I-95/I-395 Transit/TDM Study
Final Report

FEBRUARY 29, 2008

Developed by
I-95/I-395 Transit/TDM Technical Advisory Committee

Project Lead
Virginia Department of Rail and Public Transportation
1313 East Main Street, Suite 300
P.O. Box 590 • Richmond, VA 23218-0590
www.drpt.virginia.gov

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Acknowledgements

In early 2007, at the request of the regional transportation agencies and authorities, the Secretary of Transportation of the Commonwealth of Virginia asked the Department of Rail and Public Transportation (DRPT) to initiate a study and form a multijurisdictional Technical Advisory Committee to provide technical input into determining the appropriate transit services to be implemented in conjunction with the I-95/I-395 HOV/Bus/HOT Lane project.

The Technical Advisory Committee members extensively reviewed and discussed the recommendations of this study. In preparing the recommendations, the TAC reviewed the scope, inputs, demand modeling, and results of the study at every stage. The committee members who represent the interested jurisdictions and agencies agreed with the final recommendations of the study. The committee members include:

- Jim Maslanka of City of Alexandria;
- Tamara Ashby and Lynn Rivers of Arlington County;
- Randall White and Jaak Pedak of Fairfax County;
- Kathleen Beck of Fredericksburg Regional Transit (FRED);
- Lloyd Robinson and Diana Utz of the George Washington Regional Commission (GWRC)/ Fredericksburg Area Metropolitan Planning Organization (FAMPO);
- Don McAuslan of the Metropolitan Washington Council of Governments (MWCOG);
- Rick Taube of the Northern Virginia Transportation Commission (NVTC);
- Alfred Harf and Eric Marx of the Potomac and Rappahannock Transportation Commission (PRTC);
- Sara Woolfenden and Fulton deLamorton of Stafford County;
- Phyllis Kaplan of the U.S. Department of Defense;
- Christine Hoeffner of Virginia Railway Express (VRE); and
- Wendy Jia and Fred Simms of the Washington Metropolitan Area Transit Authority (WMATA).

Table of Contents

Table of Contents
(continued)

List of Tables

List of Tables
(continued)

List of Figures

List of Figures
(continued)

List of Figures
(continued)

Executive Summary

Executive Summary

The purpose of the I-95/I-395 Transit/Transportation Demand Management[1] (TDM) Study was to determine the most effective investments that could be made in transit and TDM within the I-95/I-395 Corridor using funding proposed to be available through the I-95/I-395 High-Occupancy Vehicle (HOV)/Bus/High-Occupancy Toll (HOT) Lanes project. The proposed funding is above and beyond improvements already included in the scope of the I-95/I-395 HOV/Bus/HOT Lanes project that will benefit transit and TDM.

The study was conducted by the I-95/I-395 Transit/TDM Technical Advisory Committee (TAC) consisting of members from Federal, state and local jurisdictions, transit agencies, and transportation demand management providers in cooperation with the Virginia Department of Rail and Public Transportation (DRPT). This multimodal transportation planning effort utilized the results of a market research survey, travel demand forecasting, park-and-ride demand forecasting, and transportation demand management modeling, as well as the expertise of the TAC to develop and evaluate alternative program investments. The study includes a fiscally constrained recommendation that includes planning-level cost estimates and identification of entities potentially responsible for implementation and operation of the services/improvements identified.

The Commonwealth Transportation Board will be responsible for allocating revenues that become available through the I-95/I-395 HOV/Bus/HOT Lanes project for transit and transportation demand management improvements. The recommendation of the I-95/I-395 Transit/TDM Study represents an initial planning effort with the understanding that additional analysis and coordination with service providers will be needed prior to the expenditure of any funds.

Background

The I-95/I-395 Transit/TDM Study was completed in coordination with the work being done on the I-95/I-395 HOV/Bus/HOT Lanes project proposed by Fluor-Transurban under the Public-Private Transportation Act (PPTA) with the Virginia Department of Transportation (VDOT). The proposed I-95/I-395 HOV/Bus/HOT Lanes project scope includes significant benefits for transit, including:

- 28-mile southern extension of existing HOV lanes;
- 3,000 new park-and-ride spaces in the corridor;
- 33 new entry/exit ramp facilities; and
- In-line Bus Rapid Transit (BRT) station in Lorton.

Above and beyond these improvements, an additional $195 million dollars is projected by Fluor-Transurban to be available from the project for additional transit/TDM improvements. This $195 million, plus the fare recovery for the proposed services, and a small federal contribution represent the dollars assumed to be available for the fiscally constrained Transit/TDM recommendation proposed in this study.

[1] Transportation Demand Management is the application of strategies and programs to change travel behavior in order to reduce the demand on highways and to optimize the performance of the transportation system (e.g., carpooling, vanpooling, park-and-ride facilities, guaranteed ride home programs, and shared-ride benefits and support programs).

Study Area

The study area is comprised of an area 56-miles in length and approximately five miles on either side of the corridor defined by I-95/I-395 from U.S. 1 and I-95 near Massaponax in the south to the Potomac River in the north. The Metropolitan Washington Council of Governments (MWCOG) model region was used for travel forecasting analysis. Figure ES-1 shows the general vicinity and extents of the study corridor and area. Key destinations in the study area were identified to be Washington D.C. (core and noncore), Pentagon/Pentagon City/Crystal City, Shirlington, Mark Center/Skyline, Tyson's Corner, Merrifield, Alexandria, Fort Belvior/EPG/Springfield, Woodbridge, Quantico, and Garrisonville-Aquia.

Existing Transit/TDM Service

The I-95/I-395 Corridor currently has a very high level of transit and HOV usage. For example, during the morning peak period, there are over 127 buses operating per hour on the Corridor in the vicinity of King Street in Alexandria and about 17 buses operating per hour in the Corridor in the vicinity of Fredericksburg. There are 10 WMATA Metrorail trains per hour, 2 VRE trains every hour, and 2 Amtrak trains in the morning peak period servicing the study corridor. A variety of TDM programs and services currently operate in the study corridor, including over 500 vanpools, 21 park-and-ride lots, 19 slug locations, and 5 Rideshare/Employer Outreach Programs.

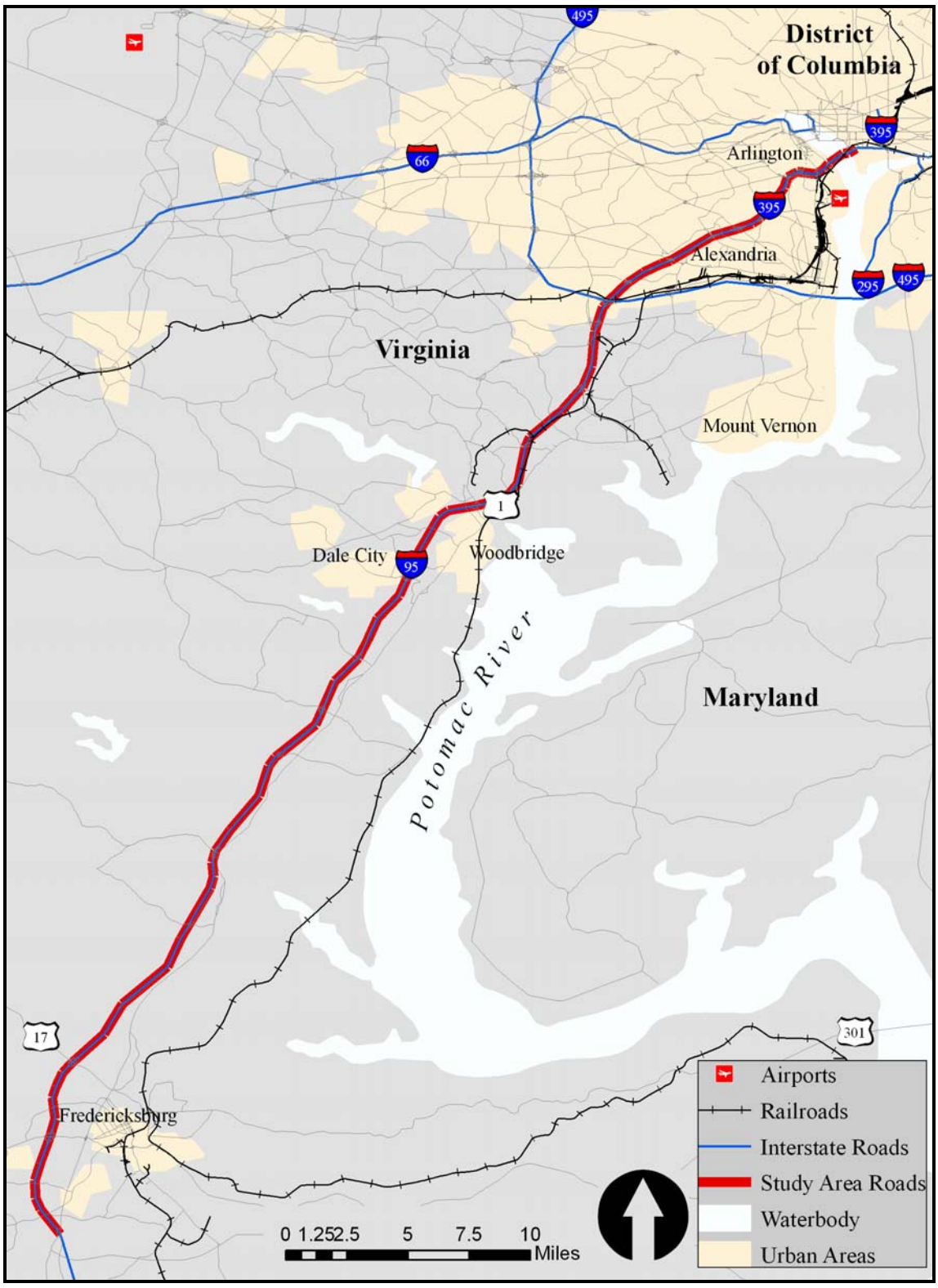
Public Outreach and Market Research

As an integral part of the study process, a public information program was conducted jointly with VDOT. Presentation boards, slides, handouts, and web site materials were developed for the purpose of informing interested citizens about the study process and to solicit input for use in the study. In-person meetings were conducted on five dates in July in five separate locations across the entire study area: Arlington, Fairfax, Prince William, Fredericksburg, and Spotsylvania. All materials from the meetings were posted to the Internet to extend the potential reach.

A market research survey also was conducted as part of the outreach effort from this study. The market research was used to determine current travel patterns by mode in the study corridor and to explore expected changes in travel behavior as a result of the construction and operation of the HOT lanes project. The survey also was used to identify the relative appeal of specific enhancements and programs needed to be in place to increase the likelihood of using alternatives to the single occupancy vehicle mode and to assess the relative impact of the alternatives to help calibrate subsequent modeling activities. Postcard invitations were mailed to some 75,000 households and direct e-mail lists with thousands of additional contacts were used to reach other potential participants. Some 3,300 respondents provided information on their current behavior, attitudes, and preferences.

The market survey analysis showed that awareness of the HOT lanes is high among commuters in the corridor. Nearly all sluggers (94 percent) are aware of the HOT lanes versus 75 percent of single occupant vehicle (SOV) users. Sluggers are especially likely (71 percent) to believe that HOT lanes will discourage drivers from picking up sluggers. However, most transit and HOV commuters say that they would not change their commute method with the introduction of the new option of paying to use the HOT lanes (i.e., 53 percent of SOV; 95 percent of vanpoolers; 81 percent of carpoolers; 91 percent of bus riders; 82 percent of sluggers; and 86 percent of train riders). Most potential HOT lane users would be drawn from existing general purpose lane low-occupancy vehicle users. The likelihood of using HOT lanes is highest among commuters from Spotsylvania, Stafford, and Prince William Counties.

Figure ES-1. Vicinity and Extents of the Study Corridor



Study Alternatives

The development of alternatives was a detailed process that involved substantial coordination of and consensus among the TAC members. First, overall guiding objectives were established. Second, key assumptions and propositions were outlined. Third, the specific approach to defining the transit and TDM alternatives was set forward.

The objectives that guided the definition and analysis of the transit/TDM alternatives were as follows:

- Preserve and increase the transit/HOV capacity, use, and operational efficiency in the managed lanes and in the corridor;
- Increase transit level of service through improvement of coverage in higher density areas and service improvements to major activity centers and destinations;
- Preserve transit and HOV ridership while implementing the HOT lanes by providing improvements that help maintain current market share for transit, carpools, and vanpools; and
- Utilize new HOT lane features to attract new transit and HOV riders by using a corridor management approach to improve existing service and serve new markets.

The study team and the TAC suggested over 60 alternatives for testing. The alternatives were combined into three tiers of investment:

- Low ($250 million);
- Medium ($500 million); and
- High (fiscally unconstrained).

With these limits in mind, the set of alternatives were detailed. In particular:

- To further promote carpooling and vanpooling (and slugging), additional TDM actions were proposed;
- New bus transit alternatives were developed to take advantage of the opportunities represented by the introduction of new access/egress points on HOV lanes;
- Existing routes were revised to serve new markets, e.g., through minor changes to route alignments;
- New commuter and express bus services were created, e.g., in the U.S. Route 1 corridor between Alexandria and the Pentagon;
- New local feeder bus services were proposed to connect commuters to VRE/Amtrak/Metrorail or commuter bus;
- New neighborhood circulators/shuttles with commuter bus were developed to provide local bus service to residential neighborhoods and continue as commuter buses to Northern Virginia and Washington, D.C.; and
- Rail extensions and other fixed facilities were considered. Potential projects included the extension of Metrorail to Potomac Mills, BRT along Route 1, enhancements to VRE/Amtrak, and in-line transit stations at major activity centers along the HOT lanes (to allow buses to stop with minimal delay).

The process of developing the tiered transit/TDM alternatives was iterative. Qualitative assessments were performed with the help of TAC members to arrive at decisions in the direction in which to take the alternatives. In addition, public and stakeholder input, market survey analysis,

current and forecast travel demand in the study area, park-and-ride needs analysis were used to develop and evaluate the alternatives.

Through the travel forecasts, the study showed that the 2006 MWCOG Constrained Long-Range Plan (CLRP) already contained significant transit service improvements to the corridor that result in high transit and HOV ridership. HOT lanes generally were not forecast to adversely impact transit or carpool mode share versus existing levels. Moreover, the proposed set of transit/TDM improvements helped to maintain high-transit and shared-ride mode share in the corridor even with the expected significant increases in overall travel in the corridor. The biggest differences found between the tested alternatives (low, medium, and high) were in the competition among transit modes (i.e., commuter bus, Metrorail, and VRE). Ultimately, the strongest performing strategies were combined from the three tiers of alternatives into a Refined Alternative and then further refined by applying financial assumptions to develop the Fiscally Constrained Recommendation.

Fiscally Constrained Transit/TDM Recommendation

The Refined Alternative was used as the basis to develop a fiscally constrained program and recommendation. The fiscally constrained program assumed reasonably available funding that amounts to $298 million. The funding for improvements would come from a combination of sources, including (in 2010 dollars):

- $195 million HOT lanes lump sum;
- $40 million in Federal (U.S DOT discretionary funding);
- *$63 million* in farebox recovery; and
- $298 million total.

The farebox recovery figure was derived from data provided by service providers for the actual services proposed. The revenue dedicated to transit/TDM improvements is subject to final negotiation by VDOT and Fluor-Transurban and allocation by the Commonwealth Transportation Board.

Since the funding available was short of the level required to fund the full Refined Alternative, prioritization and phasing was necessary to develop a Fiscally Constrained Recommendation. Should additional funding become available in the future, additional elements of the Refined Alternative should then be funded.

The recommended investment strategy for the Fiscally Constrained Recommendation calls for prioritizing and phasing the proposed improvements during actual implementation. The framework used for phasing and prioritizing projects was based on identifying and leveraging all reasonably available funding sources for the proposed improvements and protecting currently planned and programmed transit improvements and associated funding resources.

In summary, the TAC's recommendation for the fiscally constrained program includes service modifications, new services, facility improvements, and enhanced and new TDM programs. It is recommended that $137 million be spent on capital improvements and $161 million for operating expenses over a period of 20 years. The resulting Fiscally Constrained Recommendation can be summarized in year 2010 expenditures as shown in Table ES-1.

Table ES-1. Program Summary of the Fiscally Constrained Recommendation

Element	Element Cost (Millions)	Total Cost (Millions)
Transit Services		*$188.9*
Bus Service Modifications	$29.6	
New Shuttle Bus	$7.4	
New Bus Services	$130.3	
VRE	$21.6	
TDM		*$20.0*
Park-and-Ride Lots		*$37.5*
Fixed Facilities		*$51.8*
Metrorail Station Improvements	$5.0	
BRT Stations	$40.0	
Other Transit Centers	$1.5	
VRE Platform Extensions and Yard Facilities (with Longer Trains)	$5.3	
Grand Total		**$298.2**

The service modifications recommended in the fiscally constrained program include:

- Adding a fifth bus to ART Route 41 on weekdays;
- Increasing frequency on WMATA 7B by adding one bus (reduce headway from 35 minutes to 17 minutes);
- Modifying Prince William MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield Metrorail Station during peak hours;
- Improving existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency (adds two additional trips per peak period);
- Increasing frequency on OmniRide North Route 1 by adding three additional trips in each peak period, one in midday and late evening;
- Extend OmniLink Route 1 to Ft. Belvoir during peak periods; and
- Increase Virginia Railway Express (VRE) train size so that three of the Fredericksburg trains have eight cars and four have six cars.

The new bus services include:

- Shirlington to Rosslyn;
- Central Prince William to downtown Alexandria;

- Kingstowne to Shirlington to Pentagon;
- Woodbridge to Lorton/Tysons to Merrifield;
- Lake Ridge to Seminary Road area;
- Fredericksburg to Pentagon/Crystal City;
- Fredericksburg to Washington, D.C.;
- Massaponax to Washington, D.C.; and
- Lorton VRE station to EPG/Ft. Belvoir (new shuttle).

The recommended facility improvements include:

- Three new and improved transit centers;
- Four in-line BRT stations along HOT lane corridor;
- VRE Fredericksburg line platform extension at four stations;
- Increased overnight parking for VRE trains in Fredericksburg; and
- 3,750 additional new park-and-ride spaces (beyond the 3,000 proposed in the I-95/I-395 HOV/Bus/HOT Lane Project scope).

Developing the park-and-ride recommendations for the Fiscally Constrained Recommendation required allocating the available funding for spaces in a manner intended to balance multiple factors:

- Provide parking for the proposed in-line stations;
- Address areas with the largest difference between forecasted demand and forecasted capacity; and
- Minimize partial funding of park-and-ride lots and thereby minimize disruption at the facilities (minimize partial builds on lots).

The prioritization of park-and-ride needs led to several recommendations. It was recommended that the 3,000 spaces included in the scope of the I-95/I-395 HOV/Bus/HOT Lanes project be allocated as follows:

- 450 spaces in the Springfield/Lorton subarea;
- 300 spaces for the Massaponax transit center in the Fredericksburg subarea;
- 1,050 spaces at the proposed VA 610 at U.S. 1 lot; and
- 1,200 additional spaces at the Prince William Parkway (Horner Road) lot.

It was further recommended that the $37.5 million allocated for park-and-ride spaces as part of the transit/TDM strategies be used to build the following spaces:

- 175 spaces for the Fredericksburg subarea;
- 1,075 spaces for the North Stafford subarea;
- 250 spaces for the Potomac Mills subarea at the PRTC transit center; and
- 1,500 spaces needed at the VRE stations.

The enhanced and new TDM programs include capital assistance for vanpools, enhanced Guaranteed Ride Home program, financial incentives for vanpools and carpools, rideshare program operational support, TDM program marketing support, and telework program assistance.

The resulting Fiscally Constrained Recommendation was used to amend the placeholder transit/TDM program submitted to the MWCOG CLRP in 2007 as part of the I-95/I-395 HOT Lane Project. Additional study is needed to further design elements of the fiscally constrained program, including performing traffic analysis and conceptual engineering on park-and-ride and in-line station aspects. In addition, further study of transit and other mobility enhancement projects in the corridor beyond the constraints imposed by the availability of funds from the I-95/I-395 HOT Lane Project may be desired.

1.0 Introduction

1.1 Purpose

The I-95/I-395 Transit/TDM Study was conducted by the I-95/I-395 Transit/TDM Technical Advisory Committee (TAC) consisting of members from Federal, state and local jurisdictions, transit agencies, and transportation demand management (TDM) providers in cooperation with the Virginia Department of Rail and Public Transportation (DRPT). The purpose of the study was to provide the Commonwealth, transportation leaders, and decision-makers in the affected region with recommendations on a comprehensive approach to the future provision of transit and TDM services and programs in the I-95/I-395 corridor.

The study was performed by a consultant team led by Cambridge Systematics, Inc. (CS) and included KFH Group (KFH), Southeastern Institute of Research (SIR), LDA Consulting (LDAC), and William G. Allen (WGA). The consultant team worked with the TAC and DRPT to develop a comprehensive alternative transportation plan to enhance mobility through the increased provision and use of transit and TDM services in the corridor.

The multimodal transportation planning effort utilized the results of a market research survey, travel demand forecasting, park and ride forecasting, and transportation demand management modeling, as well as the expertise of the TAC to develop and evaluate alternative program investments. The study provides a recommended transit/TDM plan for the corridor and details the cost and the entities potentially responsible for implementation and operation of the services/ improvements identified. The work on this study was completed in coordination with the work being done on the I-95/I-395 Public-Private Transportation Act (PPTA) project by Fluor-Transurban and the Virginia Department of Transportation (VDOT).

1.2 Background

VDOT has entered into an interim agreement with Fluor-Transurban to build 56 miles of managed lanes in the I-95/I-395 corridor between Arlington and Massaponax, south of Fredericksburg. The final negotiated Comprehensive Agreement will be structured as a concession, meaning that the private partner will operate and maintain the managed lanes for an agreed-upon period of time in exchange for the right to collect tolls on the lanes. There are two elements of the proposed I-95/I-395 project:

- Expansion of the existing two-lane high-occupancy vehicle (HOV) system to three lanes and conversion of the existing system to an HOV/high-occupancy toll (HOT) lane system; and

- Extension of this HOV/HOT lane system an additional 28 miles south from the existing system to Fredericksburg.

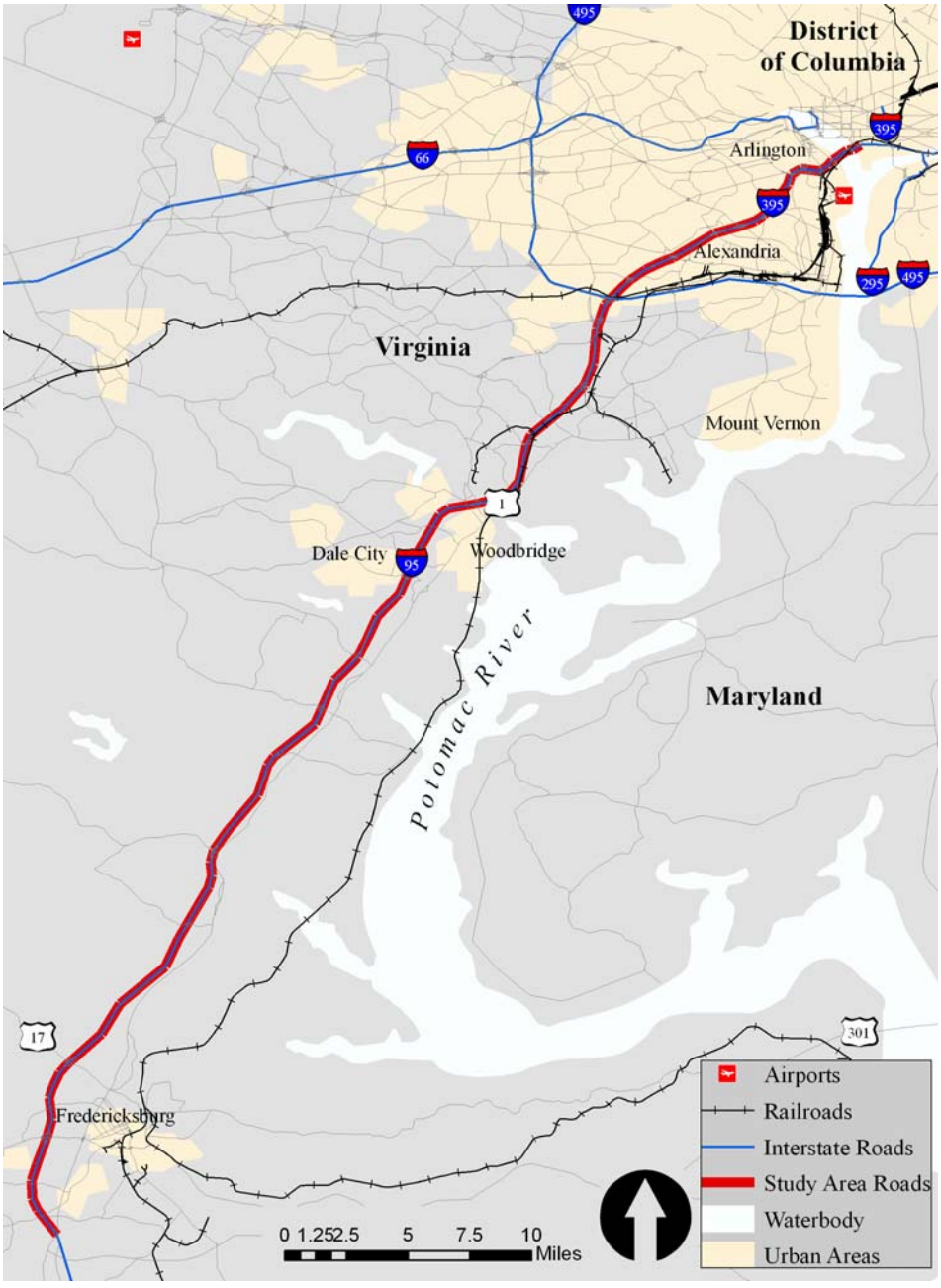
In accordance with the Public-Private Transportation Act of 1995, as amended, as well as Section 33.1-23.03:9 of the Code of Virginia governing the use of any concession payments, this study will help shape the Commonwealth's approach to using concession payments for the provision of transit/TDM services in the corridor.

The Commonwealth Transportation Board will be responsible for allocating revenues that become available through the I-95/I-395 High Occupancy Vehicle (HOV)/Bus/High Occupancy Toll (HOT) Lanes Project for transit and transportation demand management improvements. The recommendation of the I-95/I-395 Transit/TDM Study represents an initial planning effort with the understanding that additional analysis and coordination with service providers will be needed prior to the expenditure of any funds.

1.3 Study Area

The study area comprises an area approximately five miles on either side of the corridor defined by I-95/I-395 from U.S. 1 and I-95 near Massaponax in the south to the Potomac River in the north. The MWCOG model region was used for travel forecasting analysis. Figure 1-1 shows the general vicinity and extents of the study corridor and area. Key destinations in the study area were identified to be Washington D.C. (core and noncore), Pentagon/Pentagon City/Crystal City, Shirlington, Mark Center/Skyline, Tyson's Corner, Merrifield, Alexandria, Fort Belvoir/EPG/ Springfield, Woodbridge, Quantico, and Garrisonville-Aquia.

Figure 1-1. Vicinity and Extents of the Study Corridor



1.4 Study Process

This project was executed as a series of closely associated subtasks for greater efficiency. The overall study process is shown schematically in the Figure 1-2. Subtasks involved were:

- **Task 1 –** Data Assembly/Collection;
- **Task 2 –** Baseline Conditions;
- **Task 3 –** Tiered Transit/TDM Alternatives;
- **Task 4 –** Testing and Refinement of Tiered Transit/TDM Alternatives;
- **Task 5 –** Transit/TDM Demand Forecasting and Traffic Modeling;
- **Task 6 –** Sensitivity Analysis;
- **Task 7 –** Park-and-Ride Lots;
- **Task 8 –** Cost/Revenue/Subsidy Projections for the Corridor; and
- **Task 9 –** Investment Strategy.

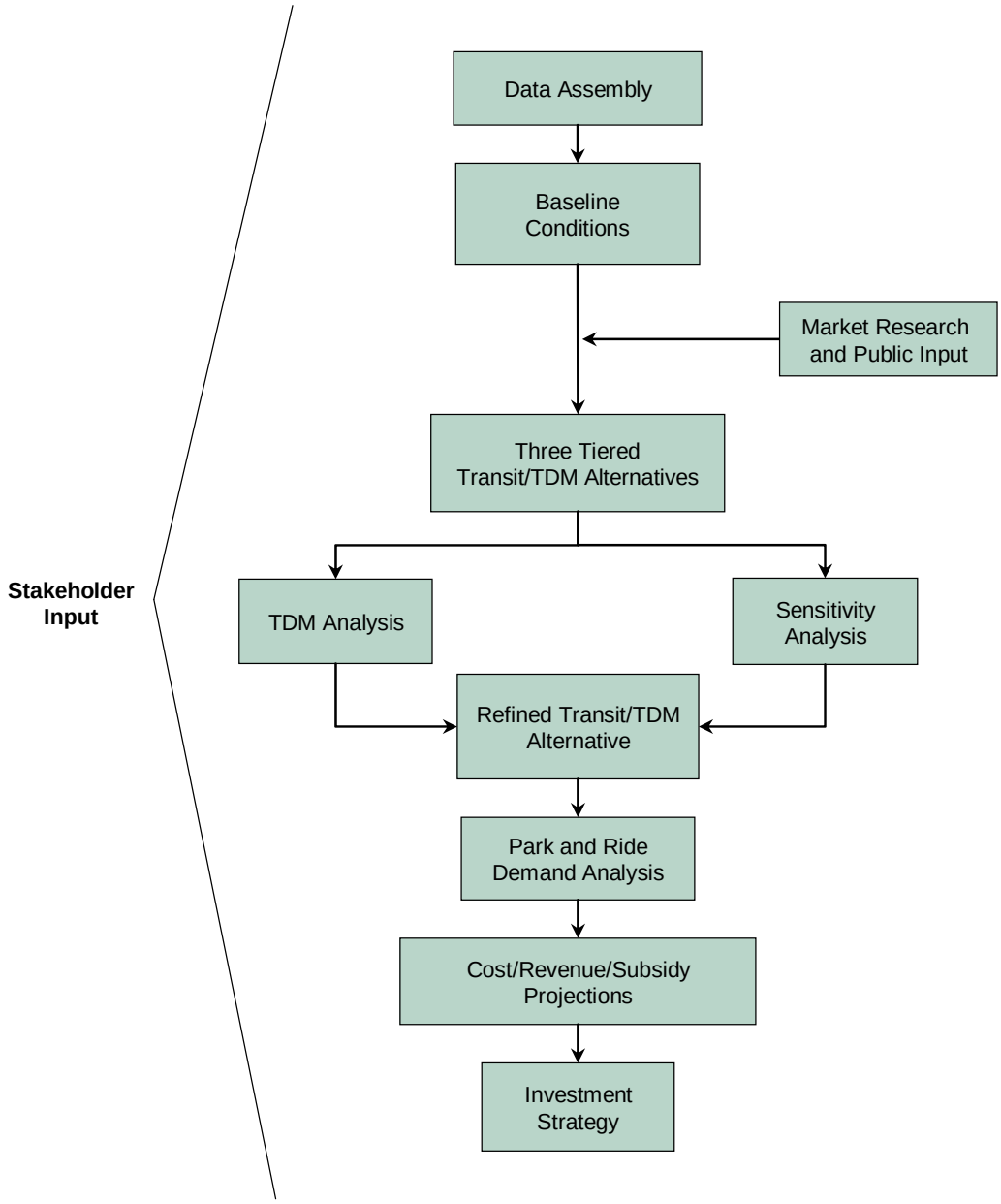
At the beginning of the study the consultant team concurrently set out to identify existing conditions and develop the baseline scenario for the study. Data was assembled on current transit service levels, use, and costs; HOT lane elements; and, future travel markets. The study team also developed an on-line market research survey to help identify public opinion and attitudes.

A baseline scenario for horizon years 2015 and 2030 was then developed. Next, three preliminary tiered alternatives (low, medium, and high) were proposed for each horizon year based on the Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Transportation Plan (CLRP). The preliminary tiered alternatives were refined and finalized based on stakeholder input and qualitative testing. Concurrently, public outreach and market research activities proceeded.

Then, the tiered transit/TDM alternatives were tested using the travel demand forecasting models and a single refined alternative was developed. Other sensitivity analyses also were performed. A special model analysis was also performed to inform the review of the TDM elements of the alternatives, and a park-and-ride demand study also was performed to identify the recommended location and quantity of new park-and-ride capacity.

