the study area. These issues are illustrated in Figures 3.41 through 3.43, with greater detail provided via the corresponding number noted on the maps. Each number on the map references a brief summary of network issue, and is accompanied by a discussion of the recommendation or action identified in relevant planning documents or discussed with local staff.

Figure 3.41 Planned Bicycle Facilities (West)

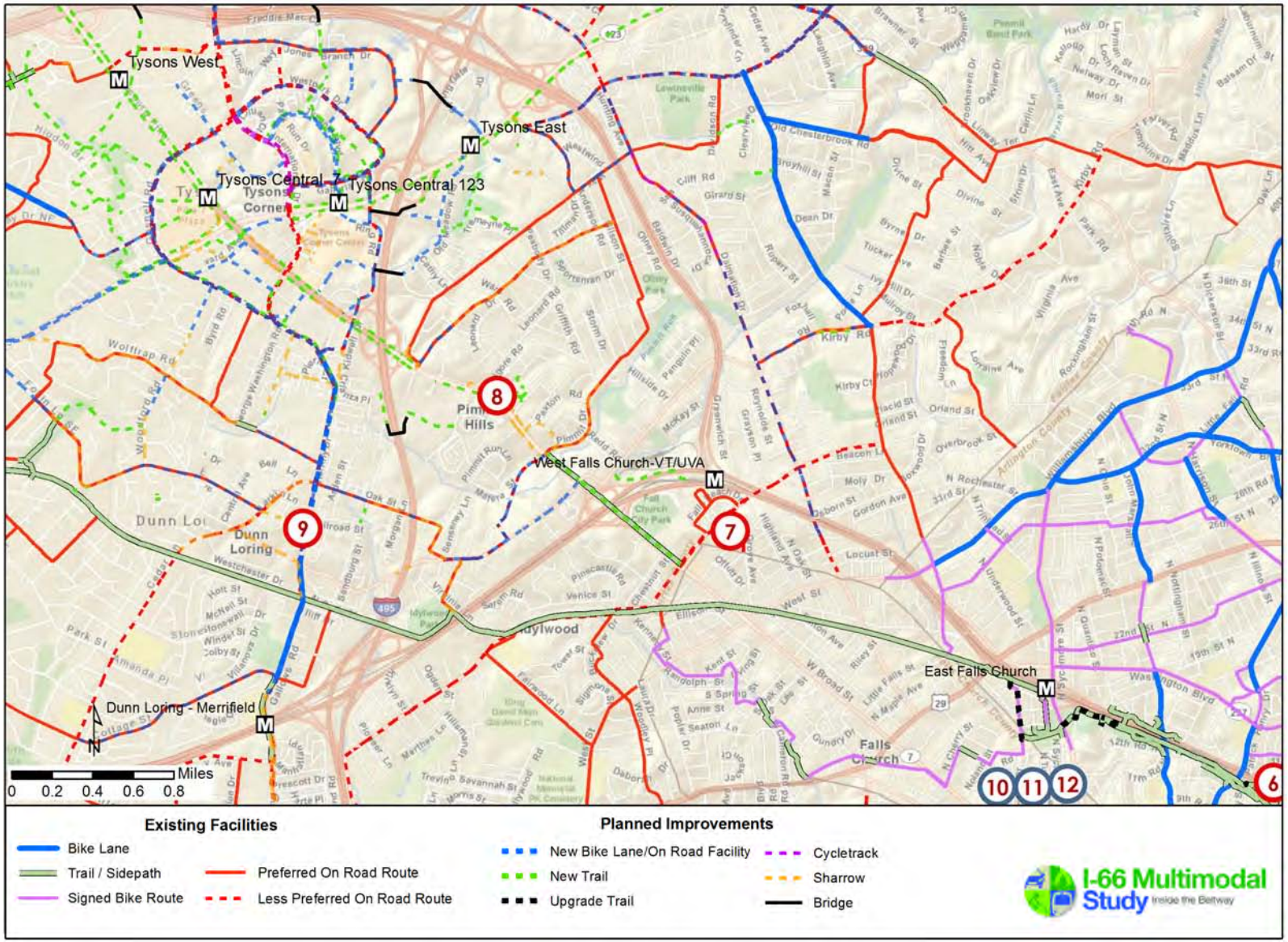


Figure 3.42 Planned Bicycle Facilities (Central)

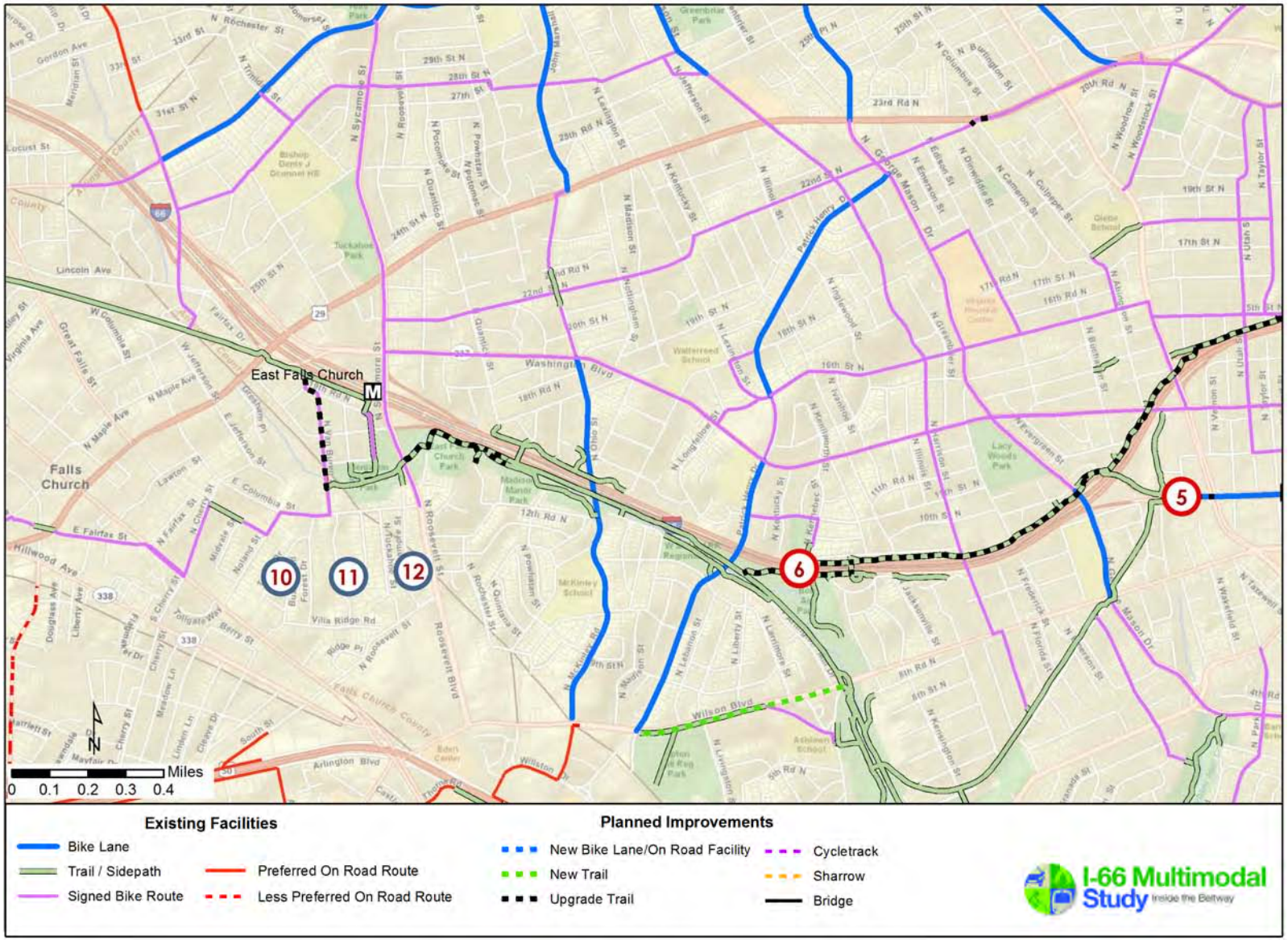
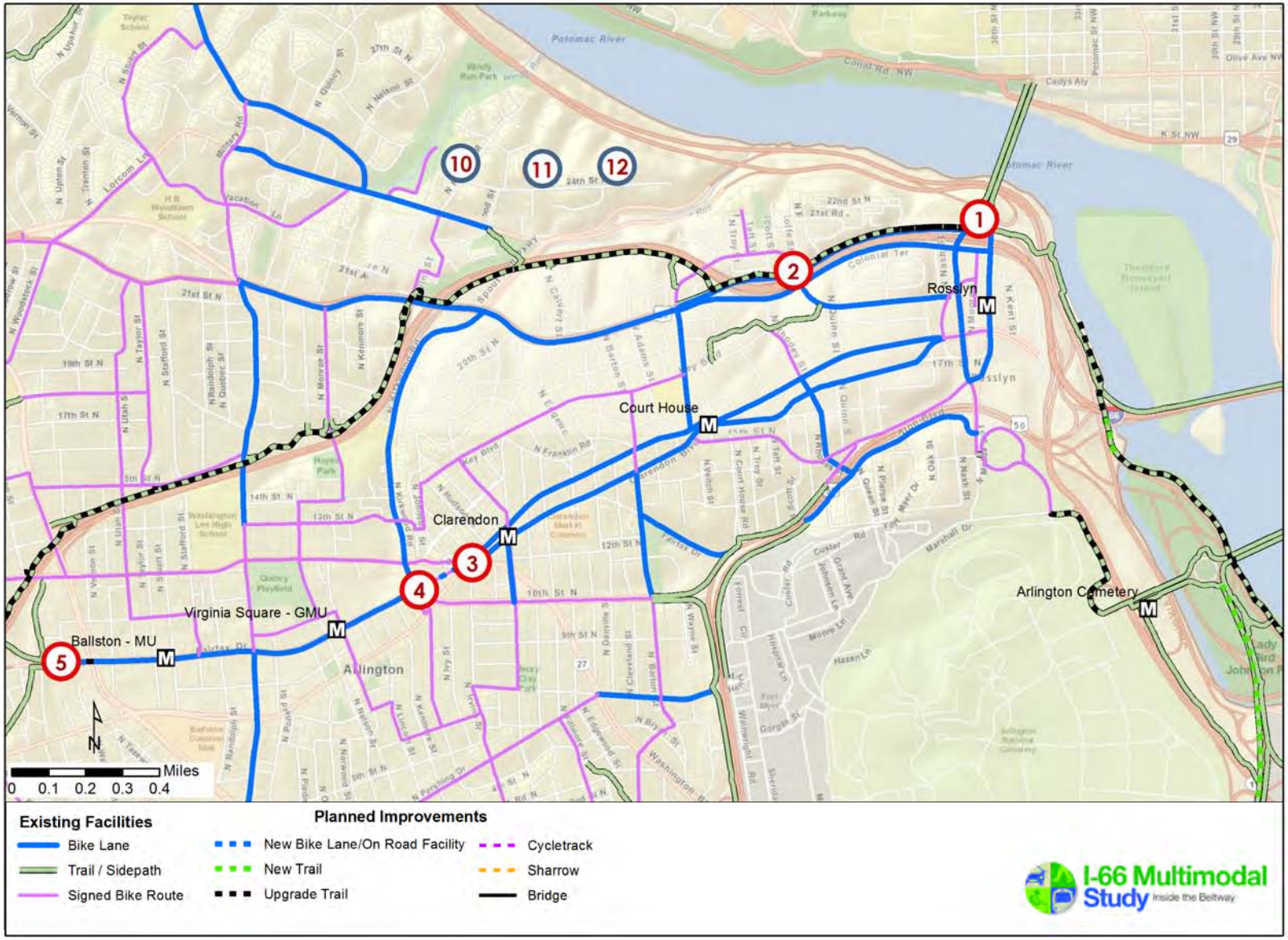


Figure 3.43 Planned Bicycle Facilities (East)



1) Lynn Street Improvements

Issue: Bicyclists and pedestrians on the Custis Trail must cross Lynn Street to access the Key Bridge and Mount Vernon Trails. Currently this is a challenging multilane crossing in an area oriented to automobile traffic.

Recommendation. Arlington County and VDOT are currently working on a design project to improve the safety and comfort of the crossing and widen the trail in this area to accommodate the volumes of trail users.

2) Scott Street Bridge

Issue: There are bike lanes on Scott Street on the south side of I-66, but no bike lanes on the bridge connecting to the Custis Trail. Curb ramps are damaged on the bridge, the crosswalk on the east leg of the intersection with Lee Highway does not line up with the curb ramp on the bridge, and utility poles obstruct the curb ramps on the corners.

Recommendation: Consider extending bicycle facilities (bike lanes or shared lane markings) across bridge. Repair curb ramps and move utility poles to prevent obstructing pedestrian access to the sidewalks on the bridge.

3) Clarendon Circle

Issue: This seven-leg intersection can be very challenging for bicyclists on Fairfax Drive due to the large numbers of turning vehicles and multiple directions that cars may be coming from.

Recommendation: Arlington County is currently evaluating design options that would simplify the intersection through a combination of road closures, conversions to one way, and road geometry changes.

4) Fairfax Drive/Kirkwood Intersection

Issue: This intersection is challenging for bicyclists and pedestrians due to the awkward geometry and multiple intersecting streets. Eastbound bicyclists on Fairfax Drive who are using the bike lane would be on the right side of the road, but the bike route to the Rosslyn-Ballston Corridor requires to cross a major traffic movement (vehicles turning onto 10th Street N) to continue on Fairfax Drive.

Recommendation: Arlington County will evaluate signage, striping, and geometry modifications at this intersection to facilitate bicycle travel.

5) Fairfax Drive/Custis Trail/Bluemont Junction Trail transition

Issue: This area can be challenging for bicyclists transitioning from the trail to the on-road section on Fairfax Drive. Auto traffic is merging/exiting I-66 at relatively high speeds and there are challenging crossings in the area.

Recommendation: Improve wayfinding in the area to assist bicyclists trying to reach the trail. Widen portions of the trail paralleling Fairfax Drive and improve pavement quality. Improve crossings at the intersection to increase bicyclist safety.

6) Custis Trail underpass near Kennebec Street/Bon Air Park

Issue: Fairly sharp turn at the bottom of a steep grade. Rapidly changes from light to dark due to the overpass. Debris accumulated at the bottom of the underpass can be hazardous for bicyclists.

Recommendation: Clear debris to improve bicyclist safety. Evaluate the need for increased lighting to address light/dark transitions. Evaluate possibility of reducing the severity of the turn, or installing addition active and passive measures to slow down bicyclists and alert them to the turn.

7) Bicycle Access to West Falls Church Metrorail Station

Issue: Poor connectivity to W&OD Trail and Tysons Corner area from W. Falls Church Metrorail Station.

Recommendation: WMATA is currently evaluating the feasibility of a trail that would connect the north side of the Metrorail Station to the Pimmit Hills neighborhood. This would facilitate access up to the Tysons Corner Area. On road and crossing improvements are needed to facilitate navigating Haycock Road. Enhanced wayfinding is needed between the Metrorail station and on the W&OD Trail to improve navigation from the trail to the station and vice versa.

8) Pimmit Hills Connection on Route 7/Leesburg Pike

Issue: Currently poor bike connectivity between Tysons Corner area and W&OD Trail/City of Falls Church. With projected growth in housing and employment in the area, need for good bicycle connections will increase.

Recommendation: As part of the Tysons Corner Bike Plan, Fairfax County is proposing to install a combination of trail and shared lane markings on Leesburg Pike to improve bike travel along the corridor.

9) Gallows Road Bike Lanes

Issue: Poor bicycle connectivity between Tysons Corner and W&OD Trail/Merrifield.

Recommendation: Fairfax County has proposed bike lanes on Gallows road between Leesburg Pike and the W&OD Trail.

In addition to the location specific issues and associated recommendations, three general issues have been identified that should be addressed on a corridor-wide level to improve conditions for bicycle commuting along the corridor.

10) Trail width and pavement condition

Issue: In many sections, the W&OD Trail and Custis Trail are too narrow to comfortably accommodate the volumes of bicyclists currently using the trail, much less the anticipated increases in ridership that are expected in the future. Furthermore, tree roots, erosion, and other impacts have deteriorated the trail surface, decreasing the safety and travel speed of bicyclists.

Recommendation: Arlington County's MTP includes recommendations to resurface and widen the Custis Trail. Similar plans should be considered for the W&OD Trail.

11) Regional Wayfinding

Issue: There is little existing signage and wayfinding in many parts of the study area. Additionally, some of the existing wayfinding is confusing.

Recommendation: Comprehensive, destination-oriented sign system is needed. Arlington is currently developing new wayfinding for portions of the Rosslyn-Ballston Corridor and other parts of the study area that will improve navigation.

12) Trail Lighting

Issue: While there is currently some lighting on portions of the Custis Trail, it should be improved and applied consistently along the trail system. As shown in the bicycle commuting figures above, many cyclists are traveling before dawn and after dusk, especially in the fall and winter when days are shorter.

Recommendation: Evaluate existing lighting and identify opportunities for enhancement. NVRPA is currently conducting a feasibility study of lighting sections of the W&OD Trail.

Additionally the City of Falls Church is working on bicycle network links that will feed into the O&D Trail and provide parallel access through Falls Church.

Bicycle and Pedestrian Transit Access

Bicycle and Pedestrian access to transit was considered as part of the development of issues and needs. Arlington County DOT and ART are currently undertaking a project to evaluate the accessibility of bus stops on major roadway corridors, as well as the accessibility of pathways to these stops. In addition, WMATA recently completed an inventory of needed bicycle and pedestrian circulation improvements at its Metrorail stations in the study area, including improvements to bicycle parking (e.g., additional bicycle parking, covered bicycle parking, increased security, etc.). According to a 2005 study by Arlington County, 72 percent of Metrorail riders in the County access stations as pedestrians.[12] A 2011 count of parked bicycles at Metrorail stations by WMATA found that some of the highest numbers of bicycle parking at Metrorail stations in the region are along the Orange Line corridor.[13]

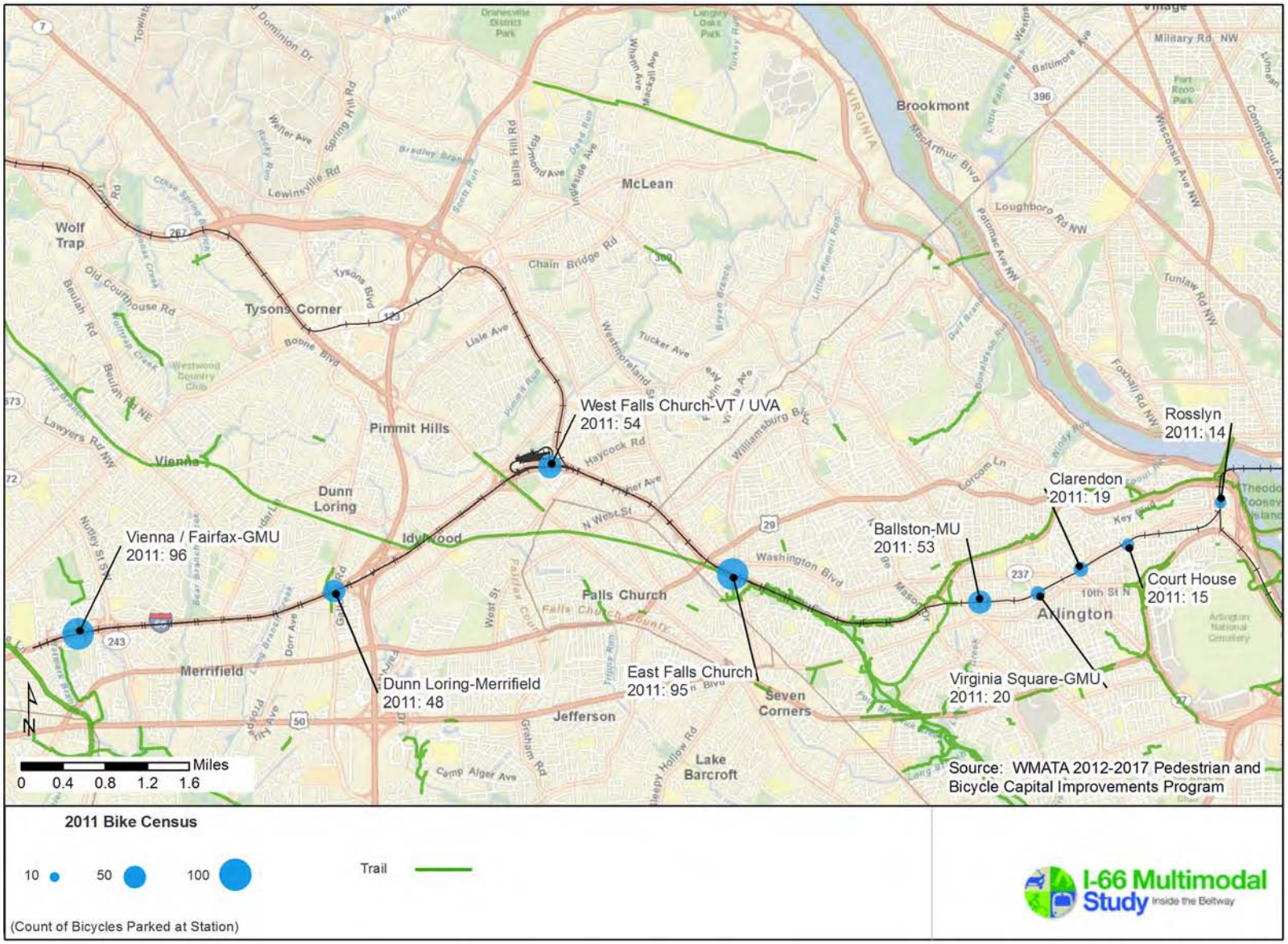
As Figure 3.44 illustrates, stations to the west tend to have higher volumes of parked bicycles. Metrorail stations located in the eastern portion of the study area, including those in the more densely populated and commercial Rosslyn-Ballston Corridor, tend to have lower numbers of bicycles parked at stations serving the Orange Line. This is likely due to the relative proximity of housing and employment to the stations compared to lower density residential neighborhoods found in the western portion of the study area. In many cases, it is simply more convenient to

[12]2005 Public Perceptions of Transit Study, Arlington County. Accessed online: http://www.commuterpage.com/research/viewAll.asp.

[13] WMATA 2012-2017 Pedestrian and Bicycle Capital Improvements Program. WMATA, completed by Toole Design Group in September, 2011.

walk to/from a Metrorail station rather than ride a bicycle. Also, bicyclists traveling from points to the west of the study area will likely ride to the Metrorail station closest to their point of origin, or to a station closest to a trail (i.e., the W&OD Trail). Proximity to the trail may help explain why the Vienna and East Falls Church Metrorail stations have significantly higher volumes of parked bicycles than other stations. Given this analysis, it is reasonable to assume that improved bicycle access to other stations may contribute to higher bicycle ridership to those stations.

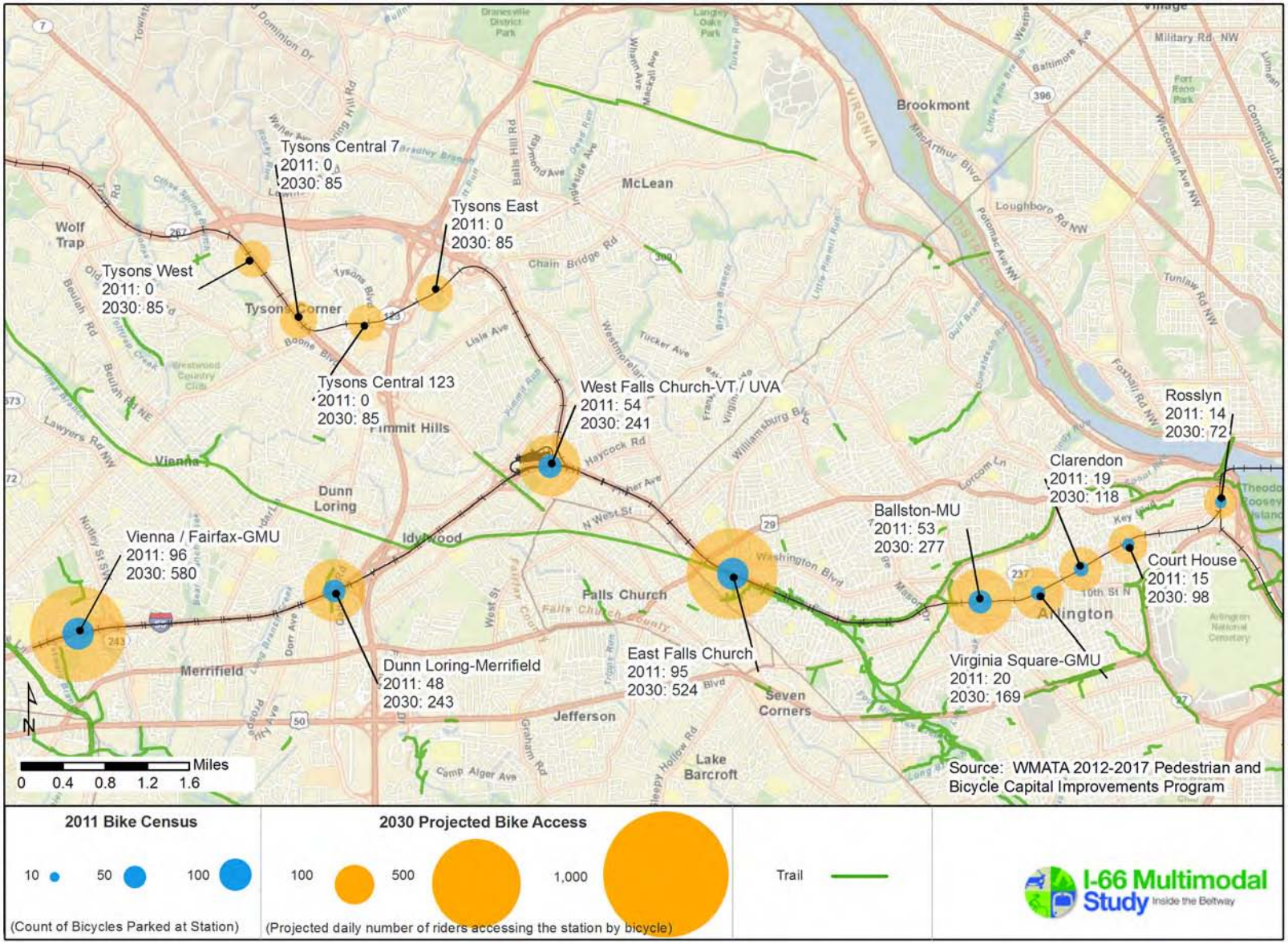
Figure 3.44 Existing Metrorail Bicycle Parking Volumes (2011)



WMATA has adopted a goal of increasing the systemwide bicycle access mode share to 2.1 percent by 2020 and 3.5 percent by 2030. According to a 2011 WMATA bicycle and pedestrian station access study , bicycle mode of access across the Metrorail system accounts for approximately 0.7 percent of all trips..[14] Changes to mode share are not anticipated to be distributed evenly across all stations. Rather, it is reasonable to assume that stations currently experiencing high bicycle mode of access shares will continue in the future. In the case of the I-66 corridor, several Metrorail stations currently have relatively high rates of bicycle access. WMATA's recent study of bicycle and pedestrian needs at Metrorail stations projected bicycle parking space requirements to meet the 2020 and 2030 mode share goals. Calculations were based on projected ridership increases at each Metrorail station and current levels of bicycle access. Figure 3.45 illustrates the estimated number of bicycle parking spaces required at stations on the Orange Line as well ast the Silver Line. These numbers are based on a total estimated need of 380 bicycle parking spaces distributed evenly across the four Silver Line stations. Actual distribution will likely vary from this based on development phasing and buildout of the recommended bicycle network.