In the final stage of the study, cost and revenue projections for a recommended investment strategy were developed. This investment strategy forms the heart of a recommended fiscally constrained transit/TDM program for adoption in the appropriate CLRPs for MWCOG and FAMPO.

Figure 1-2. Study Process



1.5 Study Communication and Outreach

The study involved an extensive communication and outreach program, both in terms of professional cross-jurisdictional collaboration and in terms of providing information to the public. The following subsections describe the Transit/TDM TAC Meetings, Regional Committee Meetings, Market Research Survey, and Public/Agency Participation Program elements of the program.

1.5.1 Transit/TDM Technical Advisory Committee Meetings

A multijurisdictional TAC, which included representatives from local, regional, state, and federal stakeholder organizations, provided technical comments and feedback to the DRPT study team throughout the study process. The TAC met approximately once per month during the course of the study. The TAC members are listed below:

- Arlington County – Tamara Ashby and Lynn Rivers;
- City of Alexandria – Jim Maslanka;
- Department of Defense – Phyllis Kaplan;
- Fairfax County – Randall White and Jaak Pedak;
- Fredericksburg Regional Transit (FRED) – Kathleen Beck;
- George Washington Regional Commission (GWRC)/Fredericksburg Area Metropolitan Planning Organization (FAMPO) – Lloyd Robinson and Diana Utz;
- Metropolitan Washington Council of Governments – Don McAuslan;
- Northern Virginia Transportation Commission (NVTC) – Rick Taube;
- Potomac and Rappahannock Transportation Commission (PRTC) – Alfred Harf and Eric Marx;
- Stafford County – Sara Woolfended and Fulton deLamorton;
- Virginia Department of Transportation (VDOT) – Rahul Trivedi, Larry Cloyed and Valerie Pardo;
- Virginia Railway Express (VRE) – Christine Hoeffner; and
- Washington Metropolitan Area Transit Authority (WMATA) – Wendy Jia and Fred Simms.

1.5.2 Regional Committee Meetings

The project team met with FAMPO/GWRC, NVTA, NVTC, and PRTC, approximately every other month, to present the status of the project, including a description of the major deliverables completed by the time of that meeting. Handouts for these meetings were available to attending members of the public and also posted to the affiliated organization web sites.

1.5.3 Market Research Survey

A market research survey was conducted as part of this study in order to profile current travel patterns by mode in the study corridor and to profile expected changes in travel behavior as a result of the construction and operation of the HOT lanes project. The survey was used to identify the relative appeal of specific enhancements and programs needed to increase the likelihood of using alternatives to driving alone and also to assess the relative impact of alternatives to help calibrate subsequent modeling activities. The survey also helped raise awareness of the study – postcards were mailed to some 75,000 households and direct e-mail lists with thousands of additional contacts were used to reach other potential participants.

1.5.4 Public Participation Program

As an integral part of the study process, a public information program was conducted jointly with VDOT. Presentation boards, slides, handouts, and website materials were developed for the purpose of informing interested citizens about the study process and to solicit input for use in the

study. In-person meetings were conducted on five dates in July in five separate locations across the entire study area: Arlington, Fairfax, Prince William, Fredericksburg, and Spotsylvania. All materials from the meetings were posted to the Internet to extend the potential reach.

2.0 Existing Conditions and Baseline Scenario

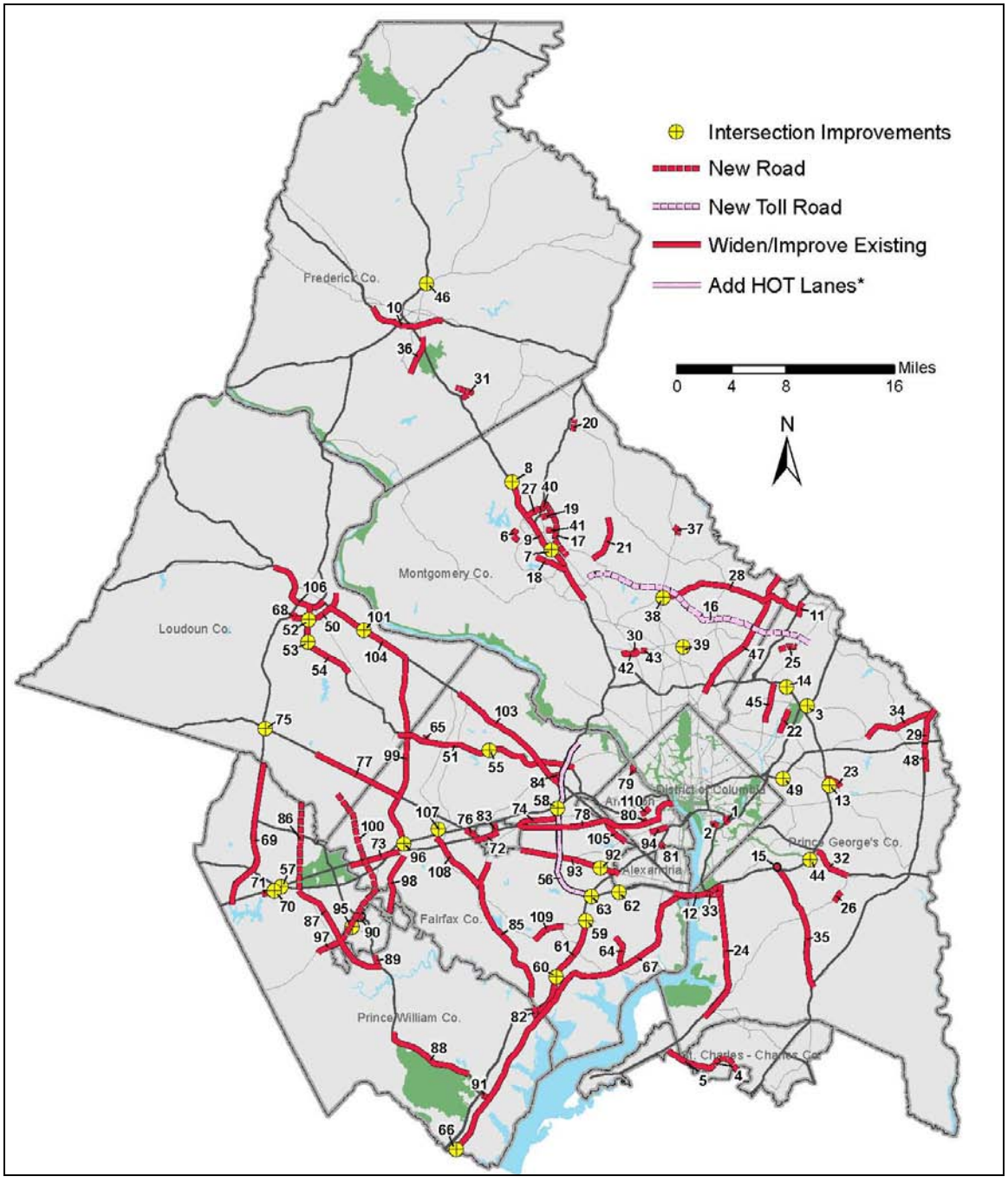
As a first step in the study process, the study team set out to determine existing conditions and to develop both a 2015 and a 2030 baseline scenario. The baseline scenarios were used to evaluate the alternatives. For this study, it was assumed that the projects and services included in the baseline scenarios comprised conditions in the I-95/I-395 corridor that were the combination of existing conditions, the 2006 Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Plan (CLRP) improvements, and the I-95/I-395 HOV/HOT lane roadway improvements proposed by VDOT and Fluor-Transurban.[1]

The CLRP for a region includes all regionally significant transportation projects and programs that are planned and a description of the funding mechanism in place or planned to pay for them. For MWCOG, it includes dozens of highway, transit, high-occupancy vehicle (HOV), bike, and pedestrian projects in the area. The study utilized the MWCOG CLRP that was the regionally adopted version (October 18, 2006) at the time of the study. Figures 2-1 through 2-3 show the improvements planned in the 2006 MWCOG CLRP (further information on the CLRP is available at http://www.mwcog.org/clrp).

The TAC helped to define the baseline scenario conditions and agreed to key assumptions for both years 2015 and 2030. The subsections below describe the key components, including existing conditions, land use forecasts, highway network, and transit/transportation demand management (TDM) Programs and Services. The same land use forecasts and highway network that are used for the baseline scenario also are used with the tiered transit/TDM alternatives.

[1] Fredericksburg Area Metropolitan Planning Organization (FAMPO) CLRP improvements could not be included directly since the FAMPO CLRP was not yet complete, but FAMPO provided input into the MWCOG CLRP and through the TAC.

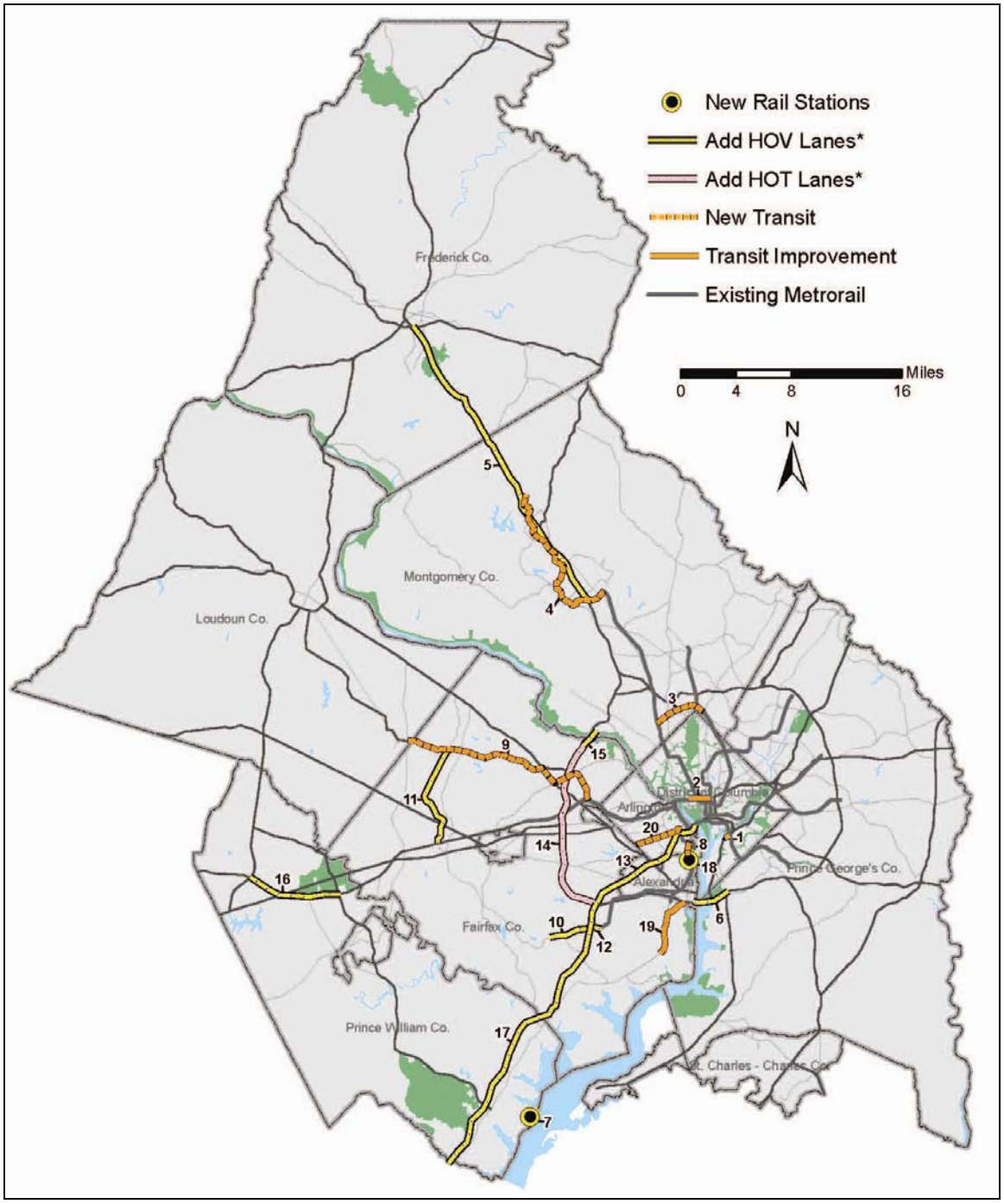
Figure 2-1. 2006 MWCOG CLRP Major Highway Improvements



Source: http://www.mwcog.org/clrp.

* HOT – High-Occupancy/Toll.

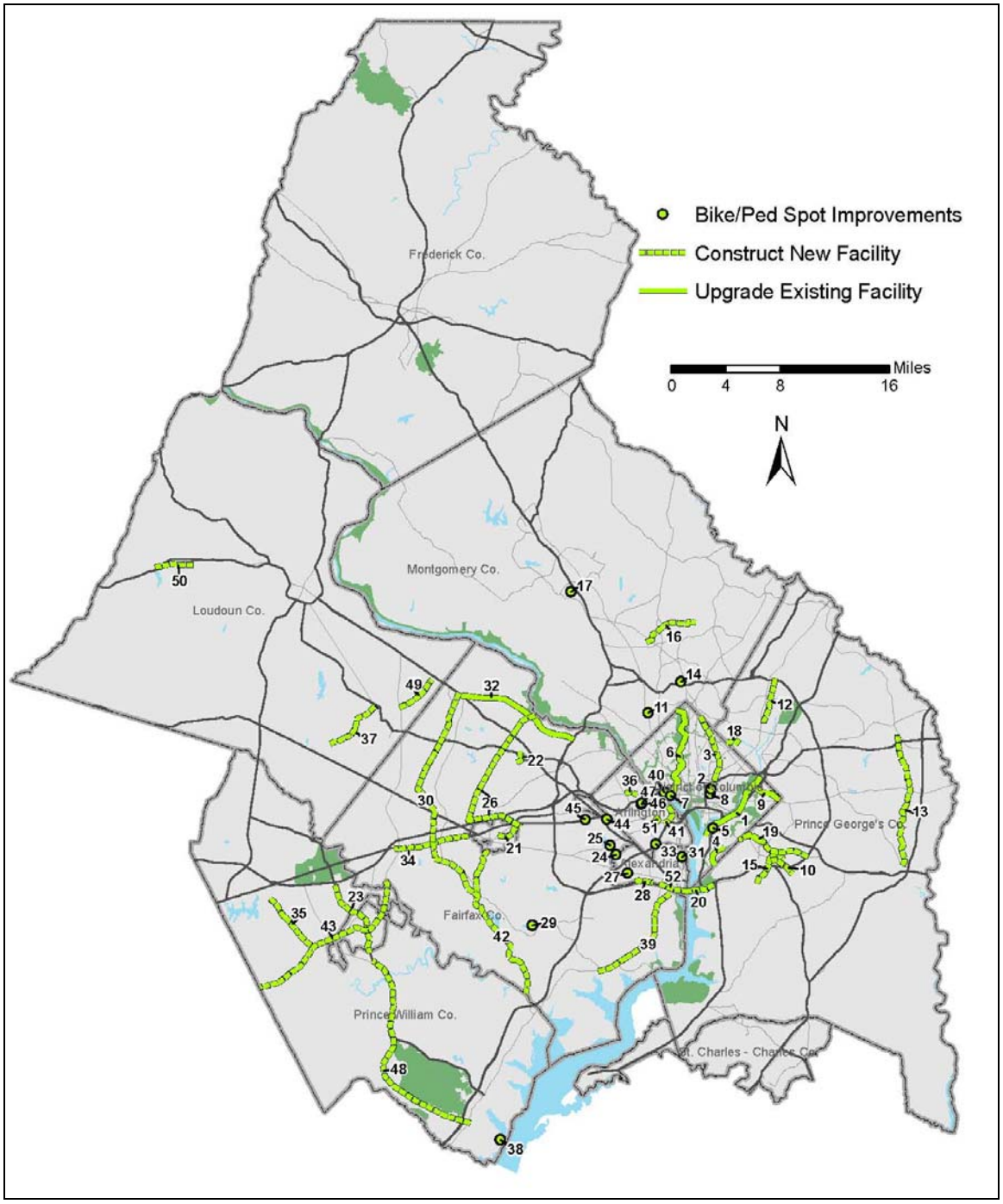
Figure 2-2. 2006 MWCOG CLRP Major Transit and HOV Improvements



Source: http://www.mwcog.org/clrp.

* HOT – High-Occupancy/Toll; HOV – High-Occupancy Vehicle.

Figure 2-3. 2006 MWCOG CLRP Major Bike and Pedestrian Improvements



Source: http://www.mwcog.org/clrp.

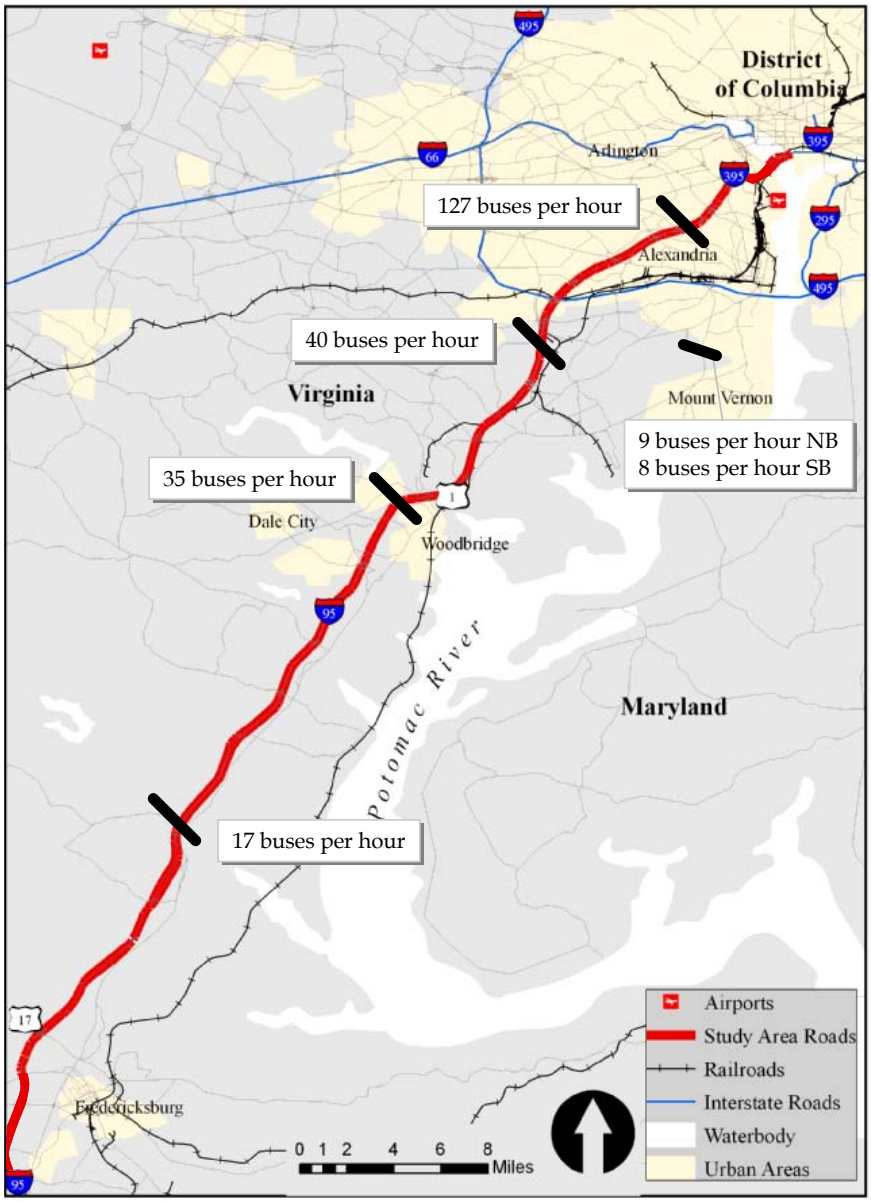
2.1 Existing Conditions

This section presents a description of the existing conditions in the study area including a summary of existing transit service, existing TDM programs and services, and existing transit and carpool usage.

2.1.1 Existing Transit Service

During the morning peak period, there are over 127 buses operating per hour in the northern portion of the corridor and about 17 buses operating per hour in the southern portion of the corridor. There are 10 WMATA Metrorail trains per hour, 2 VRE trains every hour, and 2 Amtrak trains in the morning peak period servicing the study corridor. Figure 2-4 illustrates the bus service for the year 2005 in the morning peak.

Figure 2-4. 2005 Bus Service I-95/I-395 – AM Peak



Source: MWCOG/TPB Travel Forecasting Model V2.1D#50 2006 CLRP FY 2007-2012 TIP.

2.1.2 Existing TDM Programs and Services

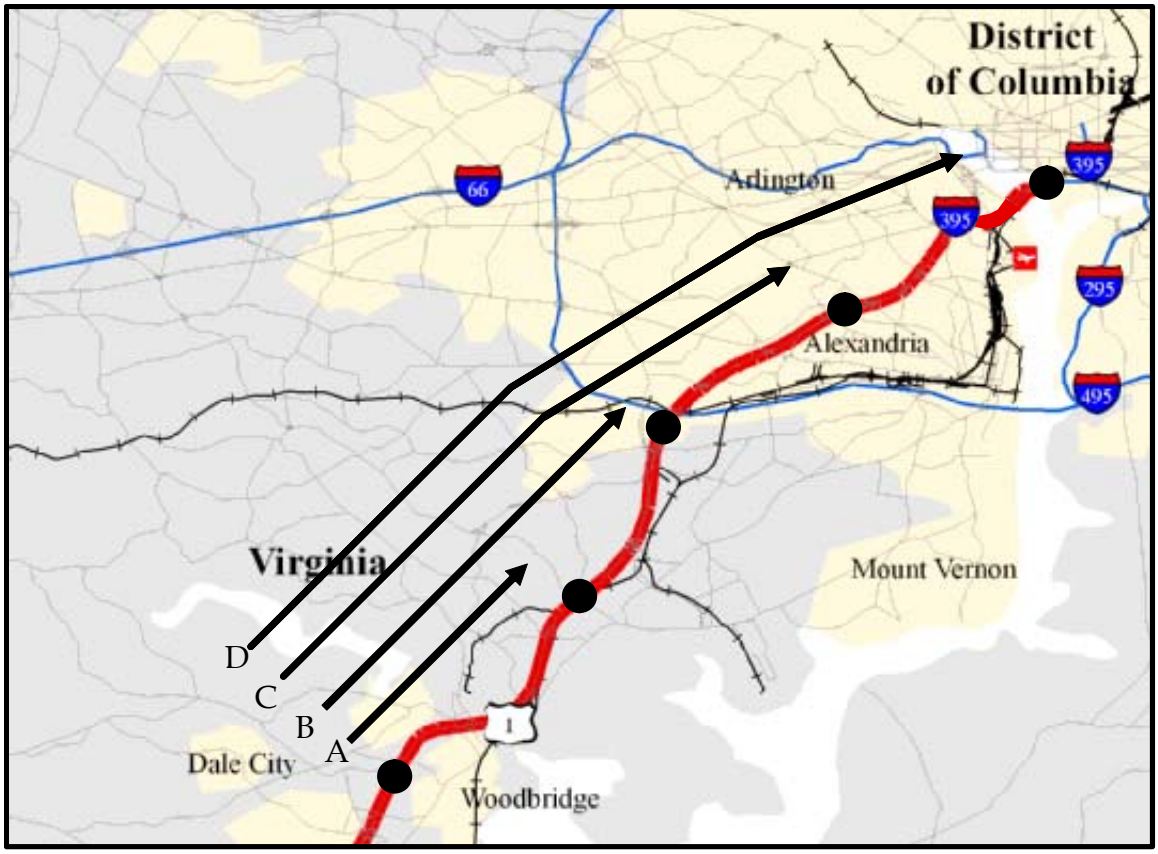
A variety of TDM programs and services currently operate in the study corridor, including:

- Five-hundred Vanpools;
- Twenty-one Park-and-Ride Lots;
- Nineteen Slug Locations;
- Five Rideshare/Employer Services Programs;
- VanStart/VanSave;
- Guaranteed Ride Home Program;
- NuRide Carpool Incentives;
- Commuter Stores;
- Metrochek Redemption Centers;
- Four Telework Centers; and
- Telework!Va Program.

2.1.3 Existing Mode Share

Figures 2-5 and 2-6 illustrate the mode share in the morning peak period for selected markets along the study corridor. The transit mode share of trips traveling from points south of Dale City along I-95 to the core increases gradually as the destination gets closer to the core. The core, due to its higher density, attracts more transit trips than other parts of the corridor. Conversely, the low-occupancy vehicle (LOV) mode share (trips with one or two occupants) drops dramatically closer to the core, as transit already is a very popular choice for trips originating south of Dale City and headed north along I-95. The transit and high-occupancy vehicle (HOV) mode shares for trips into the core are very high and indicate that the proposed transit service for the high-occupancy toll (HOT) facility should try to maintain these types of mode shares.

Figure 2-5. I-95/I-395 AM Peak Hour Mode Shares – Selected Markets



(A) Originating at or South of Dale City on I-95 and destined to Lorton.

Transit <1%
HOV 13%
LOV 87%

(B) Originating at or South of Dale City on I-95 and destined to Springfield.

Transit 0%
HOV 7%
LOV 93%

(C) Originating at or South of Dale City on I-95 and destined to Alexandria.

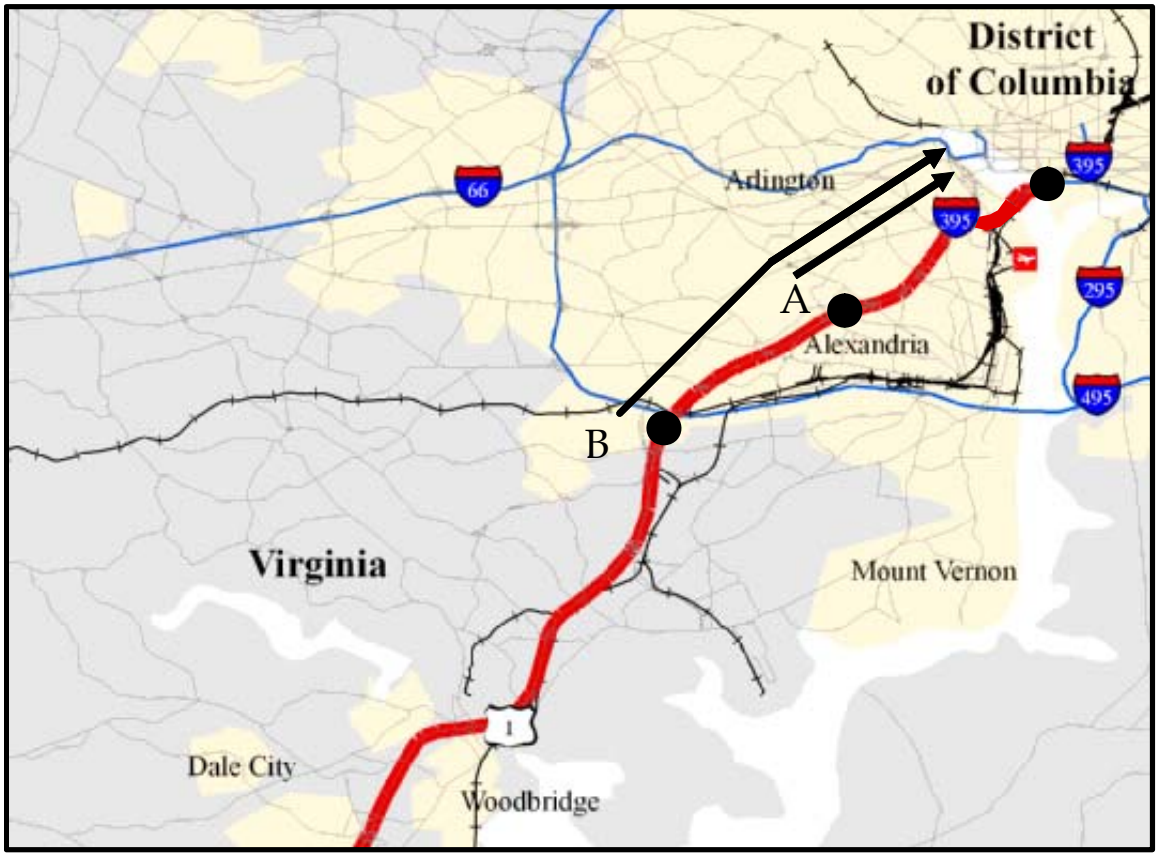
Transit 6%
HOV 4%
LOV 90%

(D) Originating at or South of Dale City on I-95 and destined to core.

Transit 6%
HOV 4%
LOV 90%

Source: *I-95 HOV Feasibility Study*, VDOT, March 2002.

Figure 2-6. I-95/I-395 AM Peak Hour Mode Shares – Selected Markets



(A) Originating at Alexandria on I-95 and destined to the core.

Transit	32%
HOV	0%
LOV	68%

(B) Originating at Springfield on I-95 and destined to the core.

Transit	17%
HOV	18%
LOV	65%

Source: *I-95 HOV Feasibility Study*, VDOT, March 2002.

2.2 Land Use Forecasts

The source of the land use forecasts used for the study was the MWCOG regional travel demand forecast model (Version 2.1D#50). Figures 2-7 through 2-10 show the forecast population and employment density in the study area for 2015 and 2030.

Figure 2-7. Population Density in the Study Area in 2015

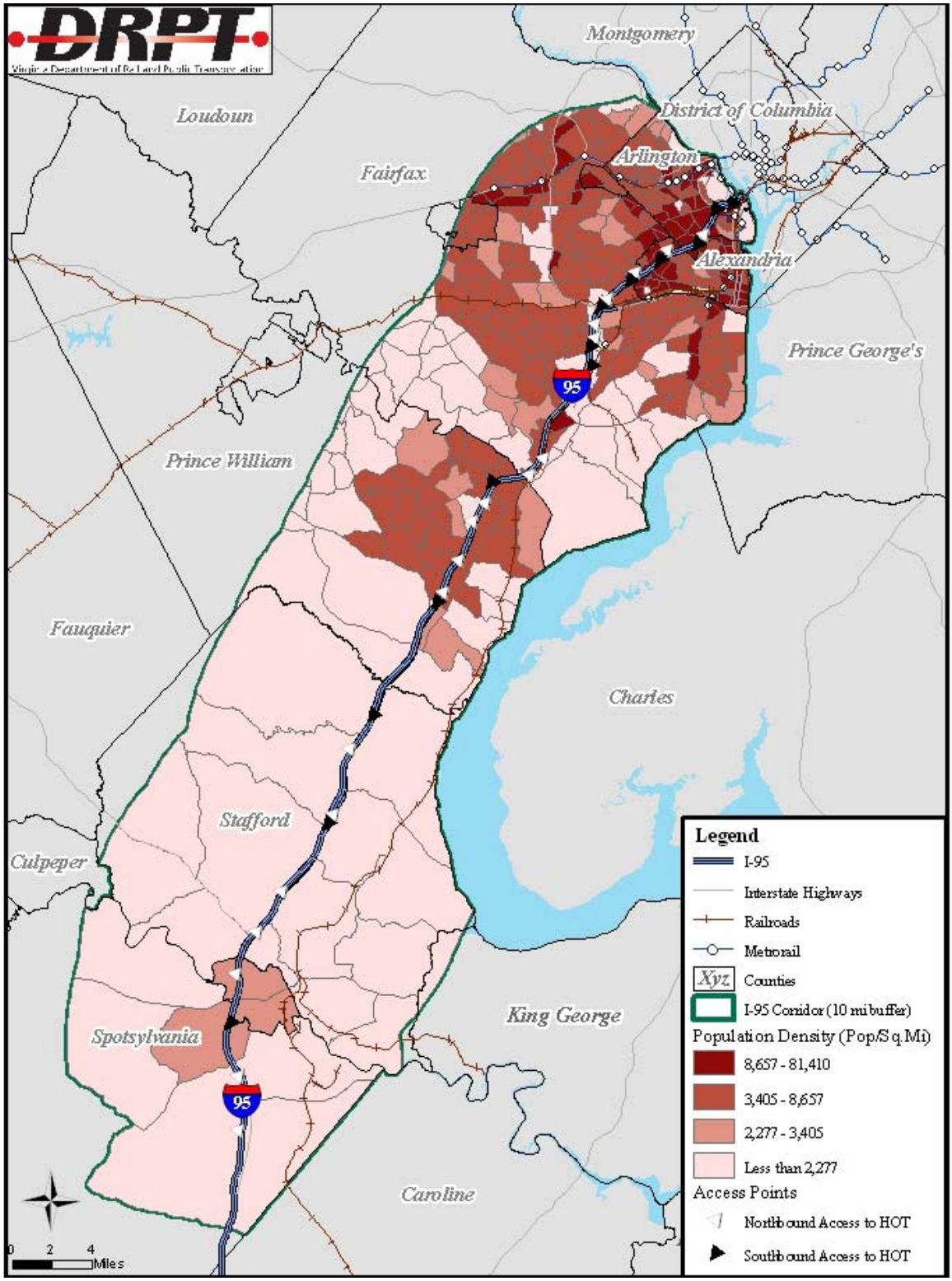


Figure 2-8. Employment Density in the Study Area in 2015

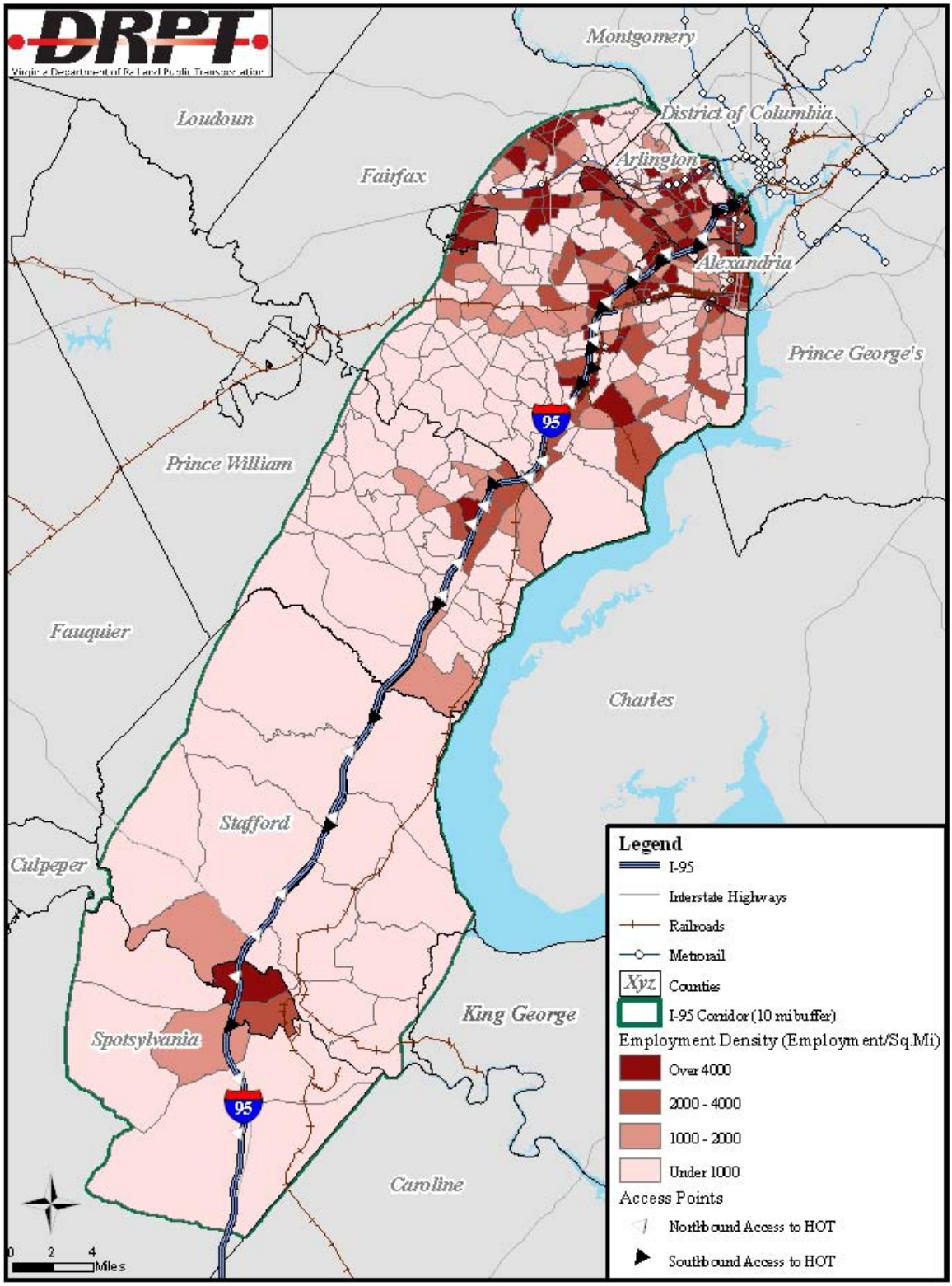


Figure 2-9. Population Density in the Study Area in 2030

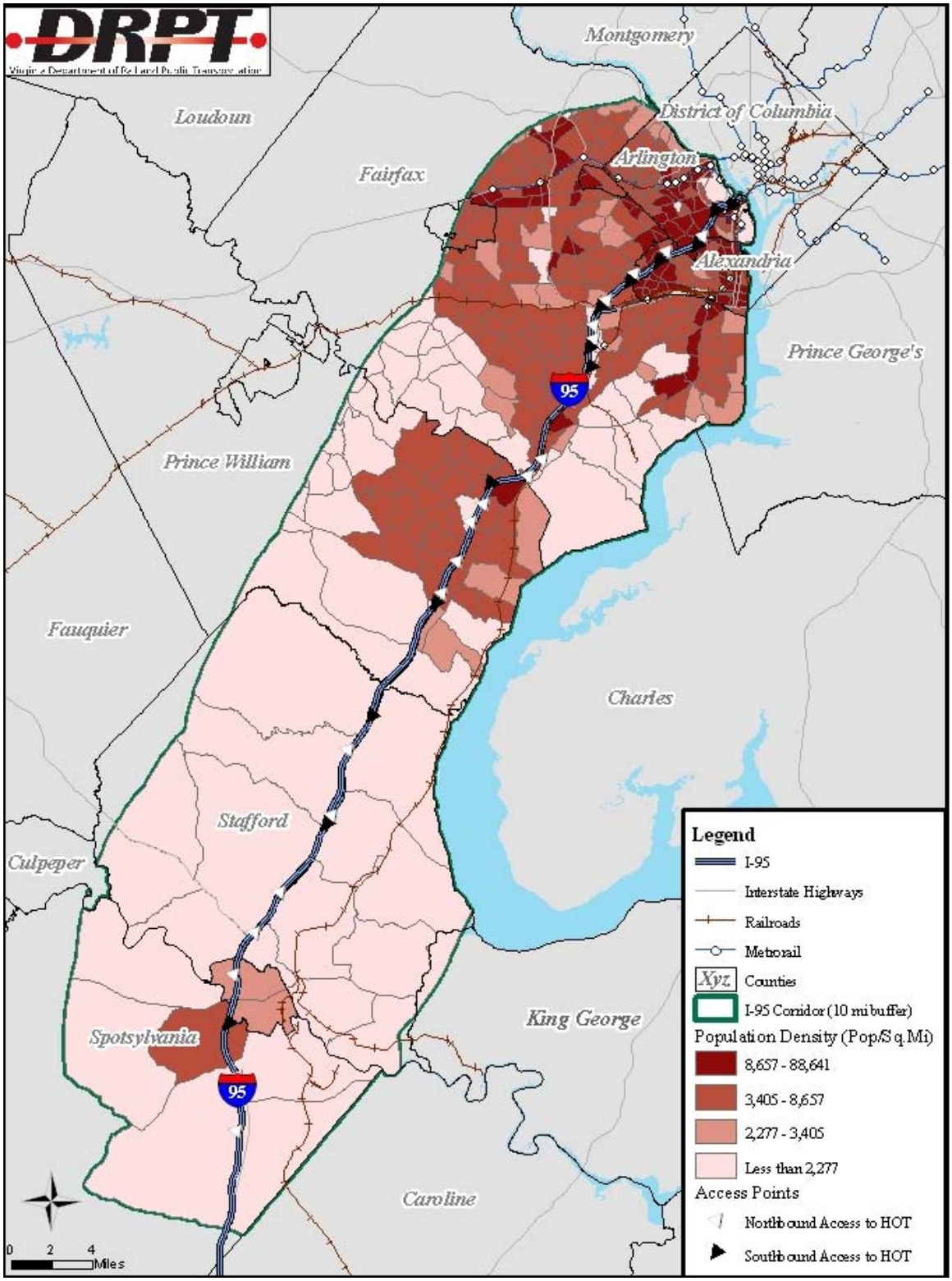
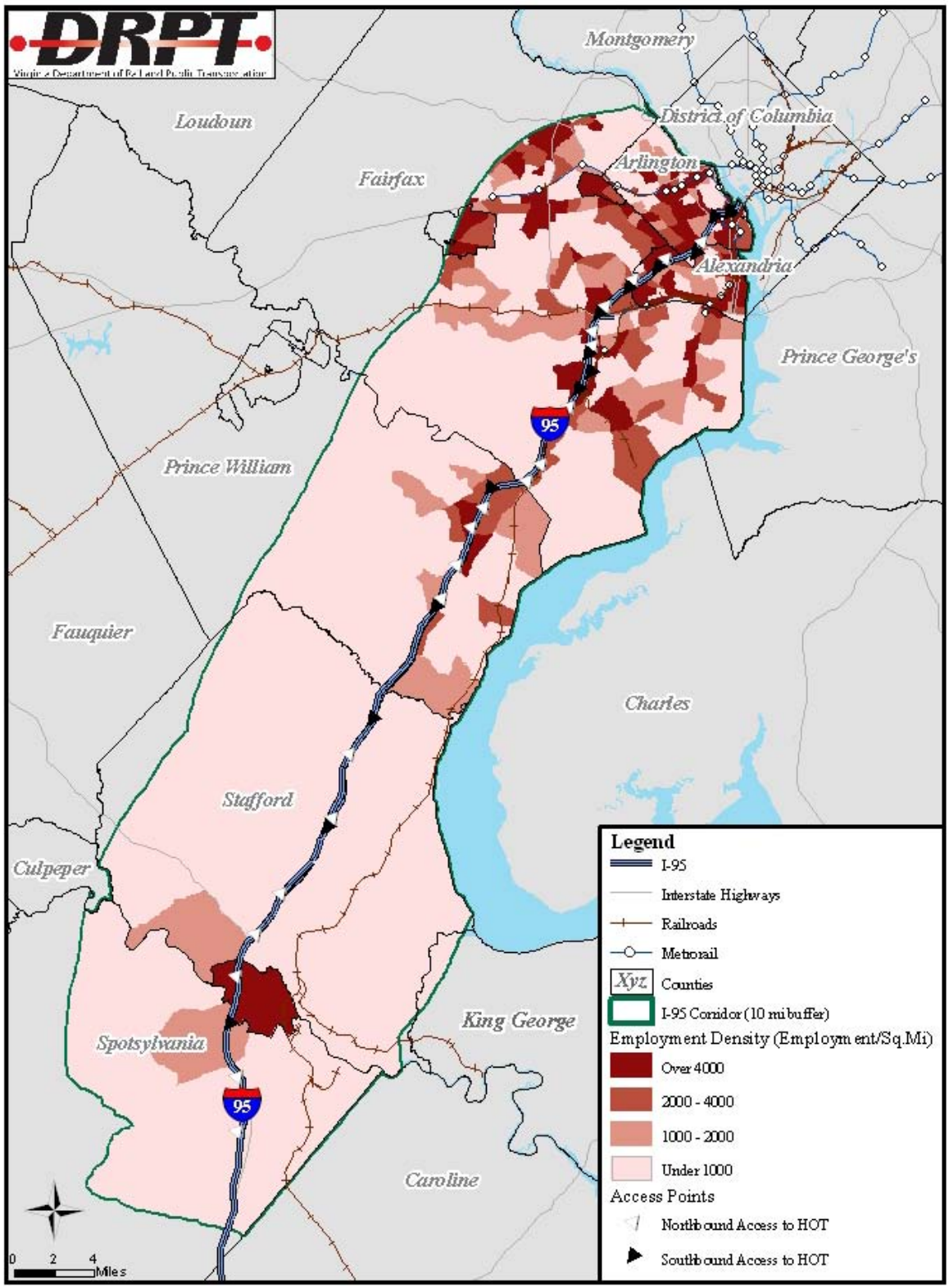


Figure 2-10. Employment Density in the Study Area in 2030



2.3 Baseline Highway Network

The highway network for the Baseline Scenario consists of the improvements identified in the 2006 MWCOG CLRP. Also included are two projects that create the 70-mile HOT lane network on the Beltway and I-95/I-395. These projects will:

- Add four new high-occupancy toll (HOT) lanes on I-495 from the Springfield Interchange to just north of the Dulles Toll Road;
- Convert the existing reversible HOV system on I-95/I-395 into HOT lanes, expanding it from two lanes to three lanes; and
- Extend two new HOT lanes 28 miles south along I-95 into Spotsylvania County.

2.4 Baseline Transit/TDM Improvements

The baseline scenario service elements were developed using a survey of existing public transit operators, review of public and private operators' web sites and service descriptions, and in-person meetings and/or e-mail discussions with public transit operators to discuss current, anticipated, and potential new services.

Existing services were augmented with the transit services planned in the 2006 MWCOG CLRP. Transit service that could potentially use the HOT lanes was assigned to the HOT lanes. This included service currently using the HOV lanes and future planned transit service that could be on the proposed HOV lanes. Finally, a TAC meeting was used to confirm the baseline transit network.

2.4.1 Regional Activity Centers

Transit market opportunity maps were developed to highlight the travel flows between origins within the study area and major destinations based on the MWCOG regional activity centers in order to facilitate the development of the baseline scenario and potential transit markets. Figure 2-11 shows the designated major attraction zones for home-based work trips originating in the I-95 corridor. Figure 2-12 is a sample map that shows the 2015 projected home-based work trips during the morning peak period from the I-95 corridor to north and west Washington D.C. (without I-95/I-395 HOT lanes). Additional maps are provided in Appendix B. These maps served as a useful device for soliciting TAC input on existing and planned transit service (including express bus/bus rapid transit, Metrorail, and commuter rail services) and TDM programs (including slugging, carpooling, vanpooling, and park-and-ride facilities) in the I-95, I-395, I-495, and Route 1 corridors.

Figure 2-11. Major Attraction Zones for Projected Home-Based Work Trips Originating in the Study Corridor

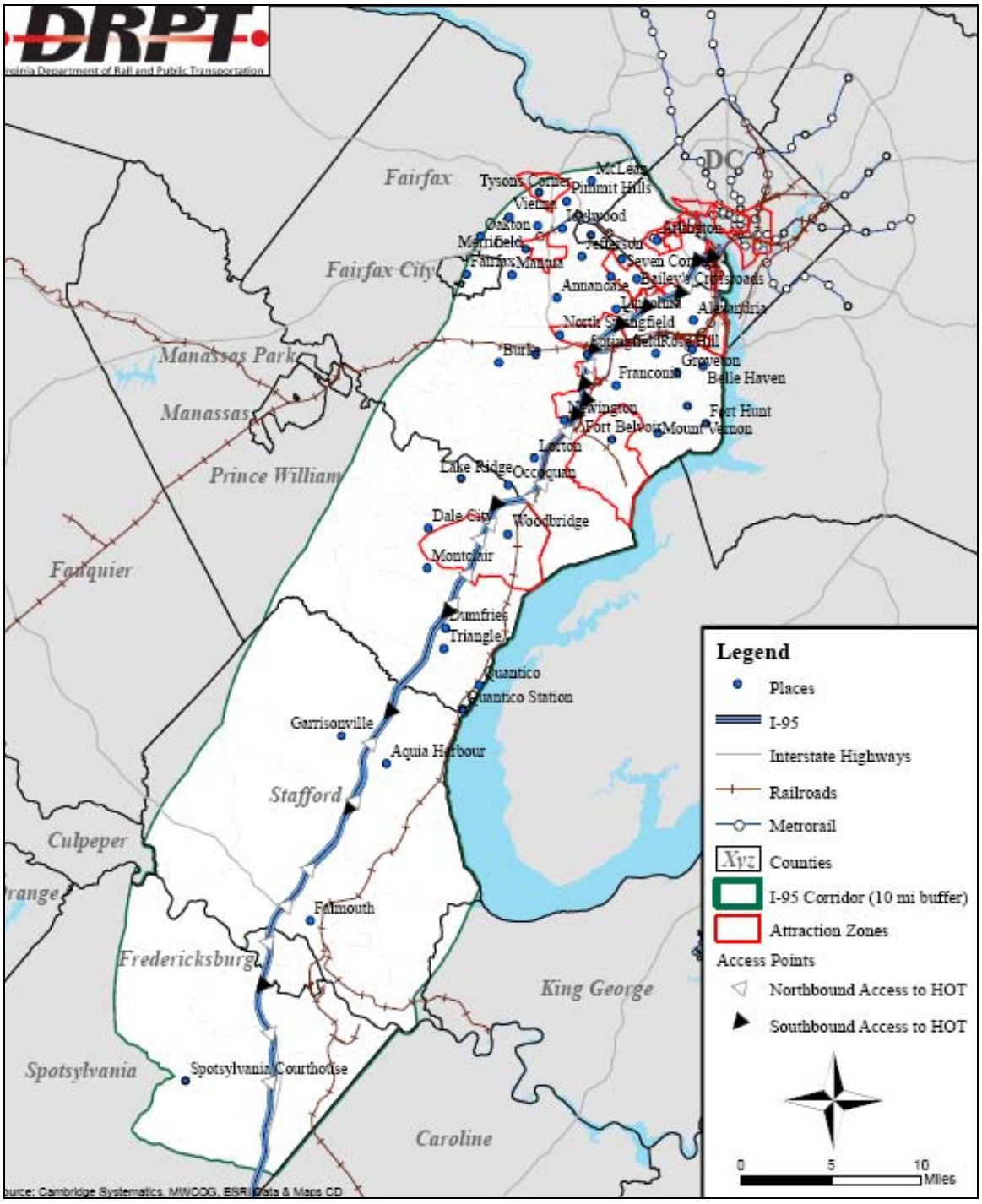


Figure 2-12. 2015 Projected Home-Based Work Trips during AM Peak Period from Study Corridor to North and West Washington D.C.

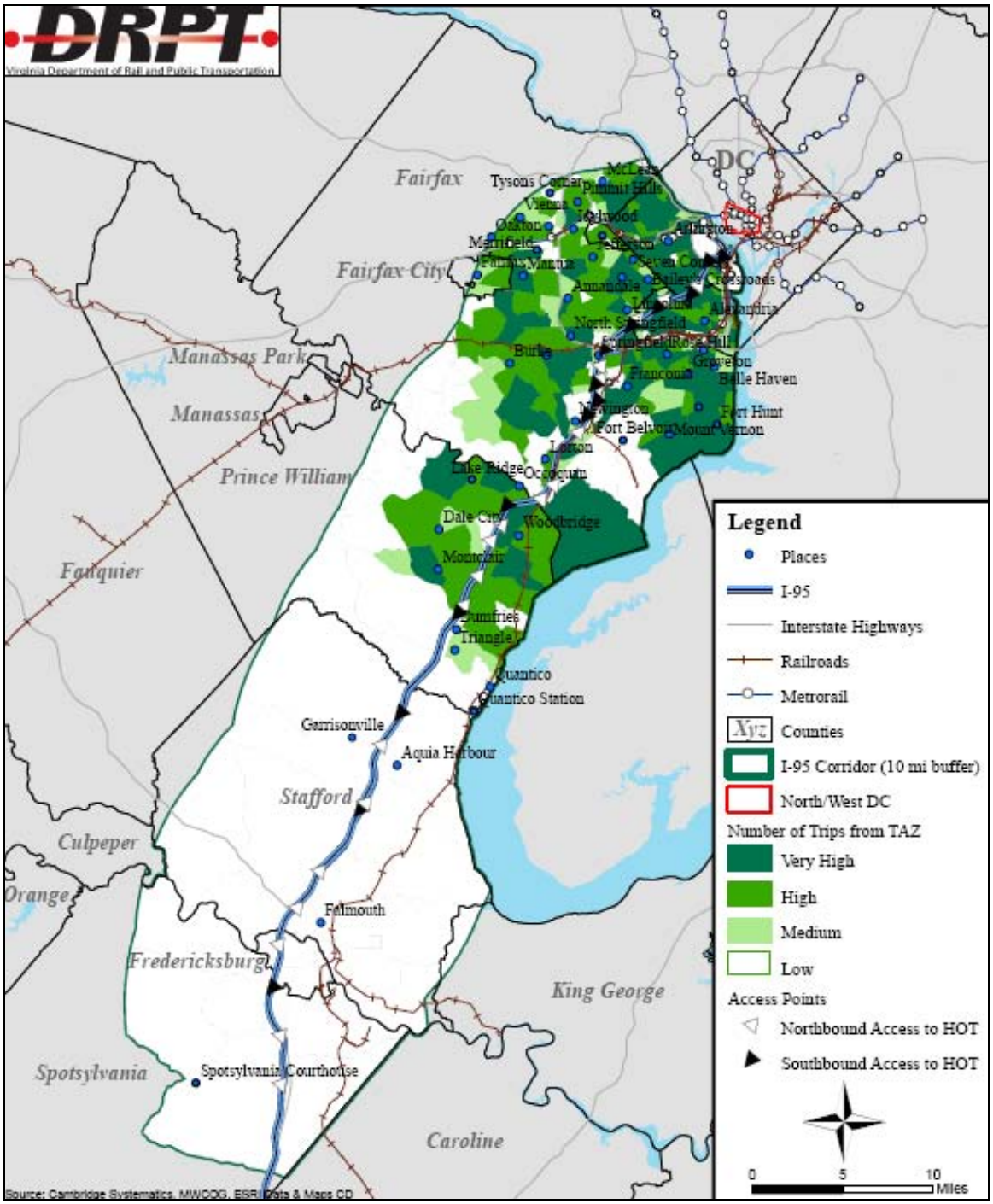


Table 2-1. Baseline (Existing and Planned Transit Service by Subarea)

Area	Current Transit Service in I-95/I-395 Corridor (From These Areas)	Summary of Current Services	Transit Improvements Planned in MWCOG CLRP[a]
Alexandria/ Arlington Areas	**Metrorail –** Ten rail stations provide service in metro area. **Metrobus –** Thirty-one routes provide local bus, commuter bus to D.C., and feeder bus to Metrorail stations. **Alexandria DASH –** Seven routes provide local and feeder bus, mostly oriented toward the city, two routes to Pentagon use the HOV lanes. **Arlington ART –** Provides local and feeder bus, two routes use the HOV lanes to feed Pentagon City Metrorail station. **VRE/Amtrak –** Commuter rail to/from Alexandria and Crystal City stations.	**Direct Links –** Local transit systems, WMATA, and VRE/ Amtrak provide a relatively high level of transit service inside the beltway. Most of these services are not directly affected by changes to the HOV lanes. **Feeder Connections –** Local transit systems and Metrobus provide connections to and from Metrorail and VRE/Amtrak stations.	Headway Improvements on Existing Routes: • Increase VRE by two trains per hour northbound; one train per hour southbound. Route Realignments: • Route 7 realignment 7X/7W start in West End of Alexandria area. New Routes or Services: • Increased service on Columbia Pike (more than 3 buses per hour); and • Increase Service I-395 NB (more than 14 buses per hour). Capital Improvements: • Improvements to Metrorail stations at King Street, Crystal City, and Pentagon; • New Metrorail station at Potomac Yard; • Transfer facilities at Columbia Pike/S. Walter Reed and Shirlington/31st Street; • Transit Center at King Street/Braddock; • Crystal City Busway with upgrade to BRT in 2012; and • HOT lanes on Beltway.

[a] The MWCOG CLRP does not include Stafford and Spotsylvania Counties – FAMPO is developing a CLRP.

Table 2-1. Baseline (Existing and Planned Transit Service by Subarea) (continued)

Area	Current Transit Service in I-95/I-395 Corridor (From These Areas)	Summary of Current Services	Transit Improvements Planned in MWCOG CLRP[a]
Springfield/ Fairfax Areas	**Fairfax Connector –** Twenty-three routes provide local and feeder service to Metrorail, 1 route operating from Springfield Metro station to Pentagon uses HOV lanes. **WMATA –** Some of the 31 routes provide local bus, commuter bus to D.C., and feeder bus to Metrorail stations. **VRE/Amtrak –** Commuter rail to Alexandria, Crystal City, D.C. from Springfield and Lorton stations.	**Direct Links –** Fairfax Connector, WMATA, and VRE/Amtrak provide a relatively high level of service for commuters into D.C./ Arlington core from Springfield and Fairfax. **Feeder Connections –** Fairfax Connector and Metrobus provide connections to and from Metrorail/VRE/Amtrak Stations.	Headway Improvements on Existing Routes: • Increase VRE by one train per hour northbound and one train per hour southbound; • Metro Blue Line decrease one train per hour; and • Increase service I-95 Northbound (more than 26 buses per hour). Route Realignments: • Fairfax Connector realignments/streamlining Mt. Vernon Area and Springfield Area. New Routes or Services: • New service on the I-495 HOT lanes connecting Dulles, Fairfax, Alexandria, Annandale, and Tysons Corner (28 buses per hour on Inner Loop). Capital Improvements: • Improvements to Metrorail station at Huntington; • Platform extension at Eisenhower Avenue Metrorail; and • Study Metrorail from Springfield to Potomac Mills Mall.
Prince William Area	**PRTC –** Eleven routes operate in the corridor to provide commuter bus service from Pentagon, Crystal City, and D.C.; and feeder bus service to Springfield Metro station. Commuter routes circulate through community.	**Direct Links –** PRTC and VRE provide relatively high level of service for commuters from the Woodbridge/Dale City area into D.C./Arlington core.	Headway Improvements on Existing Routes: • Increase VRE by one train per hour northbound and one train per hour southbound; • Improve bus service in Woodbridge/Potomac Mills Area; and • Increase service I-95 northbound (more than 27 buses per hour).

[a] The MWCOG CLRP does not include Stafford and Spotsylvania Counties – FAMPO is developing a CLRP.

[b] The access point in the Quantico Area does not appear to be “transit friendly” since it is one-directional – e.g., northbound morning buses could get off but not back on to continue on route.

Table 2-1. Baseline (Existing and Planned Transit Service by Subarea) (continued)

Area	Current Transit Service in I-95/I-395 Corridor (From These Areas)	Summary of Current Services	Transit Improvements Planned in MWCOG CLRP[a]
Prince William Area (continued)	**VRE/Amtrak –** Commuter rail to Alexandria, Crystal City, D.C. from Woodbridge, Rippon, and Quantico stations.	**Feeder Connections –** PRTC provides connections to Metrorail and VRE/Amtrak stations.	Route Realignments: • Improved bus service in Woodbridge/Potomac Mills area. Capital Improvements: • Extension of HOV lanes from Dumfries to Quantico area; • Study Metrorail from Springfield to Potomac Mills Mall; and • VRE – New Cherry Hill Station.
Stafford and Fredericksburg Areas	**FRED –** Local bus in City of Fredericksburg, Stafford, and Spotsylvania County. **VRE/Amtrak –** Provides service to Alexandria, Crystal City, D.C. from Brooke, Leland Road, and Fredericksburg stations. **Martz/Quicks –** Private commuter buses provide 22 round trips to Skyline, Pentagon, Crystal City, and D.C.	**Direct Links –** FRED bus is oriented toward local markets. Commuter service is available through private commuter buses (Martz and Quicks) and VRE/ Amtrak. VRE/Amtrak, Martz, Quicks provide a relatively high level of service from the area into D.C./Arlington. **Feeder Connections –** Local connections to commuter bus and VRE/Amtrak are limited.	Headway Improvements on Existing Routes: • Increase VRE by one train per hour northbound and one train per hour southbound; and • Increase service on I-95 Northbound (more than 16 buses per hour). New Routes or Services: • New service I-95 to I-495 to Springfield Metrorail station, Tysons Corner, and Merrifield (7.5 buses per hour).

[a] The MWCOG CLRP does not include Stafford and Spotsylvania Counties – FAMPO is developing a CLRP.

[b] The access point in the Quantico Area does not appear to be "transit friendly" since it is one-directional – e.g., northbound morning buses could get off but not back on to continue on route.

2.4.2 Baseline Service

The baseline scenario for both years 2015 and 2030 was documented on tables and maps presented to the TAC. Table 2-1 shows the baseline services.

The transit service coverage and frequency is illustrated in two figures. Figure 2-13 shows the transit coverage in the study area for 2030 under the baseline scenario. Figure 2-14 shows the increase in bus service from 2005 to 2030 in the study corridor in the morning peak period.

Figure 2-13. Transit Coverage in the Study Area for 2030

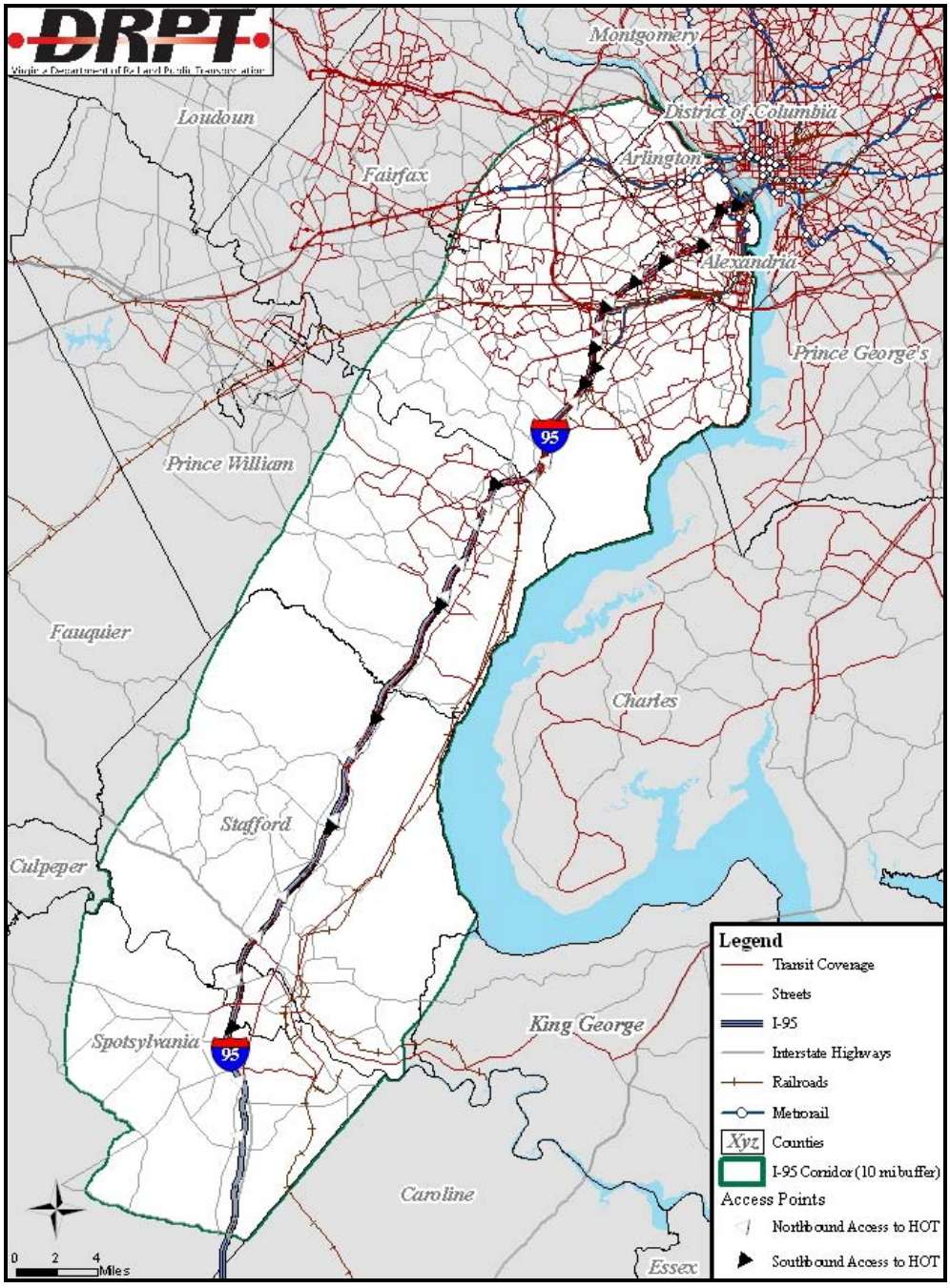
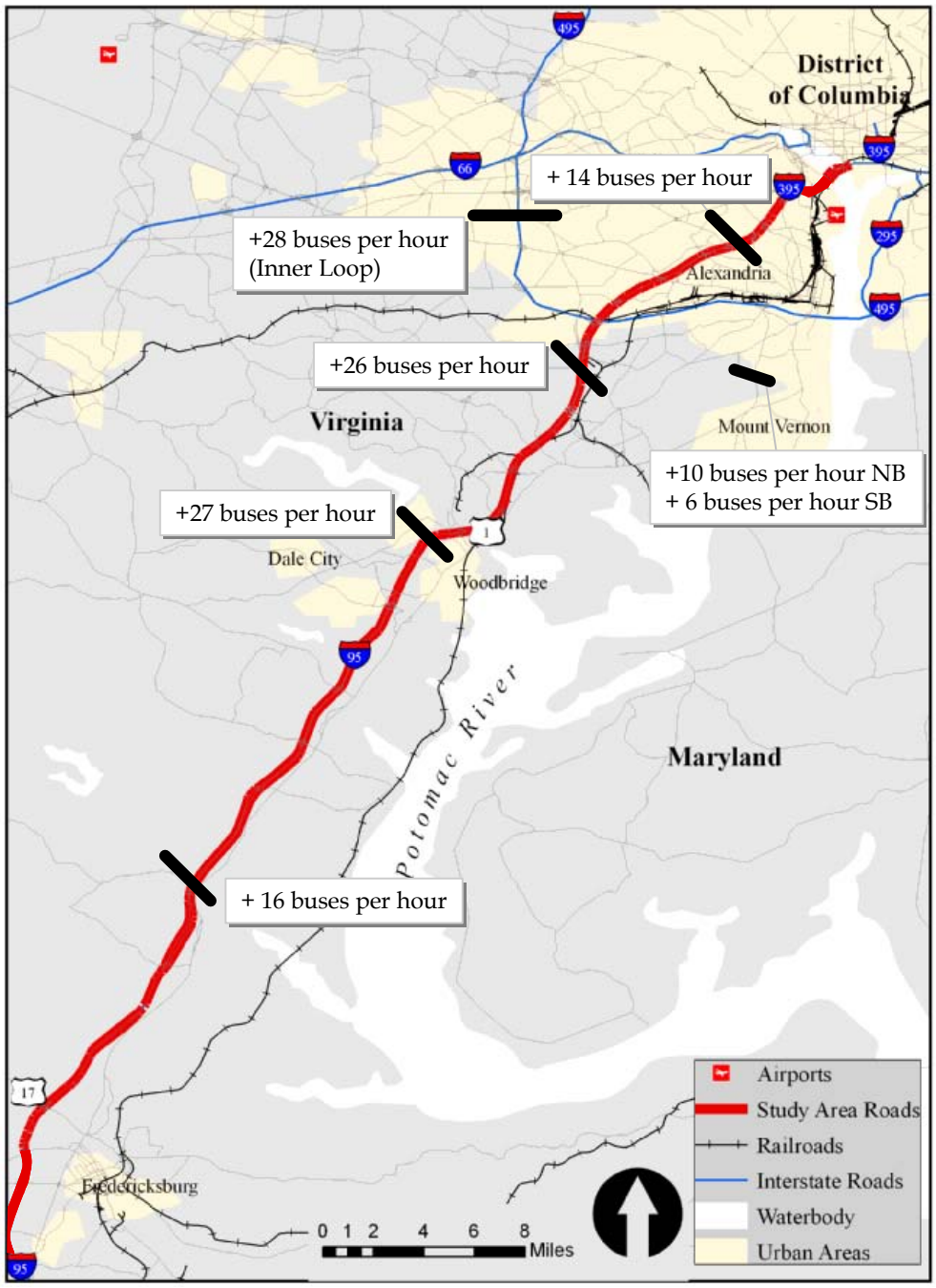


Figure 2-14. Increase in Bus Service from 2005 to 2030 – AM Peak



Source: MWCOG/TPB Travel Forecasting Model V2.1D#50 2006 CLRP FY 2007 to 2012 TIP.