[14] WMATA 2012-2017 Pedestrian and Bicycle Capital Improvements Program.

Figure 3.45 Future Metrorail Bicycle Parking Volumes (2030)



Overall Figure 3.45 demonstrates that there will be significant growth in bicycle access anticipated for Metrorail stations serving the study area. West Falls Church is projected to expereince a growth of over 500 percent and Virginia Square-GMU is projected to need over 800 percent more bicycle parking than exists today. The implications for bicycle travel extend beyond the basic bicycle parking needs at the Metrorail stations, as it will necessitate improved on- and off-road bicycle facilities to allow these trips to occur in a manner that is safe and convenient for bicyclists, and other modes as well.

In summary, the following three bicycle/pedestrian system related issues and needs were identified as a result of these analyses:

- Limitations/gaps in bicycle and pedestrian accessibility and connectivity. For example, certain intersections on the on-road Rosslyn-Ballston corridor routes may be challenging for less experienced bicyclists.

- Challenges to intermodal transfers (rail, bus, bike, car). Although many of the Metrorail stations in the study area are easily accessible by walking or bicycling. However some, such as the West Falls Church station are bounded by high volume roadways that impair bicycle and pedestrian access.

- Bottlenecks on W&OD and Custis Trails. The volume of bicyclists on the major trails in the study area is creating congestion during peak morning and evening rush hours. This is exacerbated by narrow spots in the trails, tight turns and other physical constraints.

TDM

There are a number of programs classified as TDM which are being used in or impact the study area. Discussed below are the issues and opportunities facing many of the programs, organized by program.

Telework

Potentially one of the most promising TDM components for improving congestion on the I-66 corridor is telecommuting. The percentage of teleworkers in Northern Virginia is significantly higher than the statewide average. Occasional telecommuters, as a class, are growing even faster than full-time telecommuters. Currently over a quarter of workers in the DC region occasionally telework, compared to only 11 percent in 2001.[15] The growth in occasional telecommuters is important from a congestion mitigation standpoint given that these workers do not randomly select the times they work remotely but rather consider a number of factors including predicted travel conditions. If workers who have discretion over their work times have adequate information as to likely traffic conditions, including non-recurring congestion, they can significantly contribute to the ability of the network to accommodate peak period use. Several governmental entities within the I-66 study area and environs have developed programs to encourage telecommutes. The Commuter Connections program through the

[15] http://www.mwcog.org/uploads/committee-documents/al5YW19X20100721135321.pdf

MWCOG has played a role in distributing information on telework facilitation. Direct outreach to employers on how to facilitate telework opportunities is another strategy that has been employed by transportation management agencies. The clear target groups for telework outreach are the remaining workers for whom a telework program is available but not utilized, and those employers who do not yet offer a telework option.

Compressed Work Schedules

Compressed work schedules (CWS) are another option that has a significant potential to aid traffic congestion. Compressed work schedules are typically defined as schedules that require a full-time hourly requirement within a four day work week. Employees who might be attracted to a compressed work schedule include those who require direct access to sensitive equipment or information that precludes telework, yet can use a compressed schedule to lower the total amount of time spent commuting each week. CWS provides a dual benefit: not only is a significant share of total VMT removed from the system, but the remaining VMT is pushed to non-peak hours. The Fairfax County employee outreach program, for example, supports flextime and compressed work schedule options. Compared to telework and flex-time, CWS is much more rarely utilized. Only four percent of commuters surveyed who had non-standard work hours within the region had compressed work schedules.

Carpooling Programs

Potential infrastructure investments to support carpooling include supporting commuter lots for formal and informal carpools and the continued enforcement of HOV restrictions. The need for slug lines in the corridor might begin if HOV 3+ restrictions were put into place in the corridor. The introduction of the Beltway HOT lanes may inspire some casual carpools to begin forming, but the specific travel patterns involved may not directly impact the I-66 corridor. The market research effort described in Section 6 and the travel demand forecasting work will address the potential for growth in carpools in the corridor.

Employee Commute Benefits

Employer provided benefits to encourage transit use is a TDM strategy in which local governmental entities have supported participating employers. Washington, D.C. area employers can provide transit subsidy benefits through SmarTrip. The Arlington Transportation Partners (ATP) is a collection of companies representing over 130,000 employees that began coordinating commuter benefits in 2010. Companies that do not offer a straight subsidy often allow commuters to establish tax exempt accounts for transit use and thereby encourage employees to commit to a certain minimum threshold of transit spending. The market research effort described in Section 6 explored the presence of employee commute benefits among surveyed commuters.

3.5 Synthesis of Issues and Needs

The conduct of the modal analyses described in this section of the report together have resulted in the identification of a comprehensive set of issues and needs relevant to the study area. The issues and needs are both quantitatively and qualitatively informed by the analyses performed and also reflect input received from the Lead Agency and PARC. Development of the final set

of issues and needs was an iterative process that engaged the Lead Agencies and the PARC. The issues and needs were modified where appropriate to focus on consistency as well as organizational or simplified language changes that emerged throughout the refinement process. The list of issues and needs will be used as the basis from which the preliminary mobility options will pivot.

In summary, the comprehensive set of transportation issues and needs within the study area are:

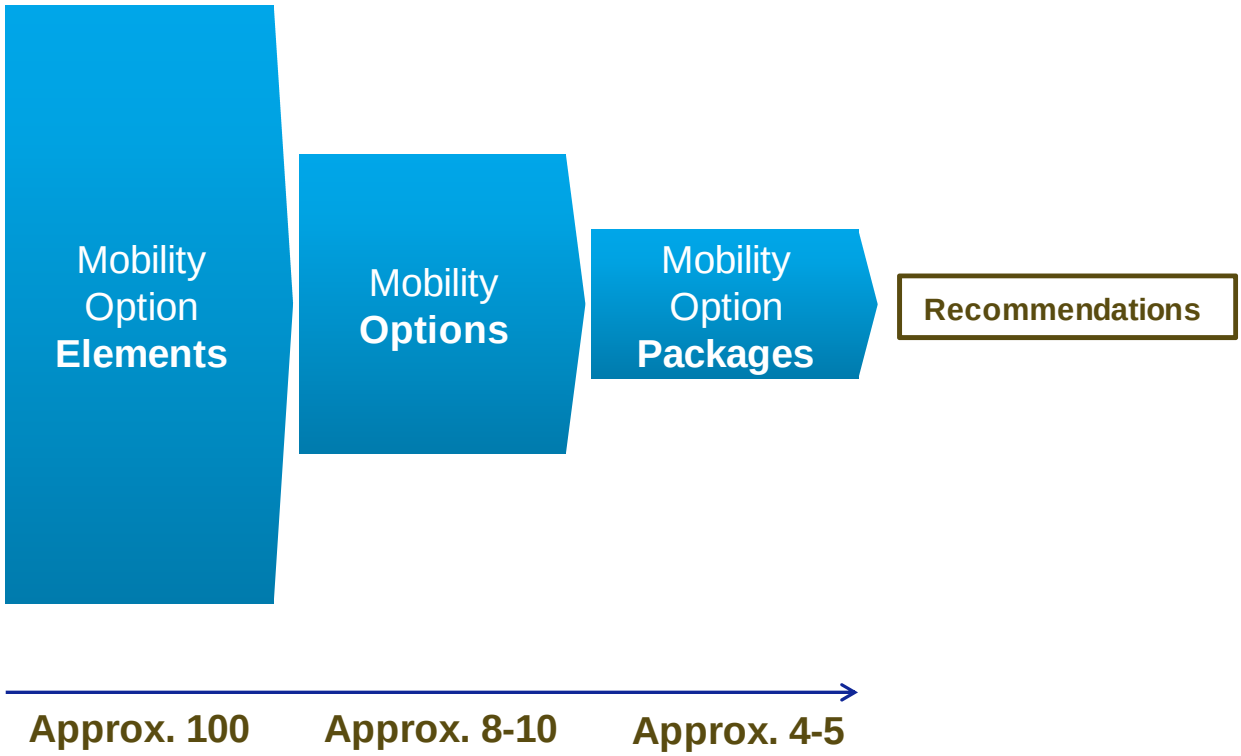
- Westbound roadway congestion
- Eastbound roadway congestion (include interchange capacity constraints at the Dulles Connector Road)
- Capacity issues at I-66/arterial interchanges
- Non-HOV users during HOV operation hours
- Orange Line Metrorail congestion
- Adverse impact of roadway congestion on bus service
- Challenges to intermodal transfers (rail, bus, bike, car)
- Bottlenecks on W&OD and Custis Trails
- Limitations/gaps in bicycle and pedestrian accessibility and connectivity.

4.0 Evaluation Methodology

4.1 Overview

The evaluation methodology was developed to provide a structured framework for arriving at a set of multimodal recommendations for the I-66 Multimodal Study. As illustrated in Figure 4.1, the evaluation methodology for the study provides a means to move from a starting point of numerous ideas – referred to as mobility option elements – down a path to recommendations, considering first a set of eight to ten mobility options and then narrowing to a set of four or five mobility option packages before developing recommendations.

Figure 4.1 Path to Recommendations



The evaluation methodology for the study involves several steps, each of which are described in more detail in the sections that follow:

- Identification of issues and needs germane to the study area;
- Identification of mobility option elements from existing planning sources and new ideas;

- Formulation and assessment of mobility options; and
- Formulation and assessment of mobility option packages.

Key inputs to refining these steps include ongoing technical analyses, PARC feedback from monthly meetings, market research findings, stakeholder interviews throughout the project duration, and public outreach at key milestones.

4.2 Identification of Issues and Needs

As described in Section 3 of this report, in order to identify issues and needs associated with the I-66 corridor inside the Beltway, a systematic process was undertaken to: 1) review relevant studies and proposed projects for the study area, 2) consider factors influencing travel, and 3) review key modal indicators of issues and needs. Together these technical activities illuminated a core set of issues and needs within the study area. Section 3 provides a discussion of the technical analyses performed in the first half of the study. The highway assessment illustrated congested areas in each direction within the study area at different times of day and considered existing and 2040 conditions. Similarly, the transit assessment revealed anticipated service changes for bus and rail in addition to known congestion bottlenecks and capacity needs. The bicycle and pedestrian assessment focused more on connectivity, network gaps, and constraints. The intelligent transportation systems (ITS) and transportation demand management (TDM) reviews focused on programs in place and planned.

The resulting list of issues and needs synthesized in Section 3 provides the foundation of the evaluation methodology and carries forward in all subsequent analyses. That is, the mobility options and the mobility option packages flow from the issues and needs.

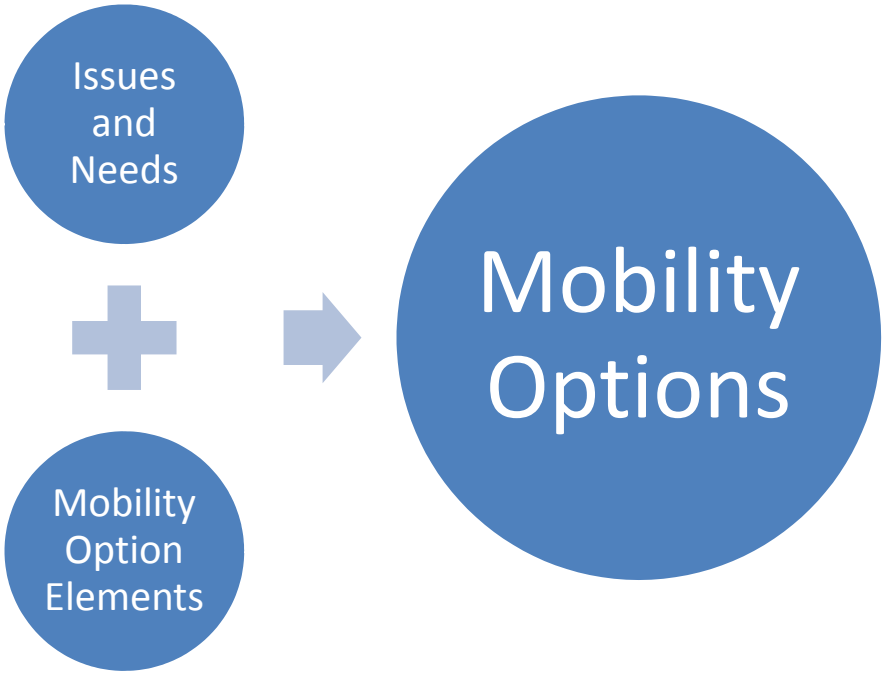
4.3 Identification of Mobility Option Elements

The study design incorporates a review of past ideas and studies for mobility enhancement as well as an opportunity for identification of potential new strategies. For the purposes of this study, mobility option elements are considered to be strategies (e.g., tolling), projects (e.g., construct ramp), policies (e.g., HOV hours), services (e.g. new/expanded bus service), and programs (e.g., TDM measures) to reduce highway and transit congestion and improve overall mobility in the study area. The inventory of mobility option elements represents all element types – highway, transit, bicycle/pedestrian, TDM, ITS – considered as part of the I-66 Multimodal Study. Section 5 covers the development and specific listing of mobility option elements identified through this study.

4.4 Formulation of Mobility Options

The issues and needs and mobility option elements serve as the basis for formulating mobility options, as illustrated in Figure 4.2. That is, all mobility options link back to issues and needs and all mobility options link back to mobility option elements.

Figure 4.2 Issues and Needs and Mobility Option Elements are the basis for Mobility Options



This process begins with organizing the issues and needs compared against potential solutions. Potential solutions were grouped into logical implementation actions that support a single or group of issues and needs. In this way, solutions offer a bridge to stimulate thinking through the formulation of potential mobility options. Some issues and needs can be grouped together to reflect overlaps in potential implementation actions. The issues and needs can also be organized by mode and sub-mode or by transportation system element.

Each mobility option is developed through a synthesis of the mobility option elements list described and presented in Section 5. The identification of elements within each preliminary mobility option considers PARC input to date and requires application of a synthesis process that:

- Focuses on the alignment of the mobility option elements with the identified issues and needs;
- Consolidates related mobility option elements;
- Keeps mobility option elements that are related to solutions;

- Ties the mobility option elements to the study area and project goal; and

- Keep mobility option elements without fatal implementation constraints. Potential fatal flaws are considered to be those that would severely limit the ability to implement (e.g., cost prohibitive; ROW prohibitive, etc.).

The intent of the synthesis process is to document the disposition of mobility option elements that are retained as part of the mobility options that are being tested. Feasibility considerations considered findings from the I-66 Transit/TDM Study and other relevant corridor studies referenced in Section 5.

Some mobility option elements may fit into bundled solutions, others are more discrete. For example, changes to bus service for one route can be considered in the context of all changes to bus service. Ultimately, each mobility option is designed to test the stand-alone network and travel benefits above and beyond implementation of the CLRP+/Baseline scenario (described in Section 5). This process of testing solutions for addressing congestion in the I-66 corridor allows the information from this round of analysis to better support decisions on the organization of mobility options into mobility option packages.

4.5 Assessment of Mobility Options

As previously noted, the foundation from which all mobility options were identified was a set of issues and needs specific to the transportation challenges in the corridor. The eight to 10 mobility options are carried forward in the study for more detailed analysis. The mobility options are assessed using the National Capital Region Transportation Planning Board (TPB) Version 2.3 travel demand forecasting model to assist in generating performance measures. This is the adopted model used for long range planning and air quality conformity testing in the region. The measures help assess how well mobility options address issues and needs. Emphasis is on the following criteria, which are outputs from the model:

- Non-SOV Mode Share – Preferred are mobility options that increase the share of non-SOV travel use in the study area.

- Person Throughput – Preferred are mobility options that increase person throughput regardless of mode. For this measure, person throughput is evaluated at four screenlines along the corridor as well as total Person Miles of Travel (PMT) within the study area.

- Vehicle Miles of Travel (VMT) – Preferred are mobility options that reduce congested VMT in the study area, specifically non-HOV recurring congestion. In addition, VMT is reported by volume to capacity ratio based level of service categories for all links in the study area.

These measures inform which options advance in whole or in part as a package. The focus for these measures is the year 2040, but year 2020 is also included to address time-phased strategy opportunities. The measures are calculated and compared to the no-build scenario (CLRP+) which includes the CLRP and transit and TDM improvements from the I-66 Transit/TDM Study as described in Section 5. As a technical matter, to economize on the schedule

requirements, a streamlined approach will be used to run the model for the mobility option evaluation (the travel patterns [i.e., trip distribution] will be held constant, but mode choice and network assignment will be rerun for each mobility option tested).

In addition to the model-based evaluation of mobility options, a qualitative assessment will also be undertaken to support the move from the assessment of mobility options to the formulation of mobility option packages. The model outputs provide a useful tool from which to evaluate good candidates of options that advance to packages, however, there may be legitimate reasons for advancing certain options over others that may not be captured by the quantitative assessment alone.

4.6 Formulation of Mobility Option Packages

The next step on the path to recommendations is using information from the mobility option assessment to formulate a set of four to five multimodal mobility option packages. That is, the identified measures of effectiveness and supplemental qualitative criteria permit an assessment of how well each mobility option addresses one or more of the identified issues and needs. The final packages for testing are anticipated to be multimodal and will be developed in coordination with the Lead Agencies and with input from the PARC.

4.7 Assessment of Mobility Option Packages

The mobility option packages will be evaluated based on a broad range of quantitative and qualitative criteria. Each mobility package will be coded into the TPB Version 2.3 travel demand forecasting model and a forecast will be generated. Through review of 1) the model output, 2) information developed through the market research, and 3) other analytical techniques, several measures will be developed to evaluate the mobility option packages:

- Non-SOV Mode Share – Preferred packages improve mode share for non-SOV modes. This includes improvements in multimodal choices reflected by increased mode shares for transit and HOV.

- Person Throughput – Preferred packages improve mobility in the corridor as measured by increased person throughput. Person throughput is calculated at the same four screenlines defined in the mobility option analysis. Person-Miles of Travel (PMT) by mode for I-66 and the total study area is also reported.

- Vehicle Miles of Travel (VMT) – Total VMT, VMT along I-66, and VMT by level of service (including congested VMT) are calculated for all links in the study area. Reductions in VMT can represent reductions in greenhouse gas emissions, better use of non-SOV modes, and improved accessibility to attractions (i.e., shorter paths).

- Travel Time – Model travel time differences are calculated for highway and transit modes as compared to the no-build option, also denoted as the base 2040 CLRP+ alternative. The travel times are calculated for select origin and destination pairs in or around the defined

study area. Changes reflect improved (or degraded) mobility and accessibility in the corridor including improved (or degraded) connections to activity centers that are located in or near the study area.

- Level of Service (LOS) Maps – LOS for the highway facilities, transit service, and bicycle facilities that are in the defined study area will be developed.

- Non-Motorized Travel – Impacts on non-motorized travel, including reporting the number of non-motorized trips from the travel demand forecasting model, will be analyzed. Non-motorized travel impacts include changes in the number of walk trips to access transit, improvements in bicycle and pedestrian connections, and changes in transit accessibility measured by the number of jobs and households within a quarter mile of transit service.

- Cost/Benefit Analysis – A modified TIGER cost/benefit approach will be applied to each of the mobility option packages. Benefits will be assessed according to the extent to which each package performs in the following categories:

  - *State of Good Repair*: Improving the condition of existing transportation facilities and systems, with particular emphasis on projects that minimize life-cycle costs;
  - *Economic Competitiveness*: Contributing to economic competitiveness over the medium- to long-term;
  - *Livability*: Fostering livable communities through place-based policies and investments that increase transportation choices and access to transportation services;
  - *Environmental Sustainability*: Improving energy efficiency, reducing dependence on oil, reducing greenhouse gas emissions and benefitting the environment; and
  - *Safety*: Improving the safety of transportation facilities and systems.

Based on the assessment measures generated for the mobility option packages, either a single preferred package will be recommended, or a recommendation will be constructed based on one or more of the package components.

5.0 Mobility Option Elements

The study design incorporates a review of past ideas and studies for mobility enhancement as well as an opportunity for the identification of potential new strategies. The initial list of mobility option elements was compiled incrementally through a review of existing planning documents, studies, and analyses (see Table 5.1) and from discussions with PARC members, the Lead Agencies, and the Consultant team.

The comprehensive set of mobility option elements – strategies (e.g., tolling), projects (e.g., construct ramp), policies (e.g., HOV hours), services (e.g., new/expanded bus service), and programs (e.g., TDM measures) – applicable in the study area represents all element types (i.e., highway, transit, bicycle/pedestrian, TDM, and ITS) considered in the I-66 Multimodal Study. The initial mobility option elements were not screened in any fashion other than for general conformity with the defined study area boundaries. As development of the initial list of mobility option elements progressed between August and October 2011, the list of mobility option elements was refined through an iterative process.

Table 5.1 Selected Sources of Mobility Options Elements

Jurisdictional[1] plans including Transit Development Plans (TDP), Bicycle and Pedestrian Master Plans, and Transportation Master Plans
2007-2008 Metropolitan Washington Council of Governments Household Travel Survey
I-66 Transit/Transportation Demand Management (TDM) Study
Idea-66 Study
National Capital Region Transportation Planning Board (TPB) Constrained Long-Range Plan
Northern Virginia Transportation Authority's "TransAction 2030" Long Range Plan
Policy goals outlined in "The Governor's Multimodal Strategic Plan for the Commonwealth of Virginia (2010)"
TransAction 2040
VDOT Project web site (http://www.virginiadot.org/projects/default.asp)
VDOT Six-Year Improvement Plan
VRE Strategic Plan
VDOT I-66 Active Traffic Management Initiative
VTrans2035 Long-Range Multimodal Transportation Plan
WMATA Capital Improvement Program FY 2011-2017
WMATA Regional Transportation System Plan

[1] Jurisdictions include Arlington, Fairfax, Loudoun and Prince William Counties as well as the Cities of Alexandria, Fairfax, Falls Church, Manassas and Manassas Park, and the District of Columbia.

Future improvements that have been identified as being within current funding capabilities of the region between 2010 and 2040 are programmed in the Financially Constrained Long-Range Transportation Plan (CLRP). CLRP projects for 2040 are assumed in the baseline for this study. In addition, the baseline for this study reflects recommendations from the I-66 Transit/TDM Study, and is designated as CLRP+. The baseline projects will be coded in the National Capital Region Transportation Planning Board (TPB) Version 2.3 Travel Demand Forecasting model and considered in the future no-build scenario. The CLRP and CLRP+/baseline projects are shown in Table 5.3.

Table 5.2 presents the list of mobility option elements derived from an existing source document or put forward for consideration by the Lead Agencies or PARC that are not already part of the baseline for this study. The mobility options that will be carried forward for more detailed analysis will be built from one or more of the mobility option elements. As such, the inventory of mobility option elements will remain relevant throughout the study.