3.0 Market Research

This section describes the market research conducted as part of the I-95/I-395 Transit/TDM Study.

3.1 Market Research Objectives

As part of the study, market research was conducted to:

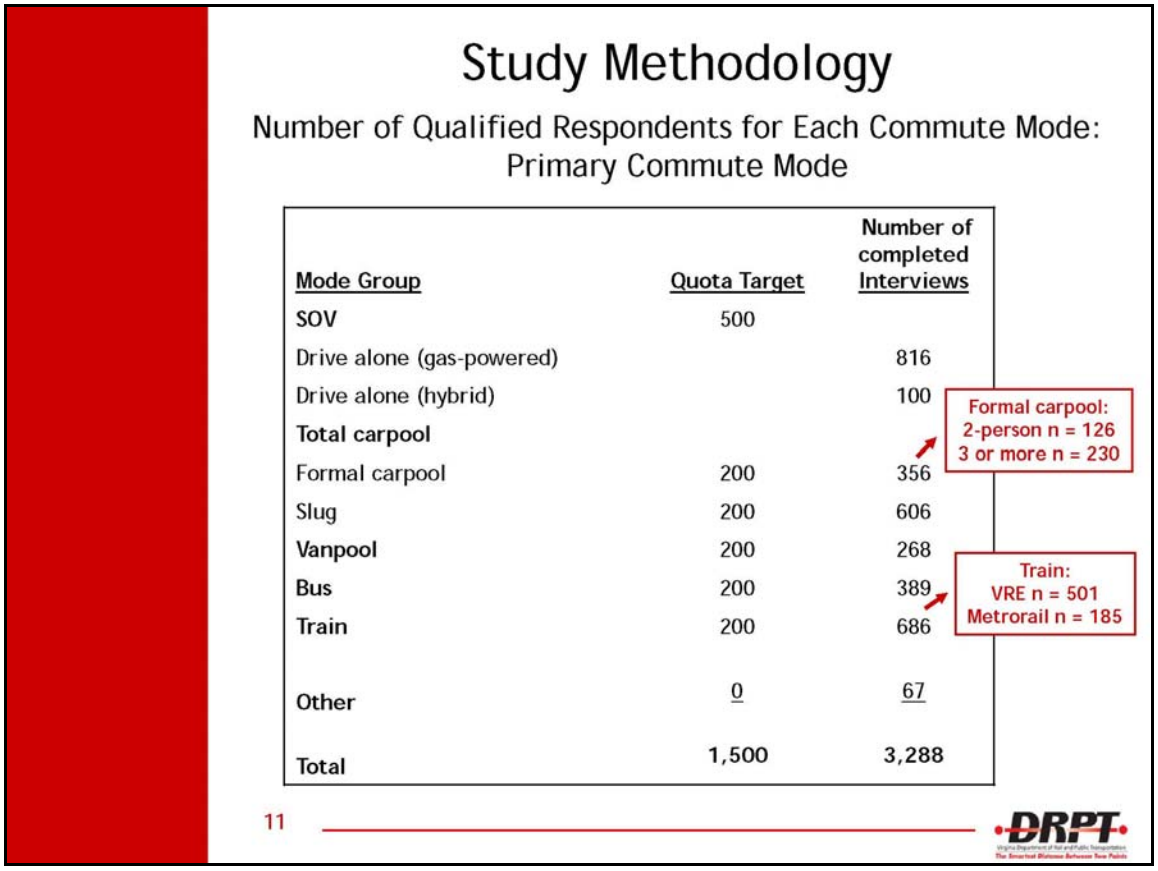
- Profile current travel patterns by modes on the I-95/I-395 corridor;
- Measure the current level of awareness, familiarity, and beliefs regarding HOT Lanes;
- Assess the propensity of commuters to change their commute behavior in response to HOT Lanes availability;
- Identify the relative appeal of specific enhancements and programs (transit/TDM alternatives) needed to increase the likelihood of using non-SOV modes; and
- Assess the relative impact of alternatives to help calibrate subsequent modeling activities.

3.2 Study Methodology

The study was conducted through an on-line survey which was developed with input from the TAC members. The survey questionnaire included elaborate skip patterns to accommodate multiple modes and origin-destination (O-D) patterns. The questionnaire was comprised of scaled attitude and opinion questions, open-ended questions, and choice experiments, where additional HOT lanes price points and time savings scenarios were tested.

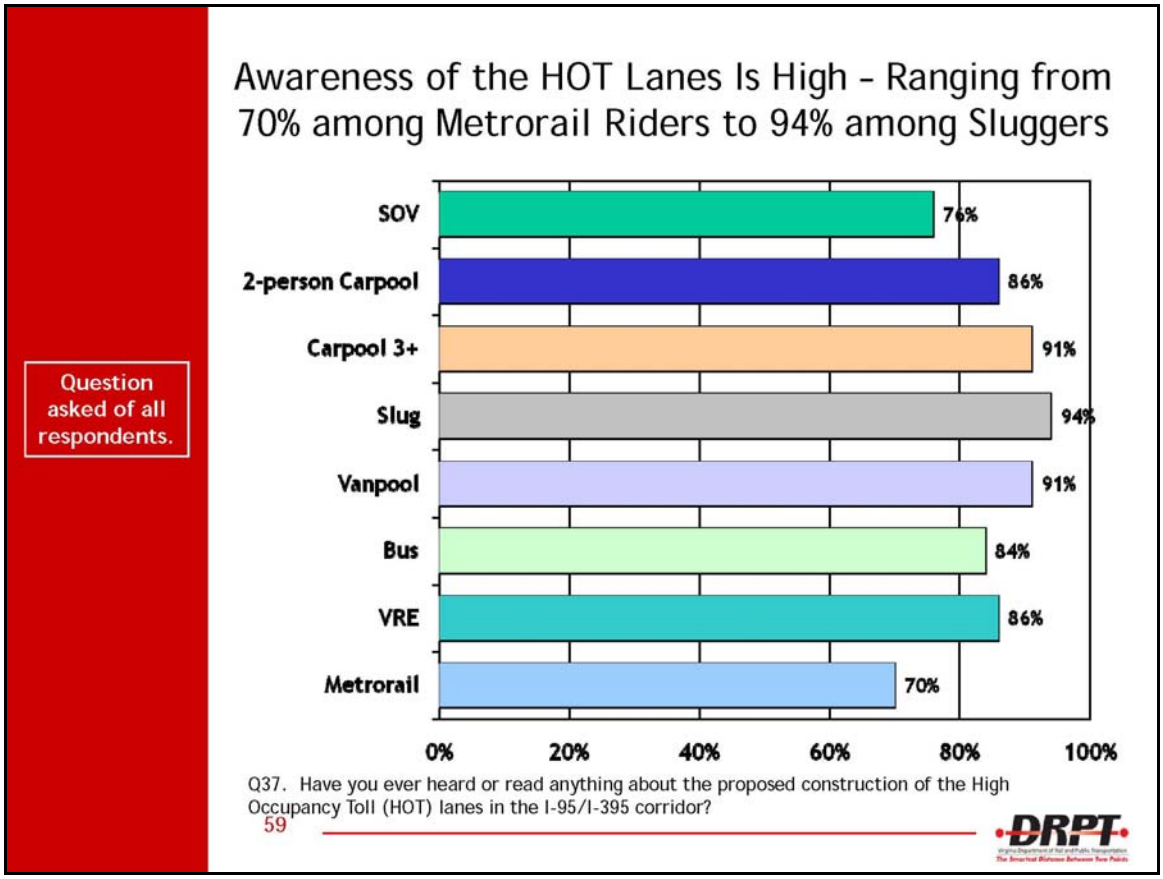
In order to qualify for this study, respondents had to commute to work or school north along the I-95/I-395 corridor during morning peak travel times, and reside in a predetermined study area defined by zip codes. The sample consists of commuters across a variety of transportation modes, including SOV (gasoline engine and hybrid), formal carpool, vanpool, slug, commuter bus, and VRE/Metrorail. Some 75,000 postcards were sent to targeted ZIP codes within the study corridor and additional people were contacted via targeted e-mail lists. A sample size quota of 200 was targeted for each transportation mode with the exception of SOV commuters, which had a sample quota of 500. Nearly 3,300 respondents were obtained across all of the targeted populations (see Figure 3-1).

Figure 3-1. Sample Sizes



The survey showed that awareness of the HOT lanes in the corridor is high. The lowest level of awareness is posted at 76 percent among SOVers. Nearly all sluggers (94 percent) are aware of the proposed HOT lanes (see Figure 3-2).

Figure 3-2. Awareness of the HOT Lanes



It was found that sluggers are especially likely (71 percent) to believe that HOT lanes will discourage drivers from picking up sluggers (see Figure 3-3). However, as highlighted in Figure 3-4 and Figure 3-5, most commuters say they would not change their commute in any way when the HOT lanes are open and functional. Among SOVs, 53 percent reported they would not change their commute in any way. Figure 3-5 provides a summary of responses for carpoolers, which are similar to other non-SOV mode users (81 percent of all carpoolers, 82 percent of sluggers, 95 percent of vanpoolers, 91 percent of bus riders, and 86 percent of train riders). Results for all modes are contained in Appendix C. The implication of this finding is that while concern seems to be high in the corridor, the abandonment of slugging would not be a likely outcome of the HOT lanes project.

Figure 3-3. Opinion on HOT Lanes Impact to Sluggers

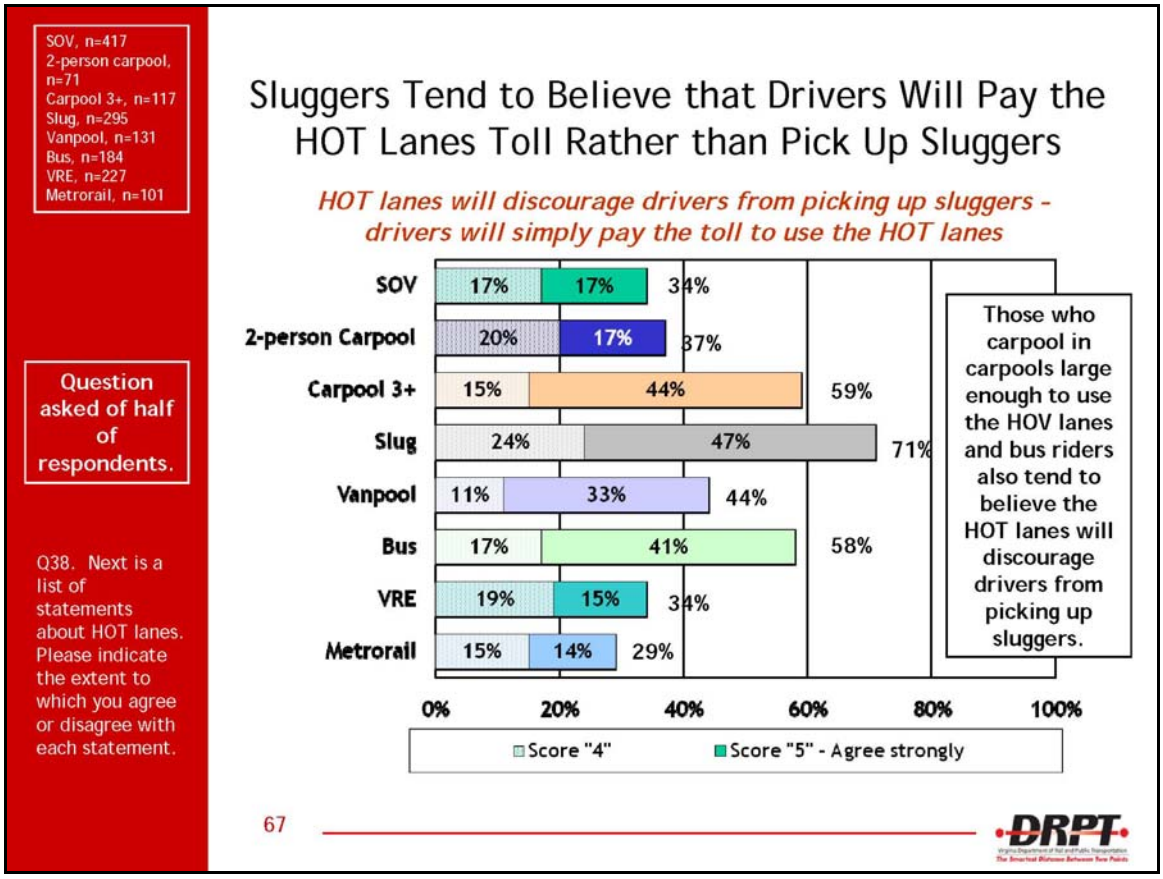


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Figure 3-4. Stated HOT Lane Usage Intentions of SOV Users

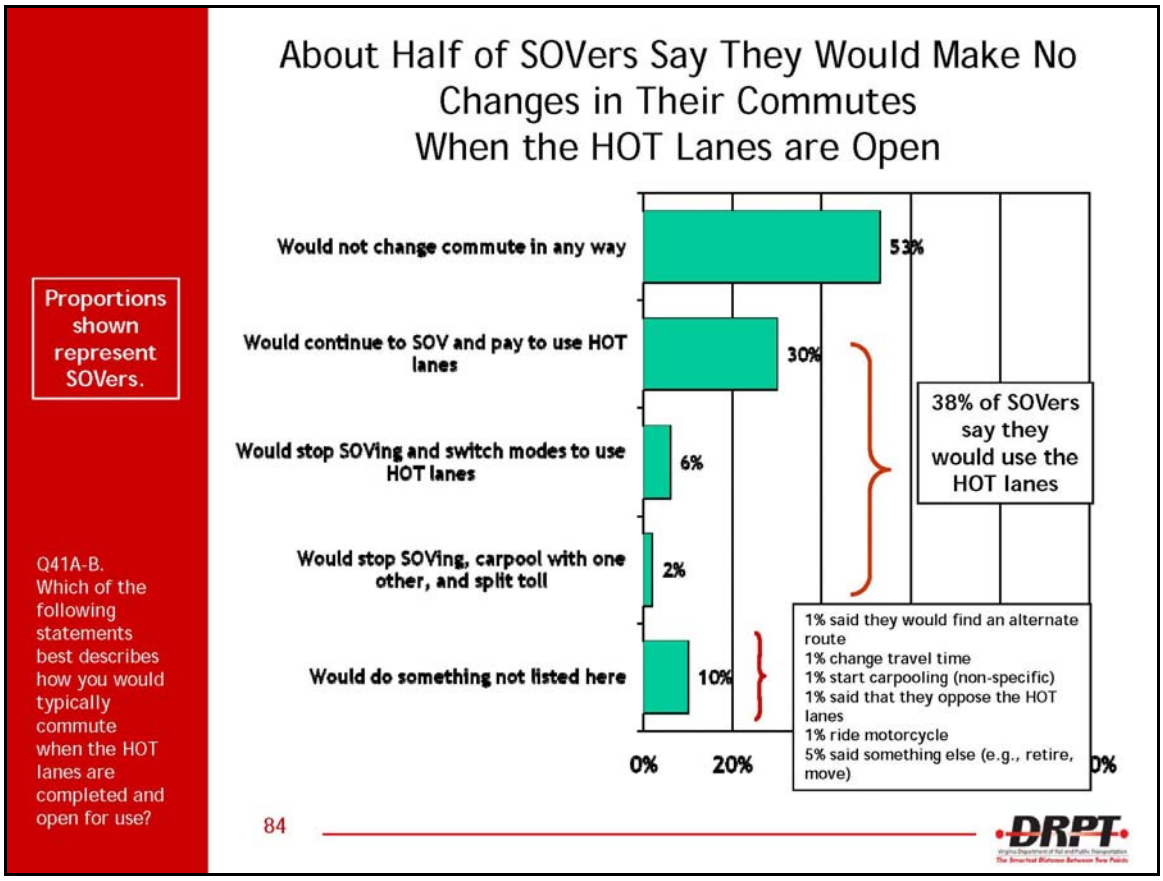
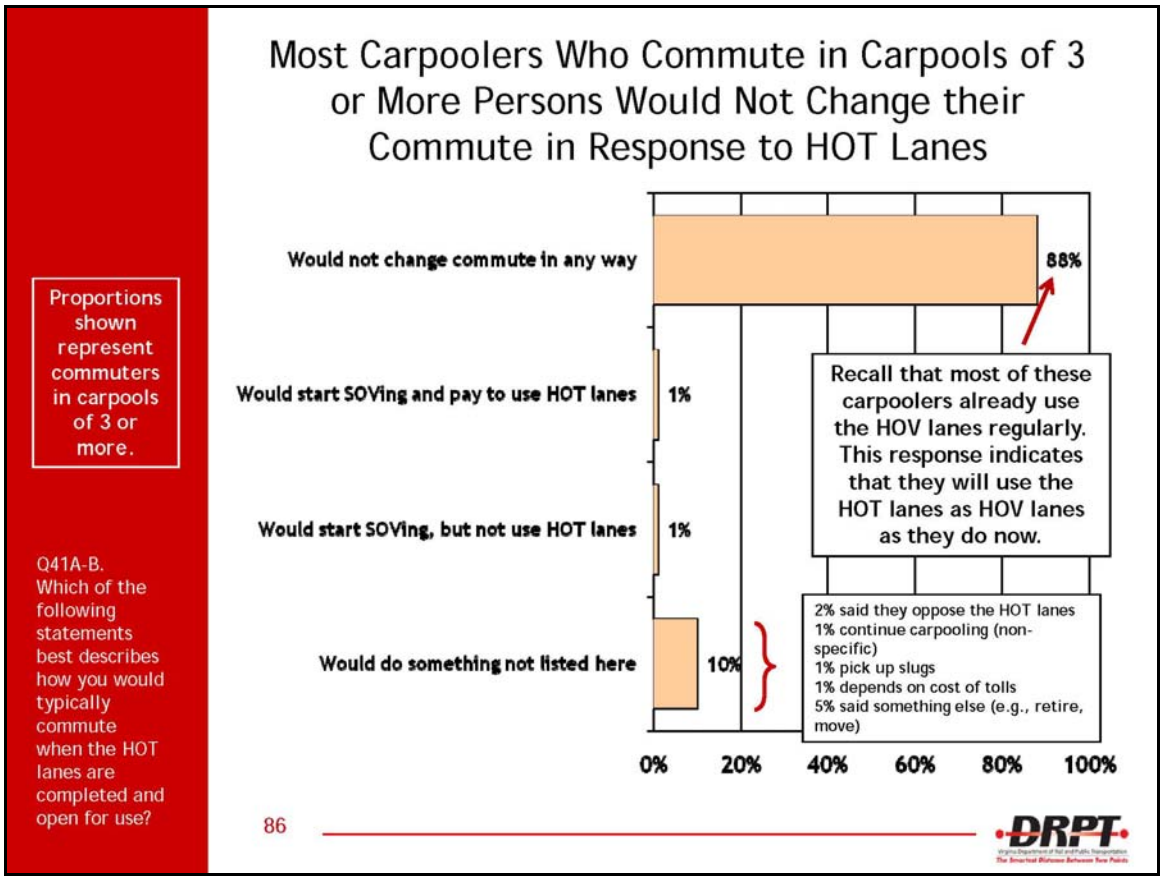
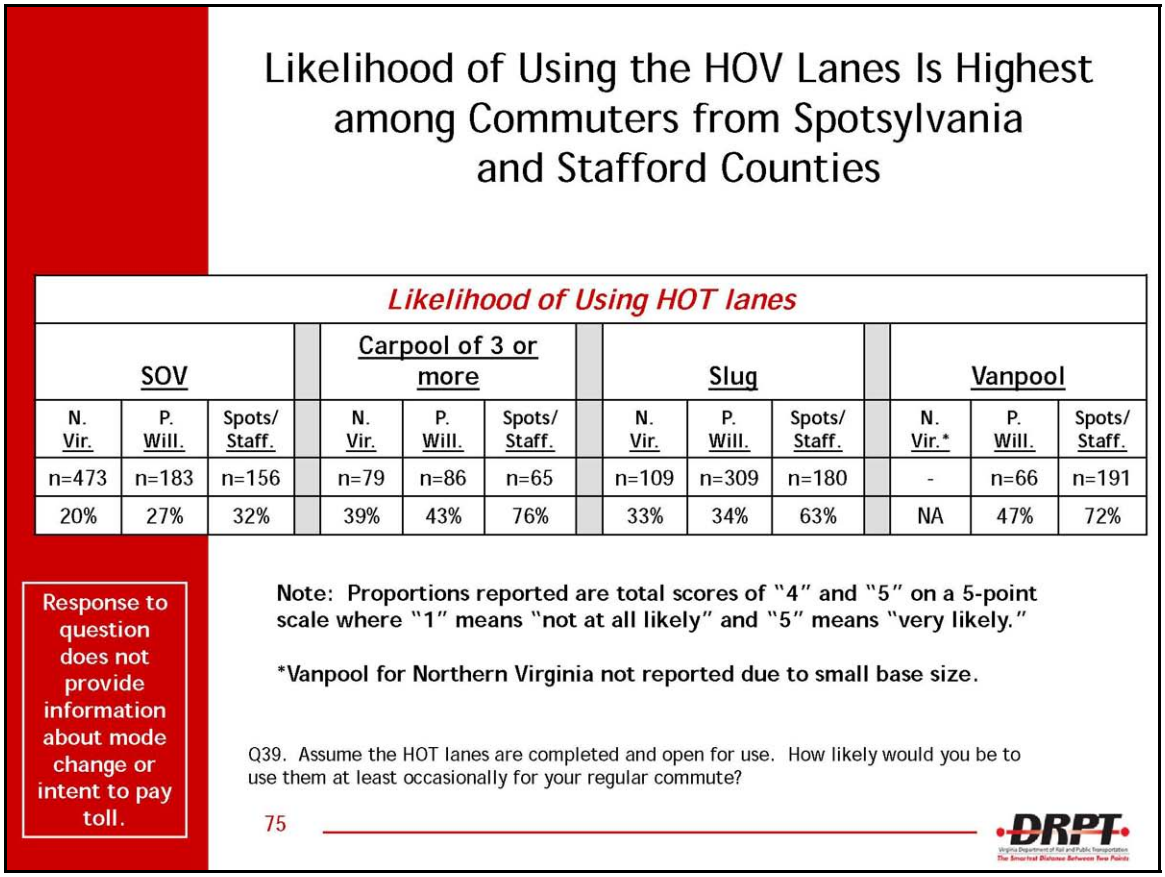


Figure 3-5. Stated HOT Lane Usage Intentions of Three-Person Carpoolers



Another finding from the survey is that the likelihood of using HOT lanes is highest among commuters who travel the farthest in the corridor (i.e., from Spotsylvania, Stratford, and Prince William Counties).

Figure 3-6. Likelihood of Using HOV Lanes



Likelihood of Using the HOV Lanes Is Highest among Commuters from Spotsylvania and Stafford Counties

Likelihood of Using HOT lanes

SOV			Carpool of 3 or more			Slug			Vanpool		
N. Vir.	P. Will.	Spots/ Staff.	N. Vir.	P. Will.	Spots/ Staff.	N. Vir.	P. Will.	Spots/ Staff.	N. Vir.*	P. Will.	Spots/ Staff.
n=473	n=183	n=156	n=79	n=86	n=65	n=109	n=309	n=180	-	n=66	n=191
20%	27%	32%	39%	43%	76%	33%	34%	63%	NA	47%	72%

Response to question does not provide information about mode change or intent to pay toll.

Note: Proportions reported are total scores of "4" and "5" on a 5-point scale where "1" means "not at all likely" and "5" means "very likely."

*Vanpool for Northern Virginia not reported due to small base size.

Q39. Assume the HOT lanes are completed and open for use. How likely would you be to use them at least occasionally for your regular commute?

75

DRPT

A detailed complete presentation of information on the survey, findings, and conclusions is presented in Appendix C.

3.3 Choice Experiment Background

As an important part of the HOT lane survey, a set of choice experiments were presented to each respondent. These experiments were designed to understand respondent's willingness to pay for the time savings associated with the HOT lanes and the propensity to switch modes in the face of a new choice option.

At the summary level, it was found that some SOV commuters (<30 percent) were willing to pay for the time savings associated with the HOT lanes, but the cost was a significant influence on this response. On the other hand, very few current non-SOV commuters (<10 percent) state an interest in switching to pay (including current slug drivers) even at lower prices. This finding suggests stability in the current transit and shared ride markets in the corridor and comports with findings suggested by the travel demand forecasting in Section 5.0.

For the choice experiments, each respondent was shown an amount of time savings, varying from 5 to 20 percent of their total travel time, and a randomly generated cost of $0.08/minute to $0.50/minute (shown to the respondent as a total cost, e.g., $4.50). For existing transit and shared ride users, the amount of time savings shown was capped so as not to be unrealistic.

Given the minutes saved and the total cost shown, respondents were asked to choose their mode of travel.

The choice options for current drive-alone respondents were: drive alone in the HOT lanes and pay the toll; switch to an HOV mode to use the HOT lanes for free; carpool with one other person and split the HOT lane toll; not change their behavior (continue to drive alone in the free lanes); or something else. Non-drive-alone respondents had the choices of driving alone and paying the HOT lane toll, driving alone in the free lanes, not changing their current mode, or something else. If a current drive-alone respondent said they would switch to an HOV mode, they were then asked to choose from the following list: carpool, become a slug driver, become a slug passenger, vanpool, ride the bus, ride a train, or other.

The survey results used in this analysis included 9,858 records, 3,835 of which were currently drive-alone respondents, and 6,023 currently non-drive-alone respondents. It should be noted that each respondent accounts for three or four records, depending on their current mode choice.

3.4 Choice Experiments Analysis

The following analysis considers all of the respondents from the choice survey exercises. Figure 3-7 shows the percentage of respondents who chose to pay the toll over all free modes at various levels of the price per minute of time savings. The price per minute of time savings was obtained by dividing the total time savings shown to the respondent by the total price shown. This was done to normalize the data in respect to travel time. In Figure 3-7, the "Not Pay" option includes all other mode choices, such as driving in the free lanes, transit, HOV 3+, etc. If a respondent currently uses a qualifying shared ride mode, a "Not Pay" choice would be to continue to use their current mode.

Figure 3-7 only shows the percentage of each price category choosing to pay, while Table 3-1 presents the percentage that each price category represents in the total population of survey respondents.

Table 3-1. Percentage of Survey Respondents in each Price Per Minute of Time Savings Category

	Price per Minute of Time Savings		
	<$0.21	**$0.21-0.35**	**$0.36-0.50**
Pay to Drive Alone	4.4%	2.9%	1.7%
Not Pay (Any Free Mode)	26.1%	33.0%	31.9%
Total	**30.5%**	**35.9%**	**33.6%**

Figure 3-8 shows the results of a binary choice model estimated from the survey data, which is the probability that a driver will choose to pay the toll to drive alone given the price per minute saved of time savings. As expected, there is a decrease in willingness to pay with the increased price per minute of time savings. The details of the binary choice model can be found in Table 3-2.

Figure 3-7. Percentage Choosing to Pay Based on the Price Per Minute of Time Savings

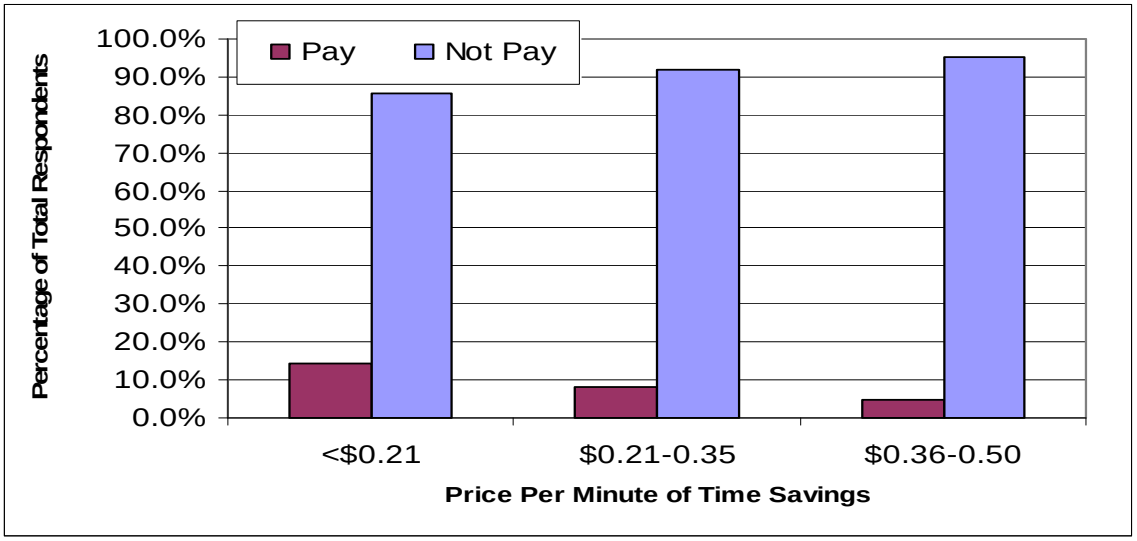


Figure 3-8. Probability of Paying Based on the Price Per Minute of Time Savings

Table 3-2. Probability of Paying at Price Per Minute of Time Savings – Binomial Logit Choice Model

Parameter	Estimate	Standard Error	T-Stat	Chi-Square
Intercept	-1.1921	0.0819	-14.56	211.7225
Benefit	-4.1519	0.3013	-13.78	189.9337

Tables 3-3 and 3-4 show the percentage of mode choice in each price per minute of time savings category relative to the total population of drive-alone survey respondents. Figures 3-8 and 3-9 differ in that they show the percentages of each mode choice in the price category relative to that price category only.

Table 3-3. Percentage of Current Drive-Alone Survey Respondents in Each New Mode Choice Category

	Price Per Minute of Time Savings		
	<$0.21	**$0.21-0.35**	**$0.36-0.50**
Drive Alone Free (General Lanes)	20.3%	25.8%	24.4%
HOT Free	2.9%	3.4%	2.3%
Split Toll (HOV-2)	1.0%	0.8%	0.8%
Drive Alone Pay (HOT Lanes)	8.7%	6.0%	3.5%
Total	**32.9%**	**36.1%**	**31.0%**

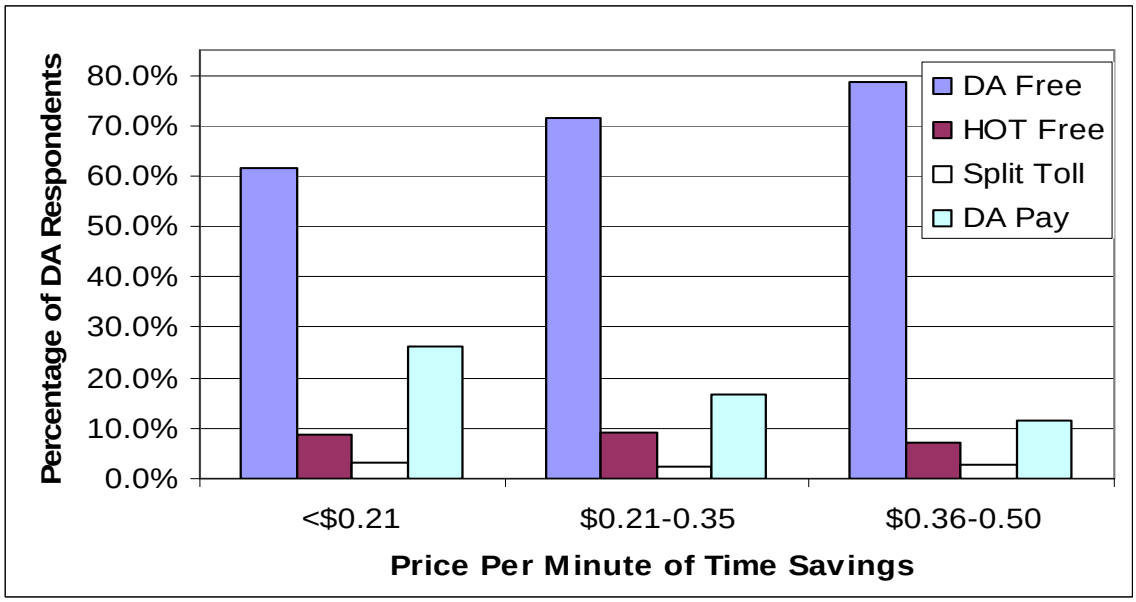
Table 3-4. Percentage of Current Non-Drive-Alone Survey Respondents in Each New Mode Choice Category

	Price Per Minute of Time Savings		
	<$0.21	**$0.21-0.35**	**$0.36-0.50**
Drive Alone Free (General Lanes)	0.6%	0.9%	0.9%
No Change	26.3%	33.6%	33.6%
Drive Alone Pay (HOT Lanes)	2.2%	1.3%	0.7%
Total	**29.1%**	**35.7%**	**35.1%**

Figures 3-9 and 3-10 show the survey results in terms of the respondents' future mode choice given the opening of the HOT lanes, split into currently drive-alone and currently non-drive-alone respondents, respectively, as they were shown different choices in the experiment. An interesting aspect of the drive-alone respondents is that a very small percentage of the respondents indicate they would switch to HOV-2 in order to split the toll price. Also of interest is that the percentage of drivers switching to pay for the HOT lanes relative to switching to an HOV mode is greater for

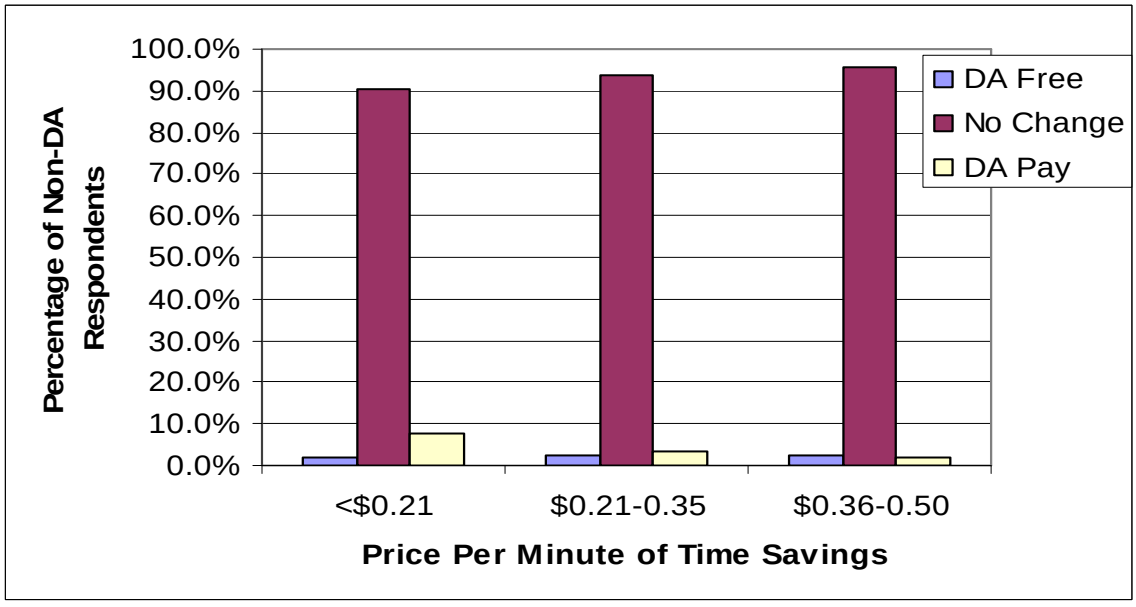
all price per minute time savings categories. Figure 3-10 indicates that most respondents who currently use a non-drive-alone mode will maintain their current non-drive-alone mode.

Figure 3-9. New Mode Choice of Current Drive-Alone Respondents Based on the Price Per Minute of Time Savings



Note: DA = Drive Alone

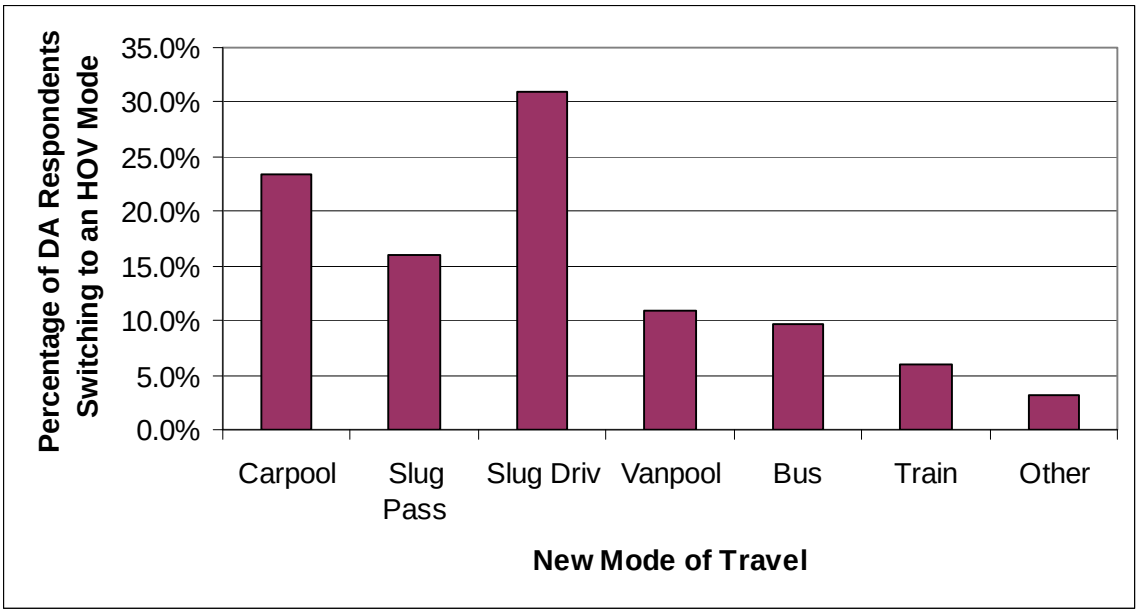
Figure 3-10. New Mode Choice of Current Non-Drive-Alone Respondents Based on the Price Per Minute of Time Savings



Note: DA = Drive Alone

Figure 3-11 displays the mode choice of current drive-alone respondents who chose an HOV mode. It should be noted that this is a small subset of the total respondents, accounting for 8.3 percent of drive-alone respondents and 3.2 percent of all respondents. According to the survey results, the largest switch is to slugging, with a combined total of 47 percent of those drive-alone respondents choosing to switch to an HOV mode.

Figure 3-11. Mode Choice of Current Drive-Alone Respondents Who Switch to an HOV Mode



3.5 Sources of Uncertainty

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. Some potential confounding influences at work in the survey responses could be that respondents chose "No Change" because they did not believe that their destination could be reached with the facility, or they did not believe that they could achieve the time savings presented to them. While information was presented to the respondents prior to the choice experiments pertaining to the toll lanes and their operation, it is impossible to control what other information or misinformation the respondent had previously received, which also could impact their response.

3.6 Appendix

The market research PowerPoint presentation appears in Appendix C, detailing the research methodology, findings, and conclusions.

4.0 Definition of Tiered Transit/TDM Alternatives

This section describes the tiered transit/TDM alternatives and refined alternatives for 2015 and 2030 and the process used to develop them. Broadly speaking, the development process consisted of a review and analysis of the market projections and planned transit improvements in the I-95/I-395 corridor.

4.1 Transit Alternative Framework

The development of alternatives was a detailed process that involved substantial coordination with and consensus among the TAC members. First, overall guiding objectives were established. Second, key assumptions and propositions were outlined. Third, the specific approach to defining the transit and TDM alternatives was set forward.

4.1.1 Goals and Objectives

The first stage of the alternatives definition process consisted of establishing the objectives that would be used to guide the overall process. The objectives that guided the definition and analysis of the transit/TDM alternatives are as follows:

- Preserve and increase the transit/HOV capacity, use, and operational efficiency in the managed lanes and in the corridor;
- Increase transit level of service through improvement of coverage in higher density areas and service improvements to major activity centers and destinations;
- Preserve transit and HOV ridership while implementing HOT lanes with the implementation of improvements that help maintain current market share for transit, carpools, and vanpools; and
- Utilize new HOT lane features to attract new transit and HOV riders by using a corridor management approach to improve existing service and serve new markets.

4.1.2 Key Assumptions

The second stage of the alternatives definition process involved determining the key assumptions and propositions that served as a framework for detailed definition and design of the three "tiered" alternatives. These included funding assumptions, proposed categories of alternatives, and considerations such as coordination with stakeholders. The resulting list of key propositions and assumptions that were agreed to included the following:

- Transit service improvements should be demand driven, i.e., alternatives should be built from existing service levels and used to meet forecasts of increased travel demand, with reference to adopted plans as appropriate; and should incorporate reasonable assumptions about cost increments and revenues;
- Investment levels committed from the earlier 2007 MWCOG I-95/I-395 HOT lanes project CLRP submittal represent a financial "placeholder" with respect to expanding/improving transit services. Transit services from this earlier submittal may or may not be incorporated into the specific transit plan proposed by this study;

- Alternatives will include, at a minimum, increments of additional cost/investment, incorporating the assumed I-95/I-395 HOT Lane Project contribution estimated at $195 million. The funding assumption was given by VDOT and the Fluor-Transurban team to the TAC. This is the amount of money projected to be available from the Project for additional transit/TDM projects;

- Assumptions about the availability of funding from specific Federal formula and discretionary programs should be arrived at and agreed to by the TAC independent of the earlier HOT lane MWCOG CLRP proposal, e.g., the likelihood of significant additional Federal discretionary funding over and above the amount that currently is committed to the region is an open question;

- Added increments of investment should be dedicated to improvements in publicly operated transit services and TDM services;

- Alternatives should be defined as those operating over major facilities in the corridor, e.g., I-95, I-395, I-495, U.S. 1, VRE, Metrorail, Amtrak, plus related feeder services;

- Where new access is proposed, a portion of projected investment should be considered to support related feeder services at major destinations, as appropriate;

- Funding related to the HOT lane project should be reserved for facility and system expansion directly related to service level increases associated with the project, i.e., this funding should not replace funds for projects or activities that already are planned or programmed;

- Alternatives should be defined to indicate changes in service levels by type of transit service and TDM programs, as well as by specific provider; and

- The design of service alternatives will be informed by stakeholder input and the results of survey data analysis.

The agreement of the TAC on these key propositions and assumptions for alternatives development permitted the detailed definition and design of the tiered alternatives to proceed.

4.1.3 Detailed Approach to Planning Transit/TDM Alternatives

The basic market of transit/TDM users in the corridor consists of commuters whose trip would benefit from HOT lane improvements. These commuters are primarily long-distance travelers from Fredericksburg, Stafford, Prince William, and Springfield who commute to the Washington, D.C./ Arlington core, but with the new egress locations along the facility some new markets also become important.

Existing transit services already provide reasonably good coverage in areas with large numbers of transit/HOV trips into the Washington, D.C./Arlington core. The tiered alternatives in this study were planned to enhance this coverage or the existing levels of service.

Table 4-1 summarizes potential transit service concepts by study subarea, which follow from existing conditions and plans as well as new transit opportunities created by the HOT Project, including new access points and new transit destinations.

Table 4-1. Potential Transit Service Concepts by Study Subarea

Area	New Transit Opportunities Created by HOT Project (New Access Points)	New Transit Markets/ Trip Destinations	Potential Transit Improvements Affecting the Subarea
Alexandria/ Arlington Areas	New transit opportunities may be created by adding access points to Seminary Road, Shirlington, and the HOT lanes on the beltway.	New transit markets will be opened up by creating new transit access to activity centers at Mark Center, Bailey's Crossroads, Skyline, Shirlington, Merrifield, and Tysons.	Serving Trips Originating in the Area: • Express bus services from the area into D.C. (new service or revision to existing WMATA service). Serving Destinations in the Area: • New PRTC or Fredericksburg/Stafford commuter services directly to these activity centers; and • Shuttle service from VRE/Metrorail/HOV commuter buses to new activity centers in Northern Virginia.
Springfield/ Fairfax Areas	New transit opportunities may be created by adding access points at Lorton, as well as the new access points in north.	New transit markets will be created with connections to Ft. Belvoir and the Engineer Proving Ground (EPG).	Serving Trips Originating in the Area: • New commuter bus services from the area into D.C./Arlington core – possibly neighborhood shuttles with express bus; and • Shuttle bus service from area to VRE for commutes to downtown Alexandria and/or D.C. Serving Destinations in the Area: • New PRTC or Fredericksburg/Stafford commuter service to Ft. Belvoir and/or EPG; • Shuttle bus service from Metrorail/VRE/Amtrak/HOV commuter buses to Ft. Belvoir and the EPG; and • Modifications to current PRTC or private commuter services to add commuter bus stops at t Ft. Belvoir.
Prince William Area	New transit opportunities may be created by adding access points at Route 123 and Potomac Mills/Dale Boulevard, as well as the access points north at Lorton and Alexandria/Arlington.	New transit markets will be created among northbound commuters from the Woodbridge/Dale City area, as well as among commuters from the south traveling to jobs in the Woodbridge/ Dale City activity center.	Serving Trips Originating in the Area: • Additional commuter bus services from the area into D.C./Arlington core – could be increased frequency on existing PRTC routes or new routes – continue concept of neighborhood shuttles with express bus. Serving Destinations in the Area: • New Fredericksburg/Stafford commuter service to Woodbridge/ Potomac Mills/Dale City.

Table 4-1. Potential Transit Service Concepts by Study Subarea (continued)

Area	New Transit Opportunities Created by HOT Project (New Access Points)	New Transit Markets/ Trip Destinations	Potential Transit Improvements Affecting the Subarea
Prince William Area (continued)			Service Both Trip Origins and Destinations: • Modifications to current PRTC or private commuter services to add commuter bus stops at the Route 123 and Potomac Mills access points; and • Shuttle service from VRE/Metrorail/HOV commuter buses to Woodbridge/Potomac Mills/Dale City.
Stafford and Fredericksburg Areas	Improvements to transit services will be created by adding access points in Garrisonville/Aquia and Fredericksburg.	The area has an unserved transit market for local bus services from the communities to the private commuter bus pick-up points (not necessarily attributable to HOT lanes).	Serving Trips Originating in the Area: • Modifications to current Martz/Quicks private commuter services to add commuter bus stops at new access points; • Additional commuter bus services from the area into D.C./Arlington core – could be increased frequency on existing Quicks/Martz or new routes; • Increased hours on FRED bus (span of service) to meet private commuter bus locations; • New neighborhood circulators to connect to VRE and/or private commuter buses to north; and • Extension of current Martz/Quicks private commuter routes to circulate in the neighborhoods.
Corridor-wide	All of Above	All of Above	• Enhanced TDM measures are needed throughout the region. Creation of new access points for car and van pools will improve these options; • Enhanced VRE/Amtrak; • Metrorail line extension to Potomac Mills; • BRT along Route 1; • In-line transit stations at major activity centers along the HOT lanes; and • Park-and-ride improvements to support transit/HOV.

4.2 Summary of Tiered Transit/TDM Alternatives

Three levels of investment were selected as target cost ceilings for the set of tiered transit/TDM alternatives, including: $250 million; $500 million; and unconstrained. With these limits in mind, the set of alternatives were detailed. In particular:

- To further promote carpooling and vanpooling (and slugging), additional TDM programs and services were proposed;
- Bus transit options currently are constrained by limitations in the access/egress points on HOV lanes. New access points accommodate new transit alternatives;
- Existing routes were revised to serve new markets, e.g., through minor changes to route alignments;
- New commuter and express bus services were created in the corridor;
- New local feeder bus service was proposed to connect commuters to VRE/Amtrak/Metrorail or commuter bus;
- New neighborhood circulators/shuttles with commuter bus were developed. These buses provide local bus service to residential neighborhoods then continue as commuter buses to Northern Virginia and Washington, D.C.; and
- Rail and other fixed facilities were created. Potential projects include the extension of Metrorail to Potomac Mills, enhancements to VRE/Amtrak, and BRT in-line transit stations at major activity centers along the HOT lanes (to allow buses to stop with minimal delay).

The process of developing the tiered transit/TDM alternatives was iterative. Qualitative assessments were performed with the help of the TAC to arrive at decisions as to the direction in which to take the alternatives. A detailed description of the elements of the final tiered transit/ TDM alternatives is presented in Table 4-2.

The final Baseline scenario consisted of the following elements:

- Existing transit/TDM service levels;
- CLRP programmed projects (2030); and
- Proposed HOT lane project improvements.

The Low Alternative scenario consisted of an approximate cost of $250 million, a 100 percent increase over existing bus service, and expanded VRE capacity. It was defined as the Baseline Scenario plus:

- Bus service modifications (frequency, routes);
- New express bus routes;
- VRE service improvements (eight-car trains in the peak, expand four-station platforms);
- Improved shuttle services, transit centers, stations, and park-and-ride facilities;
- TDM program improvements (marketing, signage, carpool/vanpool incentives, rideshare operational support); and

- Park-and-ride improvements.

The Medium Alternative scenario had an approximate cost of $500 million and represents a 145 percent increase over existing bus service, introduction of elements to bring a BRT system to the corridor, and a 45 percent increase in VRE service. It was defined as the Low Alternative scenario (which includes the Baseline improvements) plus:

- Bus Rapid Transit System (including five in-line stations);
- Increase VRE/Amtrak Fredericksburg Line trains (increase from 14 to 20 trains and increase storage);
- Three new transit centers;
- TDM improvements (vanpool/telework financial assistance, rideshare program operational support); and
- Park-and-ride improvements.

The High Alternative scenario had an unconstrained cost and represents a 145 percent increase over existing bus service, a 130 percent increase in VRE service, and a Metrorail extension. It was defined as the Medium-Alternative scenario (which includes the Low and Baseline improvements) plus:

- Metrorail extension (Franconia-Springfield to Potomac Mills Mall);
- Increase VRE/Amtrak Fredericksburg Line trains (increase from 20 to 32 trains, two new stations, storage);
- TDM improvements (vanpool financial assistance, statewide guaranteed ride home program, pilot facilitated rideshare system); and
- Park-and-ride improvements.

Table 4-2. Tiered Transit/TDM Alternatives

Tier	Originating Area	Operator	Description	Service Frequency/Span Assumptions
Service Modifications				
L	Arlington/ Alexandria/D.C.	WMATA	**WMATA 7B –** Decrease headway on 7B from 35 minutes to 17/18 minutes by adding one bus.	*Weekdays only – 6:12 a.m. to 8:50 a.m. and 4:32 p.m. to 7:17 p.m.*
L	Prince William	PRTC	**OmniRide North Route 1 –** Increase Frequency on OmniRide North Route 1 by adding additional trips in peak-period, one in midday and late evening.	*Weekdays only - add six additional trips per peak-period, one in midday and one in late evening. Assume each trip takes 100 revenue minutes.*
L	Prince William	PRTC	**OmniLink Route 1 –** Extend OmniLink Route 1 to Ft. Belvoir during peak periods.	*Weekdays only - Extends route seven miles – 4:00 a.m. runs and 4:00 p.m. runs would be extended. Assume 30 minutes additional revenue hours per run.*
L	Corridor-wide	VRE	**VRE Train Size –** Increase train size so three of the Fredericksburg trains have eight cars and four have six cars.	*Assumes VRE's planned expansion to 36 daily trains is funded and that the existing VRE locomotive fleet will be funded and in place by 2015 and the new locomotives are capable of pulling eight car consists. Also assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. Would not need additional overnight storage at Crossroads Yard/Fredericksburg or improvements for D.C. or overnight storage under this scenario.*
M	Arlington/ Alexandria/D.C.	ART	**ART 41 –** Add 5th bus to ART 41 on weekdays.	*Weekdays only - 6:30 a.m. to 8:30 p.m. Currently, every 15 minutes - increase to every 12 minutes.*
M	Prince William	PRTC	**PW MetroDirect –** Modify Prince William MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours.	*Weekdays only - involves eight peak trips (4:00 a.m. and 4:00 p.m.). 5:25 a.m. to 8:15 a.m. and 4:35 p.m. to 7:30 p.m. Assume an additional 30 minutes for circulation.*
M	Prince William	PRTC	**Dale City-Navy Yard –** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds two additional trips per peak-period.	*Weekdays, peak-period only - involves 12 peak trips (6:00 a.m. and 6:00 p.m.). 4:38 a.m. to 8:27 a.m. and 3:37a.m. to 8:00 p.m. Assume two additional trips per peak-period at 105 revenue minutes per trip.*

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

Table 4-2. Tiered Transit/TDM Alternatives (continued)

Tier	Originating Area	Operator	Description	Service Frequency/Span Assumptions
New Shuttle/Feeder Bus Services				
L	Fairfax/Springfield	Fairfax Connector	**Franconia-Springfield Metro-EPG-Ft. Belvoir Shuttle –** New shuttle service between the Springfield Metro-EPG/Ft. Belvoir via Franconia-Springfield Parkway and Fairfax County Parkway.	*Weekday peak only – 12-minute headways. Distance 15 miles/loop - 36 minutes per loop. Assume one vehicle. May need to adjust depending on access to base.*
L	Fairfax/Springfield	Fairfax Connector	**Lorton VRE-EPG-Ft. Belvoir Shuttle –** New "meet the train" shuttle or subscription service between the Lorton VRE Station-EPG/Ft. Belvoir via Telegraph Road, Fairfax County Parkway and Rolling Road/Pohick Road.	*Weekday peak only – timed to meet VRE/Amtrak trains to/from the south (6:00 a.m. and 6:00 p.m.). Distance seven to eight miles/loop – 15 minutes per loop. Assume one vehicle. May need to adjust depending on access to base.*
L	Stafford/ Fredericksburg	FRED	**FRED –** Increase Span of service and frequency on selected FRED routes to meet commuter bus - Routes 6, 2, 3, 7, 8, 11, 12, and 15. Extend some.	*Eight routes – three hours added each day.*
New Bus/Rail Services				
L	Arlington/ Alexandria/D.C.	ART	**Shirlington-Rosslyn –** New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area).	*Weekdays only – assumed 20-minute headways in peak only. Distance six miles – assume 20 minutes.*
L	Fairfax/Springfield	WMATA	**Lorton/Laurel Hill-EPG-Pentagon –** New express bus route from Lorton - EPG-Pentagon. Proposed at 15/30 minute headways in 2015 and 10/15 in 2030 – the route should serve EPG southbound in the morning and northbound in the evening.	*Weekdays only – assumed 15-minute headways in peak only (2015 proposal). Distance 15 miles – assume 45 minutes.*
L	Prince William	PRTC	**Dale City/Lake Ridge-EPG –** New OmniRide route from Dale City/Lake Ridge to EPG (BRAC EIS proposed 30-minute headway).	*Weekday 30-minute headways peak hour only. Distance 15 miles – assume 30 revenue minutes per trip.*
L	Prince William	PRTC	**Woodbridge-EPG –** New OmniRide route from Woodbridge to EPG (proposed 30-minute headway peak only).	*Weekday 30-minute headways peak hour only. Distance 10 miles – assume 20 revenue minutes per trip.*
L	Stafford/ Fredericksburg	FAMPO	**Fredericksburg-EPG/Ft. Belvoir –** New Express/BRT route from Fredericksburg to EPG and Ft. Belvoir.	*Weekday 30-minute headways peak hour only. Distance 40 miles – assume 1.5 revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

Table 4-2. Tiered Transit/TDM Alternatives (continued)

Tier	Originating Area	Operator	Description	Service Frequency/Span Assumptions
New Bus/Rail Services (continued)				
L	Stafford/ Fredericksburg	FAMPO	**Fredericksburg-D.C. –** New Express/BRT route from Fredericksburg to D.C. core (when combined with Massaponax, service would operate alternating 15 minutes).	*Weekday 30-minute headways peak hour only. Distance 55 miles – assume revenue hours per trip - 12 trips (6:00 a.m. and 6:00 p.m.).*
L	Stafford/ Fredericksburg	FAMPO	**Massaponax to D.C. –** New Express/BRT route from Massaponax to D.C. core (when combined with Fredericksburg-D.C. route, service would operate alternating 15 minutes).	*Weekday 30-minute headways peak hour only. Distance 60 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*
M	Fairfax/Springfield	WMATA	**Kingstowne-Shirlington-Pentagon –** New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria.	*Weekdays only – 30-minute headways all day – bidirectional.*
L M H	Prince William/Fairfax	PRTC	**Woodbridge-Lorton-Tysons Corner and Merrifield –** New OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons Corner. Extend to Merrifield in Medium – peak only.	*Weekdays peak hour only – 45-minute headway in Low; 30 minutes in Medium; and 20 minutes in High.*
M	Prince William	PRTC	**Central PW-Pentagon-D.C. –** New OmniRide Route to start near Hoadley Road, run express down PW Parkway to the HOV lanes - Pentagon and D.C.	*Peak hours only – 45-minute headways.*
M	Prince William	PRTC	**Central PW-Downtown Alexandria –** New route from Central Prince William County and along I-95 corridor then serving East Eisenhower Valley and Downtown Alexandria west of Washington Street.	*Weekday 45-minute headways peak hour only. Distance 20 miles – assume 45 revenue minutes per trip.*
M	Prince William	PRTC	**New OmniRide Express Route from Dale City to Seminary Road Area –** Skyline, Bailey's Crossroads and Mark Center via Seminary Road.	*Weekdays only – peak-period – 45-minute headways serving Seminary Road area – Mark Center, Skyline, and other nearby employment centers – assume four trips in each peak-period.*
M	Prince William	PRTC	**New OmniRide Express Route from Lake Ridge to Seminary Road Area –** Skyline, Bailey's Crossroads and Mark Center via Seminary Road.	*Weekdays only – peak-period – 45-minute headways serving Seminary Road area – Mark Center, Skyline, and other nearby employment centers – assume four trips in each peak-period.*

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

Table 4-2. Tiered Transit/TDM Alternatives (continued)

Tier	Originating Area	Operator	Description	Service Frequency/Span Assumptions
New Bus/Rail Services (continued)				
M	Stafford/ Fredericksburg	FAMPO	**Fredericksburg-Tysons Corner –** New express/BRT route from Fredericksburg to Tysons Corner.	*Weekday 30-minute headways peak hour only. Distance 55 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*
M	Stafford/ Fredericksburg	FAMPO	**Fredericksburg-Ballston/Rosslyn –** New Express/BRT route from Fredericksburg to Ballston/Rosslyn.	*Weekday 60-minute headways peak hour only.*
M	Stafford/ Fredericksburg	FAMPO	**Fredericksburg-Pentagon/Crystal City –** New Express/BRT route from Fredericksburg to Pentagon/Crystal City.	*Weekday 30-minute headways peak hour only. Distance 50 miles – assumed two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*
M	Corridor-wide	VRE/Amtrak	Increase number of VRE trains on the Fredericksburg Line from 14 to 20 per day (10 North/10 South). Assume mix of six- and eight-car trains.	*Assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. May need additional overnight storage at Crossroads Yard/Fredericksburg but would not need additional midday storage at D.C. under this consist mix scenario.*
H	Corridor-wide	VRE/Amtrak	Increase number of trains on Fredericksburg Line from 20 to 32 per day (16 North/16 South). Assume mix of six- and eight-car trains.	*Assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. Would also need additional overnight storage at Crossroads Yard/Fredericksburg and more midday storage in D.C.*
Fixed Facilities				
L	Arlington/ Alexandria/D.C.	WMATA	Improvements at **Pentagon Metrorail Transit Center** (additional bus bays, real-time information, traffic circulation/access/egress, security improvements).	
L	Fairfax/Springfield	Fairfax	Improvements at **Franconia-Springfield Metrorail Transit Center** (additional bus bays and bus canopies, real-time information, traffic circulation/access/egress, security improvements).	
L	Corridor-wide		**ITS projects** to improve integration of information on HOT lanes/parking lots/bus/rail – NEXT Bus.	
L	Corridor-wide		**Additional park-and-ride lot capacity** at various locations (new and/or existing lots).	