Table 5.2 Mobility Options Elements

	Category
	Highway
	Spot Improvements
1	VA 120/South Glebe Road – Signalization and intersection/interchange ramp improvements, including the addition/lengthening of turn bays, within the cited limits.
2	Signal upgrade at five major arterials in Arlington along VA 613/Wilson Boulevard and Clarendon Boulevard
	Widening
1	I-66 – Add Bus/HOV 2+ lane in each direction with HOV 2+ (both directions all lanes HOV 2+)
2	I-66 – Add Bus/HOV 3+ lane in each direction with HOV 3+ (both directions all lanes HOV 3+)
3	I-66 – Add a lane to each direction and make all three lanes HOT for 24/7
4	I-66 – Add a lane to each direction and make one lane HOT, two lanes HOV 2/3+
5	I-66 – Widen Fairfax County Line to DC District Line
6	I-66 – Widen from I-495 to Arlington County Line
7	U.S. 50/Arlington Boulevard – Widen from VA 120/South Glebe Road to VA 27/Washington Boulevard
8	VA 27/Washington Boulevard – Widen from U.S. 50/Arlington Boulevard to VA 244/ Columbia Pike
9	U.S. 29/Lee Highway – Widen from Eastern City Line of Falls Church City Line to Sycamore Street
10	U.S. 29/Lee Highway – Widen from VA 309 North/Old Dominion Drive to VA 309 South/Old Dominion Drive
11	U.S. 29/Lee Highway – Widen from VA 309 South/Old Dominion Drive to Kenmore Street
12	U.S. 29/Lee Highway – Widen from VA 243/Nutley Street to Western City Line of Falls Church City Line
13	VA 120/North Glebe Road – Widen from VA 123/Chain Bridge Road to Military Road
14	VA 120/North Glebe Road – Widen from Henderson Road to U.S. 50/Arlington Boulevard
15	VA 123/Dolley Madison Boulevard – Widen from four-lane to a six/eight-lane roadway from I-495 to VA 694/Great Falls Street

Table 5.2 Mobility Options Elements (continued)

	Category
	Reconstruction
1	U.S. 29/Lee Highway – Safety and signal improvements consistent with the Arlington County Comprehensive Plan (pedestrian signals, construction of new sidewalks, and streetscape improvements) from the Fairfax County Line to the Potomac River
	Other
1	I-66 – Institute Bus/HOV 2+ in westbound a.m. direction
2	I-66 – Institute Bus/HOV 3+ in westbound a.m. direction
3	I-66 – Eliminate exemptions (hybrid and airport traffic) and enhance enforcement
4	I-66 – Expand HOV hours to be consistent with outside the Beltway (5:30-9:30 a.m., 3:00-7:00 p.m.)
5	I-66 – Make the existing facility HOT for 24/7
	Transit
	New Bus Services
1	Wilson Boulevard Limited Stop Route (1X) from Vienna Metro Station to Ballston Metro Station[2]
2	New route Metrobus 28E on weekdays for more direct service from Skyline Plaza to East Falls Church (EFC) Metrorail station[2]
3	Restructuring Route 1C
4	New ART 45 – Columbia Pike – Rosslyn – along VA 613/Wilson Boulevard and VA 27/Washington Boulevard
5	New Route serving Arlington Hall (U.S. 50/Arlington Boulevard and George Mason Drive) and Crystal City Metrorail
6	New Route connecting Metrorail stations Pentagon City – Crystal City – Rosslyn – Courthouse
7	Ashburn North Commuter routes – Four new routes from park and ride lot in Ashburn North (VA 28/ Sully Road, VA 7/Leesburg Pike) to DC
8	Route 15 North Commuter routes – Two new routes from VA 15/James Madison Highway park and ride to Dulles Greenway (and I-66) to Rosslyn, Pentagon and DC
9	Landsdowne Commuter routes – Two new commuter routes from park and ride near VA 659/Belmont Ridge Road/VA 7/Leesburg Pike to VA 267/Dulles Greenway (and I-66) to DC
10	Bus Rapid Transit (BRT) on I-66 (without widening)
	Revisions to Bus Services
1	Washington Boulevard Line (Metrobus 2B, G and maintain 2A, C and add 2H)
2	Lee Highway Line (split Metrobus 3A at EFC and increase service on 3B)
3	Pershing Drive – Arlington Boulevard Line (terminate 4A at Seven Corners and create new 28E)
4	WFC Metro station – Tysons (realign 3T and 28T routes to make them more direct)
5	Fair Oaks to Dunn Loring Metrorail along U.S. 50/Arlington Boulevard (restructure Route 1C to reroute through Government Center and extend to West Ox Road)
6	Columbia Pike-Ballston-Courthouse – ART 41 improvements to service along VA 613/Wilson Boulevard from Courthouse Metrorail station to south of Ballston Metrorail station

Table 5.2 Mobility Options Elements (continued)

	Category
	Revisions to Bus Services (continued)
7	Ballston-Pentagon – ART 42 improvements along VA 613/Wilson Boulevard from Ballston Metrorail to Clarendon Metrorail and on VA 27/Washington Boulevard from Clarendon Metrorail to Courthouse Road
8	Shirlington – Ballston – VA square – ART 75 improvements along Wilson Boulevard
9	Shirlington – Courthouse Metro – ART 77 improvement would extend alignment to Rosslyn Metrorail station
10	Ballston-Farragut Square – Metrobus 38B – increase frequency
11	Express Cascade route – improvements to an existing route with destination at West Falls Church (WFC) Metrorail
12	Changes to the Loudoun Transit routes when Metrorail is extended to Dulles
	Bus/Vanpool Capital Improvements
1	Fairfax County passenger facility upgrades and roadway priority treatments along U.S. 50/Arlington Boulevard to support Wilson Boulevard Limited Stop Service
2	New ART maintenance facility to add CNG capacity
	New Rail Services/Capital Projects
1	Orange Line Extension to Centreville
2	Interline connection between Orange Line (Courthouse station) and Blue Line (Arlington Cemetery) along with a second interline connection between Blue and Yellow lines near Pentagon and relocation of Yellow line in the DC Core (to separate it from the Green Line
3	Ballston Metrorail Station Improvements – Fairfax Drive Sidewalk and Bus Stop Improvements
4	Ballston Metrorail Station Safety and Station Access Improvements
5	VRE extension of Manassas Line to Gainesville and/or Haymarket
6	I-66 lane widening to add Managed Lane with Express Bus operating in that lane
7	BRT along I-66 with dedicated full-time barrier separated bus-only lanes added to I-66
8	Transitway on VA 7/Leesburg Pike from Tysons to Skyline/Baileys Crossroads
9	Streetcar from Rosslyn to Georgetown via Key Bridge
10	Light rail on U.S. 50/Arlington Boulevard
	Other
1	I-66 – Permit Bus/HOV 3+ on inside shoulders of roadway during peak hours in both directions; closed off-peak
	Bicycle/Pedestrian
	Improvements and Upgrades
1	Rosslyn Circle Area Improvements – Street Level from Rosslyn Circle to Oak Street
2	Rosslyn Circle Area Improvements – Tunnel
3	Metro Station Bike Parking Enhancement
4	VA 110/Jefferson Davis Highway North Trail Renovation – From Arlington Cemetery to Marshall Drive

Table 5.2 Mobility Options Elements (continued)

	Category
	Improvements and Upgrades (continued)
4	VA 110/Jefferson Davis Highway North Trail Renovation – From Arlington Cemetery to Marshall Drive
5	Mount Vernon Trail Widening – From the George Washington Parkway to the Theodore Roosevelt Bridge
6	Custis Trail Renovation
7	Four-Mile Run Trail Widening (North) – In East Falls Church Park
8	Lyon Village–Custis Trail Upgrade –At the north end of the Lyon Village Shopping Center
9	Washington and Old Dominion Realignment at East Falls Church – Sycamore Underpass to Brandymore Castle
10	Washington and Old Dominion Trail Crossing at U.S. 29/Lee Highway
11	On-Street Bicycle Route Safety Assessment
12	Improve switchback behind Lyon Village Shopping Center (Custis Trail and U.S. 29/Lee Highway)
13	Improve bike access to East Falls Church Metro via Sycamore Street both north and south of the station
14	Improve the Washington and Old Dominion crossing of U.S. 29/Lee Highway (west of the East Falls Church Metro station) to potentially include a tunnel or bridge
15	Upgrade the trail along the Four-Mile Run streambed, where it meets the Washington and Old Dominion Trail next to the Falls Church Fire Station
	New Connectors
1	Bluemont Park to Upton Hill Park Trail – From VA 613/Wilson Boulevard to Bluemont Park
2	Clarendon Connector – From Clarendon to Fairfax Drive
3	Fairfax Drive Trail Connectors – From Fairfax Drive to Bluemont Junction
4	Iwo Jima Memorial Connection to the Theodore Roosevelt Bridge – From George Washington Parkway to Theodore Roosevelt Bridge
5	Mount Vernon Trail Extension from North Randolph Street to the Arlington County Line – From Theodore Roosevelt Island to the Arlington County Line
6	Roosevelt Bridge to Mount Vernon Trail – From the George Washington Parkway to the Theodore Roosevelt Bridge
7	Bicycle/Pedestrian Bridge Crossing (Spout Run) – From Lorcom Lane to Custis Trail
8	Mount Vernon Trail – Roosevelt Bridge Connector
9	Bicycle lane on South Washington Street from Rosemary to Hillwood
	Plans and Bicycle Parking
1	Bicycle Parking at Arlington County Facilities
2	Commercial Area Bicycle Parking – Arlington County
3	Pedestrian, Bicycle and Traffic Calming Strategic Implementation Plan (City of Falls Church)

Table 5.2 Mobility Options Elements (continued)

	Category
	ITS (Multimodal)
	Highway
1	VDOT Northern Region Operations Dynamic Message Sign Upgrades – From Arlington County Line to I-495
2	Signal Installation: City of Falls Church
3	VA 7/Leesburg Pike – Signal Timing Optimization
4	I-66 – Active Traffic Management – DB Project to Provide Enhanced Mobility and Safety (Inside Beltway: upgraded ramp meters and possible dynamic merge system at VA 267/Dulles Connector Road interchange)
	Transit
1	VA 7/Leesburg Pike – Transit Signal Priority
2	Flex and Fix-Route ITS Bus Operations Enhancement – Enhance ITS technology for Flex and Fix-Bus Routes to include computer assisted dispatching for paratransit operations and interfacing of WMATA's system with other systems in the region
3	Parking Facilities Status Reports – Use ITS to provide travelers information on the status of parking facilities in various corridors in NoVA

[1] This transit element in the Fairfax County Transit Development Plan may be included in the CLRP under a broad project description.

Table 5.3 CLRP and CLRP+/Baseline Mobility Options Elements

	Category	CLRP	CLRP+[a]
	Highway		
	Spot Improvements		
1	I-66 Westbound Spot Improvements – Westbound Auxiliary Lane from VA 237/Washington Boulevard to VA 267/Dulles Airport Access Road	■	
2	I-66 Westbound Spot Improvements – Westbound Auxiliary Lane from U.S. 29/Lee Highway to VA 120/Glebe Road	■	
3	I-66 Westbound Spot Improvements – Westbound Auxiliary Lane from Fairfax Drive to Sycamore Street	■	
	Widening		
1	U.S. 50/Arlington Boulevard – Widen to 6 lanes and implement safety improvements between Eastern City Line of City of Fairfax and Arlington County Line	■	
2	VA 7/Leesburg Pike – Widen from a four-lane roadway to six lanes from Seven Corners to Bailey's Crossroads	■	
3	VA 613/Wilson Boulevard – Widen from North Frederick Street to VA 237/Washington Boulevard	■	

Table 5.3 CLRP and CLRP+/Baseline Mobility Options Elements (continued)

	Category	CLRP	CLRP+[a]
	Reconstruction		
1	VA 27/Washington Boulevard – Reconstruct interchange at VA 244/Columbia Pike	■	
2	Courthouse Road and VA 237/10th Street North – Reconstruct the interchanges	■	
3	Glebe Road Bridge Replacement	■	
4	U.S. 50/Arlington Boulevard – Upgrade to a limited access highway via the construction of interchanges and the reconstruction of existing interchanges and intersections from the Fairfax County Line to the District of Columbia	■	
	Transit		
	New Bus Services		
1	Priority Bus on I-66 –Haymarket to DC (PRTC)		■
2	Priority Bus on I-66 – Centreville to DC (WMATA)		■
3	Priority Bus on U.S. 29/Lee Highway – Fair Oaks Mall to DC (WMATA)		■
4	Priority Bus on U.S. 50/Arlington Boulevard – Fair Oaks Mall to DC (WMATA)		■
5	Express Bus on I-66 – Fairfax County Connector Improvements – "Bus Service on Priority Routes"	■	
	Bus/Vanpool Capital Improvements		
1	Park and Ride Vanpool Facilities in Rosslyn-Ballston Corridor	■	
2	Tour Bus Facility in Rosslyn-Ballston Corridor	■	
3	Arlington County Transit Transfer Facilities – at U.S. 29/Lee Highway and North Glebe Road	■	
4	Seven Corners Transit Transfer Facility – U.S. 50/Arlington Boulevard	■	
5	Falls Church Intermodal Transit Plaza – Near U.S. 29/Lee Highway and VA 7/Broad Street	■	
6	Bus Shelters in Fairfax County	■	
7	PRTC Bus Acquisition/Replacement Program	■	
8	PRTC Rehab/Rebuild OmniRide Buses	■	
	New Rail Services/Capital Projects		
1	Extension to Dulles – East Falls Church to Wiehle Ave under construction with expected completion in 2013 – second Phase to Dulles airport and VA 772/Loudoun County Parkway	■	
2	Clarendon Metrorail Station Improvements (including canopy project)	■	
3	Rosslyn Metrorail Station Improvements (including access improvements)	■	
4	Courthouse Metrorail Station Improvements	■	
5	Ballston Metrorail Station Improvements – Ballston Station west entrance		■
6	East Falls Church Metrorail Station Improvements, including a new station entrance connecting to VA 237/Washington Boulevard		■

Table 5.3 CLRP and CLRP+/Baseline Mobility Options Elements (continued)

	Category	CLRP	CLRP+[a]
	Bicycle/Pedestrian		
	Improvements and Upgrades		
1	VA 110/Jefferson Davis Highway South Trail Paving – from VA 110 South/Jefferson Davis Highway to Memorial Drive	■	
2	VA 650/Gallows Road – On Road Bicycle Facility	■	
	TDM		
1	Enhanced Corridor Marketing		■
2	Vanpool Driver Incentive		■
3	I-66 Corridor-Specific Startup Carpool Incentives (Expanded)		■
4	Rideshare Program Operational Support		■
5	Carsharing at Priority Bus Activity Nodes		■
6	Bike Hubs/Storage at Priority Bus Activity Nodes		■
7	TDM Program Evaluation		■
8	Enhanced Virginia Vanpool Insurance Pool		■
9	Enhanced Telework!VA		■
10	Northern Virginia Ongoing Financial Incentive		■
11	Van Priority Access		■
12	Capital Assistance for Vanpools		■
13	Flexible Vanpool Network		■
14	SmartBenefits Subsidy Public Share		■
15	Mobility Centers/Mobile Commuter Stores		■
16	Real-Time Parking Information (at Metro Park and Ride facilities)		■
	ITS (Multimodal)		
	Highway		
1	Interstate ITS and Travel Information	■	
2	Primary System – Maintenance and Operational Improvements – Provision of maintenance and operational improvements along the primary system. Improvements arising from VDOT's State Traffic Operations and Safety Improvement Program, wetland mitigation monitoring, and the implementation/installation of a central, computerized traffic signal control system.	■	
	Transit		
1	District-wide Transit ITS in Other Corridors (non-Dulles) –Study/Implement ITS improvements for District-wide Transit ITS in Other Corridors (non-Dulles)	■	

[a] The I-66 Transit/TDM Study is the only source for mobility option elements classified as CLRP+.

6.0 Market Research

6.1 Overview

The I-66 Multimodal Study included a formal market research component designed to allow commuters to share their opinions, state their needs, express their preferences, and describe their travel choices regarding transportation in the I-66 corridor. The primary market research conducted for this study provides information to better understand the needs and preferences of commuters who travel this corridor regularly and to better predict commuter response to potential new and improved products and services. This section presents an overview of the I-66 Multimodal Study market research program and key findings which serve as input to the formulation and evaluation of mobility options and packages. Additional reporting on the market research is presented in the Appendix.

6.2 Market Research Objectives

The research approach was specifically designed to understand the perceptions, attitudes, and choices of commuters in the I-66 corridor inside the Beltway, including parallel facilities, and incorporates the following informational objectives:

- Identify and assess inside the Beltway commuters' perceptions of issues related to transportation, travel, and mobility in the I-66 corridor;
- Identify and rank their travel and mobility needs, expectations, and priorities;
- Determine their priorities for transportation improvements;
- Identify and profile current travel modes used, routes traveled, and purpose of trips;
- Identify the factors guiding commute choice decisions;
- Assess the propensity of commuters to change their current mode choices; and
- Identify the relative appeal of specific mobility option elements (i.e., roadway, transit, bicycle, and TDM alternatives) to increase the likelihood of using non-single occupancy vehicle (SOV) modes by assessing commuter responses to such possible changes.

6.3 Methodology

To prepare the sample for the market research effort, existing data was mined thorough review of previous marketing research conducted that related to I-66. This secondary analysis effort included the I-66 Transit/TDM Study (2009), the I-95/I-395 HOT Lanes Transit/TDM Study (2007), Idea-66 Market Research Study (2005), and the Dulles Corridor Metrorail Project Impact Study (2005). While the HOT lanes study and the impact study do not address I-66 issues

directly, respondents in these studies were identified who use I-66 on their regular commutes. Mining this data provided a solid foundation to guide the primary research effort. In addition, a recent VDOT license plate survey conducted on I-66 near Sycamore Street was used to identify ZIP codes from which to draw the market research sample.

The foundation for the market research effort was the development of an on-line survey, specifically designed for use in this study. The Participating Agency Representatives Committee (PARC) provided input to the questionnaire. Qualified respondents (e.g., travel inside Beltway) were asked to respond to scaled attitude and opinion questions, open-ended questions, and scenarios addressing preferences for mode (SOV, Priority Bus, carpool and Metrorail) given various cost and time parameters.

Approximately 75,000 postcard invitations were mailed to households in over 80 ZIP codes where qualified respondents were most likely to live. The postcard invitations informed potential respondents about the study and provided a link and six-character access code to the survey, which allows for tracking the source of responses. In addition to the postcard sample additional invitations to participate were distributed as indicated in Table 6.1.

Table 6.1 Survey Invitation Approach by Mode

Mode	Approach
Residents (SOV and other modes)	Mailed 75,000 postcards announcing study to residents living across the study area
Carpoolers	E-mailed an on-line survey invitation and link to Commuter Connections database registrants who live in the study area
Local and Express Bus	Reached through postcard mailing, Commuter Connections database, Loudoun Transit solicitation, and at Metrorail stations
Metrorail	Hand distributed postcard invitations at Metrorail stations during peak travel times, including Courthouse, Ballston, East Falls Church, West Falls Church, and Vienna
VRE	Posted survey invitation in VRE's electronic newsletter
Bike Riders and Pedestrians	Hand distributed cards on trails and paths

The survey required approximately 25 minutes for respondents to complete. The first 1,800 respondents who qualified for and completed the survey (quota strategically distributed across modes) were provided a gourmet coffee card of $5.00 as an incentive. In order to qualify, respondents had to commute to work/school in the I-66 corridor inside the Beltway (broadly defined to include nearby parallel transportation facilities) during the morning peak by any mode.

More than 3,500 completed surveys were received through the targeted methods. The final distribution of this sample by mode and direction is reported in Table 6.2. The target sample sizes were developed to ensure statistical validity of findings within an appropriate confidence

level. Data collection for this study occurred during late October/early November 2011. Respondents represented all major modes in the corridor, including SOV, formal carpool, local bus, express bus, Metrorail, VRE, and bicycle.

Table 6.2 Research Sample by Mode

Mode	Target Quota	Analytical Sample Size
SOV		
Gas Engine – Eastbound	300	781
Gas Engine – Westbound	300	255
Hybrid – Eastbound	–	171
Hybrid – Westbound	–	17
Formal Carpool – Eastbound	200	581
Formal Carpool – Westbound	100	30
Local Bus – Eastbound	125	152
Local Bus – Westbound	125	14
Express Bus – Eastbound	100	372
Express Bus – Westbound	–	19
Metrorail – Eastbound	200	674
Metrorail – Westbound	100	108
VRE – Eastbound	100	194
Bike	150	191
Total	**1,800**	**3,559**

6.4 Key Findings

This section presents key findings from the market research. The title of each key finding subsection indicates a reference number that ties to further information that is presented in the Appendix B.

In the review of the market research reported in this section, potential responses to specific alternate modes, to new products and services, and to product and service enhancements are

presented. The findings from this study indicate that commuters traveling regularly in the I-66 corridor have adopted and will continue to adopt alternate modes for their commutes. Not all commuters will change from their current mode, but those who are willing to change must have their needs and preferences met in order for alternate modes to be attractive.

Previous research has indicated that, in studies such as this, respondents tend to overestimate the likelihood that they will adopt a particular program or service. A demand discount factor has been developed that recalculates likelihood to a more realistic level. When appropriate, likelihood estimates reported for this study are recalculated using the demand discount factor. Both stated likelihood and the likelihood using the demand discount factor are reported in the graphs. Likelihood scores with the demand discount factor applied are always reported in a red color.

Key Finding: I-66 Users Have Long Commutes (#1)

Roughly two-thirds of these inside-the-beltway respondents travel both inside and outside the Beltway on their morning commutes (see Table 6.3). This pattern suggests that many have long commutes. This, in fact, holds true based on their mileage and the time commitment commutes require. Two-thirds of Metrorail riders, for example, have commutes of 41 to 90 minutes. Three-fourths of Express Bus riders have commutes of at least one hour.

Table 6.3 Travel Inside the Beltway

	SOV – East	SOV - West	Carpool – East	Local Bus – East	Express Bus – East	Metrorail East	Metrorail West	VRE
Inside the Beltway Only	31%	38%	37%	24%	37%	42%	34%	6%
Both Inside and Outside the Beltway	69%	62%	63%	76%	63%	58%	66%	94%

Key Finding: More Transportation Options are Needed (#2)

Regardless of mode, commuters recognize the challenges of commuting on I-66. Specifically, commuters believe it is getting more difficult to travel through the corridor and that congestion is making it more difficult to predict how long a trip will take. In addition, across all modes, commuters do not believe there are sufficient transportation options for commuters in the corridor.

Key Finding: Support for High-Occupancy Vehicle Lanes Vary By Type of Commuter Mode (#3 #4 #5)

In general, support for high-occupancy vehicle (HOV) lanes varies considerably across modes. SOV commuters do not readily recognize the timesaving benefits HOV lanes provide, while current HOV users, specifically carpoolers and express bus users, clearly recognize the benefits. While SOV commuters are not necessarily critical of existing HOV lanes, they are not convinced that using the HOV lanes saves time and so do not proactively promote the expansion of HOV. For example, westbound SOV respondents do not have strong views about HOV largely because they do not have experience from which to draw. In contrast, carpoolers and express bus users recognize the timesaving benefits of HOV and are supportive of more HOV in each direction because they are familiar with HOV lanes. Interestingly, nearly a quarter of respondents who currently do not use HOV lanes indicated that they would use the HOV lanes if they could use their smartphone to find a carpool partner and about the same amount say they would use the HOV lanes if it was easier to find a carpool partner.

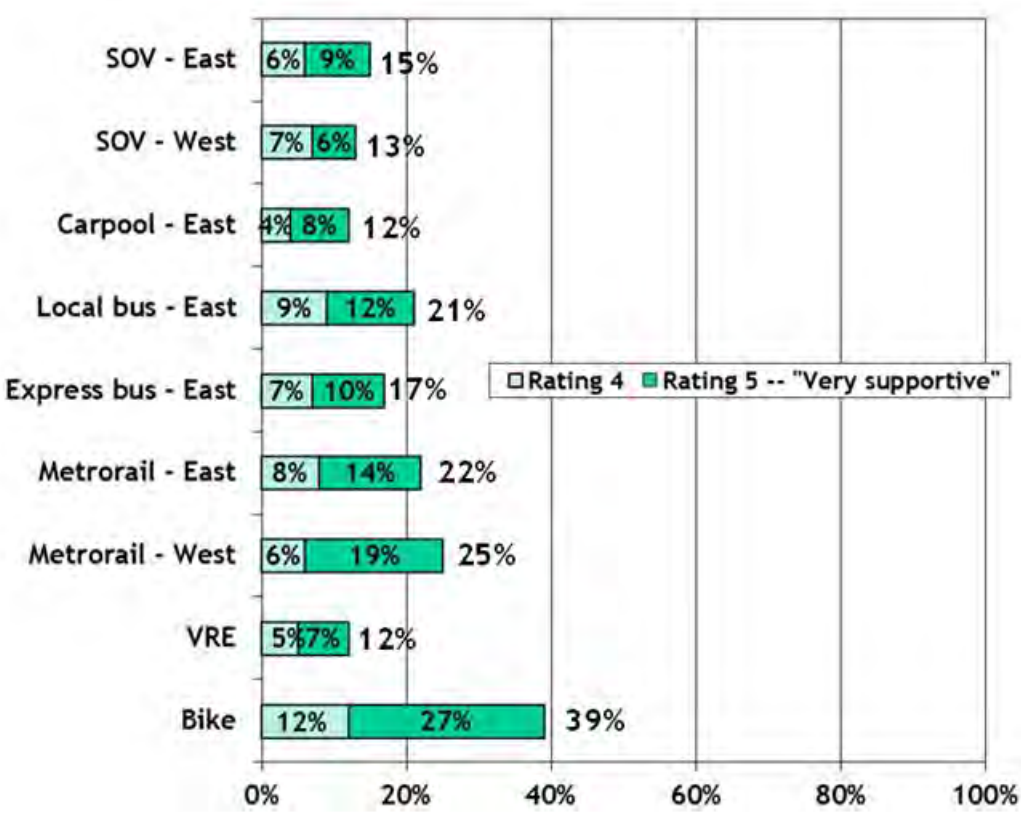
Key Finding: Changing HOV Hours May Not Stimulate Mode Shifts (#6)

Changing the duration of HOV restrictions in the morning eastbound and afternoon westbound on I-66 may not stimulate mode shifts. Commuters that currently do not use the lanes during the current HOV hours were asked if they would use the lanes given a specific change in hours (morning hours eastbound to 5:30 a.m. to 9:30 p.m. and evening hours westbound to 3:00 p.m. to 7:00 p.m.). Responses in each direction were similar, with existing carpoolers (but not lane users) reporting the most likelihood to use lanes given the change. SOV commuters are unlikely to be attracted to HOV enough to shift their travel behavior.

Key Finding: Support for a Toll and Congestion Priced Tolling is Low (#7)

Support for a toll on I-66 inside the Beltway is low, especially among those who would be paying the toll directly – SOV and carpool commuters. About 80 percent of SOV commuters and carpoolers oppose a toll. But, support for a toll also is low among transit users. Support for congestion priced tolling is slightly higher, but also low. Interestingly, among bicycle commuter respondents, 31 percent of support a toll and 39 percent support congestion priced tolling. Figure 6.1 shows responses to congestion pricing on I-66.

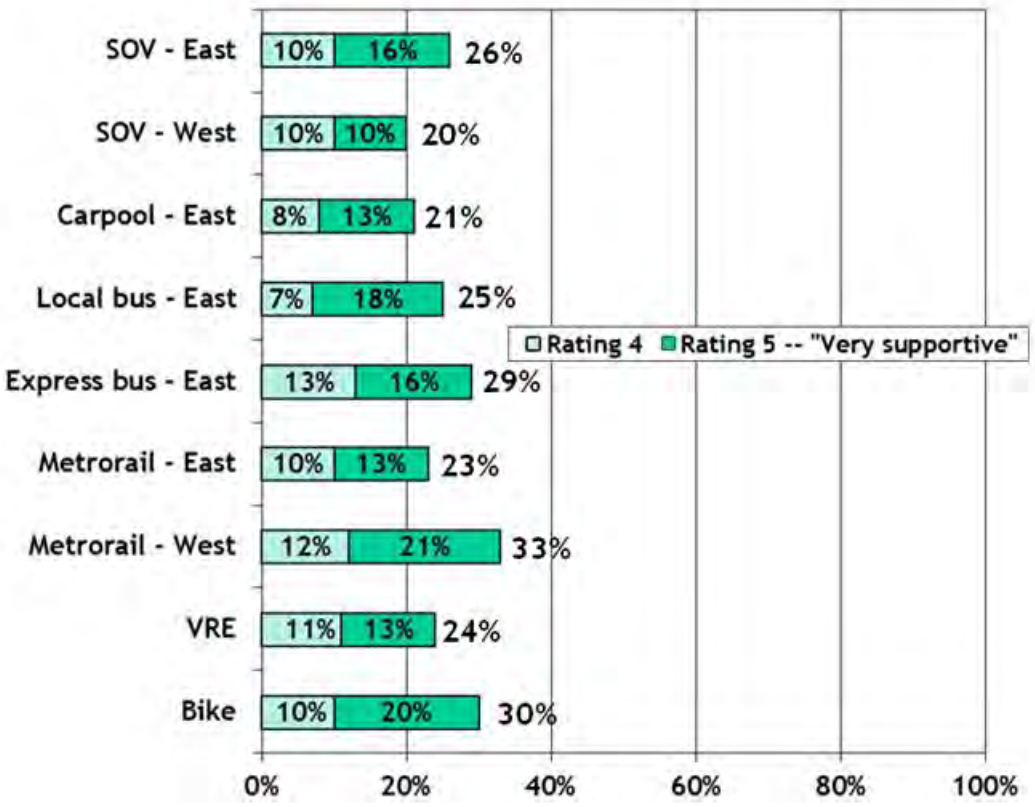
Figure 6.1 Support for Congestion Priced Tolling on I-66



Key Finding: Commuters are Familiar with the Concept of High-Occupancy Toll Lanes (#8)

Most commuters in the corridor have heard of HOT lanes, about 80 percent. As might be expected, awareness of HOT lanes is lower, near 60 percent, among westbound Metrorail respondents (these respondents do not necessarily see or know about the Beltway HOT lanes under construction). Support for HOT lanes is higher than support for a general toll, but approximately a quarter of commuters supporting HOT lanes on I-66 inside the Beltway. Figure 6.2 illustrates the support for HOT lanes inside the Beltway.

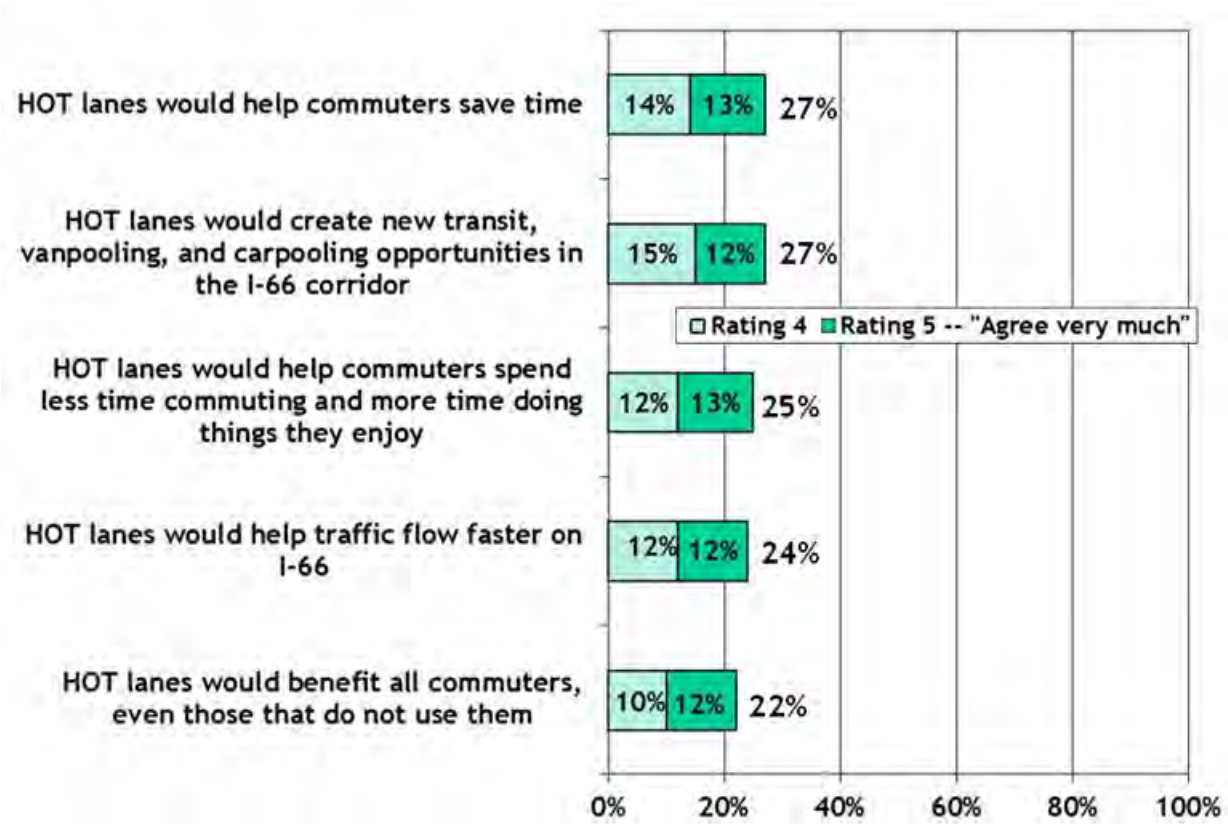
Figure 6.2 Support for High-Occupancy Toll Lanes on I-66 Inside the Beltway



Key Finding: Commuters do not Understand the Benefits of HOT Lanes (#9)

The benefits of HOT lanes (congestion free travel) are important in selling HOT lanes to the public. Although respondents indicate awareness of "HOT lanes," they do not have a high level of familiarity with or understanding of HOT lanes. They often do not recognize the benefits of HOT lanes. In fact, only about 25-35 percent of commuters across all modes recognized each of five benefits tested. Figure 6.3 displays the survey results for eastbound SOV commuters. Results for other commuter segments were similar (slightly higher understanding for express bus respondents).

Figure 6.3 Agreement with High-Occupancy Toll-Lane Benefits on I-66 among Eastbound SOV Commuters



Key Finding: Support for Changes to Existing HOV Lanes Vary (#10 #11)

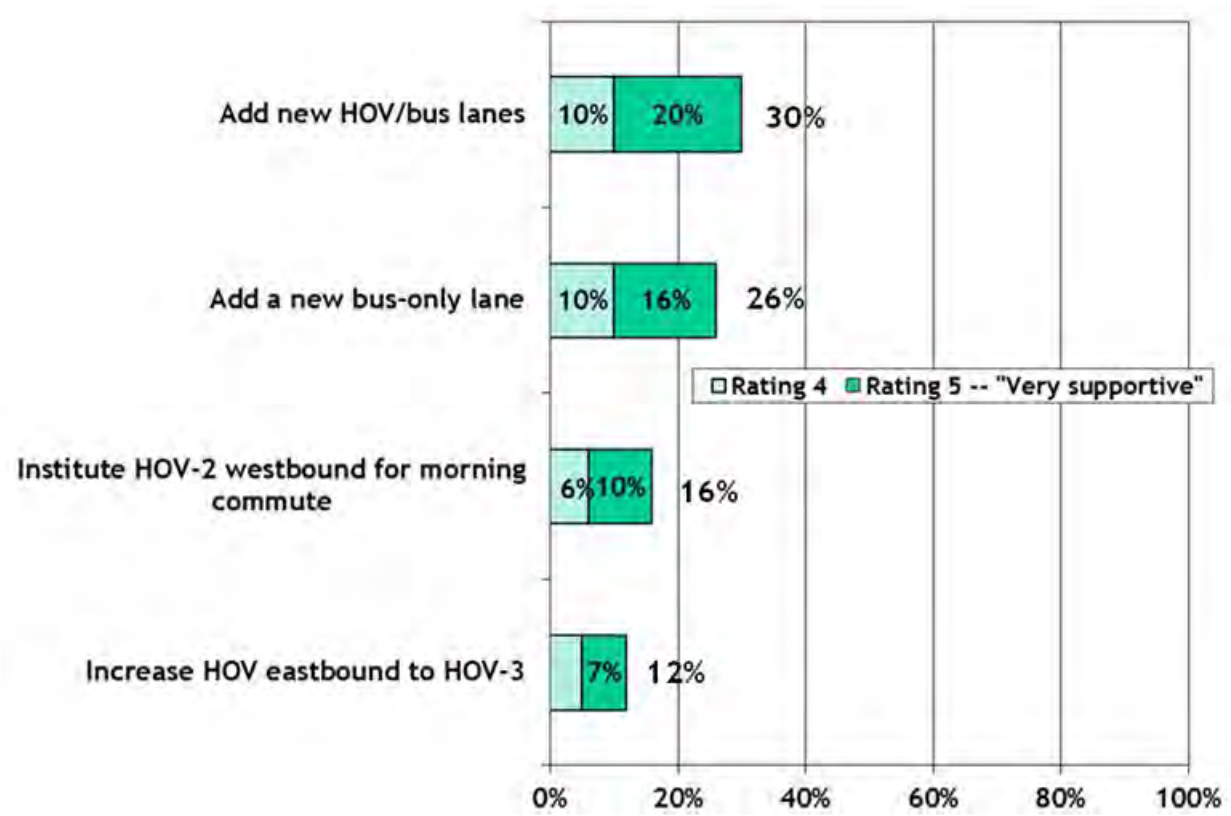
Several options to change the configuration or restrictions on I-66 were presented, including:

- Increase current eastbound restriction from HOV-2 to HOV-3;

- Institute HOV-2 westbound for morning commute[1];
- Add a new bus-only lane; and
- Add new HOV/bus lanes.

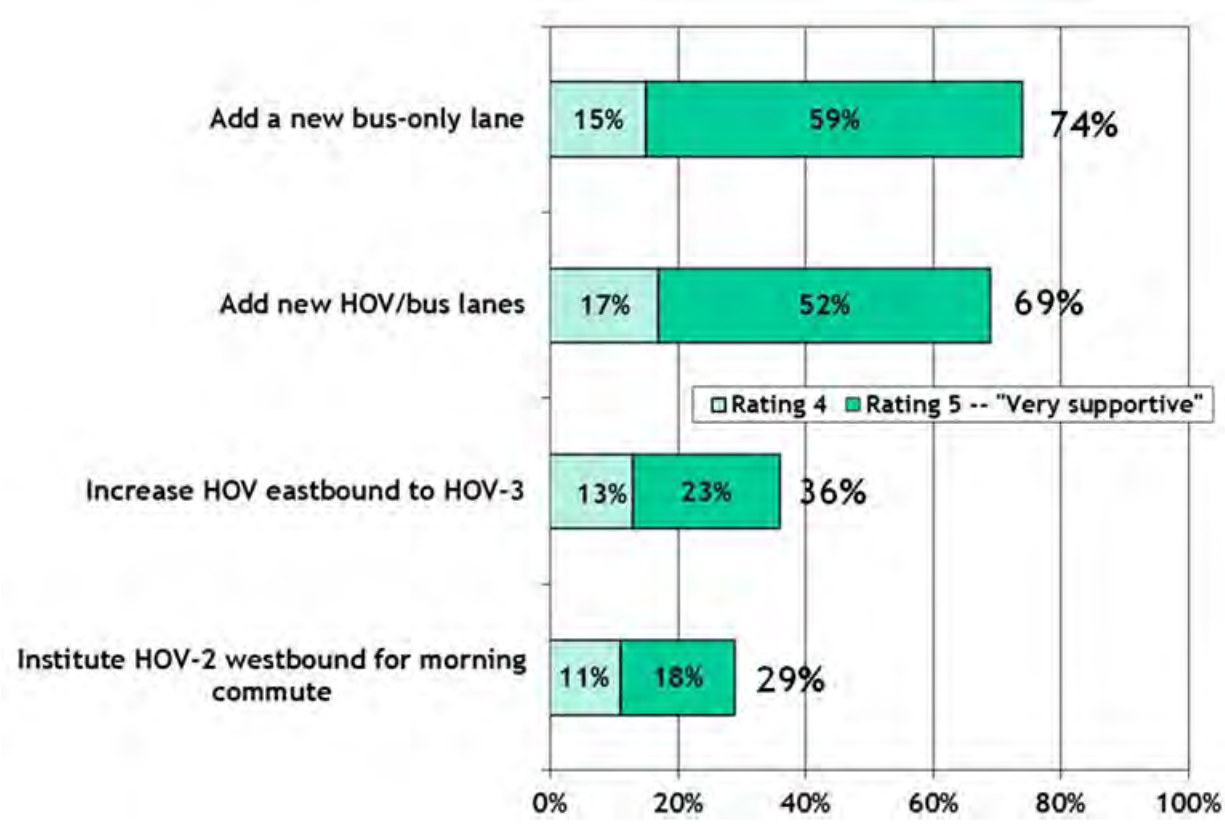
Support for adding new HOV/bus lanes and adding a new bus-only lane is highest among bus riders and lowest among SOV commuters, ranging from 74 percent to 26 percent. Unlike SOV commuters, carpoolers understand the benefits of HOV since they can personally relate to them. Similarly, bus riders for both local and express bus, are highly supportive of bus lanes. Support among rail riders, both VRE and Metrorail, falls between these extremes and is closer to the level of bus riders. Support for changing the eastbound restriction from HOV-2 to HOV-3 is low, especially among SOV and carpool commuters. Comparing Figure 6.4 showing the response for SOV commuters and Figure 6.5 showing the response for express bus commuters shows the extremes.

Figure 6.4 Response by Eastbound SOV Commuters to I-66 Facility Changes



[1] Respondents may or may not have assumed that under this scenario a parallel restriction of HOV-2 in eastbound evening commute would be instituted.

Figure 6.5 Response by Eastbound Express Bus Commuters to I-66 Facility Changes



Key Finding: Attracting New Riders to Metrorail Requires Travel Time Savings (#12)

The survey shows that to attract new riders requires travel time savings. Commuters would be most attracted to Metrorail if it was faster than their current mode. Figure 6.6 shows the response by eastbound SOV commuters; Figure 6.7 shows the highest response, among eastbound local bus commuters.

Figure 6.6 Stated Likelihood of Riding Metrorail by Eastbound SOV Commuters

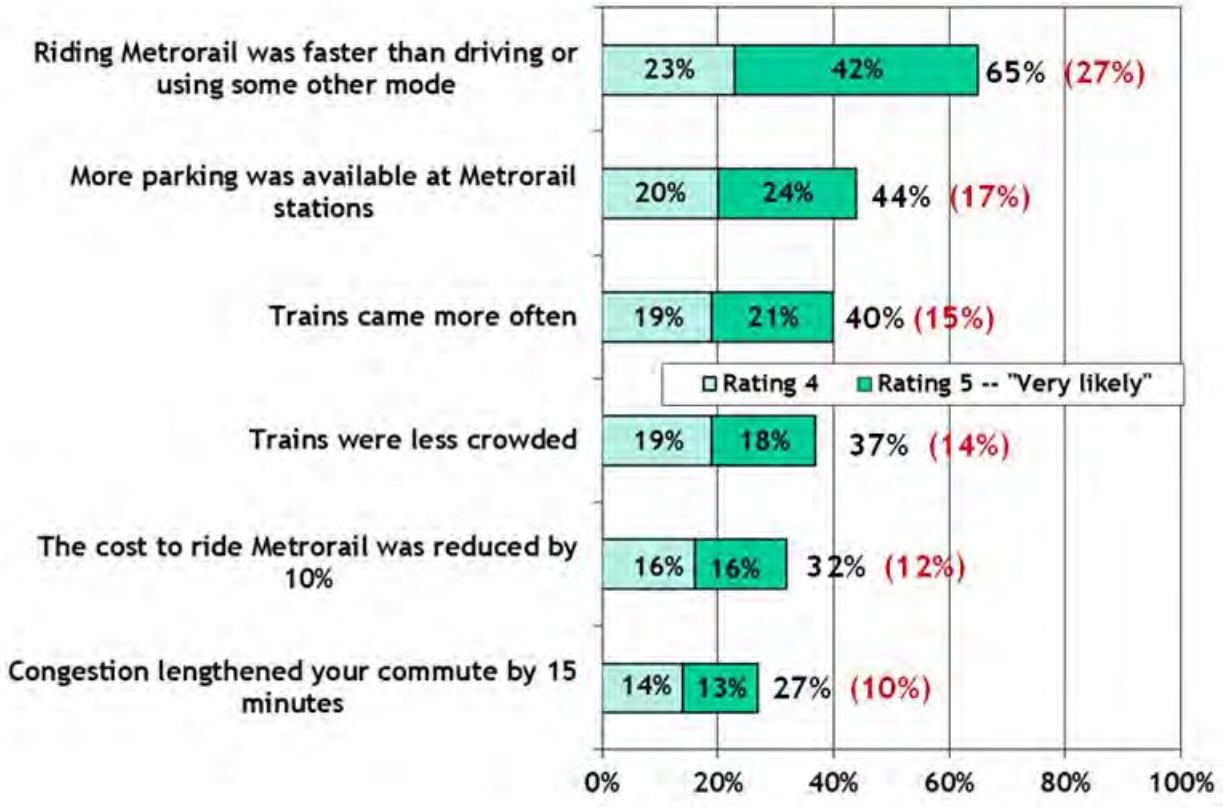
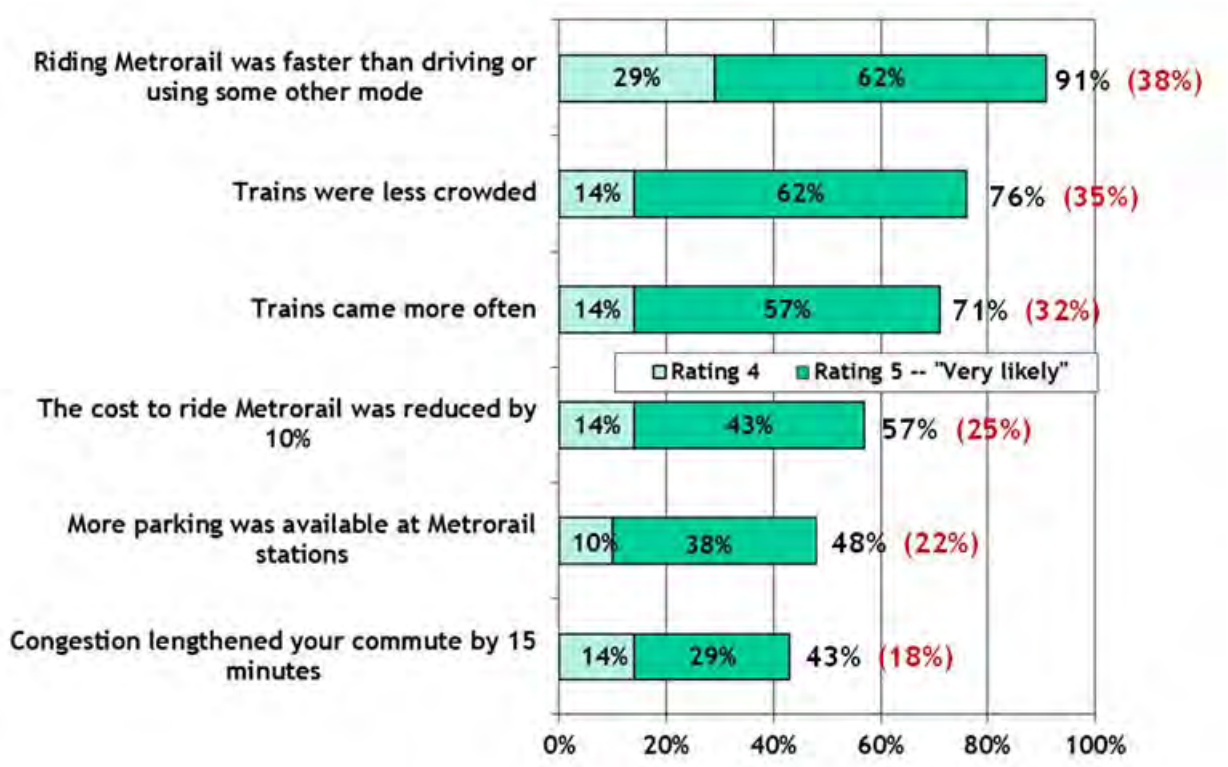


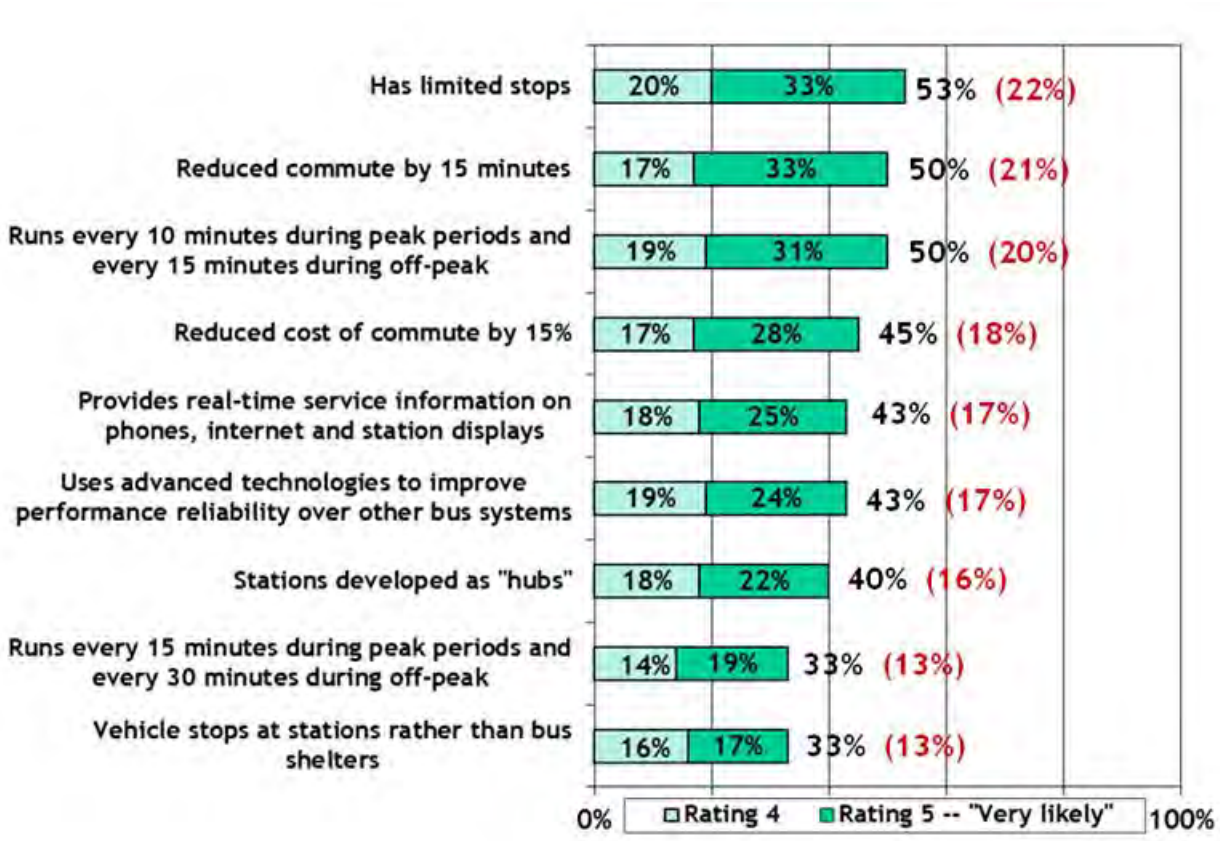
Figure 6.7 Stated Likelihood of Riding Metrorail by Eastbound Local Bus Commuters



Key Finding: Priority Bus Has Appeal (#13)

There is interest in Priority Bus services and that confirms elements of the baseline approach for this study. The appeal of Priority Bus is based in travel time savings. It would be selected if it made the commute faster. Perceived speed of Priority Bus is related to having limited stops and running every 10 minutes. Existing transit riders value the potential to save time using Priority Bus and would consider switching to it. Figure 6.8 shows that some SOV commuters also express interest in using Priority Bus given various attributes.

Figure 6.8 Attractiveness of Priority Bus to Eastbound SOV Commuters Given Suggested Attributes



Key Finding: Employer Programs Make a Difference (#14)

The survey responses show employer programs make a difference. Transit users tend to work for employers who offer transit assistance. Carpoolers tend to work for employers who offer carpool support. SOVers work where there is free or subsidized parking. Table 6.4 illustrates.

Table 6.4 Program Usage among Commuters of Each Mode Whose Employers Offer Program

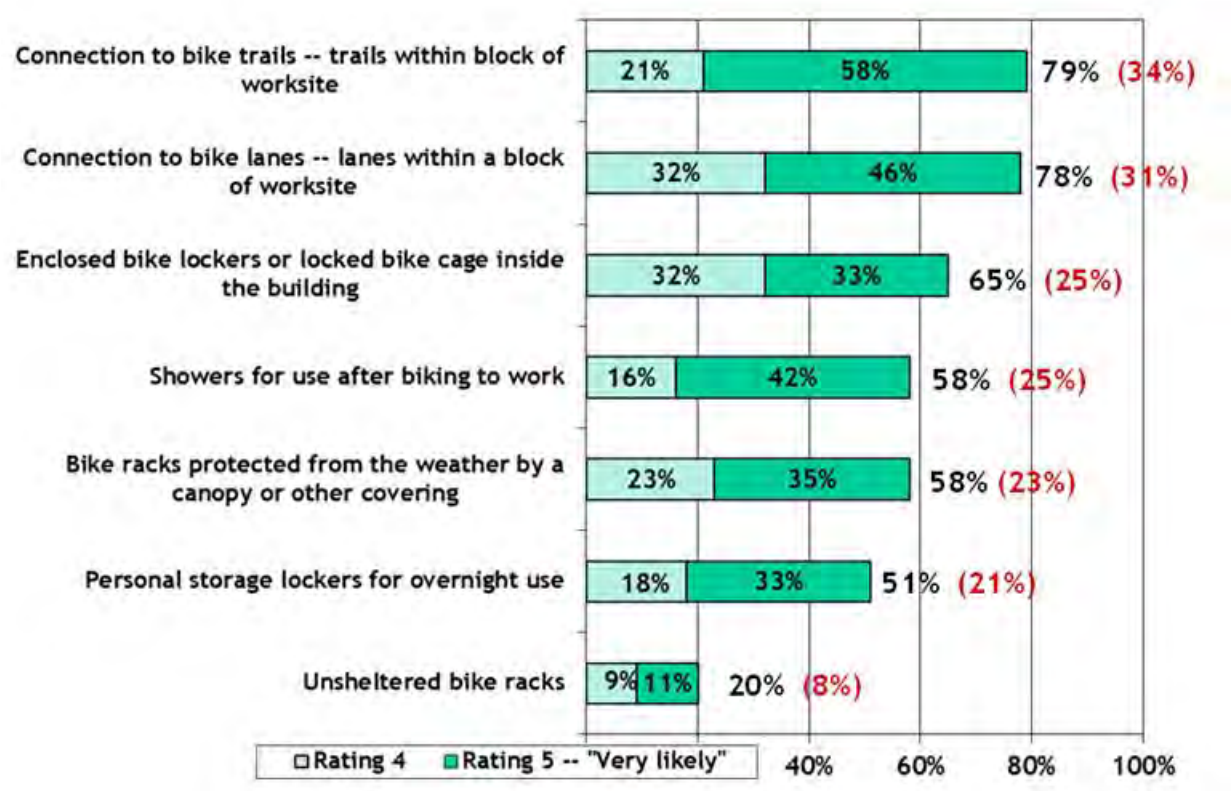
	SOV – East	SOV – West	Carpool – East	Local Bus – East	Express Bus – East	Metrorail – East	Metrorail – West	VRE	Bike
Free/ Subsidized Parking	86%	86%	84%	32%	27%	33%	33%	37%	36%
Preferred Parking for Car/ Vanpools	9%	3%	41%	6%	6%	7%	4%	8%	2%
Transit Fare Support	18%	18%	38%	92%	92%	90%	92%	93%	63%
Pre-Tax Salary Deduction for Transit	29%	25%	48%	83%	73%	74%	83%	80%	48%
Ride-Matching	11%	16%	19%	11%	19%	11%	20%	14%	7%
Flexible Work Hours	83%	79%	73%	79%	81%	78%	78%	78%	78%
Compressed Work Week	47%	42%	44%	40%	48%	43%	51%	50%	37%
Telework	77%	75%	69%	75%	77%	69%	70%	73%	59%
Shuttle To Transit Station	17%	26%	27%	53%	54%	51%	75%	51%	41%

Key Finding: Trail/Path Connections and Workplace Support Could Attract Bicycle Riders (#15)

Overall, the likelihood of riding a bike to work is fairly low among current non-riders. But, with no programs or services mentioned, about 10 percent of current non-users say they are likely to ride a bike in the future. Connections to bike trails/paths and lanes are the most compelling features and services to attract new bike riders. Enclosed bike lockers and showers at

work also help to attract new bike riders. Unsheltered bike racks are not particularly compelling. The results from eastbound SOV commuters are summarized in Figure 6.9.