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

Table 4-2. Tiered Transit/TDM Alternatives (continued)

Tier	Originating Area	Operator	Description	Service Frequency/Span Assumptions
Fixed Facilities (continued)				
L M H	Corridor-wide	VRE	**Platform Extensions** at selected stations.	*In order for VRE to run eight-car trains, platforms at key stations should be extended – VRE estimate 4 stations needing platform improvements. Can have 8 car trains at short platforms but not optimum.*
M	Fairfax/Springfield	Fairfax	**Transit Center** near Ft. Belvoir/EPG.	
M	Fredericksburg	FAMPO	**Transit Center** at Route 610.	
M	Fredericksburg	FAMPO	**Transit Center** at Massaponax.	
M	Corridor-wide		**In line transit station**s considered along the corridor – four in-line stations included in cost.	*Suggested locations: Seminary Road vicinity, Lorton (included in HOT project cost rather than here), Prince William Parkway, VA Route 610, U.S. 17/ Warrenton.*
M	Corridor-wide	VRE	**Overnight Storage in Fredericksburg.**	*With the increase in trains to 20, VRE will need additional storage at Crossroads in Fredericksburg.*
H	Fairfax/Springfield	WMATA	**Metrorail Extension** from Springfield to Lorton/Ft. Belvoir.	
H	Fairfax/Springfield	WMATA	**Metrorail Extension** from Lorton/Ft. Belvoir to Potomac Mills Mall.	
H	Fredericksburg	VRE	**New VRE Station** at Route 17 in Spotsylvania County.	
H	Fredericksburg	VRE	**New VRE Station** at Widewater in Stafford County.	
H	Corridor-wide	VRE	**D.C. Midday Storage and Overnight Storage in Fredericksburg.**	*When beyond 20 trains a day, VRE will need additional storage capacity in D.C. and Fredericksburg to permit increased service frequency on existing routes.*
H	Corridor-wide	VRE	Other Capital Improvements.	*In order to increase VRE above 40 trains/day (both lines), additional improvements are needed; this is being studied/simulated by DRPT. Requirements unknown.*

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

Table 4-2. Tiered Transit/TDM Alternatives (continued)

Tier	Originating Area	Program	Description
TDM Program Elements			
L	Corridor-wide	**Carpool Incentives**	*Rewards and incentives for carpoolers.*
L	Corridor-wide	**Electronic Toll Transponders for Vanpools**	*Provide free electronic toll transponders to vanpools. (Although vanpools will use the toll lanes for free, this program is included in case some type of verification is needed to determine that the vehicle is a vanpool)*
L	Corridor-wide	**Rideshare Program Operational Support**	*Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.*
L	Corridor-wide	**TDM Programs Marketing**	*Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets. New signage in park-and-ride lots and along corridor to promote TDM programs.*
L	Corridor-wide	**Vanpool Driver Incentives**	*Provide incentives to get new drivers and retain existing drivers for vanpools.*
L	Corridor-wide	**Vanpool Insurance**	*Increase vanpool insurance premium pool buy-down for vanpools.*
L	Corridor-wide	**Vanpool Tracking**	*Provide free electronic toll transponders to vanpools.*
L	Corridor-wide	**VanStart/VanSave**	*Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats.*

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

Table 4-2. Tiered Transit/TDM Alternatives (continued)

Tier	Originating Area	Program	Description
TDM Program Elements (continued)			
M	Corridor-wide	**Capital Cost of Contracting for Vanpools**	*Incentives, IT monitoring and reporting of vanpool mileage, and promotion of capital cost of contracting for vanpools.*
M	Corridor-wide	**Telework Program Assistance**	*Financial incentives for employers that start new telework programs at their worksites, funding for home-based equipment costs and consulting support.*
H	Corridor-wide	**Capital Assistance For Vanpools**	*Provide financial assistance for the purchase or lease of vans for vanpools.*
H	Corridor-wide	**Enhanced Guaranteed Ride Home**	*Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday.*
H	Corridor-wide	**HOVER Pilot Program**	*HOVER is a facilitated "park and ride-share" system that involves tracking of all participants' usage, and sharing of costs and benefits through a combination of financial and "HOVER Ride Credit" accounts. Members earn credits for picking up passengers and passengers use their credits to ride. Ride credits are tracked electronically. A park-and-ride lot with 150-200 spaces is needed.*

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

4.3 Refined Alternative

The consultant team used the travel demand forecasting model to evaluate the relative performance of the service modifications and new services suggested as a part of the tiered alternatives. Results from the travel demand forecasting are presented in Section 5.0.

Based on the forecasting results, the TAC decided to develop a Refined Alternative that would incorporate the most promising projects while maintaining a program cost similar in magnitude to the original Medium Alternative. Table 4-3 provides a detailed description of the resulting Refined Alternative. The following sections provide some additional background on the formulation of the alternative.

4.3.1 Refining the Bus Service Elements

Bus service changes and new services were examined in terms of trips per revenue hour to help identify the most promising projects for the Refined Alternative. Services were categorized as poor, marginal, good, or high performers based on this metric. Bus services with fewer than 10 trips per hour were categorized as poor performers and were considered for elimination in the refined alternative. The following bus services fell under this category:

- Franconia-Springfield Metro to EPG/Ft. Belvoir (reverse commute);
- Fredericksburg Internal Shuttles;
- Fredericksburg to Tysons Corner; and
- Fredericksburg to Ballston/Rosslyn.

Bus services with 10 to 20 trips per hour were categorized as marginal performers and were considered for service cuts in the refined alternative. The following bus services fell under this category:

- In the Low Alternative, Woodbridge to Lorton to Tysons Corner (competes with other services along same route – consider operating to Merrifield even in the Low Alternative); and
- Fredericksburg to EPG/Ft. Belvoir (had 6 trips per peak, maybe reduce to 4 trips per peak, have selected Fredericksburg-Washington, D.C. runs stop at Ft. Belvoir, or reconsider with BRAC).

Services with 20 to 100 trips per hour were categorized as good performers and were retained in the refined alternative. The following services fell under this category:

- Lorton VRE-EPG/Ft. Belvoir Shuttle;
- Woodbridge to EPG;
- Dale City/Lake Ridge to EPG;
- Fredericksburg to Washington, D.C.;
- Massaponax to Washington, D.C.;
- Central Prince William County to Pentagon to Washington, D.C.;
- Dale City to Seminary Road area;
- Lake Ridge to Seminary Road area; and
- Fredericksburg to Pentagon/Crystal City.

Services with over 100 trips per hour were categorized as high performers and were retained in the refined alternative with a recommendation to consider increasing service. The following services fell under this category:

- Lorton/Laurel Hill to EPG to Pentagon;
- Kingstowne to Shirlington to Pentagon;
- Shirlington to Rosslyn;
- Central Prince William to Downtown Alexandria; and
- *In Medium and High Alternative* – Woodbridge to Lorton to Tysons Corner to Merrifield (extension to Merrifield opens new market and distinguishes it from other routes).

4.3.2 Refining the Rail Service and Other Elements

Service frequency improvements to VRE in the Medium and High Alternatives performed well (the model does not respond to changes in train capacity in the Low Alternative). The extension of Metrorail attracted riders, but primarily at the expense of competing bus and VRE service. Given the large investment required to realize a Metrorail extension, it was set aside for the current analysis. The High Alternative enhancements to VRE were similarly set aside due to cost considerations.

Table 4-3. Refined Alternative

Originating Area	Operator	Description	Service Frequency/Span Assumptions
Service Modifications			
Arlington/Alexandria/D.C.	ART	**ART 41** -Add 5th bus to ART 41 on weekdays.	*Weekdays only – 6:30 a.m. to 8:30 p.m. Currently, every 15 minutes – increase to every 12 minutes.*
Arlington/Alexandria/D.C.	WMATA	**WMATA 7B –** Decrease headway on 7B from 35 minutes to 17/18 minutes by adding one bus.	*Weekdays only – 6:12 a.m. to 8:50 a.m. and 4:32 p.m. to 7:17 p.m.*
Prince William	PRTC	**Dale City-Navy Yard –** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds two additional trips per peak-period.	*Weekdays, peak-period only – involves 12 peak trips (6:00 a.m. and 6:00 p.m.). 4:38 a.m. to 8:27 a.m. and 3:37 p.m. to 8:00 p.m. Assume two additional trips per peak-period at 105 revenue minutes per trip.*
Prince William	PRTC	**OmniRide North Route 1 –** Increase frequency on OmniRide North Route 1 by adding additional trips in peak-period, one in midday, and late evening.	*Weekdays only – add three additional trips per peak-period, one in midday and one in late evening. Assume each trip takes 100 revenue minutes.*
Prince William	PRTC	**OmniLink Route 1 –** Extend OmniLink Route 1 to Ft. Belvoir during peak periods.	*Weekdays only – Extends route 7 miles – 4:00 a.m. runs and 4:00 p.m. runs would be extended. Assume 30 minutes additional revenue hours per run.*
Prince William	PRTC	**PW MetroDirect –** Modify Prince William MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours.	*Weekdays only – involves eight peak trips (4:00 a.m. and 4:00 p.m.). 5:25 a.m. to 8:15 a.m. and 4:35 p.m. to 7:30 p.m. Assume an additional 30 minutes for circulation.*
Corridor-wide	VRE	**VRE Train Size –** Increase train size so three of the Fredericksburg trains have eight cars and four have six cars.	*Assumes VRE's planned expansion to 36 daily trains is funded and that the existing VRE locomotive fleet will be funded and in place by 2015 and the new locomotives are capable of pulling eight car consists. Also assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. Would not need additional overnight storage at Crossroads Yard/Fredericksburg or improvements for D.C. or overnight storage under this scenario.*

Table 4-3. Refined Alternative (continued)

Originating Area	Operator	Description	Service Frequency/Span Assumptions
New Shuttle/Feeder Bus Services			
Alexandria	Alexandria	**Seminary Road Shuttle –** New shuttle from Seminary Road In-line stations to jobs at Mark Center and Skyline.	*Weekday peak only – 15-minute headways. Distance three miles/loop – 15 minutes per loop. Assume one vehicle.*
Fairfax/Springfield	Fairfax Connector	**Franconia-Springfield Metro-EPG-Ft. Belvoir Shuttle –** New shuttle service between the Springfield Metro-EPG-Ft. Belvoir via Franconia-Springfield Parkway and Fairfax County Parkway.	*Weekday peak only – 12-minute headways. Distance 15 miles/loop – 36 minutes per loop. Assume three vehicles. May need to adjust depending on access to base.*
Fairfax/Springfield	Fairfax Connector	**Lorton VRE-EPG-Ft. Belvoir Shuttle –** New "meet the train" shuttle or subscription service between the Lorton VRE Station-EPG/Ft. Belvoir via Telegraph Road, Fairfax County Parkway and Rolling Road/Pohick Road.	*Weekday peak only – timed to meet VRE/Amtrak trains to/from the south (6:00 a.m. and 6:00 p.m.). Distance seven to eight miles/loop – 15 minutes per loop. Assume two vehicles. May need to adjust depending on access to base.*
New Bus/Rail Services			
Arlington/Alexandria/D.C.	ART	**Shirlington-Rossyln –** New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area).	*Weekdays only – assumed 20-minute headways in peak only. Distance six miles – assume 20 minutes.*
Fairfax/Springfield	WMATA	**Kingstowne-Shirlington-Pentagon –** New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria.	*Weekdays only but all day – 30-minute headways offpeak and 20-minute headways in peak – bidirectional.*
Fairfax/Springfield	WMATA	**Lorton/Laurel Hill –EPG-Pentagon –** New express bus route from Lorton – EPG-Pentagon. Proposed at 15/30-minute headways in 2015 and 10/15 in 2030 – comment that the route should serve EPG southbound in the morning and northbound in the evening.	*Weekdays only – assumed 10-minute headways in peak only. Distance 15 miles – assume 45 minutes.*
Prince William/Fairfax	PRTC	**Woodbridge-Lorton-Tysons and Merrifield –** New OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons to Merrifield.	*Weekdays peak hour only – 30-minute headways.*
Prince William	PRTC	**Central PW-Downtown Alexandria –** New route from Central Prince William County and along I-95 corridor then serving East Eisenhower Valley and Downtown Alexandria west of Washington Street.	*Weekday 30-minute headways peak hour only. Distance 20 miles – assume 45 revenue minutes per trip.*

Table 4-3. Refined Alternative (continued)

Originating Area	Operator	Description	Service Frequency/Span Assumptions
New Bus/Rail Services (continued)			
Prince William	PRTC	**Central PW-Pentagon-D.C. –** New OmniRide Route to start near Hoadley Rd, run express down PW Parkway to the HOV lanes – Pentagon and D.C.	*Peak hours only – 45-minute headways.*
Prince William	PRTC	**Dale City/Lake Ridge-EPG –** New OmniRide route from Dale City/Lake Ridge to EPG (BRAC EIS proposed 30-minute headway).	*Weekday 30-minute headways peak hour only. Distance miles -15 miles – assume 30 revenue minutes per trip.*
Prince William	PRTC	**Dale City to Seminary Road Area-** New OmniRide Express Route from Dale City to Skyline, Bailey's Crossroads and Mark Center via Seminary Road.	*Weekdays only – peak-period – 45-minute headways serving Seminary Rd area – Mark Center, Skyline and other nearby employment centers – assume four trips in each peak-period.*
Prince William	PRTC	**Lake Ridge to Seminary Road Area –** New OmniRide Express Route from Lake Ridge to Skyline, Bailey's Crossroads and Mark Center via Seminary Road.	*Weekdays only – peak-period – 45-minute headways serving Seminary Rd area – Mark Center, Skyline and other nearby employment centers – assume four trips in each peak-period.*
Prince William	PRTC	**Woodbridge-EPG –** New OmniRide route from Woodbridge to EPG (proposed 30-minute headway peak only).	*Weekday 30-minute headways peak hour only. Distance 10 miles – assume 20 revenue minutes per trip.*
Stafford/ Fredericksburg	FAMPO	**Fredericksburg-D.C. –** New Express/BRT route from Fredericksburg to D.C. core (when combined with Massaponax, service would operate alternating 15 minutes).	*Weekday 30-minute headways peak hour only. Distance 55 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*
Stafford/ Fredericksburg	FAMPO	**Fredericksburg-EPG/Ft. Belvoir –** New Express/BRT route from Fredericksburg to EPG and Ft. Belvoir.	*Weekday 30-minute headways peak hour only. Distance 40 miles – assume 1.5 revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*
Stafford/ Fredericksburg	FAMPO	**Fredericksburg-Pentagon/Crystal City –** New Express/ BRT route from Fredericksburg to Pentagon/Crystal City.	*Weekday 30-minute headways peak hour only. Distance 50 miles – assumed two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*
Stafford/ Fredericksburg	FAMPO	**Fredericksburg-Tysons Corner-Merrifield** – Extension of the new Woodbridge-Lorton-Tysons-Merrifield route-OmniRide express route from East PW to new Lorton VRE easy on/off to Tysons to Merrifield.	*Weekday 30-minute headways peak hour only – included as an extension of the Prince William-Tysons-Merrifield route. Distance 55 miles – 12 trips (6:00 a.m. and 6:00 p.m.). Could be run with transfer at Lorton rather than non-express through Woodbridge.*
Stafford/ Fredericksburg	FAMPO	**Massaponax to D.C.** – New Express/BRT route from Massaponax to D.C. core (when combined with Fredericksburg-D.C. route, service would operate alternating 15 minutes).	*Weekday 30-minute headways peak hour only. Distance 60 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).*
Corridor-wide	VRE/Amtrak	Increase number of VRE trains on the Fredericksburg Line from 14 to 20 per day (10 North/10 South). Assume mix of six and eight car trains.	*Assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. May need additional overnight storage at Crossroads Yard/Fredericksburg but would not need additional midday storage at D.C. under this consist mix scenario.*

Table 4-3. Refined Alternative (continued)

Originating Area	Operator	Description	Service Frequency/Span Assumptions
Fixed Facilities			
Arlington/Alexandria/D.C.	WMATA	Improvements at **Pentagon Metrorail Transit Center** (additional bus bays, real-time information, traffic circulation/access/egress, security improvements).	
Fairfax/Springfield	Fairfax	Improvements at **Franconia-Springfield Metrorail Transit Center** (additional bus bays and bus canopies, real-time information, traffic circulation/access/egress, security improvements).	
Fairfax/Springfield	Fairfax	**Transit Cente**r near Ft. Belvoir/EPG.	
Fredericksburg	FAMPO	**Transit Center** at Massaponax.	
Fredericksburg	FAMPO	**Transit Center** at Route 610.	
Corridor-wide		**Additional park-and-ride lot capacity** at various locations (new and/or existing lots).	
Corridor-wide		**In line transit station**s considered along the corridor – four in-line stations included in cost.	*Suggested locations: Seminary Road vicinity, Lorton (included in HOT project cost rather than here), Prince William Parkway, VA Route 610, U.S. 17/Warrenton.*
Corridor-wide		**ITS projects** to improve integration of information on HOT lanes/parking lots/bus/rail – NEXT Bus.	
Corridor-wide	VRE	**Overnight Storage in Fredericksburg.**	*With the increase in trains to 20, VRE will need additional storage at Crossroads in Fredericksburg.*
Corridor-wide	VRE	**Platform Extensions** at selected stations.	*In order for VRE to run eight-car trains, platforms at key stations should be extended – VRE estimate four stations needing platform improvements. Can have eight-car trains at short platforms but not optimum.*

Table 4-3. Refined Alternative (continued)

Originating Area	Program	Description
TDM Program Elements		
Corridor-wide	**Capital Assistance For Vanpools**	*Provide financial assistance for the purchase or lease of vans for vanpools. Incentives, IT monitoring and reporting of vanpool mileage, and promotion of capital cost of contracting for vanpools. Provide free electronic toll transponders to vanpools.*
Corridor-wide	**Carpool Incentives**	*Rewards and incentives for carpoolers.*
Corridor-wide	**Electronic Toll Transponders for Vanpools**	*Provide free electronic toll transponders to vanpools. (Although vanpools will use the toll lanes for free, this program is included in case some type of verification is needed to determine that the vehicle is a vanpool)*
Corridor-wide	**Enhanced Guaranteed Ride Home**	*Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday.*
Corridor-wide	**HOVER Pilot Program**	*HOVER is a facilitated "park and ride-share" system that involves tracking of all participants' usage, and sharing of costs and benefits through a combination of financial and "HOVER Ride Credit" accounts. Members earn credits for picking up passengers and passengers use their credits to ride. Ride credits are tracked electronically. A park-and-ride lot with 150 – 200 spaces is needed.*
Corridor-wide	**Rideshare Program Operational Support**	*Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.*
Corridor-wide	**TDM Programs Marketing**	*Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets. New signage in park-and-ride lots and along corridor to promote TDM programs.*

Table 4-3. Refined Alternative (continued)

Originating Area	Description	Service Frequency/Span Assumptions
TDM Program Elements (continued)		
Corridor-wide	**Telework Program Assistance**	*Financial incentives for employers that start new telework programs at their worksites, funding for home-based equipment costs and consulting support.*
Corridor-wide	**Vanpool Driver Incentives**	*Provide incentives to get new drivers and retain existing drivers for vanpools.*
Corridor-wide	**Vanpool Insurance**	*Increase vanpool insurance premium pool buy-down for vanpools.*
Corridor-wide	**VanStart/VanSave**	*Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats.*

5.0 Travel Demand Forecasts

This section presents the results of the travel demand forecast for the I-95/I-395 Transit/TDM Study as well as a brief overview of the methodology. The travel demand forecasting effort for this analysis focuses on two design years and four scenarios comprised of a baseline scenario and three build alternatives. In addition, a final refined alternative and two other sensitivity alternatives were tested. As described in Section 2.0, the baseline scenario represents the existing network, the proposed HOT facilities, and other planned facilities, services, and programs identified in the CLRP or by the TAC. The alternatives were evaluated for years 2015 and 2030.

The travel demand forecast estimated demand for usage of motorized modes, including low-occupancy vehicles with one or two occupants (LOV), high-occupancy vehicles with three or more occupants (HOV), commuter rail passengers, heavy rail passengers, bus passengers, and bus to rail passengers. The forecasts were used to analyze and refine a set of comprehensive transit and TDM measures.

The travel demand forecast model being applied for this project was the adopted and approved MWCOG regional travel demand forecast model set Version 2.1D#50. It covers the entire metropolitan region and at the time of this study it was the current model set adopted for conformity analysis.

As a post-process to the Version 2.1D#50 model, the study applied two additional exclusive steps. The first step was the application of a post-process nested-logit mode choice model. This is a model developed for the Washington Metropolitan Area Transit Authority (WMATA) for application to the MWCOG model results. It is being used similarly on other studies in the region and is slated to be incorporated into the next version of the MWCOG travel demand forecast model, Version 2.3. The chief benefit of the post-process mode choice model is that it more precisely examines submode choices, including access choice and specific transit mode choices.

The second post-process used was a subzone highway assignment. This was done to improve the accuracy of the highway forecast for zones in the southern boundary area of the MWCOG model network. The model network has less detail at the boundaries. We applied the Fredericksburg Area Metropolitan Planning Organization (FAMPO) zone structure in the southern boundary area to improve the accuracy of the highway assignment and obtain more accurate highway congested travel impedances.

In addition to these two post-processors, the study had two additional post-processors that ran as supplements: 1) a park-and-ride lot demand forecasting tool; and 2) a TDM analysis framework. These tools utilized outputs from the regional forecasting tool as inputs, and were applied with feedback to the regional forecasting tool for purposes of interpreting results.

5.1 Regional Forecasting Tool Details

The MWCOG travel demand forecast model uses a series of submodels or steps to forecast potential travel demand given the future land use and transportation networks. The regional transportation options are represented in terms of a network. The network represents all of the transportation services and infrastructure. This network includes transit and highway facilities. The Washington metropolitan area is divided into 2,191 traffic analysis zones (TAZ). In the more densely populated areas there are a greater number of TAZs and in less dense areas the TAZs are larger. At the boundaries of the modeled areas the TAZs are larger and the highway network is less detailed. In the primary modeled jurisdictions, the highway network is more detailed and the corresponding number of TAZs is greater.

5.2 Results of Baseline and Tiered Transit/TDM Alternative Analysis

The project and service elements of each of the tiered transit/TDM alternatives were represented in the inputs for the travel demand forecasting tools. The models were applied for horizon years 2015 and 2030. The following section provides an overview of these forecasts.

Table 5-1 presents the aggregate demand, high-level mode choice for each alternative (High, Medium, and Low) for 2015 and 2030. The results show an increase in total work trips in the study corridor of 24 percent from year 2000 to year 2015 and 42 percent from year 2000 to year 2030. Regionally there is a 26 percent increase for year 2015 and a 44 percent increase for year 2030, which corresponds to the corridor results.

Overall, for work trips in the corridor, the mode shares remain approximately unchanged with HOV around 6 percent, transit around 33 percent, and LOV around 60 percent. The land use patterns and highway network in the area have encouraged the current patterns and these patterns are forecast to continue given the proposed future land use and infrastructure in the corridor. Specifically, many new jobs are expected to locate in areas that are outside of the current core and that are currently outside existing transit service markets.

For usage of specific modes in the study corridor, there is an increase of approximately 19 percent for HOV, 15 percent for transit, and 30 percent for LOV from year 2000 to year 2015. For year 2030 the approximate increase in HOV from the base year is the same as in year 2015. Even though the number of HOV trips is fairly constant between years 2015 and 2030, the markets and travel sheds change from 2015 to 2030. There is a 30 percent increase in transit trips from year 2000 to year 2030 for the corridor and a 53 percent increase in LOV home-based work trips from year 2000 to year 2030. The introduction of additional direct-to-destination bus services is partially responsible for the dampening of Metrorail ridership in several 2030 scenarios. The large investment in the High Alternative results in only a small increase in transit mode share as compared to the other investment levels.

Table 5-1. Mode Choice Model Results (Post-Processor) for Tiered Alternatives

Home-Based Work Trips

Mode	2000	2015 BSL	2015 LO	2015 MED	2015 HI	2030 BSL	2030 LO	2030 MED	2030 HI
Study Area									
LOV	520,791	678,819	677,677	675,319	673,042	795,818	794,583	789,992	791,018
TRN	317,851	365,902	367,134	368,285	370,338	412,418	414,002	414,822	418,378
HOV	61,668	73,437	72,949	72,573	71,725	73,003	72,881	72,680	71,837
Total	**900,310**	**1,118,158**	**1,117,760**	**1,116,177**	**1,115,105**	**1,281,239**	**1,281,466**	**1,277,494**	**1,281,233**
LOV	57.8%	60.7%	60.6%	60.5%	60.4%	62.1%	62.0%	61.8%	61.7%
TRN	35.3%	32.7%	32.8%	33.0%	33.2%	32.2%	32.3%	32.5%	32.7%
HOV	6.8%	6.6%	6.5%	6.5%	6.4%	5.7%	5.7%	5.7%	5.6%
Study Area to Core									
LOV	100,442	115,674	115,216	114,594	113,372	116,553	116,187	115,660	114,850
TRN	225,176	248,867	249,492	249,968	251,220	274,330	275,201	275,246	277,377
HOV	33,597	40,299	39,863	39,558	38,758	36,394	36,284	36,062	35,301
Total	**359,215**	**404,840**	**404,571**	**404,120**	**403,350**	**427,277**	**427,672**	**426,968**	**427,528**
LOV	28.0%	28.6%	28.5%	28.4%	28.1%	27.3%	27.2%	27.1%	26.9%
TRN	62.7%	61.5%	61.7%	61.9%	62.3%	64.2%	64.3%	64.5%	64.9%
HOV	9.4%	10.0%	9.9%	9.8%	9.6%	8.5%	8.5%	8.4%	8.3%

Modes
LOV Low-occupancy vehicle (less than three occupants)
TRN Transit
HOV High-occupancy vehicle (three or more occupants)

Table 5-2 shows the output from the WMATA Post-Processor model for the submodes. These are home-based work trips. The submodes are motor bus (MB), Metrorail or heavy rail (HR), commuter rail (CR), and motor bus to Metrorail (MB-HR).

The submode choice results by alternative show that where transit service was increased the mode usage increased. In the High Alternative, Metrorail was extended to serve Lorton and Potomac Mills. This new service competed with the commuter rail service and, in this alternative, Metrorail mode share increased while commuter rail mode share decreased. That is, extending Metrorail to Potomac Mills appears to redistribute transit users among different modes rather than increasing transit usage. It can also be noted that bus has a large share of the trips in the corridor, but it also represents the bulk of the transit service provided in the corridor. Commuter rail has the lowest mode share but also the least amount of service provided.

Table 5-2. Mode Choice Model Results (Post-Processor) for Tiered Alternatives

Home-Based Work Trips Submode Level

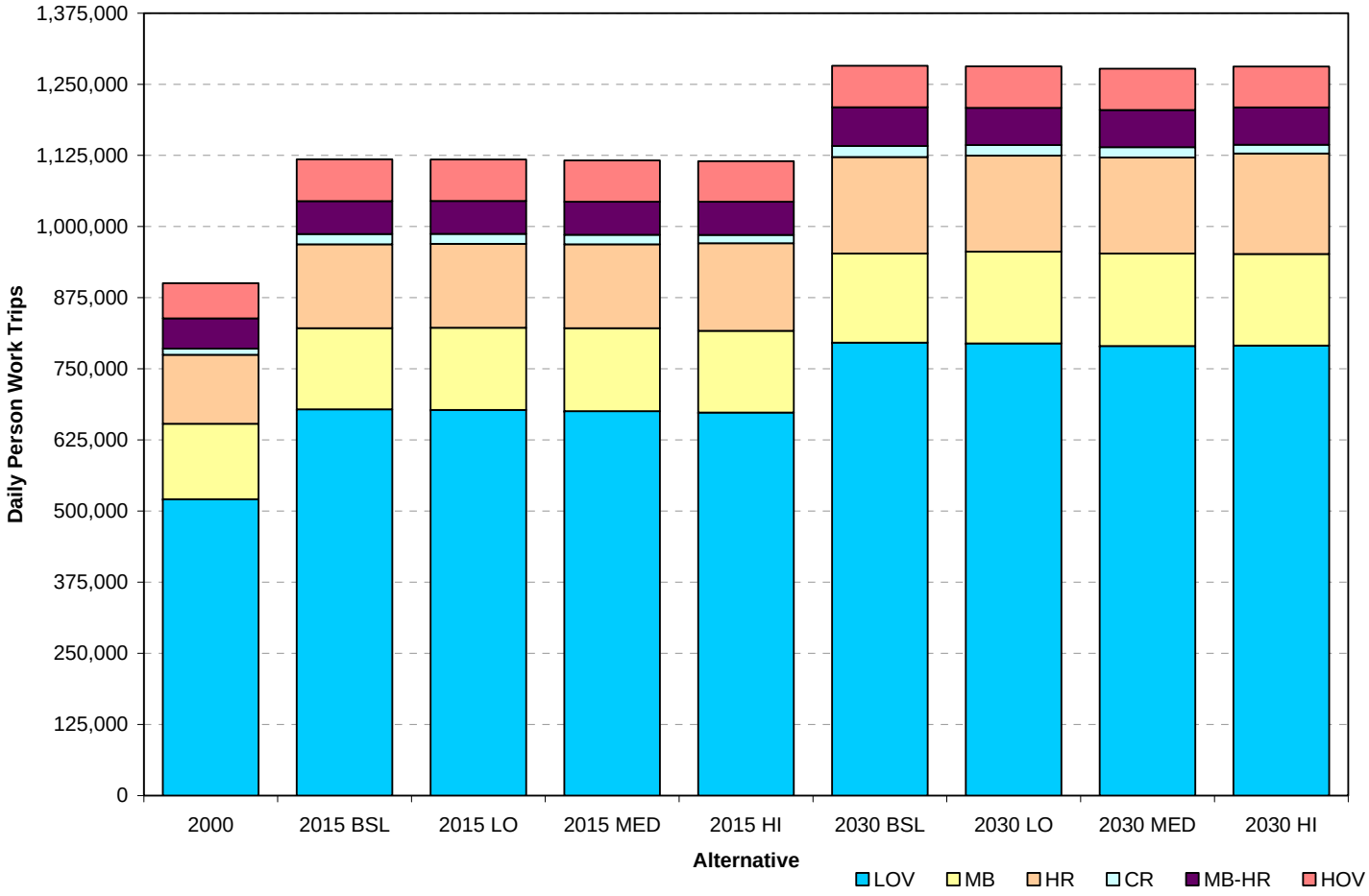
Mode	2000	2015 BSL	2015 LO	2015 MED	2015 HI	2030 BSL	2030 LO	2030 MED	2030 HI
Study Area									
MB	132,595	142,409	144,551	146,002	143,766	156,921	161,309	162,649	160,784
HR	121,407	147,525	147,469	147,327	153,988	169,374	168,640	168,672	176,414
CR	10,561	18,009	17,365	16,985	14,660	19,360	18,678	18,069	15,559
MB-HR	53,264	57,958	57,734	57,946	57,899	68,162	65,352	65,406	65,590
MB	42%	39%	39%	40%	39%	38%	39%	39%	38%
HR	38%	40%	40%	40%	42%	41%	41%	41%	42%
CR	3%	5%	5%	5%	4%	5%	5%	4%	4%
MB-HR	17%	16%	16%	16%	16%	16%	16%	16%	16%
Study Area to Core									
MB	75,964	76,389	77,715	78,170	76,334	81,438	83,974	84,038	82,449
HR	102,194	118,507	118,433	118,420	123,628	133,616	133,150	133,281	139,109
CR	8,299	14,198	13,707	13,431	11,432	14,732	14,244	13,842	11,718
MB-HR	38,715	39,776	39,636	39,940	39,825	45,350	43,834	44,079	44,099
MB	34%	31%	31%	31%	30%	30%	31%	31%	30%
HR	45%	48%	47%	47%	49%	49%	48%	48%	50%
CR	4%	6%	5%	5%	5%	5%	5%	5%	4%
MB-HR	17%	16%	16%	16%	16%	16%	16%	16%	16%

Transit Mode

MB Motor Bus
HR Heavy Rail (Metrorail)
CR Commuter Rail (VRE)
MB-HR Motor Bus to Heavy Rail

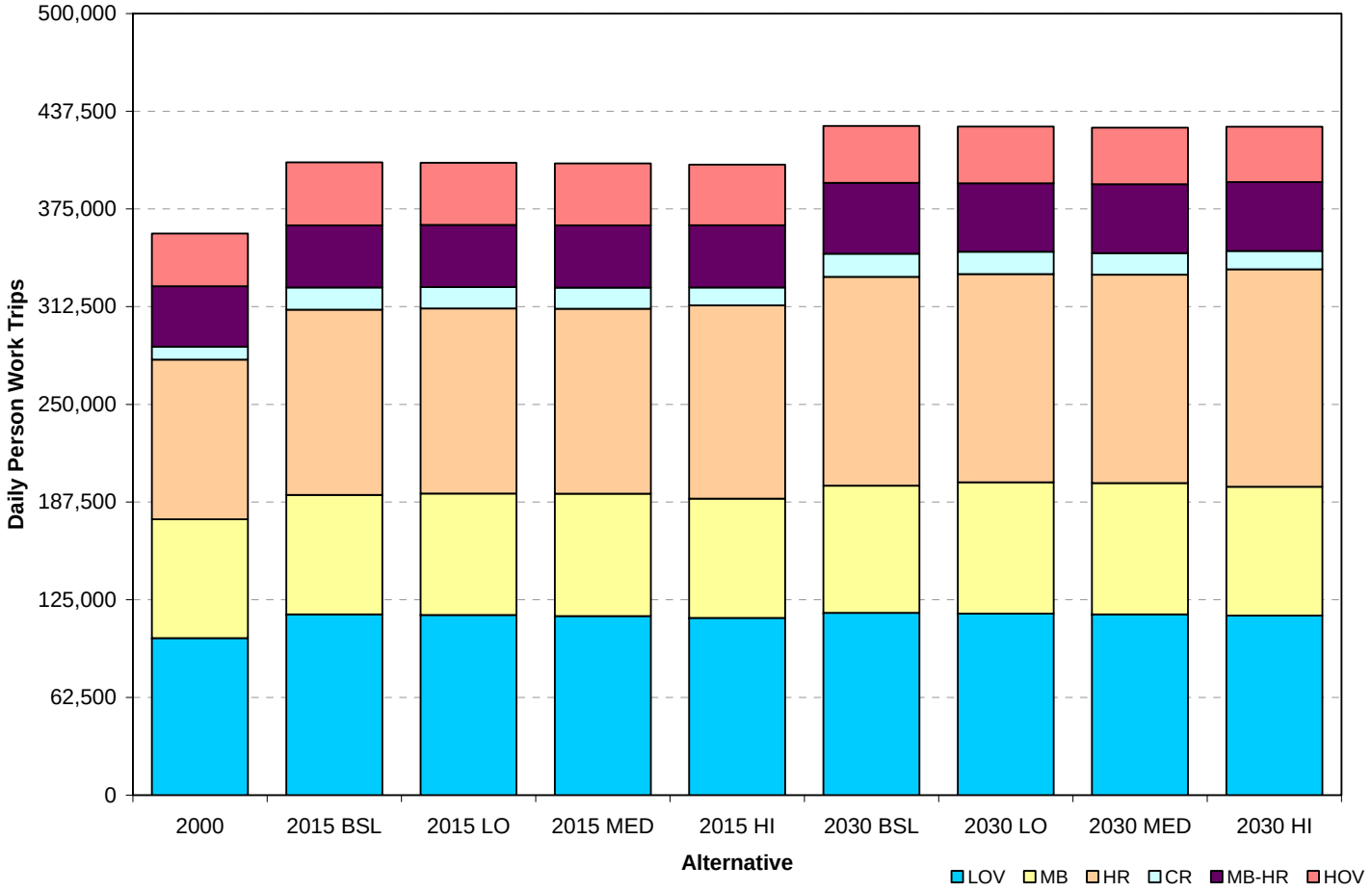
Figures 5-1 through 5-2 graphically represent the data included in the tables. These charts highlight the results and show that there are small percentage changes in primary mode choice among the alternatives on a study area and study-area-to-the-core basis. These small changes in mode choice are due to the fact that the corridor has very robust transit service and high HOV patronage under the existing conditions. Most of the differences in performance among the proposed alternatives are in submode choice (i.e., shifts among bus (MB), Metrorail (HR), and commuter rail (CR)).

Figure 5-1. Corridor Mode Share – Tiered Alternatives



LOV – Low-occupancy vehicle
MB – Motor bus
HR – Metrorail or heavy rail
CR – Commuter rail
MB-HR – Motor bus to Metrorail
HOV – High-occupancy vehicle
BSL – Baseline
LO – Low
MED – Medium
HI – High

Figure 5-2. Corridor Mode Share to Core – Tiered Alternatives



LOV – Low-occupancy vehicle
MB – Motor bus
HR – Metrorail or heavy rail
CR – Commuter rail
MB-HR – Motor bus to Metrorail
HOV – High-occupancy vehicle
BSL – Baseline
LO – Low
MED – Medium
HI – High

Table 5-3 gives the assignment summary for home-based work trips in the AM peak period in the northbound direction only based on the gross model results at two locations: Crossing the Beltway (I-495) and Crossing Glebe Road. These screenlines provide a snapshot of the transit ridership in the corridor. Outside the Beltway HOV carries the bulk of the person work trips northbound, while inside the Beltway the person trips are more equally distributed among transit modes and HOV. This could be a function of the quality of service and the increase of bus service inside the Beltway. Commuter rail carries the smallest number of people but also has less service than other modes.

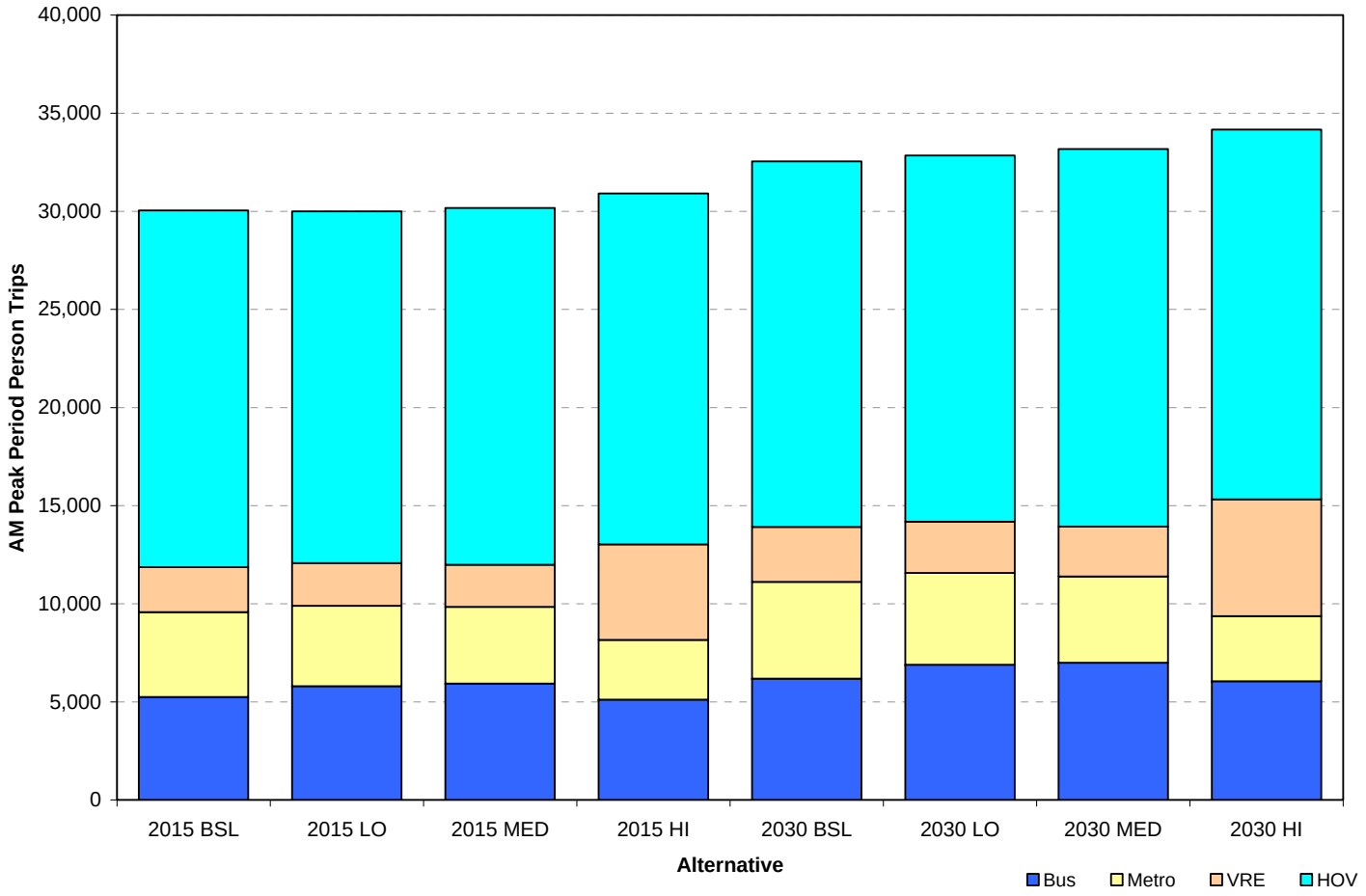
Figures 5-3 and 5-4 provide a graphical illustration of the differences in transit usage among alternatives at the same screenlines. The table and figures help illustrate, for example, that in the High Alternative (which includes an extension of Metrorail to Potomac Mills Mall) Metrorail ridership comes, in part, from competing bus transit and commuter rail transit modes.

Table 5-3. Assignment Summary for Tiered Alternatives

Home-Based Work AM Peak Period Northbound Trips (Gross Model Results)

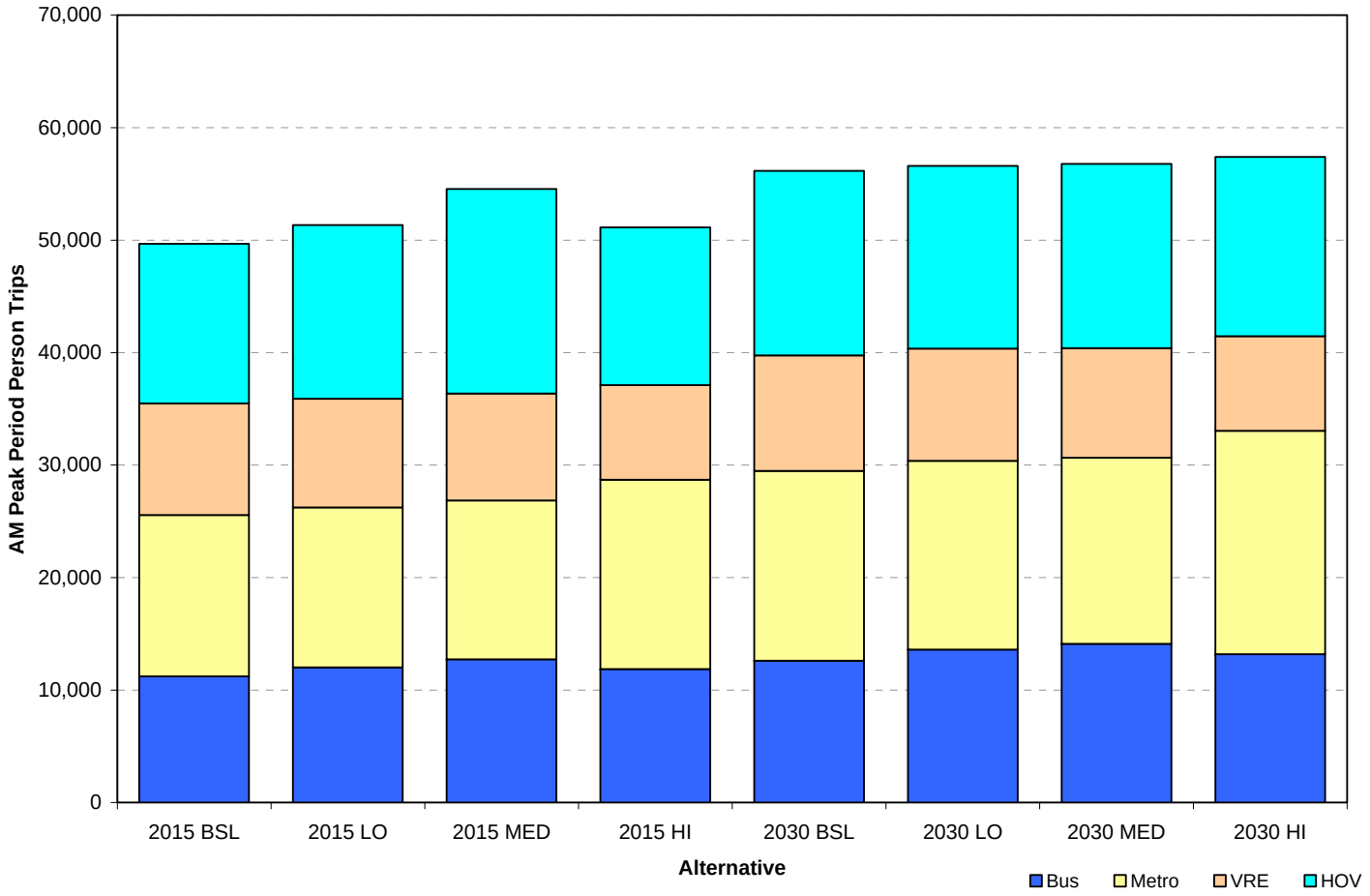
Mode	2015 BSL	2015 LO	2015 MED	2015 HI	2030 BSL	2030 LO	2030 MED	2030 HI
Crossing Beltway								
Bus	5,250	5,798	5,936	5,114	6,182	6,892	6,995	6,049
Metro	4,329	4,095	3,906	3,043	4,939	4,683	4,397	3,322
VRE	2,289	2,179	2,151	4,868	2,800	2,608	2,552	5,951
HOV	18,177	17,931	18,177	17,889	18,624	18,663	19,230	18,846
Total	**30,045**	**30,003**	**30,170**	**30,914**	**32,545**	**32,846**	**33,174**	**34,168**
Bus	17.5%	19.3%	19.7%	16.5%	19.0%	21.0%	21.1%	17.7%
Metro	14.4%	13.6%	12.9%	9.8%	15.2%	14.3%	13.3%	9.7%
VRE	7.6%	7.3%	7.1%	15.7%	8.6%	7.9%	7.7%	17.4%
HOV	60.5%	59.8%	60.2%	57.9%	57.2%	56.8%	58.0%	55.2%
Crossing Glebe Road								
Bus	11,224	12,007	12,726	11,870	12,612	13,612	14,109	13,194
Metro	14,337	14,228	14,128	16,836	16,881	16,762	16,557	19,865
VRE	9,931	9,666	9,514	8,403	10,258	9,990	9,730	8,405
HOV	14,190	15,444	18,177	14,025	16,413	16,239	16,383	15,927
Total	**49,682**	**51,345**	**54,545**	**51,134**	**56,164**	**56,603**	**56,779**	**57,391**
Bus	22.6%	23.4%	23.3%	23.2%	22.5%	24.0%	24.8%	23.0%
Metro	28.9%	27.7%	25.9%	32.9%	30.1%	29.6%	29.2%	34.6%
VRE	20.0%	18.8%	17.4%	16.4%	18.3%	17.6%	17.1%	14.6%
HOV	28.6%	30.1%	33.3%	27.4%	29.2%	28.7%	28.9%	27.8%

Figure 5-3. Northbound Trips on I-95 at Beltway – Tiered Alternatives



BSL – Baseline
LO – Low
HI – High
VRE – Virginia Railway Express
MED – Medium
HOV – High-occupancy vehicle

Figure 5-4. Northbound Trips on I-395 at Glebe Road – Tiered Alternatives



BSL – Baseline
LO – Low
HI – High
VRE – Virginia Railway Express
MED – Medium
HOV – High-occupancy vehicle

5.3 Refined Alternative Scenario

The Refined Alternative reflects the best services from all of the alternative testing. It was developed from the tiered transit/TDM alternatives based on the model results and discussions with the TAC. The Refined Alternative was tested for both a 2015 and a 2030 horizon year.

The Refined Alternative produced results similar to the Medium-Level Alternative. Compared to the Baseline Alternative the transit mode share increases slightly. Results of the 2015 and 2030 Refined Alternative scenario are shown in Tables 5-4 and 5-5 and Figures 5-5 through 5-8.

As Table 5-4 shows, the forecast for the Refined Alternative has a slight decrease in LOV trips while the HOV share stays constant. The Refined Alternative shows a lowering of LOV mode share. This is a result of the good performance of the collection of transit service improvements included in it. The shifts in share are small, though, due to the forecast changes in land use in the study area, including new job opportunities outside of the core, as well as the proposed highway network improvements. The mode share for trips to the metropolitan core is very healthy compared to other areas in the region and nationally.

Table 5-4. Mode Choice Model Results (Post-Processor) for Refined Alternatives
Home-Based Work Trips

Mode	2000	2015 BSL	2015 Refined	2030 BSL	2030 Refined
Study Area					
LOV	520,791	678,819	675,268	795,818	790,722
TRN	317,851	365,902	367,384	412,418	415,795
HOV	61,668	73,437	72,351	73,003	72,828
Total	**900,310**	**1,118,158**	**1,115,003**	**1,281,239**	**1,279,345**
LOV	57.8%	60.7%	60.6%	62.1%	61.8%
TRN	35.3%	32.7%	32.9%	32.2%	32.5%
HOV	6.8%	6.6%	6.5%	5.7%	5.7%
Study Area to Core					
LOV	100,442	115,674	114,977	116,553	115,951
TRN	225,176	248,867	248,952	274,330	275,598
HOV	33,597	40,299	39,478	36,394	36,273
Total	**359,215**	**404,840**	**403,407**	**427,277**	**427,822**
LOV	28.0%	28.6%	28.5%	27.3%	27.1%
TRN	62.7%	61.5%	61.7%	64.2%	64.4%
HOV	9.4%	10.0%	9.8%	8.5%	8.5%

Modes
LOV Low-occupancy vehicle (less than three occupants)
TRN Transit
HOV High-occupancy vehicle (three or more occupants)

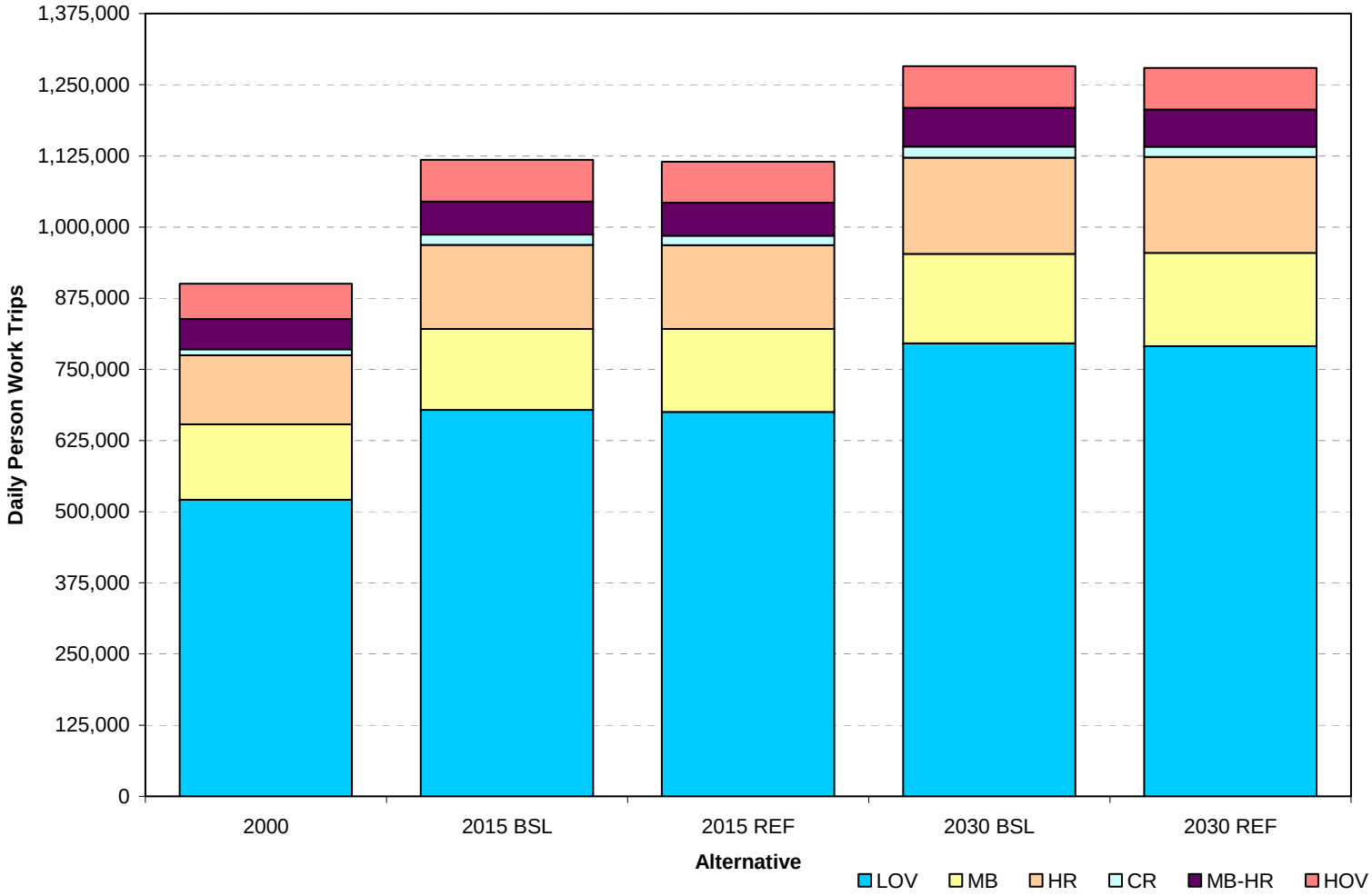
The submode forecasts, shown at the two screenlines (i.e., crossing the Beltway and crossing Glebe Road), show an increase in mode share for bus in the Refined Alternative versus in the Baseline Alternative due to the associated increase in bus service. The mode share within the transit submodes reflects a more equal distribution within the Beltway than outside the Beltway.

Table 5-5. Assignment Summary for Refined Alternatives

Home-Based Work AM Peak Period Northbound Trips
(Gross Model Results)

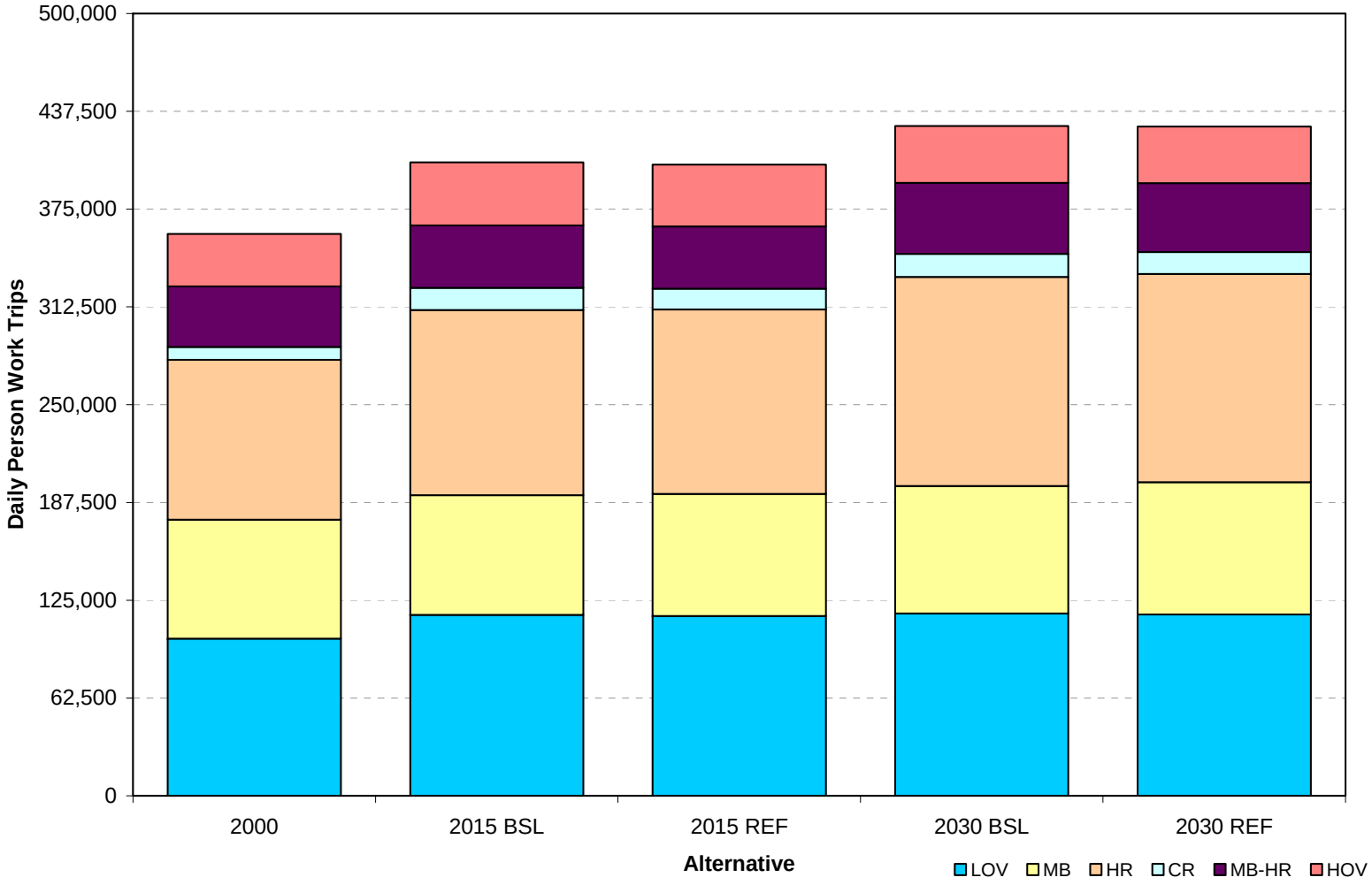
	Crossing Beltway			
Mode	**2015 BSL**	**2015 REF**	**2030 BSL**	**2030 REF**
Bus	5,250	6,023	6,182	7,204
Metro	4,329	3,875	4,939	4,428
VRE	2,289	2,114	2,800	2,504
HOV	18,177	16,503	18,624	19,164
Total	**30,045**	**28,515**	**32,545**	**33,300**
Bus	17.5%	21.1%	19.0%	21.6%
Metro	14.4%	13.6%	15.2%	13.3%
VRE	7.6%	7.4%	8.6%	7.5%
HOV	60.5%	57.9%	57.2%	57.5%
	Crossing Glebe Road			
Bus	11,224	12,746	12,612	12,426
Metro	14,337	14,021	16,881	13,724
VRE	9,931	9,415	10,258	9,073
HOV	14,190	12,201	16,413	15,615
Total	**49,682**	**48,383**	**56,164**	**50,838**
Bus	22.6%	26.3%	22.5%	24.4%
Metro	28.9%	29.0%	30.1%	27.0%
VRE	20.0%	19.5%	18.3%	17.8%
HOV	28.6%	25.2%	29.2%	30.7%

Figure 5-5. Corridor Submode Share – Refined Alternative



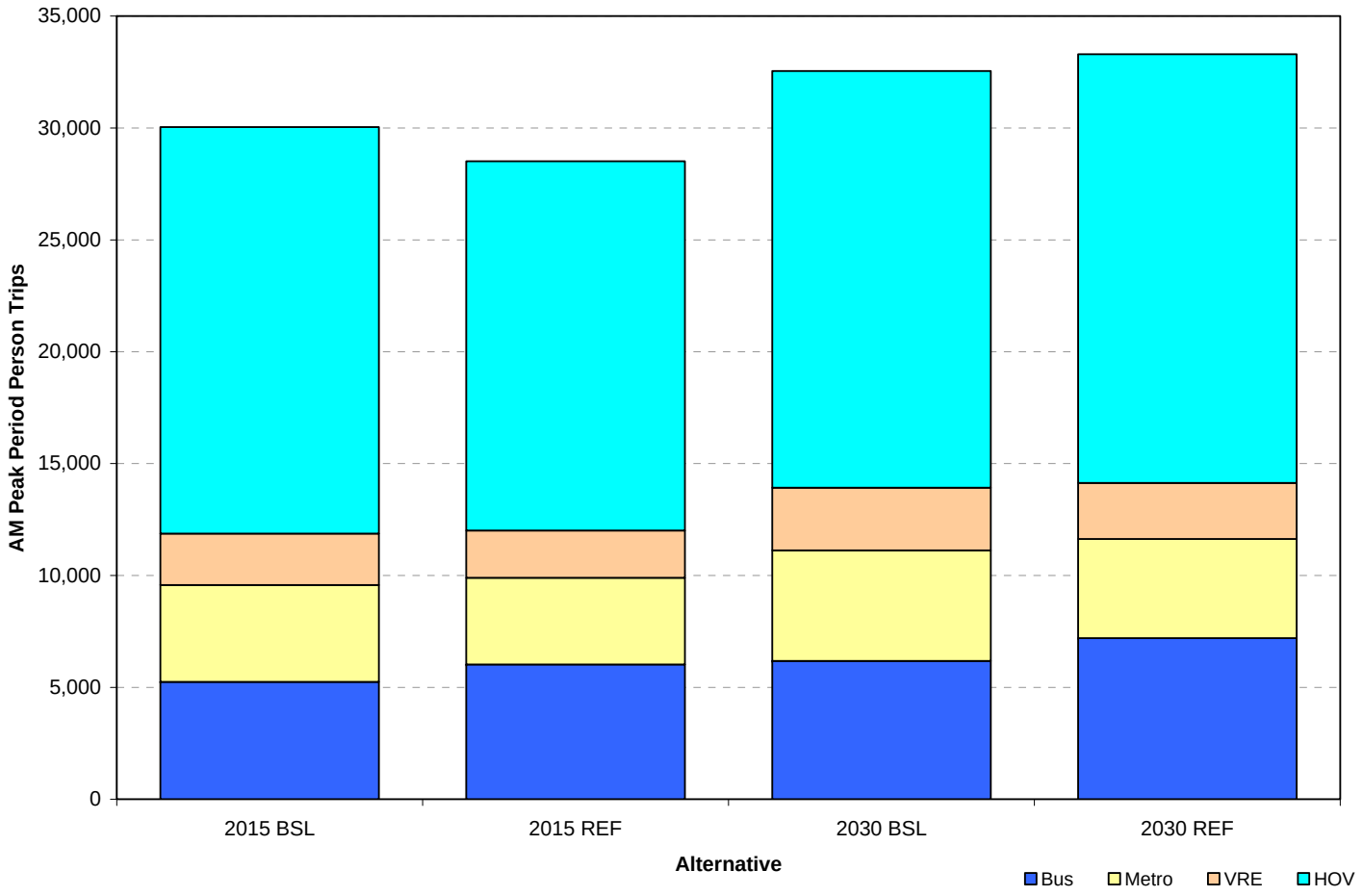
LOV – Low-occupancy vehicle **HR –** Metrorail heavy rail **MB-HR –** Motor bus to heavy rail **BSL –** Baseline
MB – Motor bus **CR –** Commuter rail **HOV –** High-occupancy vehicle **REF –** Refined Alternative

Figure 5-6. Corridor Submode Share to Core – Refined Alternative



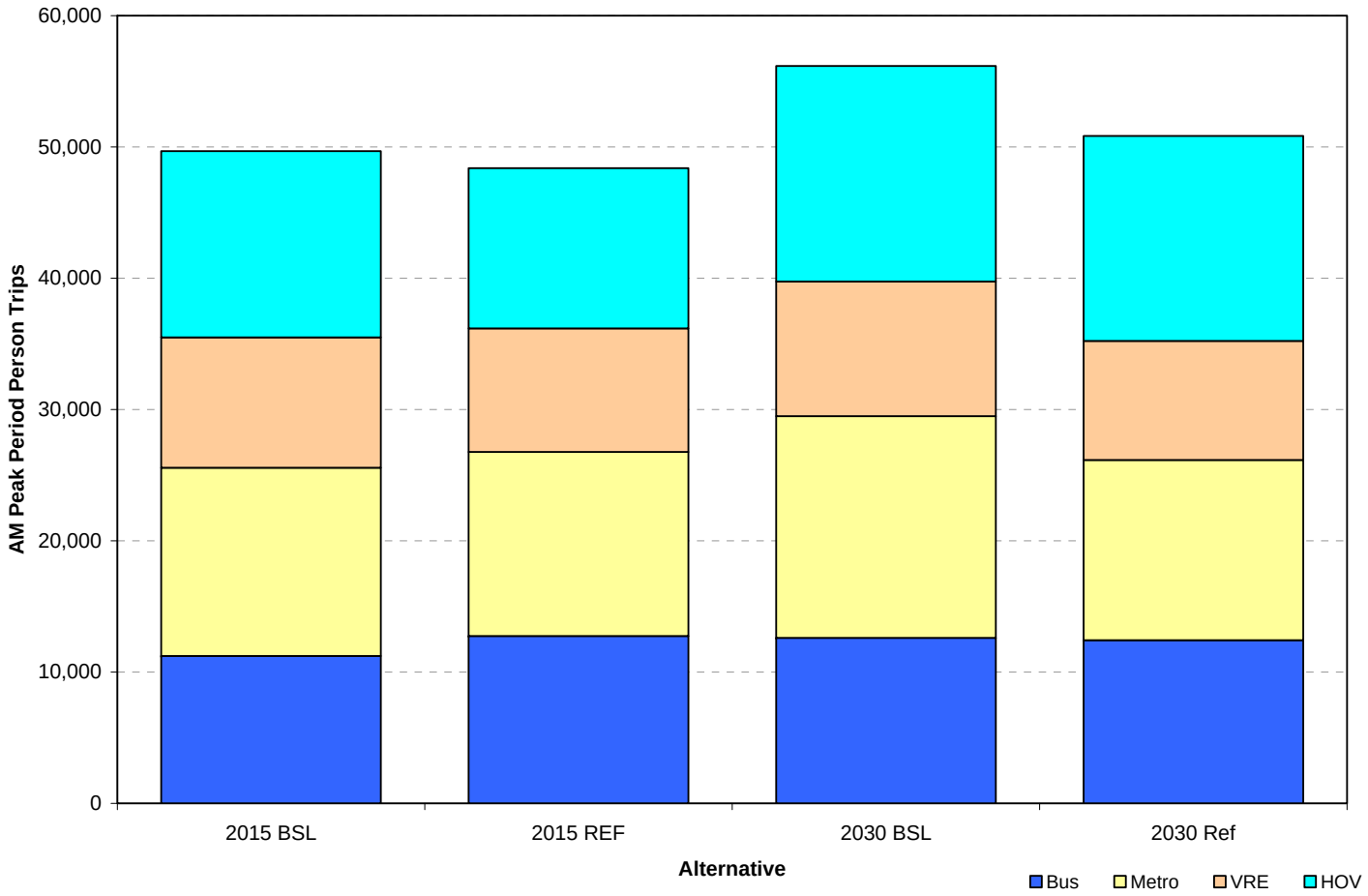
LOV – Low-occupancy vehicle
MB – Motor bus
HR – Metrorail heavy rail
CR – Commuter rail
MB-HR – Motor bus to heavy rail
HOV – High-occupancy vehicle
BSL – Baseline
REF – Refined Alternative

Figure 5-7. Northbound Trips on I-95 at Beltway – Refined Alternative



VRE – Virginia Railway Express
HOV – High-occupancy vehicle
BSL – Baseline
REF – Refined Alternative

Figure 5-8. Northbound Trips on I-395 at Glebe Road – Refined Alternative



VRE – Virginia Railway Express
HOV – High-occupancy vehicle
BSL – Baseline
REF – Refined Alternative

5.4 Other Sensitivity Analysis Scenarios

The project and service elements of the sensitivity analysis for the Refined Alternative were represented in the inputs for the travel demand forecasting tools. This section presents a few key findings of the sensitivity analysis.