Figure 6.9 Likelihood of Riding a Bicycle by Eastbound SOV Commuters Given Improvements



Key Finding: New Transit Options are Most Appealing to Current Transit Users (#16)

New transit options in the I-66 corridor inside the Beltway are more attractive to current transit users. Given situations when the costs are the same and the travel time is the same, transit users would pick transit over some other mode. If new transit options offer time savings, current transit users are especially likely to switch to the new transit mode.

These findings are derived from the use of a "tradeoff analysis" which was conducted as part of the survey. Respondents were asked to make trades that reflected what is and is not important to them in terms of travel time, commute cost, and mode used. In these carefully controlled experiments, respondents were asked which one option they would select, given scenarios that vary specific conditions. In each scenario, the respondent was presented with a different combination of attributes and asked which combination they select. The type of decision that the respondents made in each scenario was designed to mimic the real market.

In the analysis, it was revealed that SOV commuters and alternative mode commuters responded differently, reflecting different weights placed on commute time, cost, and mode. For SOV commuters, the three attributes (time, cost, and mode) receive relatively equal weight. Looking further at the stated choices by SOV commuters shows the value placed on travel by specific modes. SOV commuters place a positive utility on traveling in an SOV mode all things being equal. In contrast, these commuters place a nearly neutral utility on traveling on Metrorail, and negative utility on traveling by bus or carpool, with travel by carpool being the most negative. This negative utility would have to be overcome with appropriate time or cost savings for these choices to be made. That is, there is a higher hurdle to overcome for SOV commuters to consider carpooling or riding a bus than to consider using Metrorail, all things being equal.

Among alternative mode commuters, the three attributes (time, cost, and mode) did not receive equal weighting in making decisions. For these commuters, time was most important (47 percent of the decision), followed by cost (35 percent of the decision), and then mode (18 percent of the decision). Analyzing the stated choices made by alternative mode commuters showed that they place positive utility on traveling by rail or bus and ascribe a small negative utility to traveling by SOV and a large negative utility to traveling by carpool. That is, all things being equal, alternative mode commuters prefer to use transit over driving alone or, especially, carpooling.

The Appendix includes some of the numeric backup for the discussion presented here.

Key Finding: Being in Control of Commute is Especially Important to SOV Commuters (#17)

In past surveys, commuters have always given priority to "time" in selecting their commute mode. But, this study allowed us to understand the decision-making of SOV commuters more thoroughly. Being "in control" of their commute is more important to SOV commuters than to commuters using other modes. In fact, 88 percent of eastbound SOV commuters said that being in control of their commute is important in their mode choice compared to 92 percent who said that the time their commute takes is important. So, on any given day, control may be more important than time to SOV commuters. In contrast, 71 percent of eastbound express bus riders said that being in control of their commute is important in their mode choice compared to 95 percent who said that the time their commute takes is important. Reliable travel time is important to commuters using both modes.

6.5 Sources of Uncertainty

The market research findings are based on an on-line survey. Survey data is very useful in obtaining patterns and indications of human behavior, but all survey data has uncertainty, as human subjects introduce variability through levels of understanding, personal agendas, etc. In addition, there is some self-selection bias in the sample in that survey respondents represented people in the population that chose to fill out the survey (a small gourmet coffee card incentive was provided to help obtain a higher response rate). While information was presented to the respondents prior to the questions, it is impossible to control what other

information or misinformation the respondent had previously received, which also could impact their response. However, there is confidence that the findings from the survey work is highly informative to the study, in part due to the size of sample obtained and the manner in which the data have been used and summarized.

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7.0 Next Steps

This Interim Report is intended to provide an account of the I-66 Multimodal Study progress to date and document the evaluation methodology and the foundation for the preliminary mobility options. The study continues to advance toward a May 2012 completion though the following activities:

- **Finalize Mobility Options –** Preliminary mobility options will be presented to the PARC and to the public at two public meetings scheduled for December 2011. Public input will be incorporated as appropriate and the mobility options will be finalized in consultation with the Lead Agencies and PARC by the January 2012.

- **Evaluation of Options –** In accordance with the evaluation process described in Section 4, the final set of mobility options will be simulated for 2040 conditions and evaluated using selected criteria. The results of this preliminary testing exercise will help formulate a set of four to five multimodal mobility option packages. The mobility option packages will be coded into the travel demand forecasting model and a forecast will be generated for each package. Modeling results for each mobility option package will be displayed in a set of Level of Service (LOS) maps for highway, transit, and bicycle to illustrate the effects of the various mobility option packages.

The preliminary testing of the mobility options, the more detailed running of the mobility option packages through the model, and mapping of the results is anticipated to be a fluid process that will commence once the mobility options are finalized in December 2011 and will extend through March 2012. Select activities, principally the cost/benefit analysis, may continue into April 2012.

Public Information and Outreach

There are two rounds of public meetings planned at locations in Arlington and Fairfax Counties, and the City of Falls Church. These meetings are planned around key study milestones and are intended to solicit input by providing opportunities for public participation, to disseminate timely information about the study, and to provide a forum to discuss stakeholder issues. The first round of public meetings is scheduled as follows:

Fairfax County/Falls Church Meeting
December 6, 2011
6:00-8:00 p.m.
Mary Ellen Henderson Middle School
7130 Leesburg Pike
Falls Church, VA 22043

Arlington County Meeting
December 14, 2011
6:00-8:00 p.m.
Arlington County Government Offices
2100 Clarendon Boulevard
Arlington, VA 22201

Additional public meetings at locations in both Arlington and Fairfax Counties are planned for April 2012. The target date for publication of the final report is May 4, 2012.

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Appendix A

Transportation Demand Management Programs

Table A.1 Transportation Demand Management (TDM) Programs in the I-66 Study Area

Service Area	Services Offered	Usage
Arlington County	Park and Ride Lots (4) • Ballston Public Garage • North Quincy Street • Four Mile Run • WMATA – East Falls Church	The following lots are currently fully utilized: North Quincy Street, Four Mile Run, WMATA – East Falls Church.
Arlington County	Arlington County Commute Services (ACCS)	44 percent of 958 respondents who took the 2010 Commuter Connections "State of the Commute Survey" had heard of ACCS services and 21 percent of those respondents use it. In FY 2010, ACCS reduced traffic in Arlington by 39,600 trips.
Arlington County	ACCS Marketing Program	In 2010, ACCS attended 43 transportation fairs reaching 3,245 commuters.
Arlington County	Arlington Transportation Partners (ATP)	Commuter benefits programs offered in Arlington in FY 2010: • Arlington employers (637 member companies representing 130,393 employees). • Residential communities (313 member buildings representing 65,108 apartment/ condo units). • Developers and visitor services (41 hotels).
Arlington County	Slug Lines (Pentagon, Crystal City, Rosslyn)	N/A
Arlington County	Commuter Stores (Ballston, Crystal City, Rosslyn, Shirlington, and the Mobile Commuter Store)	In FY 2010, the stores combined had record sales of $8,921,132 and 200,000 customers.
Arlington County	Carshare	Zipcar has more than 50 cars at 32 locations throughout Arlington.
Arlington County	CommuterPage.com	In FY 2010, web visits increased over the previous fiscal year from 1.18 million to 1.45 million. New enhanced web sites were designed and constructed for BikeArlington, WalkArlington, Arlington Transportation Partners, and Arlington Transit.

Table A.1 Transportation Demand Management (TDM) Programs in the I-66 Study Area (continued)

Service Area	Services Offered	Usage
Arlington County	CommuterDirect.com	In FY 2010, the Center responded to 20,670 phone calls and sold $20,580,758 in fare media sales. They also processed 128,888 individual transactions and 1086 corporate transactions.
Arlington County	Logistics and Distribution	In FY 2010, ACCS: • Produced and distributed 180 customized transportation options tool kits to employer key contacts. • Distributed 326 Personalized Commute Planners. • Distributed e- Solutions newsletter to 1,276 key employer contacts. • Distributed 600,000 timetables and brochures to individuals, companies and information displays. Installed map and schedule information at 425 ART and 55 Pike Ride bus stops. Installed ART RealTime decals on every ART bus stop flag. Repaired or replaced over 100 ART bus stops due to vandalism, storms or accidents.
Arlington County	BikeArlington	Partnered with Capital Bikeshare, the largest bikesharing program in the nation. Since its launch in 2010, the bikesharing system has attracted over 17,000 members, logged nearly one million trips and amassed a total of 116 stations and 1,100 bicycles in the District of Columbia and Arlington, VA.
Arlington County	WalkArlington	In FY 2010, 4,089 people attended Walkabouts and Walk Arlington events.
Arlington County	Commercial Site Plan TDM	In FY 2010, the ATP assisted 10 site plan properties with TDM compliance requirements.
Arlington County	HOV Lanes	According to the 2010 Commuter Connections "State of the Commute Survey," 27 percent of all regional commuters use one of the available HOV Lanes. (n=6629)

Table A.1 Transportation Demand Management (TDM) Programs in the I-66 Study Area (continued)

Service Area	Services Offered	Usage
Arlington County	Transit Services • ART • VRE • Metrobus • Metrorail	ART – 1.9 million riders annually. FY 08 VRE – 3.6 million annually. FY 09 Metrobus – 134 million. FY 09 Metrorail – 223 million.
Fairfax County	Park and Ride lots including West Falls Church Metro Station and shared space lots "Kiss and Ride" Bicycle parking with lockers	27,836 spaces within Fairfax County.
Fairfax County	Tytran TMA coordinates ridesharing, guaranteed ride home and employer services The county supports the RideSource program for ride matching Commuter connections web site facilitates ride matching and guaranteed ride home	Tytran has a membership of 25 organizations.
Fairfax County	ZipCar has locations at GMU and West Falls Church Metro along with significant vehicle availability along U.S. 50.	
Fairfax County	Distributes alternative mode use packets, maps and other informational material	N/A
Fairfax County	Utilizes "Commuter Page" web site to coordinate transit information	N/A
Fairfax County	County provides a match for the Bike Benefit program	N/A

Table A.1 Transportation Demand Management (TDM) Programs in the I-66 Study Area (continued)

Service Area	Services Offered	Usage
Fairfax County	Fairfax county supports HOV facilities on I-66, I-95, and I-395 and the Dulles Toll Road	N/A
Fairfax County	Employee Outreach Program seeks to encourage telework, flextime and other programs that reduce SOV use	Telework in the region has grown from 13 to 25 percent since 2004.
Virginia Statewide Program	Telework VA!	N/A
Metropolitan Washington Council of Governments (MWCOG) Commuter Connections Program	Regional Ridematching	There are over 1,000 vanpools in operation in the Washington metropolitan region. Carpool N/A
MWCOG Commuter Connections Program	Regional Guaranteed Ride Home (GRH)	According to the 2010 Commuter Connections "State of the Commute Survey," five percent of 328 regional commuters said they had registered for or used a GRH service in the past two years.
MWCOG Commuter Connections Program	Regional TDM Marketing	According to the 2010 Commuter Connections "State of the Commute Survey," nearly six in 10 (58 percent) respondents said they had seen, heard, or read advertising for commuting in the six months, and 70 percent of these respondents could cite a specific advertising message. (n=6629)
MWCOG Commuter Connections Program	Van Start/Van Save	N/A
MWCOG Commuter Connections Program	NuRide Carpool	8,593 NuRide users live in the Washington, DC region.
MWCOG Commuter Connections Program	Employer Outreach	According to the 2010 Commuter Connections "State of the Commute Survey," more than six in 10 (61 percent) respondents said their employer offered one or more incentives or support services transit/vanpool, info on travel options, biking/walking services, carpool/vanpool parking, guaranteed ride home, carpool subsidy).

Table A.1 Transportation Demand Management (TDM) Programs in the I-66 Study Area (continued)

Service Area	Services Offered	Usage
MWCOG Commuter Connections Program	Telework	According to the 2010 Commuter Connections "State of the Commute Survey,"25 percent of all regional workers telecommute, which represents 600,000 workers regionwide.
MWCOG Commuter Connections Program	Bike to Work Day	The 2010 event generated over 9,000 registrants, up from 7,640 in 2009.

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Appendix B

Market Research Study Report

I-66 Multimodal Inside The Beltway Market Research Study Key Findings

November 15, 2011

Outline of this Report

- Objectives
- Methodology
- Key Findings

Market Research Objectives

- Identify and assess inside the Beltway commuters' perceptions of issues related to transportation, travel and mobility in the I-66 corridor
- Identify and rank their travel and mobility needs, expectations and priorities
- Determine their priorities for transportation improvements
- Identify and profile current travel modes used, routes traveled and purpose of trips
- Identify the factors guiding commute choice decisions
- Assess the propensity of commuters to change their current mode choices
- Identify the relative appeal of specific mobility option elements (i.e., roadway, transit, bicycle and TDM alternatives) to increase the likelihood of using non-SOV modes by assessing commuter responses to such possible changes

Study Methodology

- In order to meet the objectives established for this research, an online survey was conducted among commuters in the I-66 corridor.
- A Topics Guide was developed and used to create the questionnaire. The Participating Agency Representatives Committee (PARC) reviewed and provided input for both the Topics Guide and the questionnaire.
- The questionnaire was programmed and tested prior to launch. It included elaborate skip patterns to accommodate multiple modes, travel behaviors and commute patterns. It required approximately 25 minutes for respondents to complete the survey.
- The questionnaire included scaled attitude and opinion questions, open-ended questions, and "scenario testing," addressing preferences for mode (SOV, Priority Bus, carpool and Metrorail) given various cost and time parameters.
- A $5 gourmet coffee card was offered to respondents as a "thank you" incentive.

Study Methodology

- In order to qualify for this study, respondents had to commute to work/school in the I-66 corridor inside the Beltway. They could be traveling along I-66, U.S. 29, U.S. 50, Wilson Boulevard, Clarendon Boulevard, Washington Boulevard or other roadway in the corridor. Alternatively, they could be traveling one of these roadways but had chosen a mode that did not require them to travel one of these roadways, such as riding a bike, Metrorail, or VRE.
  - They had to be traveling *inside* the Beltway.
  - Their commute had to occur during morning peak travel times.
  - They could be traveling any direction.

Study Methodology

- The sample consists of commuters across a variety of transportation modes:
  - SOV (gasoline engine and hybrid)
  - Formal carpool
  - Vanpool
  - Express bus
  - Local bus
  - Metrorail
  - VRE
  - Bike or walk
- Sample size quotas were established for each commute mode, headed east and headed west. Target sample sizes ranged from 100 to 300.

Survey Invitation Approach By Mode

- Residents (SOVers and other modes): Mailed 75,000 postcards announcing this study to residents living across the study area.
- Carpoolers: Emailed an online survey invitation and link to COG's Commuter Connections' database registrants who live in the study area.
- Local and Express Bus: Reached through postcard mailing, Commuter Connections' database and at Metrorail stations.
- Metrorail: Hand distributed postcard invitations at various Metrorail stops during peak travel times.
- VRE: Posted survey invitation in VRE's electronic newsletter.
- Bike Riders and Pedestrians: Hand distributed cards on trails and paths.

Research Sample by Mode

- Mode classification is based on primary commute mode, using this question:

  Which of the following types of transportation do you use as your **primary mode of commute** on your morning trip to work or school? That is, which do you use most days of the week? If you use more than one type of transportation on a single day, please tell us the type you use for the **longest portion** of your trip to work or school.

- Some commuters ride a bus, rail or bike although this mode might not be their primary commute mode. Thus, regardless of whether these alternate modes are their primary modes, all bus and rail riders and all bike riders and pedestrians are also classified by these "other" modes. Consequently, some of the mode classifications are not mutually exclusive.

Research Sample by Mode

Mode and direction defined by morning commute. VRE runs only east during morning peak.

Mode	Target Quota	Analytical Sample Size
SOV		
Gas engine – Eastbound	300	781
Gas engine – Westbound	300	255
Hybrid – Eastbound	-	171
Hybrid – Westbound	-	17
Formal carpool – Eastbound	200	581
Formal carpool – Westbound	100	30
Local bus – Eastbound	125	152
Local bus – Westbound	125	14
Express bus – Eastbound	100	372
Express bus – Westbound	-	19
Metrorail – Eastbound	200	674
Metrorail – Westbound	100	108
VRE – Eastbound	100	194
Bike	150	191
Total	**1,800**	**3,559**

Note: In addition, 33 vanpoolers and 9 pedestrians (only) completed the survey.

Data Analysis

- In this summary, data will focus on these groups:
  - Eastbound SOV
  - Westbound SOV
  - Eastbound Carpool
  - Eastbound Local Bus
  - Eastbound Express Bus
  - Eastbound Metrorail
  - Westbound Metrorail
  - VRE
  - Bike

Key Findings

#1

Roughly two-thirds of these inside-the-beltway respondents travel both inside and outside the Beltway on their morning commutes. This pattern suggests that many have long commutes. This, in fact, holds true based on their mileage and the time commitment commutes require. Two-thirds of Metrorail riders, for example, have commutes of 41-90 minutes. Three-fourths of Express Bus riders have commutes of at least one hour.

Travel inside the Beltway

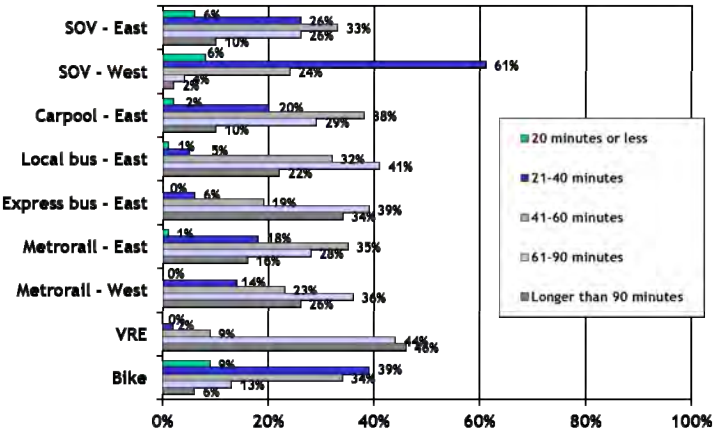
VRE Riders Are Most Likely to Travel Both Inside and Outside the Beltway; Eastbound Metrorail Riders Are Least Likely to Travel Both Inside and Outside the Beltway; Other Modes More Closely Resemble Metrorail than VRE

	SOV - East	SOV - West	Carpool - East	Local bus - East	Express bus - East	Metro -rail - East	Metro rail - West	VRE
Inside the Beltway only	31%	38%	37%	24%	37%	42%	34%	6%
Both inside and outside the Beltway	69%	62%	63%	76%	63%	58%	66%	94%

Q3a. When you travel on I-66 on your morning commute, do you travel only inside the Beltway or do you travel both inside and outside the Capital Beltway?

Length of commute - minutes

SOVers and Bikeriders Have the Shortest Commutes (in minutes), While VRE Riders Have the Longest; Many Express Bus Riders Also Have Fairly Long Commutes

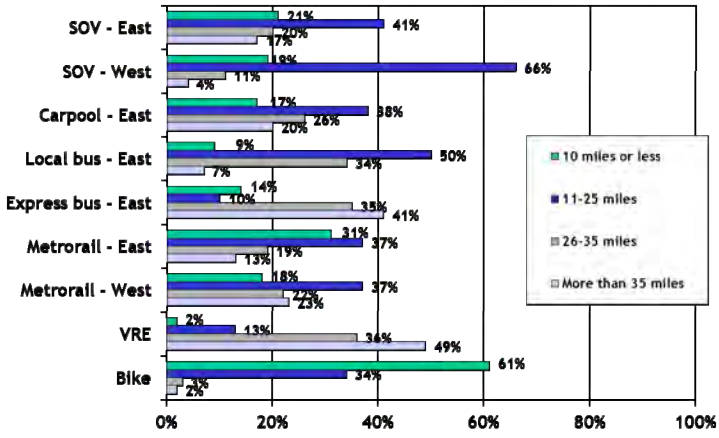


Q55. On average, about how many minutes long is your **total** morning commute, door-to-door?

Length of commute - miles

Not Surprisingly, VRE Riders Travel the Most Miles for their Commute – Nearly Half Travel More than 35 Miles; In Contrast, Nearly a Third of Eastbound Metrorail Riders Travel 10 Miles or Less

-- But, 61% of Bike Riders Travel 10 Miles or Less --



Q56. About how many miles long is your **total** morning commute, door to door?

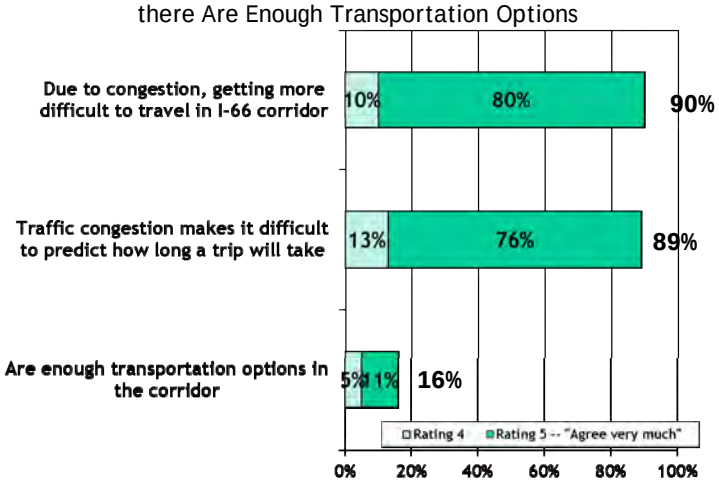
#2

Regardless of their current mode, commuters recognize the challenges of commuting on I-66: difficulty traveling through the corridor and predicting how long a trip will take. Across all modes, commuters do not believe there are sufficient transportation options in the corridor at present.

Percep-tions of I-66 corridor - Eastbound SOV

Proportions indicate those who agree that the statement describes travel in the I-66 corridor.

Eastbound SOVers Believe It Is Getting More Difficult to Travel through the Corridor and that Congestion Is Making It More Difficult to Predict How Long a Trip Will Take; But, They Do Not Believe there Are Enough Transportation Options

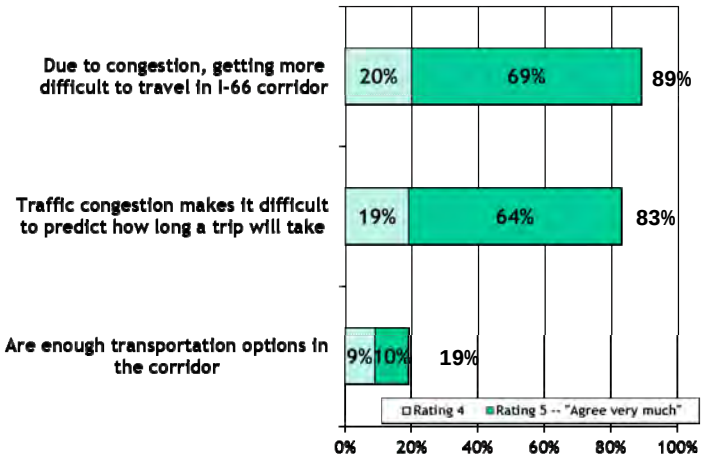


Q69. To what extent do you agree with each of the following statements about travel in the I-66 corridor? Please use a scale of 1 to 5 for your answers, where "1" means that you "do not agree at all" and "5" means that you "agree very much" that the statement describes travel in the I-66 corridor.

Percep-tions of I-66 corridor - Westbound SOV

Proportions indicate those who agree that the statement describes travel in the I-66 corridor.

Westbound SOVers Agree that Congestion Makes It More Difficult to Travel in the Corridor and to Predict Trip Time; and, They Think there Are Not Enough Transportation Options

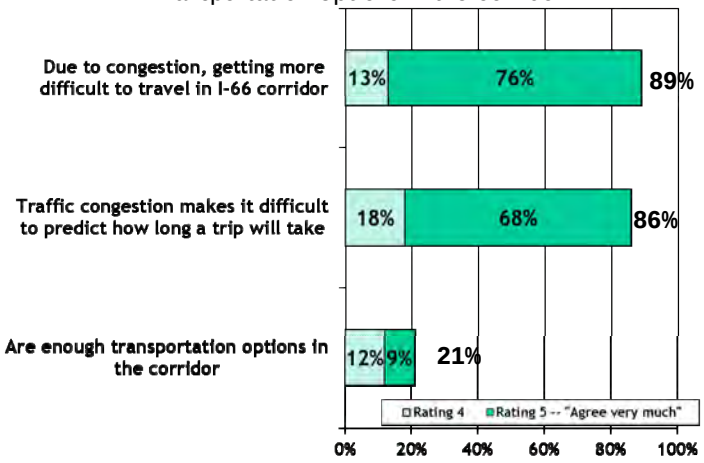


Q69. To what extent do you agree with each of the following statements about travel in the I-66 corridor? Please use a scale of 1 to 5 for your answers, where "1" means that you "do not agree at all" and "5" means that you "agree very much" that the statement describes travel in the I-66 corridor.

Percep-tions of I-66 corridor - Eastbound carpool

Proportions indicate those who agree that the statement describes travel in the I-66 corridor.

Carpoolers Agree that It Is Getting More Difficult to Travel in the Corridor and Traffic Makes It Difficult to Predict the Time a Trip Will Take; They Do Not Think there Are Enough Transportation Options in the Corridor

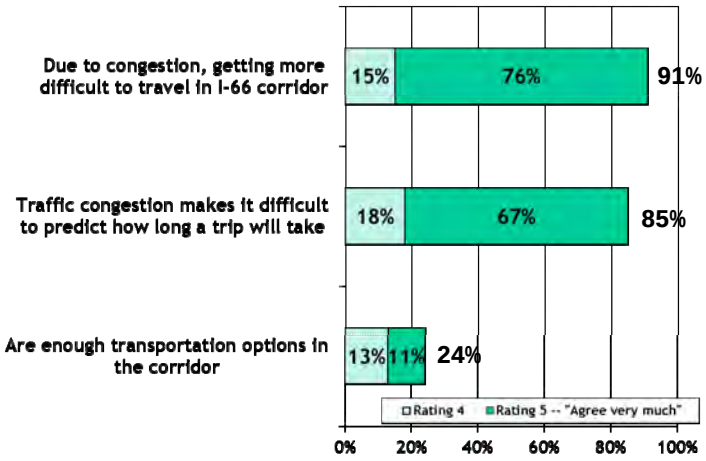


Q69. To what extent do you agree with each of the following statements about travel in the I-66 corridor? Please use a scale of 1 to 5 for your answers, where "1" means that you "do not agree at all" and "5" means that you "agree very much" that the statement describes travel in the I-66 corridor.

Percep-tions of I-66 corridor - Eastbound Local bus

Proportions indicate those who agree that the statement describes travel in the I-66 corridor.

Local Bus Riders Agree with Carpoolers and SOVers Regarding Traffic Congestion and Transportation Options in the I-66 Corridor

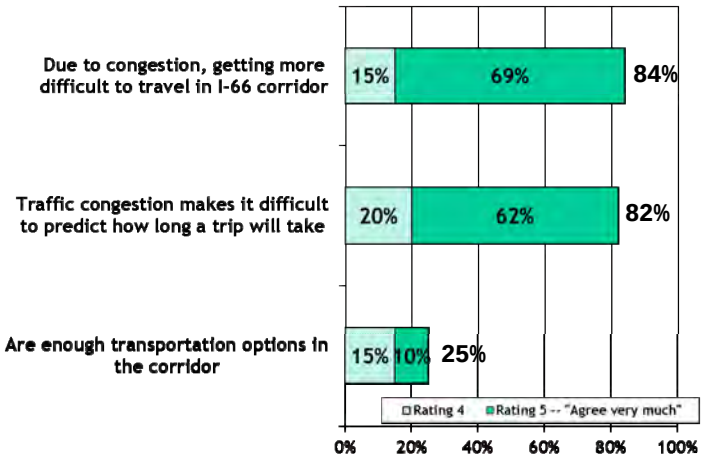


Q69. To what extent do you agree with each of the following statements about travel in the I-66 corridor? Please use a scale of 1 to 5 for your answers, where "1" means that you "do not agree at all" and "5" means that you "agree very much" that the statement describes travel in the I-66 corridor.

Percep-tions of I-66 corridor - Eastbound Metrorail

Proportions indicate those who agree that the statement describes travel in the I-66 corridor.

The Views of Eastbound Metrorail Riders Are the Same

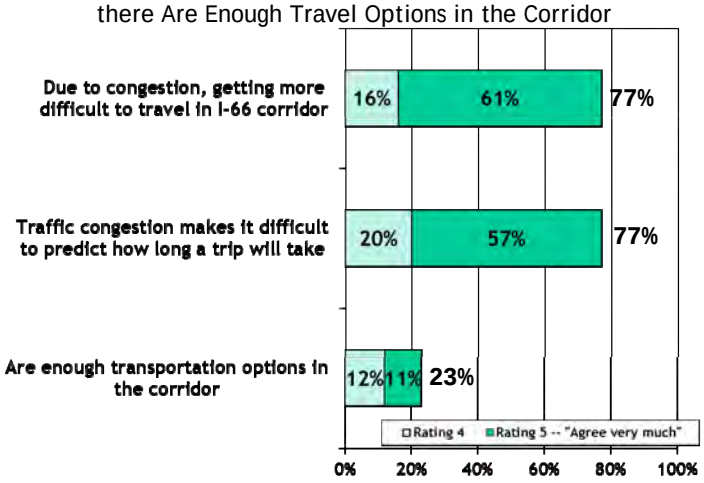


Q69. To what extent do you agree with each of the following statements about travel in the I-66 corridor? Please use a scale of 1 to 5 for your answers, where "1" means that you "do not agree at all" and "5" means that you "agree very much" that the statement describes travel in the I-66 corridor.

Percep-tions of I-66 corridor - Westbound Metrorail

Proportions indicate those who agree that the statement describes travel in the I-66 corridor.

Similarly, Westbound Metrorail Riders Believe Congestion Is Making Travel in the Corridor More Difficult and Making It More Difficult to Predict How Long a Trip Will Take; They Are Not Convinced that there Are Enough Travel Options in the Corridor



Q69. To what extent do you agree with each of the following statements about travel in the I-66 corridor? Please use a scale of 1 to 5 for your answers, where "1" means that you "do not agree at all" and "5" means that you "agree very much" that the statement describes travel in the I-66 corridor.

#3

#4

#5

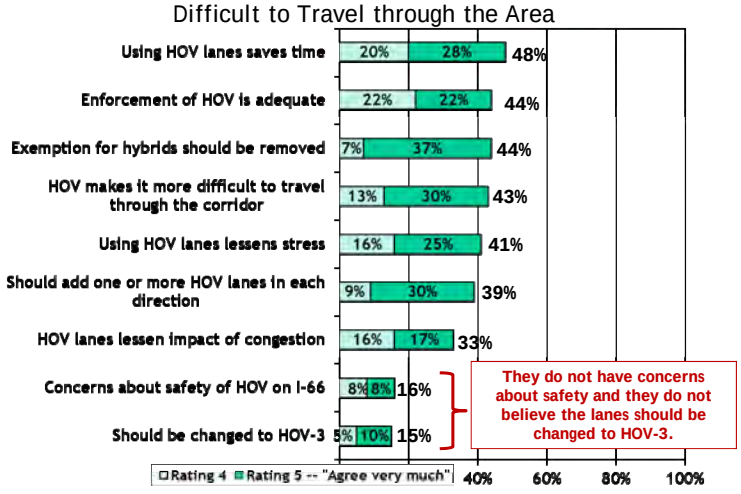
#3: Support for HOV lanes varies considerably across mode. SOVers do not always recognize the benefits of the HOV lanes. Even though they are not highly critical of the HOV lanes, they do not necessarily believe that HOV lanes should be added. In contrast, carpoolers and express bus users recognize the benefits of the HOV lanes, particularly in terms of saving time. They believe one or more HOV lanes should be added in each direction.

#4: Although SOVers are not convinced that using the HOV lanes saves time, they would be most convinced to try HOV lanes if they could save time by using the lanes. Additionally, non-SOV commuters who do not use the HOV lanes would also be most convinced to use the lanes if it would save them time.

#5: About a quarter of non-HOV users say they would use the HOV lanes if they could use their smartphone to find a carpool partner. About the same amount say they would use the HOV lanes if it was easier to find a carpool partner.

Opinions of HOV on I-66 - Eastbound SOV

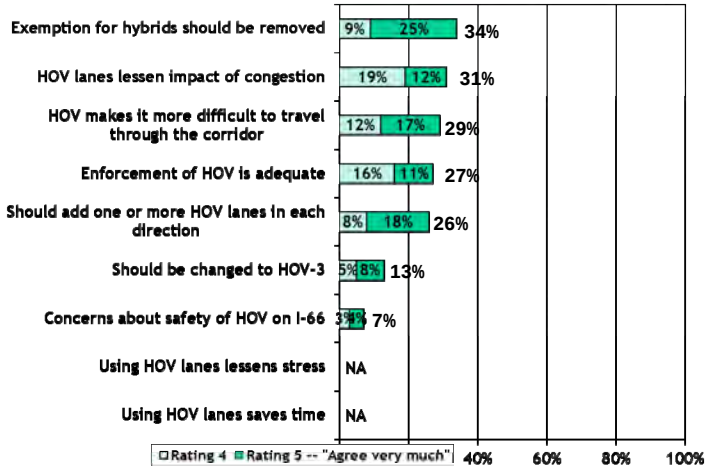
Eastbound SOVers Express Mixed Views about the HOV Lanes on I-66; All Are Not Convinced that the HOV Lanes Save Time; But, All Don't Believe the HOV Lanes Make It More Difficult to Travel through the Area



Q74. To what extent do you agree with each of the following statements about the HOV lanes on I-66 inside the Beltway? Please use a scale of 1 to 5 for your answers where "1" means that you "do not agree at all" and "5" means that you "agree very much."

Opinions of HOV on I-66 - Westbound SOV

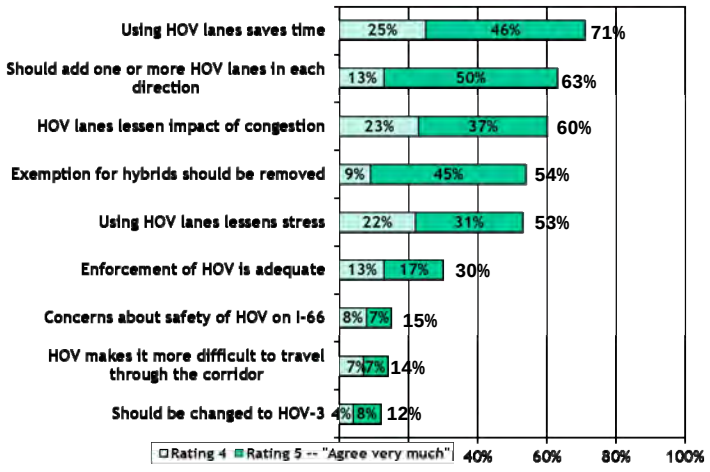
Westbound SOVers Do Not Seem to Have Strong Views about the HOV Lanes



Q74. To what extent do you agree with each of the following statements about the HOV lanes on I-66 inside the Beltway? Please use a scale of 1 to 5 for your answers where "1" means that you "do not agree at all" and "5" means that you "agree very much."

Opinions of HOV on I-66 - Eastbound carpool

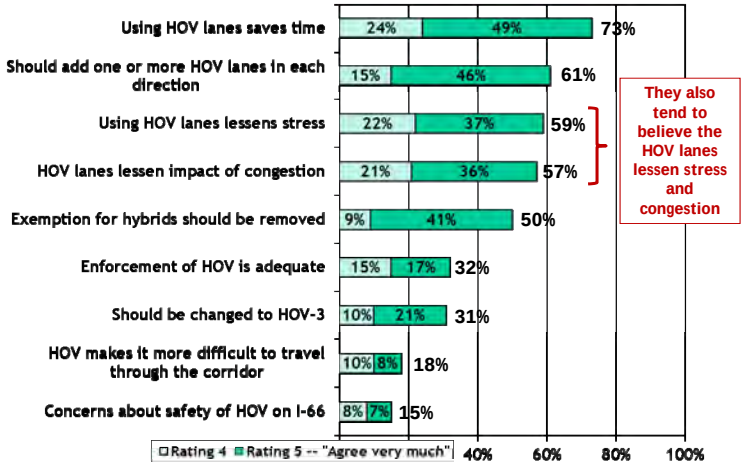
Carpoolers Believe that Using the HOV Lanes Saves Time, That HOV Lanes Should Be Added, and that HOV Lanes Lessen the Impact of Congestion; But, They Are Not Convinced that Enforcement Is Adequate



Q74. To what extent do you agree with each of the following statements about the HOV lanes on I-66 inside the Beltway? Please use a scale of 1 to 5 for your answers where "1" means that you "do not agree at all" and "5" means that you "agree very much."

Opinions of HOV on I-66 – Eastbound Express bus

Most of All, Express Bus Riders Believe the HOV Lanes Save Time; But, They would Like More HOV Lanes Added



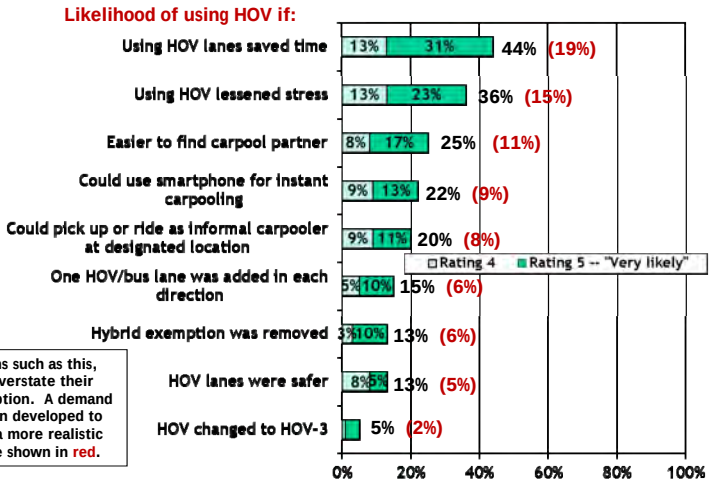
They also tend to believe the HOV lanes lessen stress and congestion

Q74. To what extent do you agree with each of the following statements about the HOV lanes on I-66 inside the Beltway? Please use a scale of 1 to 5 for your answers where "1" means that you "do not agree at all" and "5" means that you "agree very much."

Likelihood of using HOV lanes under various conditions – Eastbound SOV

Question asked of those who do not currently use HOV lanes.

Eastbound SOVers Would Be Most Persuaded to Use the HOV Lanes If the Lanes Saved Time or Lessened Stress; In Addition, about 1 out of 10 Would Use the HOV Lanes if It Was Easier to Find a Carpool Partner



On behavioral questions such as this, respondents tend to overstate their likelihood of using the option. A demand discount factor has been developed to calculate responses to a more realistic level. Those values are shown in red.

Q77. How likely would you be to use the HOV lanes for your commute at least occasionally if:

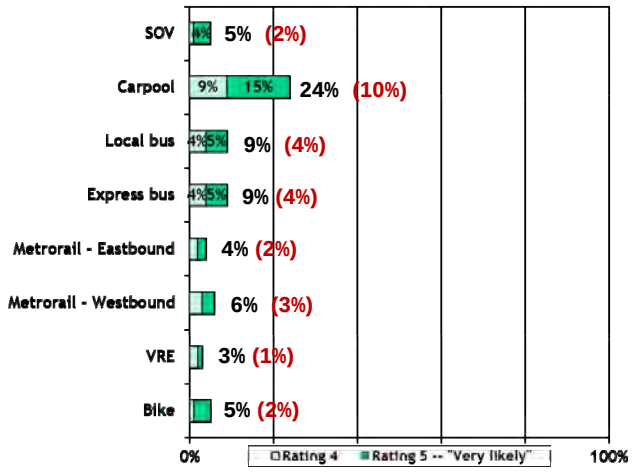
#6

Changing the hours of HOV enforcement would attract some new users. But, the change would not attract many SOVers. It would attract carpoolers not using the lanes currently. The pattern is similar whether the hours in the morning are changed to 5:30 – 9:30 or the hours in the afternoon are changed to 3:00 – 7:00.

Impact of changing morning HOV hours - Eastbound morning commuters

Responses shown for those who do not currently use HOV lanes.

Changing the Morning Hours of HOV Would Attract a Few New HOV Users, Particularly Current Carpoolers

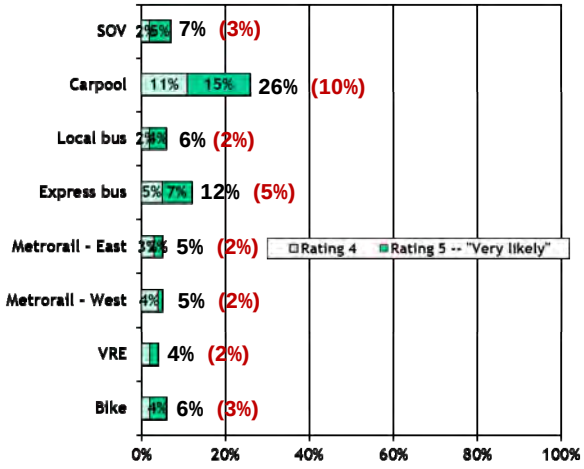


Q78. Assume that the HOV lane restrictions eastbound on I-66 inside the Beltway went into effect at 5:30 a.m. and stayed in effect until 9:30 a.m., instead of going into effect at 6:30 a.m. and staying in effect until 9:00 a.m. as they now do. How likely would you be to use the eastbound HOV lanes inside the Beltway for your morning commute if they went into effect at 5:30 a.m. instead of 6:30 a.m. and stayed in effect until 9:30 a.m. instead of 9:00 a.m.?

Impact of changing afternoon HOV hours - Westbound afternoon commuters

Responses shown for those who do not currently use HOV lanes.

A Few New Commuters Would Use the HOV Lanes if the Afternoon Hours Were Changed to 3:00 to 7:00 pm, Primarily Current Carpoolers



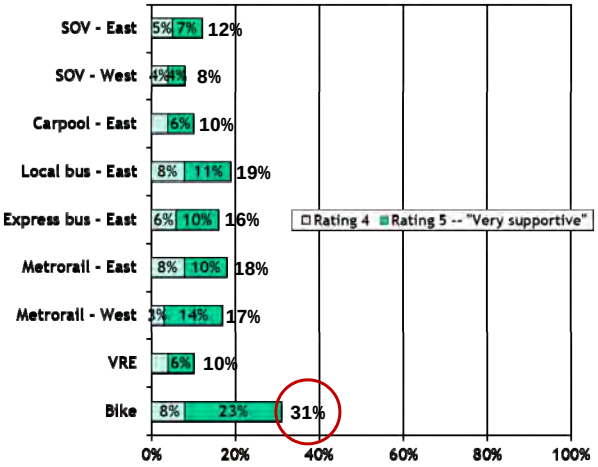
Q79. Assume that the HOV lane restrictions westbound on I-66 inside the Beltway went into effect at 3:00 p.m. and stayed in effect until 7:00 p.m., instead of staying in effect from 4:00 p.m. until 6:30 p.m., as they now do. How likely would you be to use the westbound HOV lanes inside the Beltway for your afternoon commute if they went into effect at 3:00 p.m. and stayed in effect until 7:00 p.m.?

#7

Support for a toll on I-66 inside the Beltway is low, especially among those who would be paying the toll directly – SOVers and carpoolers. In fact, about 80% of SOVers and carpoolers oppose a toll. But, support for a toll is also low among transit users. Support for congestion priced tolling is also low.

Support for toll on I-66

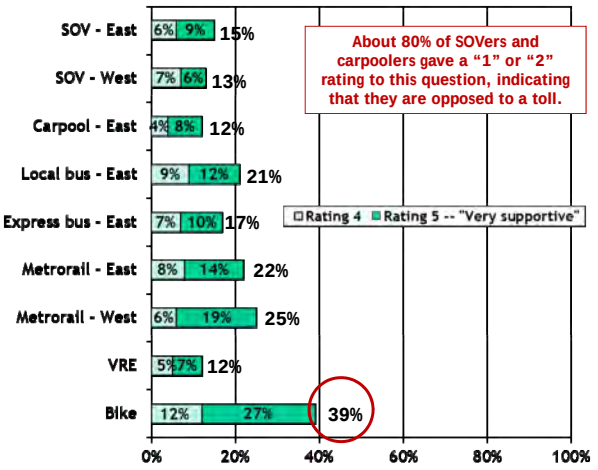
Support for a Toll on I-66 Is Fairly Low, Especially among those Who Would Most Likely Be Paying the Toll Directly – SOVers and Carpoolers; Support Is Highest among Bike Riders



Q80. Assume that a toll is put in place for all traffic on I-66. All vehicles would pay a toll to travel on I-66. How supportive would you be of putting a toll on I-66? By supportive, we mean that you believe that tolling should be put in place inside the Beltway on I-66.

Support for congestion priced tolling on I-66

Support for Congestion Priced Tolling on I-66 Is about the Same as Support for Tolling in General on I-66 – Fairly Low; The Highest Level of Support Is Posted for Bike Riders



About 80% of SOVers and carpoolers gave a "1" or "2" rating to this question, indicating that they are opposed to a toll.

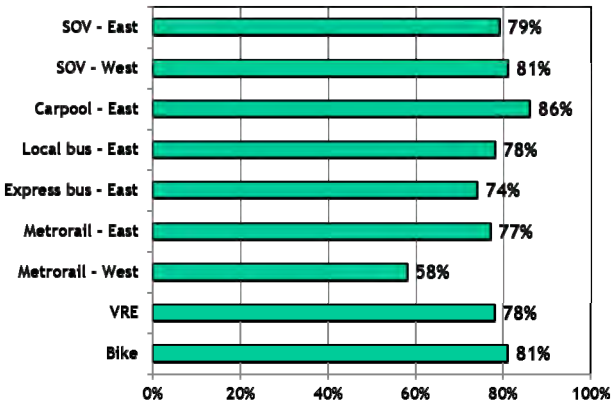
Q80a. [Description of congestion priced tolling] How supportive would you be of pricing possible tolls on I-66 using a congestion pricing approach? By supportive, we mean that you believe that congestion priced tolling should be put in place for tolls inside the Beltway on I-66.

#8

Most commuters in the corridor have heard of HOT lanes, about 80%. Support for HOT lanes is higher than support for a general toll. About a quarter of commuters support HOT lanes on I-66 inside the Beltway.

Aware of HOT lanes

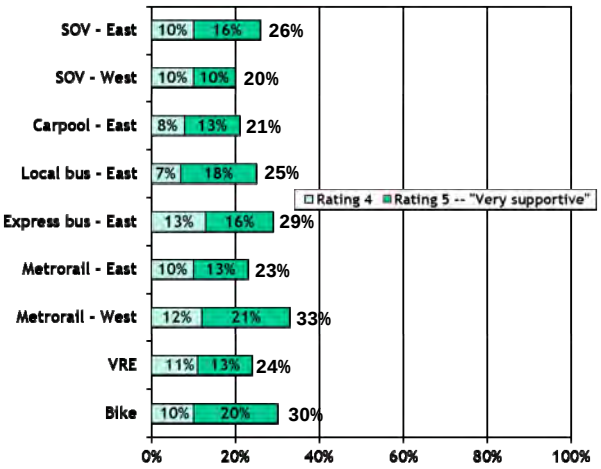
Awareness of the HOT Lanes Concept Is Fairly High; about 8 out of 10 Have Heard of HOT Lanes



Q81. Have you ever heard or read anything about an idea referred to as "HOT lanes," or High Occupancy Toll lanes?

Support for HOT lanes

Support for HOT Lanes on I-66 Is Slightly Higher than Support for Tolling in General; about a Quarter Support HOT Lanes on I-66



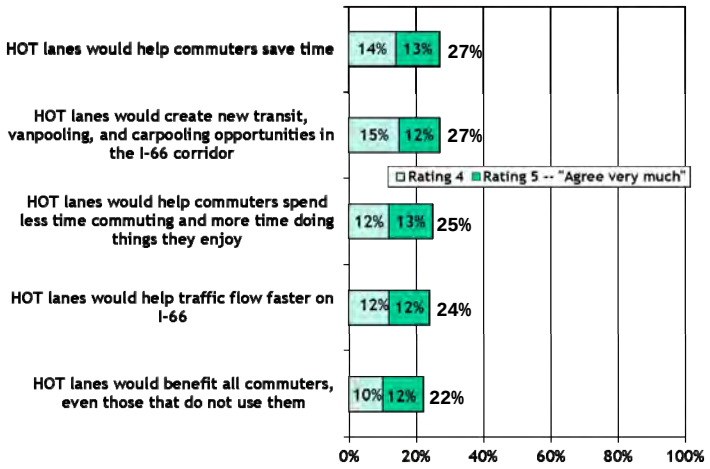
Q82. [Explanation of HOT lanes.] How supportive are you of implementing HOT lanes on I-66 inside the Beltway, 7 days a week, 24 hours a day? By supportive, we mean that you believe HOT lanes should be put in place on I-66 inside the Beltway.

#9

The benefits of HOT lanes are important in selling HOT lanes to the public. But, although commuters may have heard of HOT lanes, they do not have a high level of familiarity with or understanding of HOT lanes. The often do not recognize the benefits of HOT lanes. Only about 25-35% of commuters recognized each of five benefits tested.

Opinions about HOT lanes – Eastbound SOV

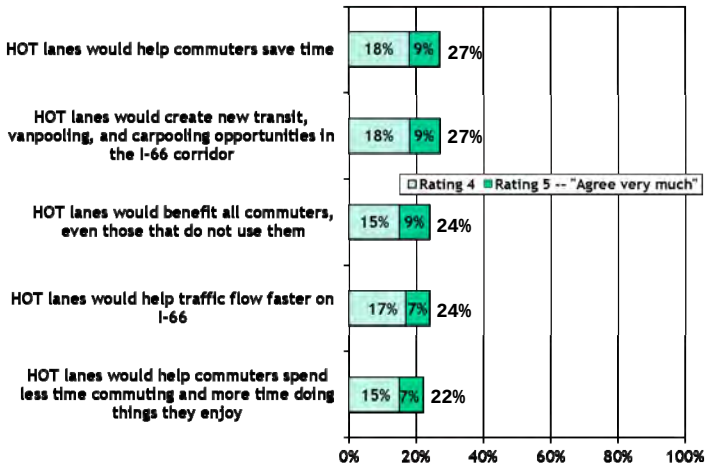
Only about a Quarter of Eastbound SOV Commuters Recognize these Benefits of HOT Lanes



Q85. Next is a list of statements about potential HOT lanes on I-66. Please indicate the extent to which you agree or disagree with each statement. Use a scale of 1-5 for your answer where "1" means that you "do not agree at all" with the statement and "5" means that you "agree very much" with the statement.

Opinions about HOT lanes – Westbound SOV

Similarly, about a Fourth of Westbound SOVers Recognize these Benefits of HOT Lanes



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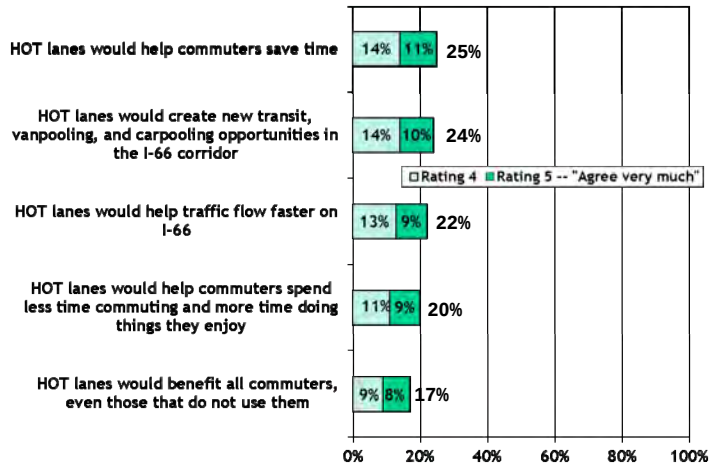
Opinions about HOT lanes – Eastbound carpool

Carpoolers Are Most Likely to Recognize Saving Time and New Transportation Options as Benefits of HOT Lanes; But, Still, Only about a Quarter of Carpoolers Recognize these Benefits of HOT Lanes



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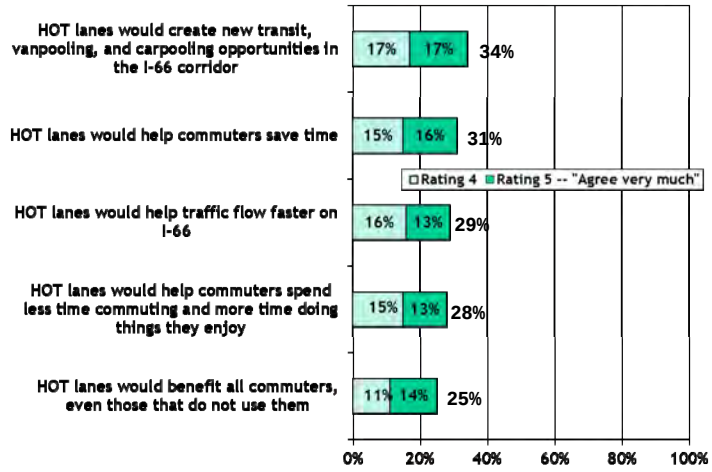
Opinions about HOT lanes – Eastbound Express bus

Express Bus Riders Are about as Likely to See the Benefits of HOT Lanes as Other Commuters



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#10

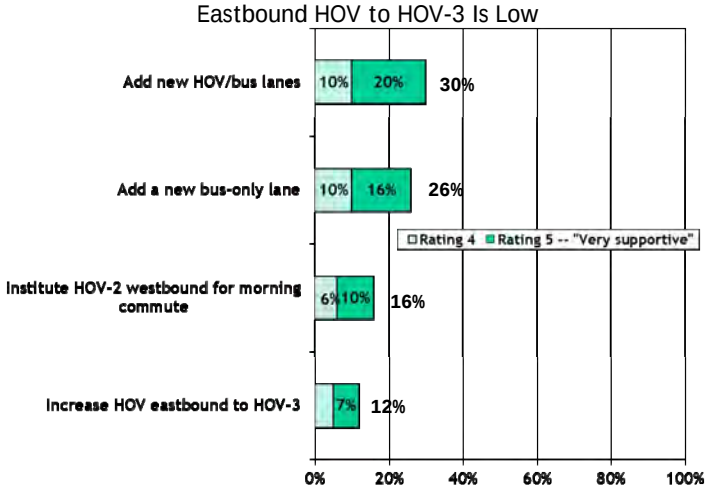
#11

#10: Support for adding new HOV/bus lanes and adding a new bus-only lane varies. Support is highest among bus riders and lowest among SOVers, ranging from 74% to 26%. Support among rail riders, both VRE and Metrorail, falls between these extremes and is closer to the level of bus riders.

#11: Support for changing the Eastbound HOV-2 restriction to HOV-3 is low. It is especially low (only around 10%) among SOVers and carpoolers.

Support for I-66 changes – Eastbound SOV

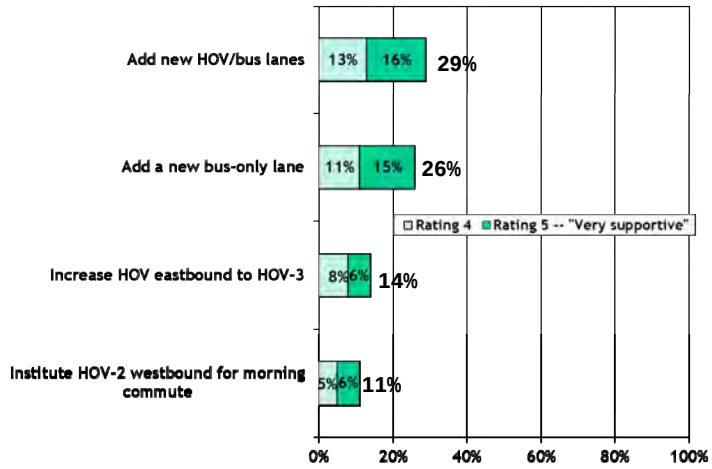
Of these Four Options for I-66 Changes, Eastbound SOVers Express the Greatest Support for Adding New HOV/Bus Lanes and Adding a New Bus-Only Lane; Support for Increasing Eastbound HOV to HOV-3 Is Low



Q88. Numerous suggestions have been made by the public and by officials for changes to I-66 to improve the flow of traffic on I-66 inside the Beltway. How supportive are you of each of these possible changes to I-66 inside the Beltway? By supportive, we mean that you believe that this change should be made.

Support for I-66 changes – Westbound SOV

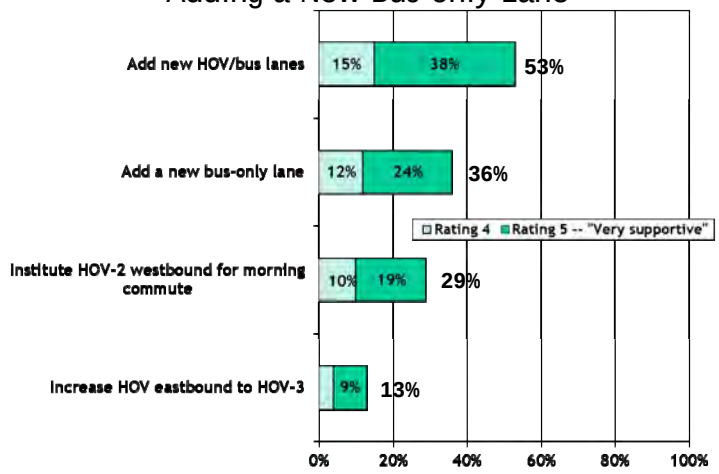
Westbound SOVers Also Voice the Most Support for Adding HOV/Bus Lanes and Adding a New Bus-Only Lane



Q88. Numerous suggestions have been made by the public and by officials for changes to I-66 to improve the flow of traffic on I-66 inside the Beltway. How supportive are you of each of these possible changes to I-66 inside the Beltway? By supportive, we mean that you believe that this change should be made.

Support for I-66 changes – Eastbound carpool

Over Half of Carpoolers Support Adding New HOV/Bus Lanes to I-66; More than a Third Support Adding a New Bus-only Lane



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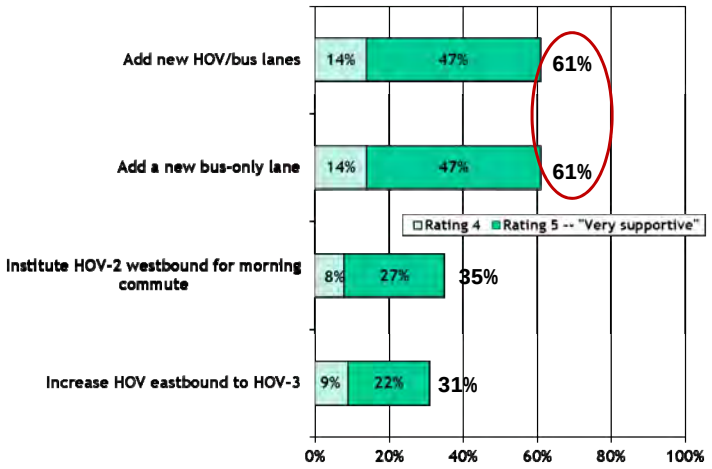
Support for I-66 changes – Eastbound local bus

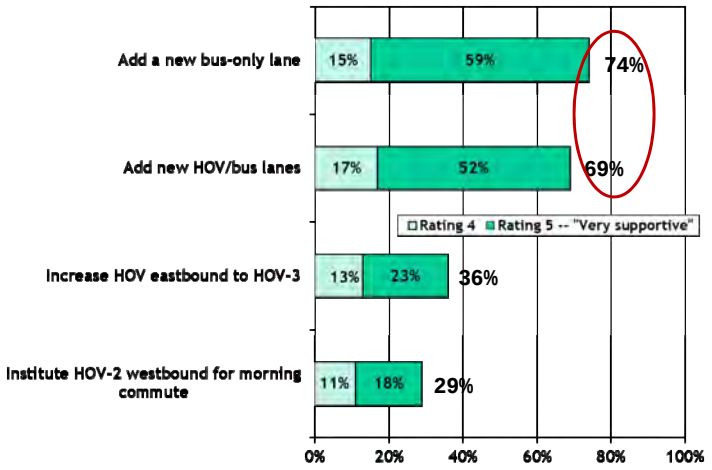
Not Surprisingly, Bus Lanes Are the Most Appealing Options for Local Bus Riders



Q88. Numerous suggestions have been made by the public and by officials for changes to I-66 to improve the flow of traffic on I-66 inside the Beltway. How supportive are you of each of these possible changes to I-66 inside the Beltway? By supportive, we mean that you believe that this change should be made.

Support for I-66 changes – Eastbound express bus

Express Bus Riders Are Even More Supportive of New Bus Lanes than Are Local Bus Riders



Q88. Numerous suggestions have been made by the public and by officials for changes to I-66 to improve the flow of traffic on I-66 inside the Beltway. How supportive are you of each of these possible changes to I-66 inside the Beltway? By supportive, we mean that you believe that this change should be made.

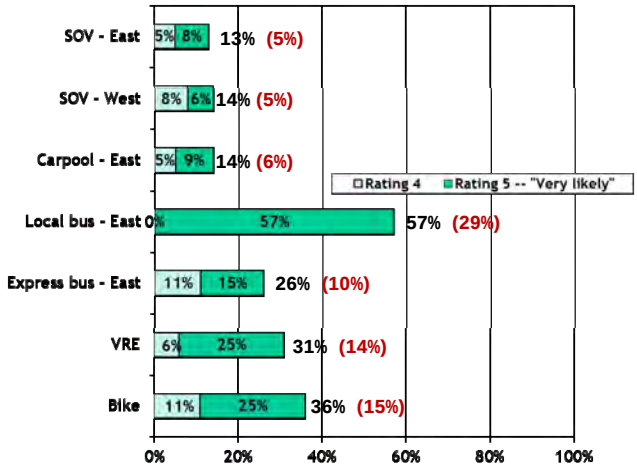
#12

To attract new riders to Metrorail, it's all about travel time. Commuters would be most attracted to Metrorail if it was faster than their current mode.

Likelihood of riding Metrorail

Question asked of those who do not currently ride Metrorail and it is available for their commute.

SOV Commuters and Carpoolers Express the Lowest Interest in Riding Metrorail; Local Bus Riders Express the Most Interest

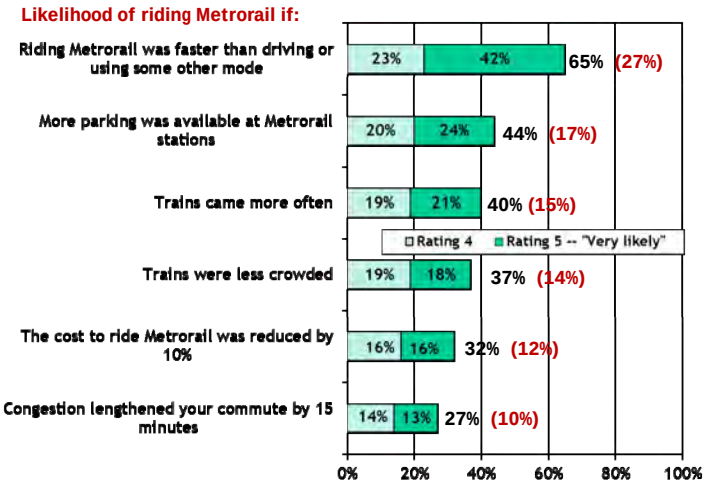


Q90. Regardless of the mode of transportation you use today for your commute, how likely are you to use Metrorail for at least part of your commute at least 1-2 days a week in the future? Please use a scale of 1 to 5 for your answer, where "1" means that you are not at all likely and "5" means that you are very likely.

Likelihood of riding Metrorail under various conditions - Eastbound SOV

Question asked of those who do not currently ride Metrorail and it is available for their commute.

A Faster Commute Would Attract New Riders to Metrorail



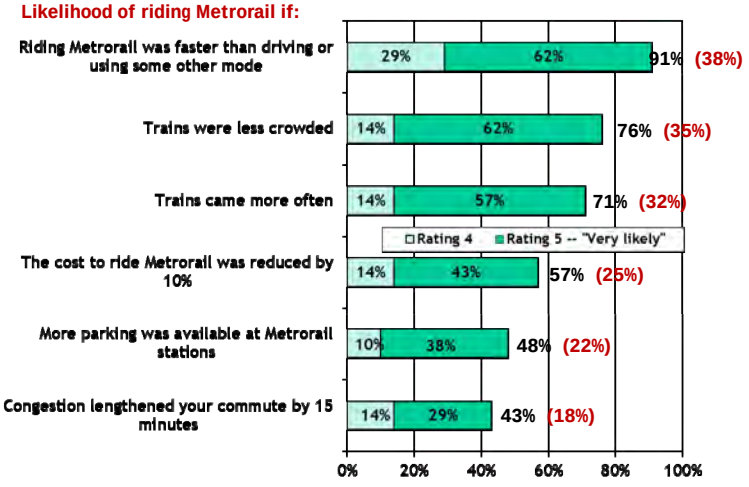
Q91. How likely would you be to use Metrorail for at least part of your commute 1-2 days a week under each of the following conditions?

I-66 Multimodal Study

Likelihood of riding Metrorail under various conditions - Eastbound local bus

Question asked of those who do not currently ride Metrorail and it is available for their commute.

Local Bus Riders Express Interest in Riding Metrorail Under Several Scenarios: If the Train Were Faster than Other Modes, If Trains Were Less Crowded and Came More Often, and If the Cost to Ride Metrorail Was Reduced by 10%



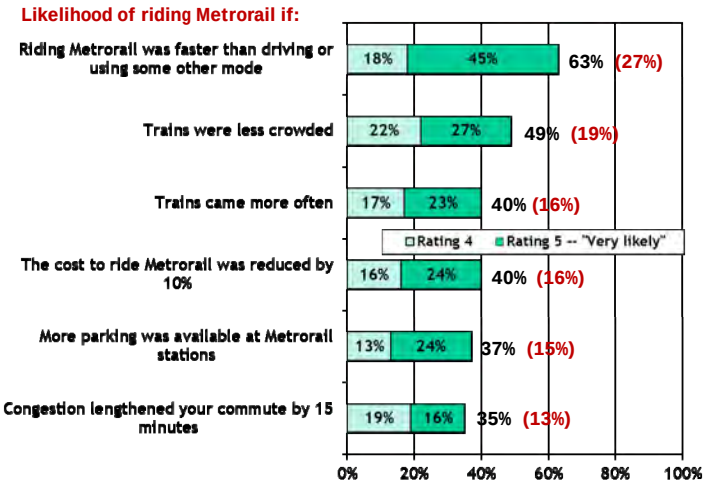
Q91. How likely would you be to use Metrorail for at least part of your commute 1-2 days a week under each of the following conditions?

I-66 Multimodal Study

Likelihood of riding Metrorail under various conditions - Eastbound Express bus

Question asked of those who do not currently ride Metrorail and it is available for their commute.

A Faster Commute Also Appeals to Current Express Bus Riders



Q91. How likely would you be to use Metrorail for at least part of your commute 1-2 days a week under each of the following conditions?

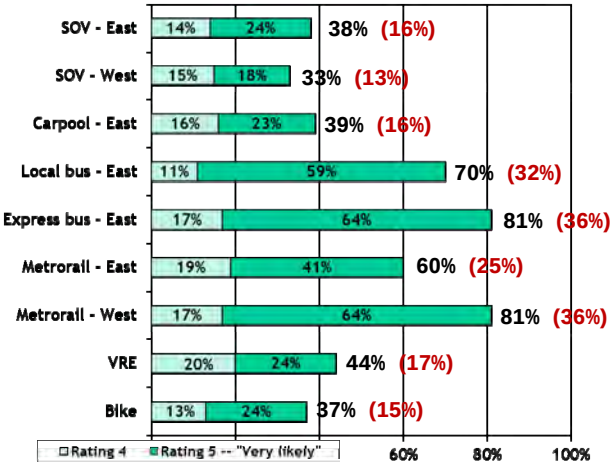
#13

There is interest in Priority Bus services, and that confirms elements of the baseline approach for this study. The appeal of Priority Bus is based in speed. It would be selected if it made the commute faster. Perceived speed of Priority Bus is related to having limited stops and running every 10 minutes.

Likelihood of using Priority Bus service

Question asked of all respond-ents.

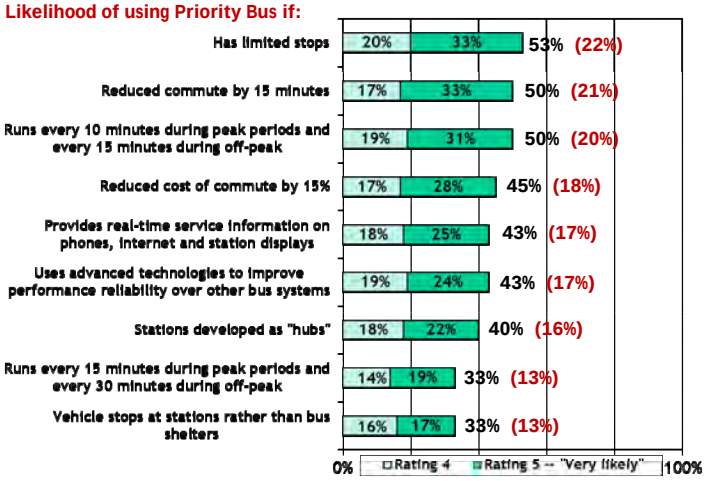
Current Bus Riders and Current Metrorail Riders Express the Greatest Likelihood of Using a Priority Bus; About a Third of SOVers, Either Direction, Say They Would Likely Use Priority Bus



Q105. Suppose a Priority Bus service was conveniently accessible from the area where you live to your destination, that is the place where you work or attend school. How likely would you be to use a Priority Bus service for your regular commute to work or school at least 2 days per week?

Likelihood of using Priority Bus based on specific features - Eastbound SOV

Eastbound SOVers Would Be Most Likely to Ride Priority Bus if It Had Limited Stops, Reduced their Commute by 15 Minutes or Ran Every 10 Minutes During Peak Periods

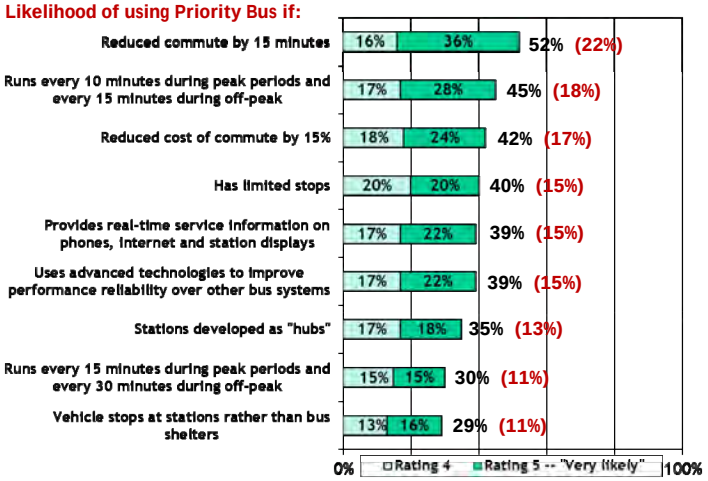


Q107. How likely would you be to use Priority Bus services based on the following information about this service?

Likelihood of using Priority Bus based on specific features – Westbound SOV

For Westbound SOVers, the Two Most Compelling Features of a Priority Bus Are Reducing Commute Time and Frequent Service

Likelihood of using Priority Bus if:

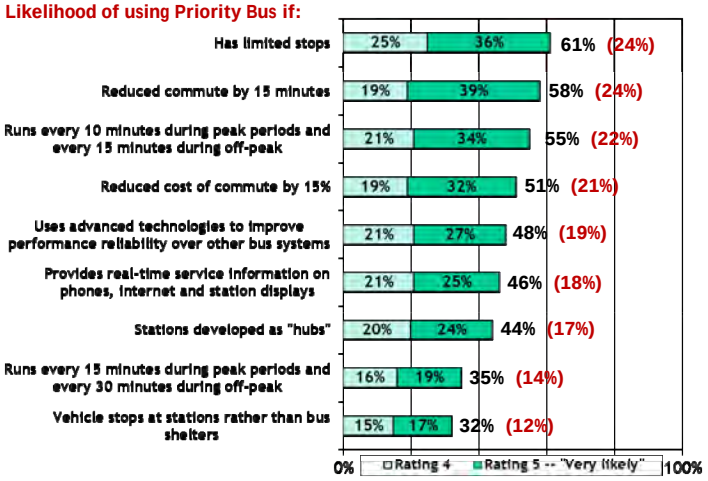


Q107. How likely would you be to use Priority Bus services based on the following information about this service?

Likelihood of using Priority Bus based on specific features – Eastbound carpool

For Carpoolers, the Potential Time Savings of Priority Bus Is Most Appealing – Its Limited Stops, Reduction of Commute Time and Running Every 10 Minutes

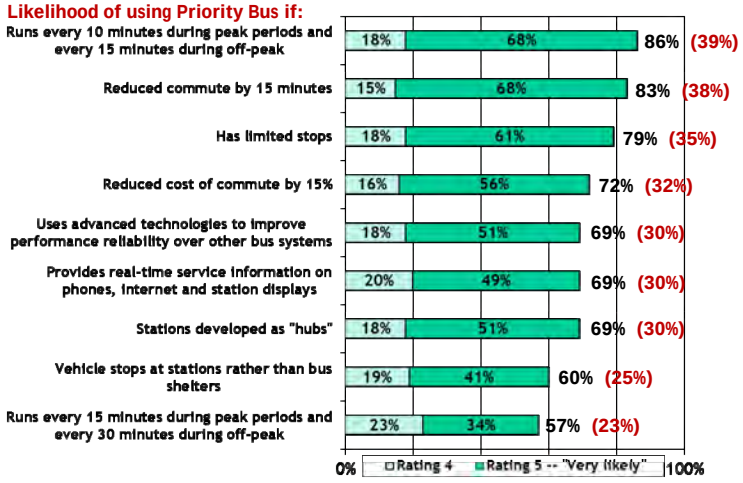
Likelihood of using Priority Bus if:



Q107. How likely would you be to use Priority Bus services based on the following information about this service?

Likelihood of using Priority Bus based on specific features - Eastbound local bus

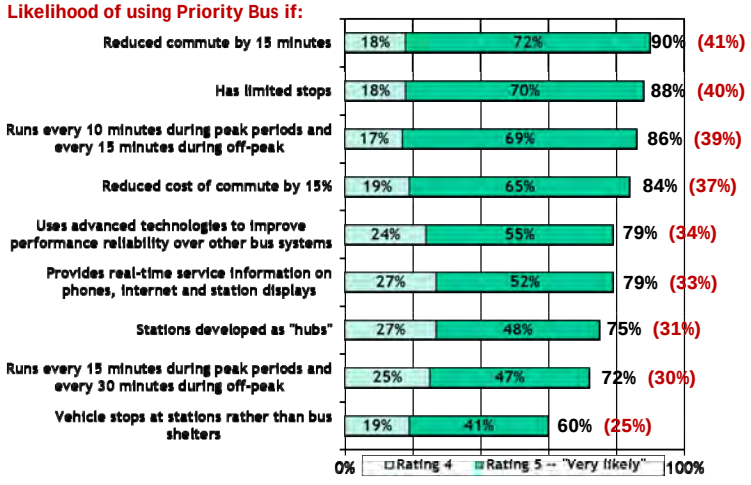
Generally, All of the Potential Benefits of Priority Bus Enhance Its Appeal among Current Local Bus Riders; But, Benefits Related to Time Are Most Persuasive



Q107. How likely would you be to use Priority Bus services based on the following information about this service?

Likelihood of using Priority Bus based on specific features - Eastbound express bus

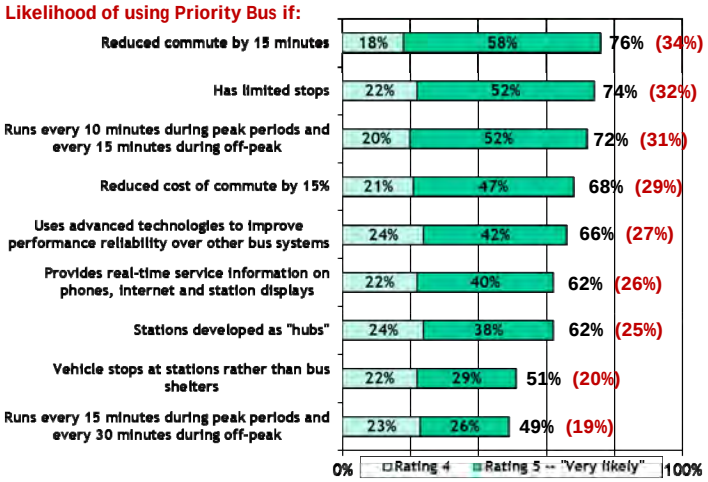
Among Express Bus Riders, All of the Potential Benefits of Riding a Priority Bus Are Persuasive; the Weakest Is Stopping at Stations Rather than Shelters



Q107. How likely would you be to use Priority Bus services based on the following information about this service?

Likelihood of using Priority Bus based on specific features - Eastbound Metrorail

Eastbound Metrorail Riders Would Be Most Likely to Ride a Priority Bus if It Reduced their Commute by 15 Minutes, Has Limited Stops, Runs Every 10 Minutes or Reduced Cost of Commute by 15%



Q107. How likely would you be to use Priority Bus services based on the following information about this service?

#14

Employer programs make a difference. Transit users tend to work for employers who offer transit assistance. Carpoolers tend to work for employers who offer carpool support. SOVers work where there is free or subsidized parking.

Commute programs offered by employer

SOVers Often Work for Organizations that Have Free or Subsidized Parking; Transit Users Often Work for Organizations that Provide Transit Fare Support

-- Carpoolers Are More Likely than the Other Mode Users to Work for an Organization that Offers Ridematching and Preferred Parking for Carpools --

	SOV - East	SOV - West	Carpool - East	Local bus - East	Express bus - East	Metrorail - East	Metrorail - West	VRE	Bike
Free/subsidized parking	60%	77%	50%	35%	32%	33%	42%	36%	46%
Preferred parking for car/vanpools	18%	13%	30%	23%	21%	22%	22%	26%	23%
Transit fare support	42%	20%	56%	68%	64%	66%	60%	67%	64%
Pre-tax salary deduction for transit	27%	16%	30%	31%	38%	36%	40%	35%	34%
Ridematching	11%	8%	20%	13%	17%	16%	19%	15%	15%
Flexible work hours	59%	64%	64%	64%	67%	66%	70%	68%	77%
Compressed work week	30%	25%	44%	44%	42%	41%	42%	42%	45%
Telework	43%	42%	55%	56%	56%	55%	61%	58%	65%
Shuttle to transit station	14%	12%	14%	10%	12%	11%	19%	18%	14%

Q128. Which of the following does your employer offer?

Commute programs offered by employer

SOVers and Carpoolers Take Advantage of Free or Subsidized Parking; Transit Riders Utilize Fare Support or Pre-tax Deduction Programs; Transit Riders Also Take Advantage of Shuttle Service

	SOV - East	SOV - West	Carpool - East	Local bus - East	Express bus - East	Metrorail - East	Metrorail - West	VRE	Bike
Free/subsidized parking	86%	86%	84%	32%	27%	33%	33%	37%	36%
Preferred parking for car/vanpools	9%	3%	41%	6%	6%	7%	4%	8%	2%
Transit fare support	18%	18%	38%	92%	92%	90%	92%	93%	63%
Pre-tax salary deduction for transit	29%	25%	48%	83%	73%	74%	83%	80%	48%
Ridematching	11%	16%	19%	11%	19%	11%	20%	14%	7%
Flexible work hours	83%	79%	73%	79%	81%	78%	78%	78%	78%
Compressed work week	47%	42%	44%	40%	48%	43%	51%	50%	37%
Telework	77%	75%	69%	75%	77%	69%	70%	73%	59%
Shuttle to transit station	17%	26%	27%	53%	54%	51%	75%	51%	41%

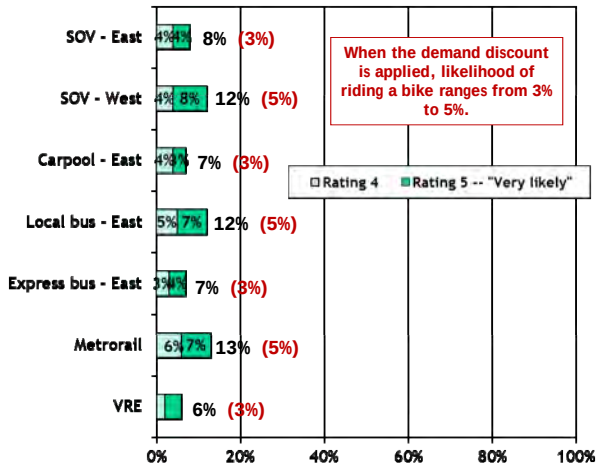
Q129. Do you use this program?

#15

Overall, likelihood of riding a bike to work is fairly low among current non-riders. But, still, with no programs or services mentioned, about 10% of current non-users say they are likely to ride a bike in the future. Connections to bike trails/paths and lanes are the most compelling features and services to attract new bike riders. Enclosed bike lockers and showers at work also help to attract new bike riders. Unsheltered bike racks are not particularly compelling.

Likelihood of riding bike for commute

Stated Likelihood of Riding a Bike in the Future Is Fairly Low, Ranging from 13% among Current Metrorail Riders to 6% among Current VRE Riders

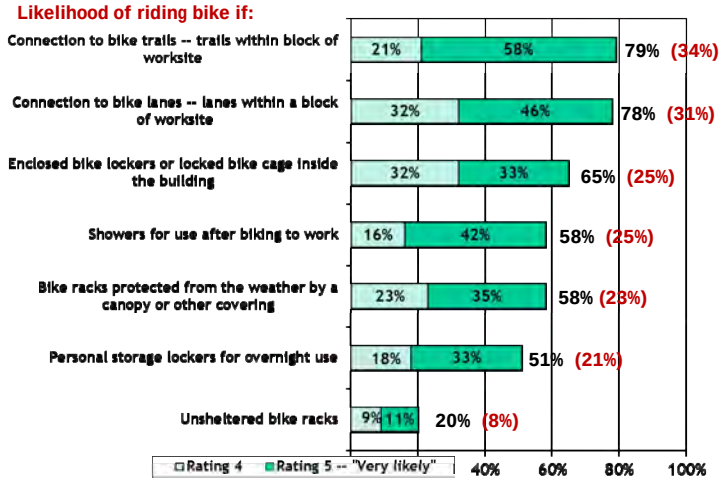


Q115. Regardless of the mode of transportation you use today for your commute, how likely would you be to ride a bike for at least part of your commute in the future?

Likelihood of riding bike if specific facilities at work – Eastbound SOV

Responses shown for Eastbound SOVers who answered "4" or "5" to likelihood of riding bike.

Among Eastbound SOVers Who Are Interested in Riding a Bike, Connections to Bike Trails and Bike Lanes from their Worksite Would Be the Most Persuasive Facility or Service

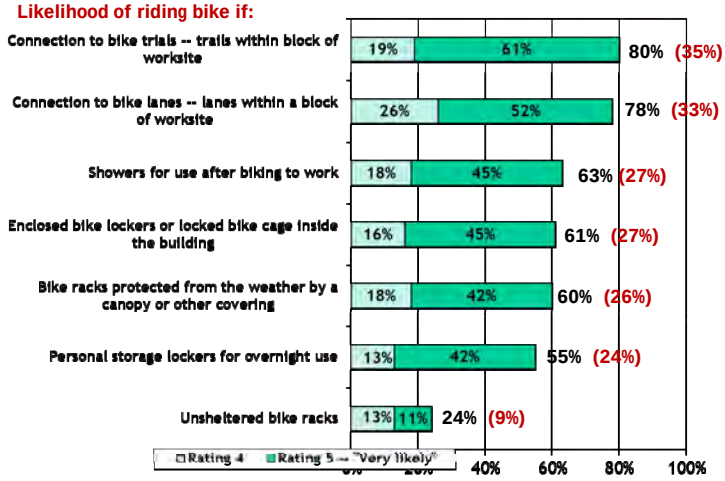


Q116. How likely would you be to ride a bike for at least part of your commute if the following were available at your worksite?

Likelihood of riding bike if specific facilities at work – Westbound SOV

Responses shown for Westbound SOVers who answered "4" or "5" to likelihood of riding bike.

For Westbound SOVers, Connections to Bike Trails and Lanes Are Also the Most Persuasive Facilities and Services

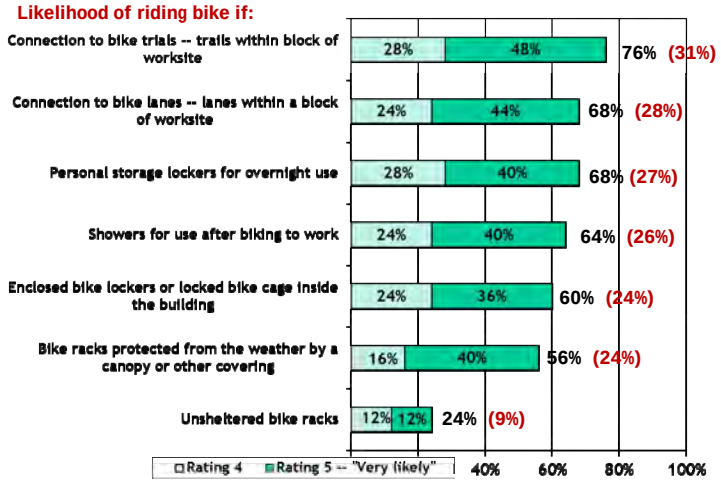


Q116. How likely would you be to ride a bike for at least part of your commute if the following were available at your worksite?

Likelihood of riding bike if specific facilities at work – Eastbound Express bus

Responses shown for Westbound express bus riders who answered "4" or "5" to likelihood of riding bike. Local bus not shown due to small sample size.

Express Bus Riders Would Be Most Persuaded to Ride a Bike if there Were Bike Trails Close to their Worksite

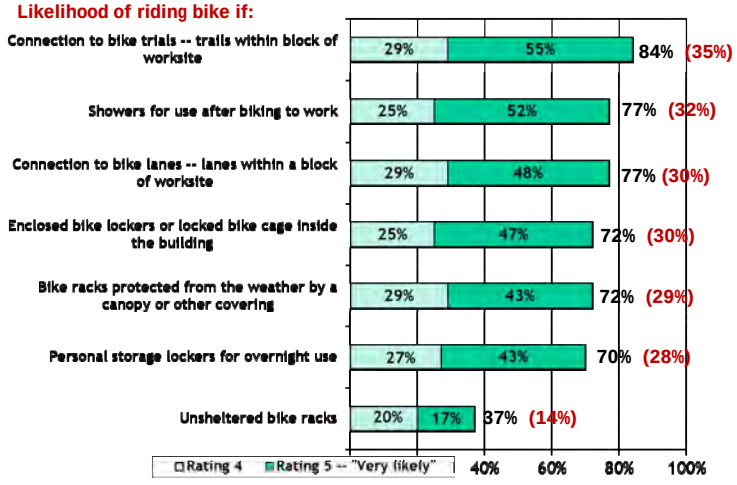


Q116. How likely would you be to ride a bike for at least part of your commute if the following were available at your worksite?

Likelihood of riding bike if specific facilities at work – Eastbound Metrorail

Responses shown for Metrorail riders who answered "4" or "5" to likelihood of riding bike. VRE not shown due to small base size.

With the Exception of Unsheltered Bike Racks, All of the Facilities Tested Could Convert Eastbound Metro Riders to Bike Riders



Q116. How likely would you be to ride a bike for at least part of your commute if the following were available at your worksite?

Likelihood of riding bike if services available

Of the Three Services Below, a Customized Bike Map Is More Appealing than Bike Safety Training or Bike Skills Training

Likelihood of riding bike if:	SOV – East	SOV - West	Carpool - East	Express bus - East	Metrorail - East
Bike safety training	14% (6%)	12% (5%)	16% (5%)	28% (11%)	30% (11%)
Bike skills training	14% (5%)	16% (7%)	21% (7%)	32% (11%)	29% (11%)
A customized bike map	42% (17%)	45% (18%)	37% (16%)	56% (22%)	49% (21%)

Responses shown for those who answered "4" or "5" to likelihood of riding bike.

Q118. How likely would you be to ride a bike for at least part of your commute if the following were available to you?

New transit options in the I-66 corridor inside the Beltway are more attractive to current transit users. Given situations when the costs are the same and the travel time is the same, transit users would pick transit over some other mode. If new transit options offer time savings, current transit users are especially likely to switch to the new transit mode.

Choice Based Conjoint Analysis Was Used

- Conjoint analysis allows us to identify and prioritize the factors important in (purchase) decision making. It is sometimes referred to as "trade-off analysis" because respondents are asked to make trades that reflect what is and is not important to them. It is a multivariate technique that measures the relative importance of different variables, attributes, or product features related to a brand, product, or service.
- In these carefully controlled experiments, respondents are asked which one product they would select, given scenarios that vary specific conditions. In each scenario, the respondent is presented with a different combination of attributes and asked which combination they select. The type of decision that the respondents make in each scenario is designed to mimic the real market.
- Choice Based Conjoint was used for this analysis because it works well for decisions that are made for longer periods of time. That is, commuters do not typically change commute modes every day or even every week.

Question Used for Scenario Testing

Please read the following 3 options, Option A, Option B, and Option C.

Option A	Option B	Option C
You could commute by (insert commute mode). Your commute trip would (be ____ minutes shorter/____ minutes longer/require the same amount of time as it currently does). It would cost _____ compared to your current commute.	You could commute by (insert commute mode). Your commute trip would (be ____ minutes shorter/____ minutes longer/require the same amount of time as it currently does). It would cost _____ compared to your current commute.	You could commute by (insert commute mode). Your commute trip would (be ____ minutes shorter/____ minutes longer/require the same amount of time as it currently does). It would cost _____ compared to your current commute.

Which would you be most likely to select for your commute, Option A, B, or C?

Attribute Levels Tested

- Commute Mode:
  - Single occupancy vehicle
  - Carpool
  - Priority Bus
  - Metrorail
- Time Reduction:
  - 10% less than current commute
  - 20% less than current commute
  - 30% less than current commute
  - the same as current commute
  - 30% more than current commute
  - 20% more than current commute
  - 10% more than current commute

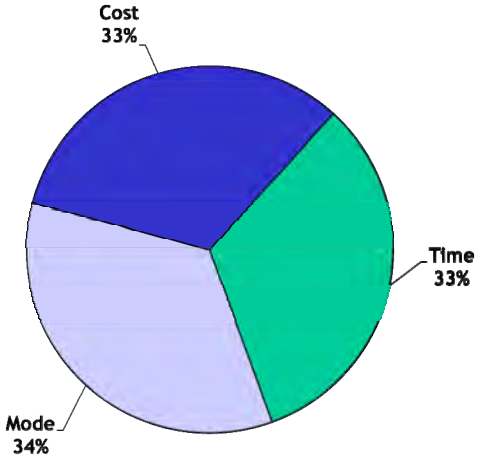
  (Note: Times were asked in terms of minutes rather than as percentages.)
- Cost:
  - 10% less than current commute
  - 20% less than current commute
  - 30% less than current commute
  - the same as current commute
  - 30% more than current commute
  - 20% more than current commute
  - 10% more than current commute

SOV Commuters

Relative impact of commute mode, cost and time - SOV Commuters

The larger the positive value, the more the attribute is preferred. The larger the negative value, the less an attribute is preferred.

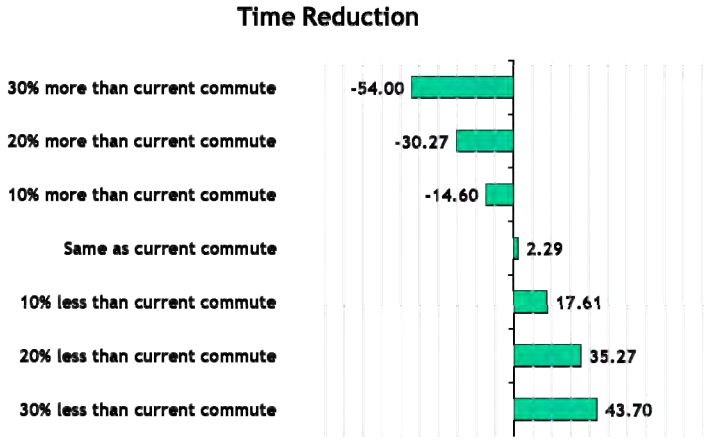
Cost, Time, and Mode Are about Equally as Important for Current SOV Commuters



Impact of time savings - SOV Commuters

The larger the positive value, the more the attribute is preferred. The larger the negative value, the less an attribute is preferred.

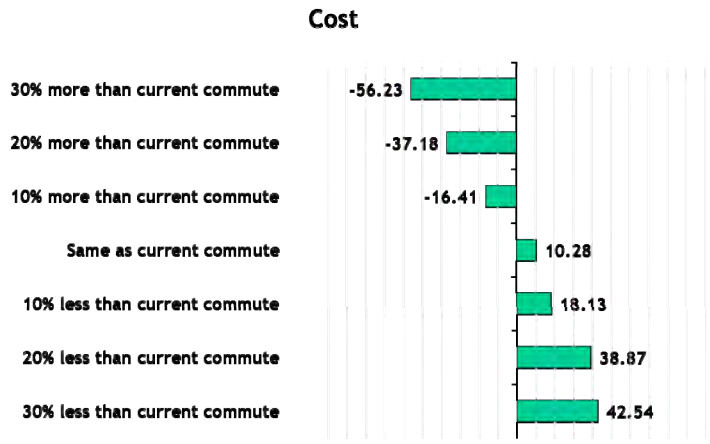
As with Respondents Overall, Preference Is Highly Correlated with Time Saved among Current SOV Commuters



Impact of cost - SOV Commuters

The larger the positive value, the more the attribute is preferred. The larger the negative value, the less an attribute is preferred.

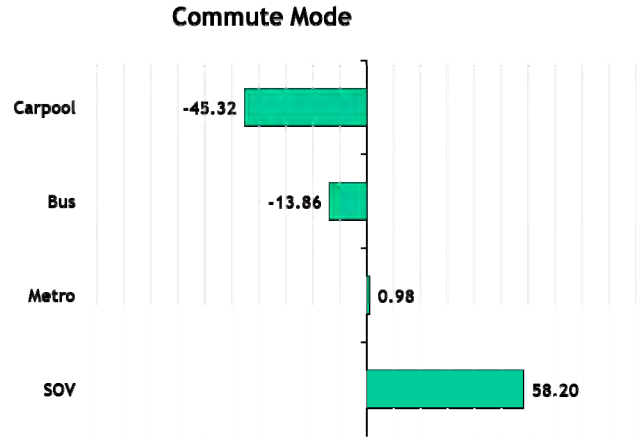
Likewise, Among Current SOVers, Preference Is Highly Correlated with Price Such that Lower Prices Are More Preferred



Impact of mode - SOV Commuters

The larger the positive value, the more the attribute is preferred. The larger the negative value, the less an attribute is preferred.

Current SOV Commuters Are Even More Likely than Those Overall to Prefer Driving Alone

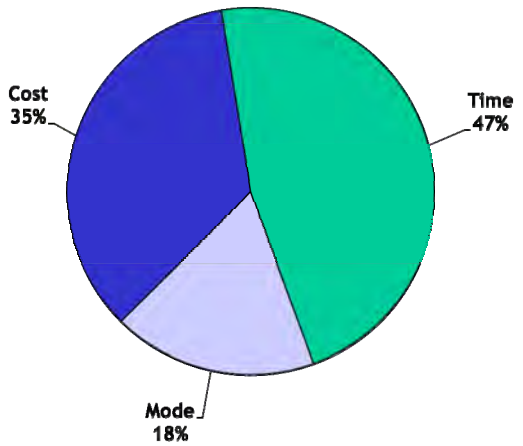


Alternate Mode Commuters

Relative impact of commute mode, cost and time -

Alternate Mode Commuters

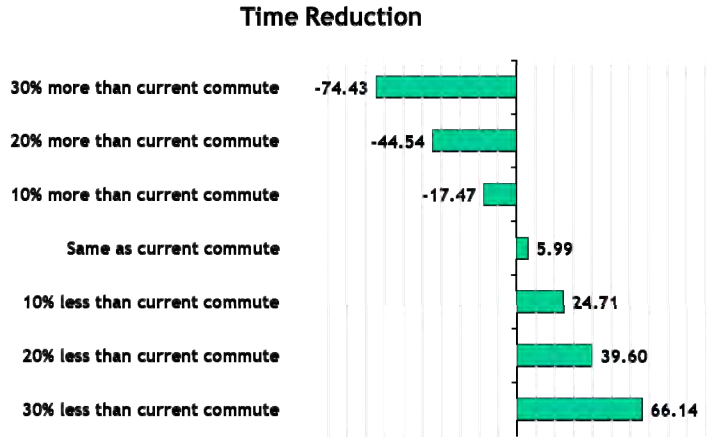
For Those Already Using Alternate Modes, Time Is the Most Important Factor in Their Commute Decision



Impact of time savings - Alternate Mode Commuters

The larger the positive value, the more the attribute is preferred. The larger the negative value, the less an attribute is preferred.

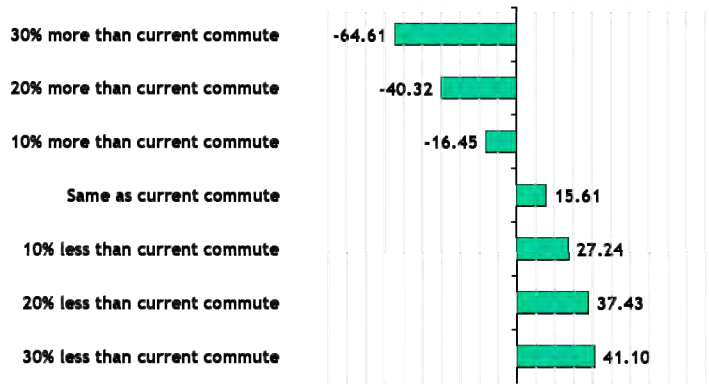
As with Other Respondents, Preference Is Highly Correlated with Time Saved among Those Currently Using Alternate Modes



Impact of cost - Alternate Mode Commuters

The larger the positive value, the more the attribute is preferred. The larger the negative value, the less an attribute is preferred.

Likewise, Among Current Alternate Mode Commuters, Preference is Highly Correlated with Price Such that Lower Prices Are More Preferred

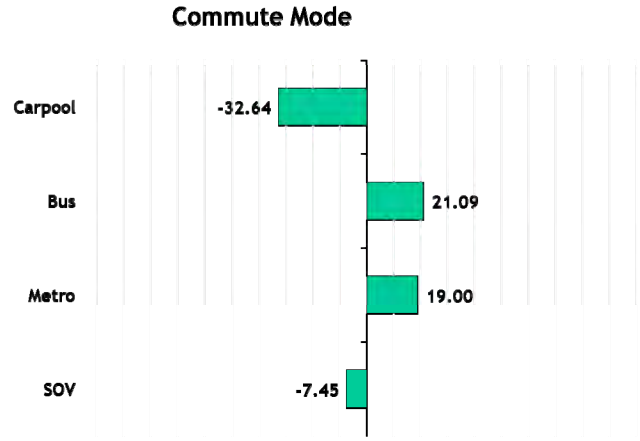


Impact of mode -

Alternate Mode Commuters

The larger the positive value, the more the attribute is preferred. The larger the negative value, the less an attribute is preferred.

Those Currently Using Alternate Modes Show a Preference for Bus and Metro

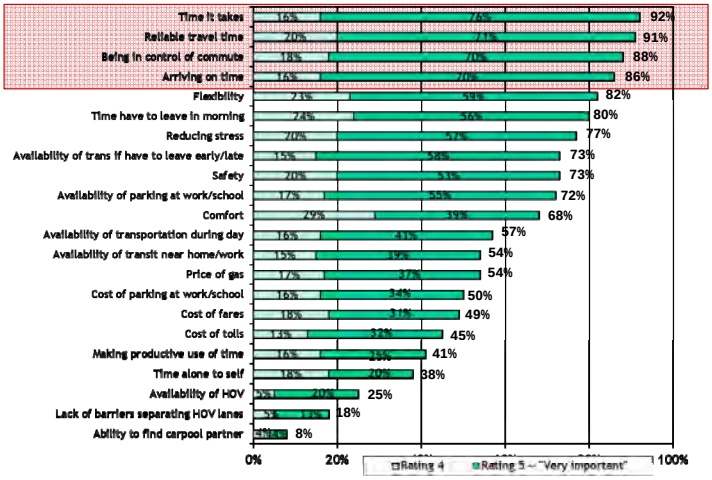


#17

In past surveys, commuters have always given priority to "time" in selecting their commute mode. But, this study allows us to understand the decision making of SOVers more thoroughly. Being "in control" of their commute is more important to SOVers than to commuters using other modes. In fact, 88% of eastbound SOVers said that being in control of their commute is important in their mode choice compared to 92% who said that the time their commute takes is important. So, on any given day, control may be more important than time to SOVers.

Attribute importance - Eastbound SOV

Eastbound SOVers Emphasize Time When Selecting their Commute Mode; But, Being in Control of their Commute Is Also Especially Important



Q67. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your morning commute trip? For your answers, please use a scale of 1 to 5 where "1" means it is "not at all important" and "5" means it is "very important" in choosing your mode of transportation. How important is each of the following?

Attribute importance - Eastbound Carpool

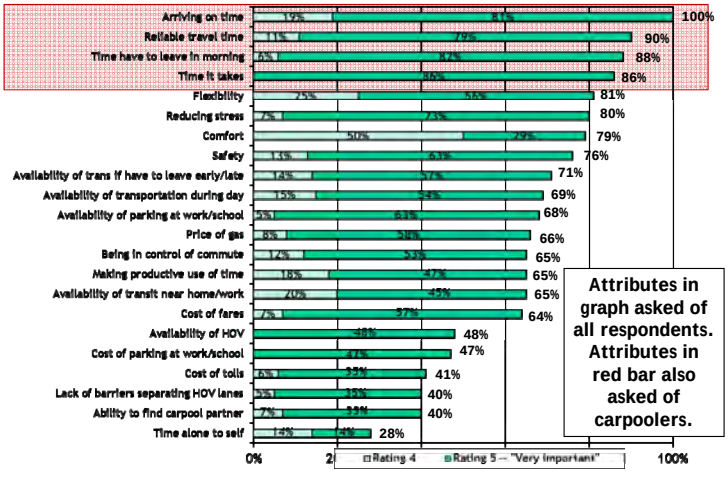
Carpoolers were also asked the importance of:

Preferential parking for carpools 51%

Avail. of parking at pick-up point 36%

Slug lines 14%

When Selecting their Commute Mode, Eastbound Carpoolers Are Concerned about Time: Arriving on Time, Reliable Travel Time, Time Have to Leave in Morning, and the Time the Trip Will Take



Attributes in graph asked of all respondents. Attributes in red bar also asked of carpoolers.

Q67. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your morning commute trip? For your answers, please use a scale of 1 to 5 where "1" means it is "not at all important" and "5" means it is "very important" in choosing your mode of transportation. How important is each of the following?

Attribute importance - Eastbound Express bus

Bus riders were also asked the importance of:

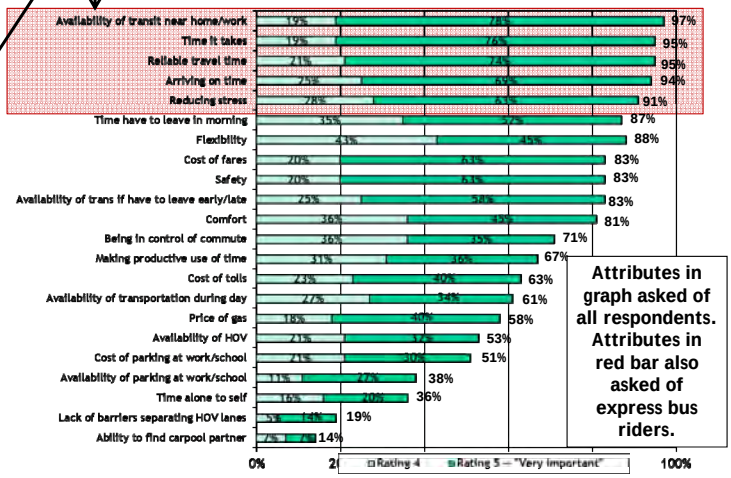
Avail. of bus at right time 100%

Avail. of parking at pick-up point 75%

Employer provided transit subsidy 80%

Cost of parking at pick-up point 59%

Availability of Transit at the Right Time and Time Management Are Important to Express Bus Riders – Along with Reducing Stress



Attributes in graph asked of all respondents. Attributes in red bar also asked of express bus riders.

Q67. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your morning commute trip? For your answers, please use a scale of 1 to 5 where "1" means it is "not at all important" and "5" means it is "very important" in choosing your mode of transportation. How important is each of the following?