5.4.1 Scenarios Tested for Sensitivity Analysis

Four combinations of scenarios and horizon years were tested during the sensitivity analysis task of the project using the study model framework, as follows:

- The Refined Alternative represented good performing services and was developed from the tiered transit/TDM alternatives based on the model results and discussions with the TAC. The refined alternative was tested for both a 2015 and a 2030 horizon year;

- The BRAC land use scenario was tested with the transit/TDM elements that made up the Refined Alternative. The specific scenario tested reflected changes in socioeconomic data in the vicinity of the applicable Fairfax County and Quantico sites and used the study model framework to evaluate this alternative for a single horizon year of 2015; and

- The fare buy-down policy scenario was tested with the transit/TDM elements included in the Baseline Alternative for a single horizon year of 2030. The fare buy-down scenario was structured to apply to peak-direction transit services that are in the I-95/I-395 corridor (traveling northbound in the AM peak period and southbound in the PM peak period). The buy-down policy for the purpose of this analysis was assumed to be a 50 percent reduction in fares applicable to bus and VRE trips.

5.4.2 Sensitivity Analysis Mode Choice Results

The results of the analysis show that in the study area and from the study area to the core, there are small percentage changes in primary mode choice among the alternatives as compared to the baseline. In reviewing these forecasts, it is an important fact that the Baseline Alternative increases transit service significantly over existing levels and quality of service. All of the presented results show daily home-based work trips. This was the focus market in developing the transit/TDM alternatives as well as the refined alternative and other sensitivity analysis. Most of the differences among the performance of the proposed alternatives are in submode choice (i.e., shifts among bus, Metrorail, and commuter rail). The fare buy-down policy tested for year 2030 did show shifts in mode usage in the study corridor primarily from high-occupancy vehicle (HOV) to transit, but only a small shift from low-occupancy vehicles (LOV) to transit. Table 5-6 and Figures 5-9 and 5-10 summarize the results of the sensitivity analysis.

Figures 5-9 through 5-10 are summary charts which graphically show the results of the modeling effort. Figure 5-9 shows the study area mode share for 2015 and 2030. Figure 5-10 shows the mode share results for trips in the study area to the metropolitan core areas for both years 2015 and 2030.

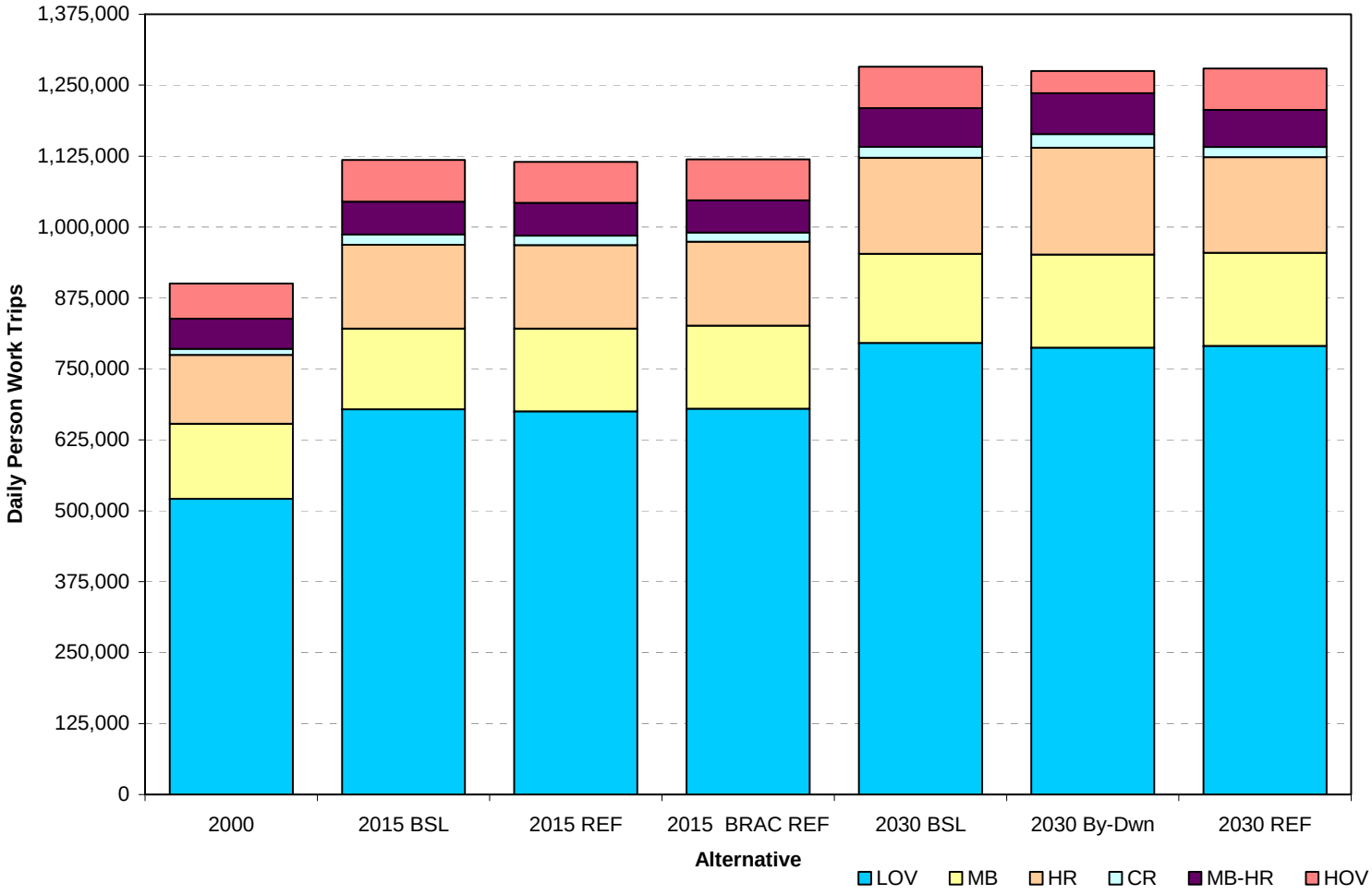
Table 5-6. Mode Choice Results (Post-Processor) for Sensitivity Analysis

Home-Based Work Trips

Mode	2000	2015 Baseline	2015 Refined	2015 Refined BRAC	2030 Baseline	2030 Refined	2030 Baseline Fare Policy
Study Area							
LOV	520,791	678,819	675,268	679,858	795,818	790,722	787,331
TRN	317,851	365,902	367,384	367,424	412,418	415,795	448,588
HOV	61,668	73,437	72,351	72,027	73,003	72,828	39,392
Total	**900,310**	**1,118,158**	**1,115,003**	**1,119,309**	**1,281,239**	**1,279,345**	**1,275,311**
LOV	57.8%	60.7%	60.6%	60.7%	62.1%	61.8%	61.7%
TRN	35.3%	32.7%	32.9%	32.8%	32.2%	32.5%	35.2%
HOV	6.8%	6.6%	6.5%	6.4%	5.7%	5.7%	3.1%
Study Area to Core							
LOV	100,442	115,674	114,977	114,068	116,553	115,951	97,332
TRN	225,176	248,867	248,952	250,957	274,330	275,598	305,739
HOV	33,597	40,299	39,478	39,292	36,394	36,273	23,497
Total	**359,215**	**404,840**	**403,407**	**404,317**	**427,277**	**427,822**	**426,568**
LOV	28.0%	28.6%	28.5%	28.2%	27.3%	27.1%	22.8%
TRN	62.7%	61.5%	61.7%	62.1%	64.2%	64.4%	71.7%
HOV	9.4%	10.0%	9.8%	9.7%	8.5%	8.5%	5.5%

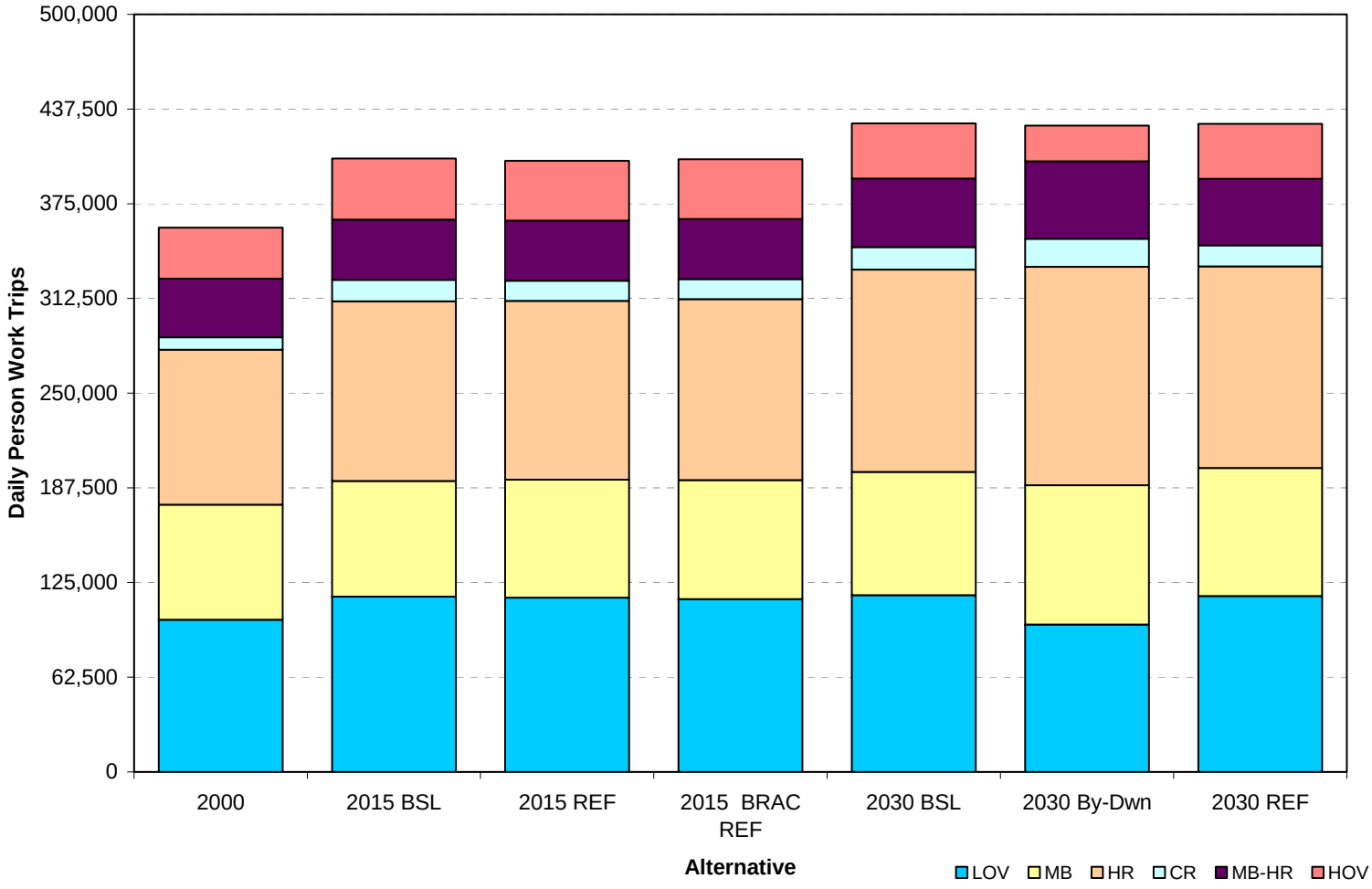
Modes
LOV Low-occupancy vehicle (less than three occupants)
TRN Transit
HOV High-occupancy vehicle (three or more occupants)

Figure 5-9. Corridor Submode Share – Sensitivity Analysis



LOV – Low-occupancy vehicle **HR –** Metrorail or heavy rail **MB-HR –** Motor bus to heavy rail **BSL –** Baseline
MB – Motor bus **CR –** Commuter rail **HOV –** High-occupancy vehicle **REF –** Refined alternative
BRAC REF – Base Closure and Realignment Commission sensitivity **By-Dwn –** Fare buy-down sensitivity

Figure 5-10. Corridor Submode Share to Core – Sensitivity Analysis



LOV – Low-occupancy vehicle **HR –** Metrorail or heavy rail **MB-HR –** Motor bus to heavy rail **BSL –** Baseline
MB – Motor bus **CR –** Commuter rail **HOV –** High-occupancy vehicle **REF –** Refined Alternative
BRAC REF – Base Closure and Realignment Commission sensitivity **By-Dwn –** Fare buy-down sensitivity

5.4.3 Summary of Sensitivity Analysis Results

- The Refined Alternative performed as well as the Medium Alternative of the tiered transit/TDM alternatives, but at a lower total estimated cost.

- The BRAC model results showed an increase in LOV trips in the study corridor, but no significant change in mode shares.

- The fare buy-down showed a seven percent increase in transit mode share, but most of that came from the HOV market. A small percentage of the increase in transit mode share did come from the LOV market, but the cost of providing the buy down was prohibitive, especially given the limitations in achieving LOV reduction.

5.5 Appendix

Appendix D provides an additional description of the model used and its validation. A series of summary origin-destination mode choice results maps are also presented in Appendix D. These maps depict the origin and destination flows of work trips for the morning peak period from major travel markets to major travel markets in the study area and the associated mode choice for the following scenarios and horizon years: 2015 Refined Alternative; 2015 BRAC; 2030 Baseline; and 2030 Refined Alternative.

6.0 Transportation Demand Management – Model Results

6.1 Overview of Methodology

The transportation demand management (TDM) analysis estimated the reduction in single-occupant vehicle (SOV) trips that could be generated by implementing TDM strategies to encourage commuters who use I-95/I-395 for commuting to shift from SOV to carpooling, vanpooling, transit, and teleworking. The alternatives tested included a range of strategies grouped in the following general categories:

- Financial incentives for high-occupancy vehicle (HOV) modes:
  - Incentives for vanpools (capital cost, insurance, driver incentives, and start-up and empty seat subsidies); and
  - Incentives for carpools.
- TDM information and assistance services:
  - Park-and-ride and TDM information signage;
  - TDM/HOV marketing; and
  - Rideshare program support (e.g., additional staff for rideshare information assistance).
- Other rideshare support:
  - Guaranteed Ride Home service; and
  - Slug/casual carpool staging areas.
- Telework incentives for employers; and
- Electronic/tracking system support:
  - HOV/high-occupancy toll (HOT) lane transponders for vanpools; and
  - Carpool/vanpool mileage tracking.

As with the transit service analysis, the TDM strategy packages were tested at three levels: low; medium; and high. Higher-level packages added new strategies and/or enhanced programs.

The TDM strategies were assumed to be implemented areawide, rather than applied to specific routes/links on the transportation network, as was the case for the transit service analysis. However, most of the strategies were assumed to be targeted primarily to the residence areas in the southern section of the corridor and to residence areas that would be considered “feeders” to I-95 for commuting.

The primary estimation tool used for this analysis was the Federal Highway Administration (FHWA) Travel Demand Management (TDM) model. This model calculates expected SOV trip reduction and mode split for a sizeable range of TDM strategies, using a set of defined inputs and known starting trip and mode split conditions. Additional details of the model and how it was used in the analysis are provided in the next section of this document.

6.2 FHWA TDM Model Background

The Federal Highway Administration (FHWA) Travel Demand Management (TDM) model used for the analysis predicts changes in travelers' likelihood to use various modes of travel when offered particular TDM strategies. The model uses a pivot-point logit approach that begins with known travel conditions and a known mode split and predicts a revised mode split when TDM strategies are applied. The model was developed using data from numerous metropolitan regions in the United States and can be used with default assumptions set for metropolitan areas of various sizes and characteristics, but a desirable feature of the model is that it can be customized to use local calculation coefficients, if they are available. Thus, it offers an opportunity to tailor the analysis to be most representative of a particular area or region.

The model offers tools for analyzing both areawide and employer-based strategies. The model accommodates testing of strategies that provide a travel cost saving (e.g., financial incentives or parking charges) or time saving (e.g., transit frequency improvement or HOV lanes). Additionally, the model can be used to predict trip reduction from work hours arrangements (e.g., telework and compressed schedules) and from noncost and nontime TDM support services that make use of non-SOV modes more convenient or more desirable, but do not change the time or cost to use the modes. Several of these analysis options were used in the I-95/I-395 Corridor analysis.

The model also is designed to be used for a variety of situations, including a geographic subarea, a metropolitan area (with limitations), and an individual work site. The geographic subarea is most applicable to the I-95/I-395 corridor TDM analysis, because most of the TDM strategies in the project are assumed to be offered across a subset of Northern Virginia jurisdictions, but primarily to the traveling public at large, rather than to individual employer work sites.

As noted earlier, the analysis assumed that some strategies would be offered in or targeted to distinct portions of the study area and the model permits the user to define both origin and destination areas for the analysis. This feature also was used in the analysis to fine-tune the application of the strategies.

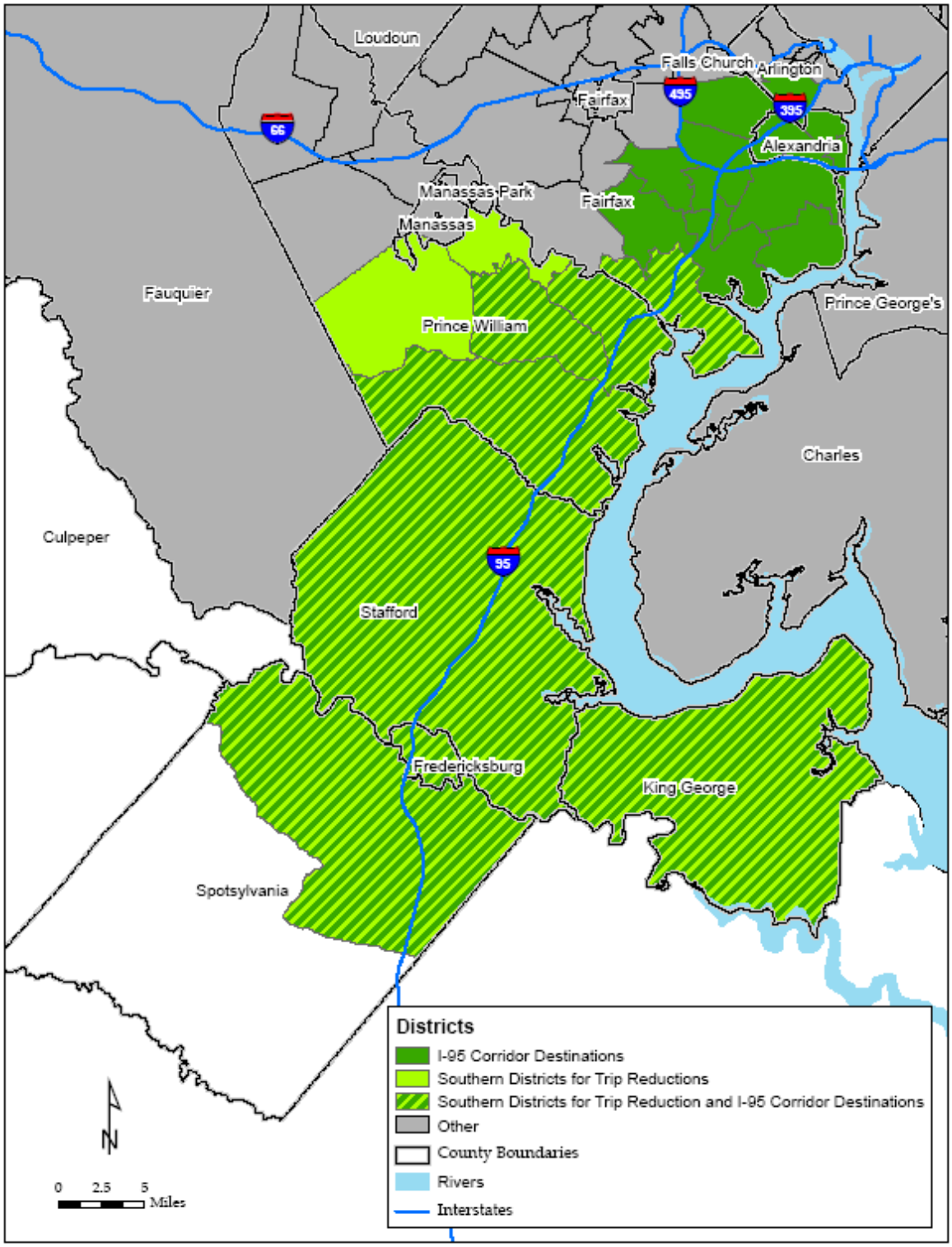
6.3 Model Inputs

The TDM model predicts change in vehicle trips from a set of starting travel conditions that include person, vehicle, and transit trips by origin-destination (O-D) pairs for home-based work (HBW) AM peak trips. In this analysis, the 2,191 TAZs of the Metropolitan Washington Council of Government (MWCOG) model were combined into 66 districts, due to model limitations and ease of interpreting the results.

Another adjustment was made to the trip tables prior to running the TDM model to remove trips assumed to be reduced by TDM strategies that could not be modeled, such as TDM marketing. This was done by applying trip reduction factors to account for TDM program marketing, ride-share program operational support, telework program assistance, and the enhanced guaranteed ride home program. These factors were applied to trips originating in the southern districts, which include eastern Prince William County, Stafford County, Fredericksburg, King George County, and northern Spotsylvania County to avoid double counting marketing efforts by MWCOG, as shown in Figure 6-1, labeled "Southern Districts for Trip Reduction." The trip reduction factors were developed using professional experience with the local market, as described in Appendix B.

Because the study area is larger than the actual I-95/I-395 highway corridor, trips originating and ending outside the actual corridor were removed from the analysis process. The destinations used in the TDM model were limited to the actual corridor. Figure 6-1 shows the corridor destinations.

Figure 6-1. TDM Analysis Origin and Destination Districts



The second set of inputs to the TDM model was for the specific strategies to be tested. The two strategy types analyzed using the TDM model were vanpool and carpool incentives. The TDM strategies applied and how they were translated into the TDM model inputs are shown in Tables 6-1 through 6-3. The detailed assumptions used in developing the strategy model inputs are described in Appendix B.

Several elements were determined not to be explicitly represented with the FHWA TDM model, including electronic toll transponders for vanpools, TDM program signage, signage in park-and-ride lots, vanpool tracking, and the HOVER Pilot Program. Both the park-and-ride lot signage and the TDM program signage were assumed to be captured under the TDM programs marketing strategy, and the vanpool tracking and electronic toll transponders were assumed to have no direct benefit. The HOVER program does not have sufficient precedence to determine its impact on mode share.

Table 6-1. TDM Elements in the Low Alternative

Program Element	Description	Modeling Strategy
Carpool Incentives	Rewards and incentives for carpoolers.	$0.50/day/person subsidy.
Electronic Toll Transponders	Provide free electronic toll transponders to vanpools.	Insignificant to test in TDM model.
Rideshare Program Operational Support	Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.	Reduce vehicle trips originating in southern districts by 0.1 percent.
TDM Programs Marketing	Expand TDM marketing efforts in the corridor and feeder markets. New signage in park-and-ride lots and along corridor to promote TDM programs.	Reduce vehicle trips originating in southern districts by 0.1 percent.
Vanpool Driver Incentives	Provide financial incentives to attract new drivers and retain existing drivers for vanpools.	$1/vehicle subsidy.
Vanpool Insurance	Increase vanpool insurance premium pool buy-down for vanpools.	$2.80/day/vehicle subsidy.
Vanpool Tracking	Develop a tracking mechanism (GPS, cell phone) to track vans used for vanpools.	No benefit to vanpools, not tested in TDM model.
VanStart/VanSave	Financial support for vacant seats for new vanpools during start-up and established vanpools with temporary vacancies.	$12/vehicle subsidy.

Table 6-2. New and Revised TDM Elements in the Medium Alternative

Program Element	Description	Modeling Strategy
Capital Cost of Contracting for Vanpools	Incentives, IT monitoring and reporting of vanpool mileage, and promotion of Capital Cost of Contracting for Vanpools.	$12/vehicle subsidy.
Rideshare Program Operational Support	Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.	Reduce vehicle trips originating in southern districts by 0.15 percent.
Telework Program Assistance	Financial incentives and assistance for employers.	Reduce person trips by 0.12 percent.

Table 6-3. New and Revised TDM Elements in the High Alternative

Program Element	Description	Modeling Strategy
Capital Assistance for Vanpools	Provide financial assistance for the purchase or lease of vans for vanpools.	$4/vehicle subsidy.
Enhanced Guaranteed Ride Home Program	Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday.	Reduce vehicle trips originating in the southern districts by 0.1 percent.
HOVER Pilot Program	HOVER is a facilitated “park-and-ride-share” system that involves tracking of all participants’ usage and sharing of costs and benefits through a combination of financial and “HOVER Ride Credit” accounts. Members earn credits for picking up passengers and passengers use their credits to ride.	No precedence from which to establish the impact on mode share, and so not tested in the TDM model.

6.4 TDM Model Results

The TDM model was run six times, including a run for the low, medium, and high alternatives for each horizon years of 2015 and 2030.

The predicted trip reduction for each run was calculated by dividing the output morning peak home-based work (HBW) vehicle trip tables from the TDM model by the original MWCOG model vehicle trip tables. This produced single-occupancy vehicle trip reduction factors to account for mode shifts caused by each of the TDM measures applied. Overall, the trip reduction rates exhibited very similar behavior across all six model runs.

Table 6-4 gives more detail on the statistics of the trip reduction factors by model run, shown as a percentage reduction of single-occupancy vehicle trips over all O-D pairs, as well as total trips reduced.

Table 6-4. Single-Occupancy Vehicle Trip Percent Reduction Rates

	2015			2030		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**
Minimum	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maximum	68.0%	68.0%	75.0%	75.0%	75.0%	75.0%
Average	1.3%	1.5%	1.6%	1.4%	1.6%	1.7%
Standard Deviation	0.047	0.049	0.054	0.052	0.053	0.056
Total Trips Reduced	**14,300**	**14,890**	**15,260**	**20,260**	**20,980**	**21,430**

For example, the trip reduction for the low alternative for 2015 ranged from a low of 0.0 percent to a high of 68.0 percent across the range of O-D pairs. The average for all O-D pairs was 1.3 percent reduction for this alternative in 2015. The averages for the medium and high alternatives in 2015 were 1.5 and 1.6 percent reduction, respectively. For the 2030 case, the average reductions for the low, medium, and high alternatives were 1.4, 1.6, and 1.7 percent, respectively.

It is important to note that districts with large trip reduction factors typically had small base numbers of trips – a reduction of one or two trips in such cases causes a large percentage change. For this reason, it is most appropriate to use only the overall average reductions.

Table 6-4 also shows the total predicted daily SOV trips reduced for each alternative and analysis year. In 2015, the trips reduced ranged from 14,300 for the low alternative to 15,260 for the high alternative. In 2030, the total trips reduced ranged from 20,260 to 21,430.

Figures 6-2 and 6-3 graphically show the percent vehicle trip reduction rates for the low alternative in the year 2030, averaged over the origin end and the destination end, and are representative of the pattern of reductions seen for all alternatives. As illustrated in Figure 6-2, trip reduction rates were highest for origins in the southern portion of the study area. As shown in Figure 6-3 and as expected, the reverse was true for the destination areas; trip reduction rates were highest for destinations in the northern area of the study area.

At the end of this section, Figures 6-4 through 6-9 illustrate the total trips reduced throughout the modeled area. These graphics illustrate that the results are very similar for all three alternatives, with most of the reductions occurring in the southern districts of the corridor due to the higher program application in those districts. The single district encompassing Maryland and the District of Columbia also has a large number of trips reduced, which is due to the fact that the district is much larger than any of the other districts. The few districts which have no trip reductions are due to low numbers of trips originating and destined for those zones.

Figure 6-2. Vehicle Trip Percent Reduction for 2030 Low-Alternative Origin Districts

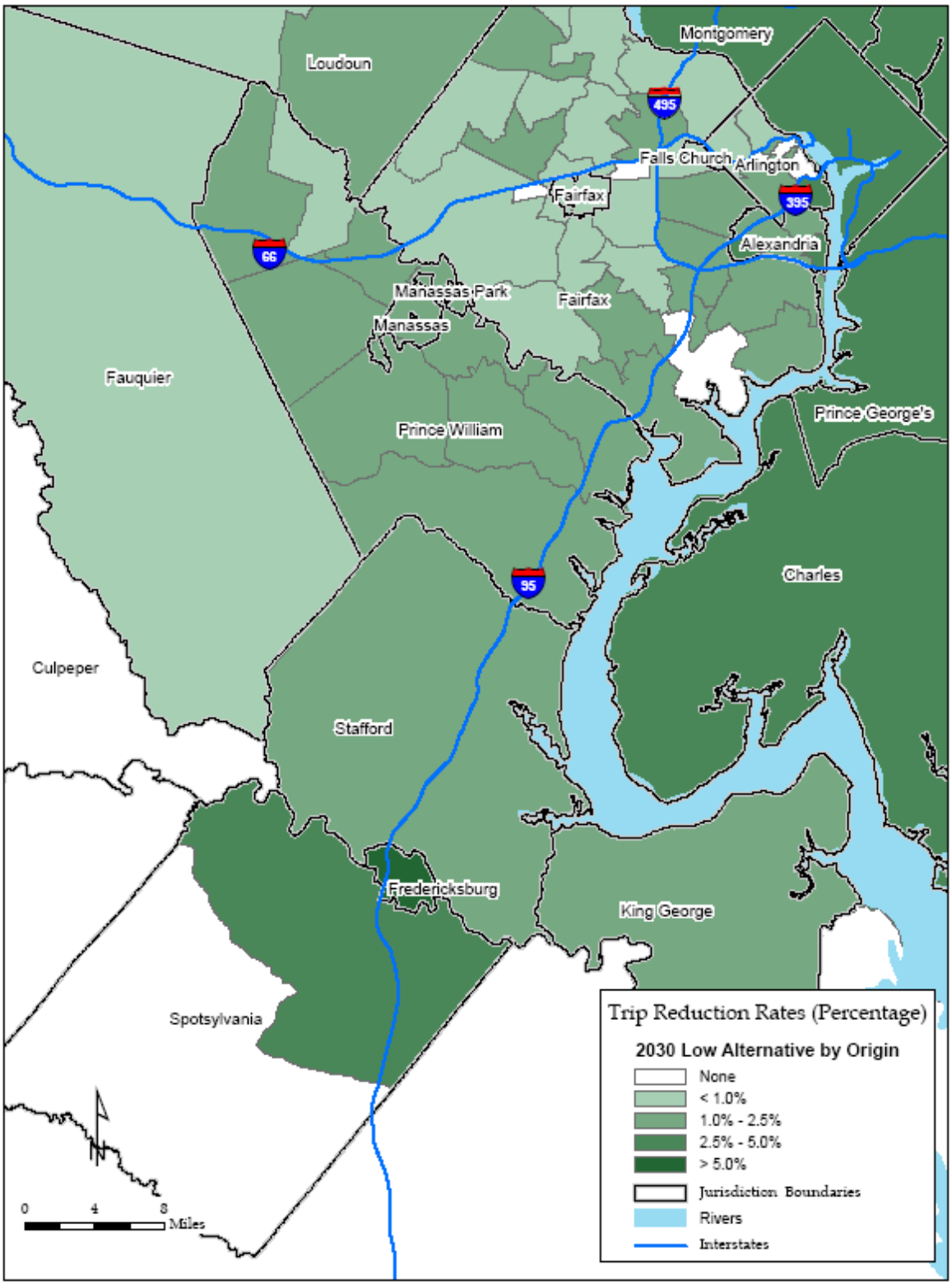


Figure 6-3. Vehicle Trip Percent Reduction for 2030 Low-Alternative Destination Districts

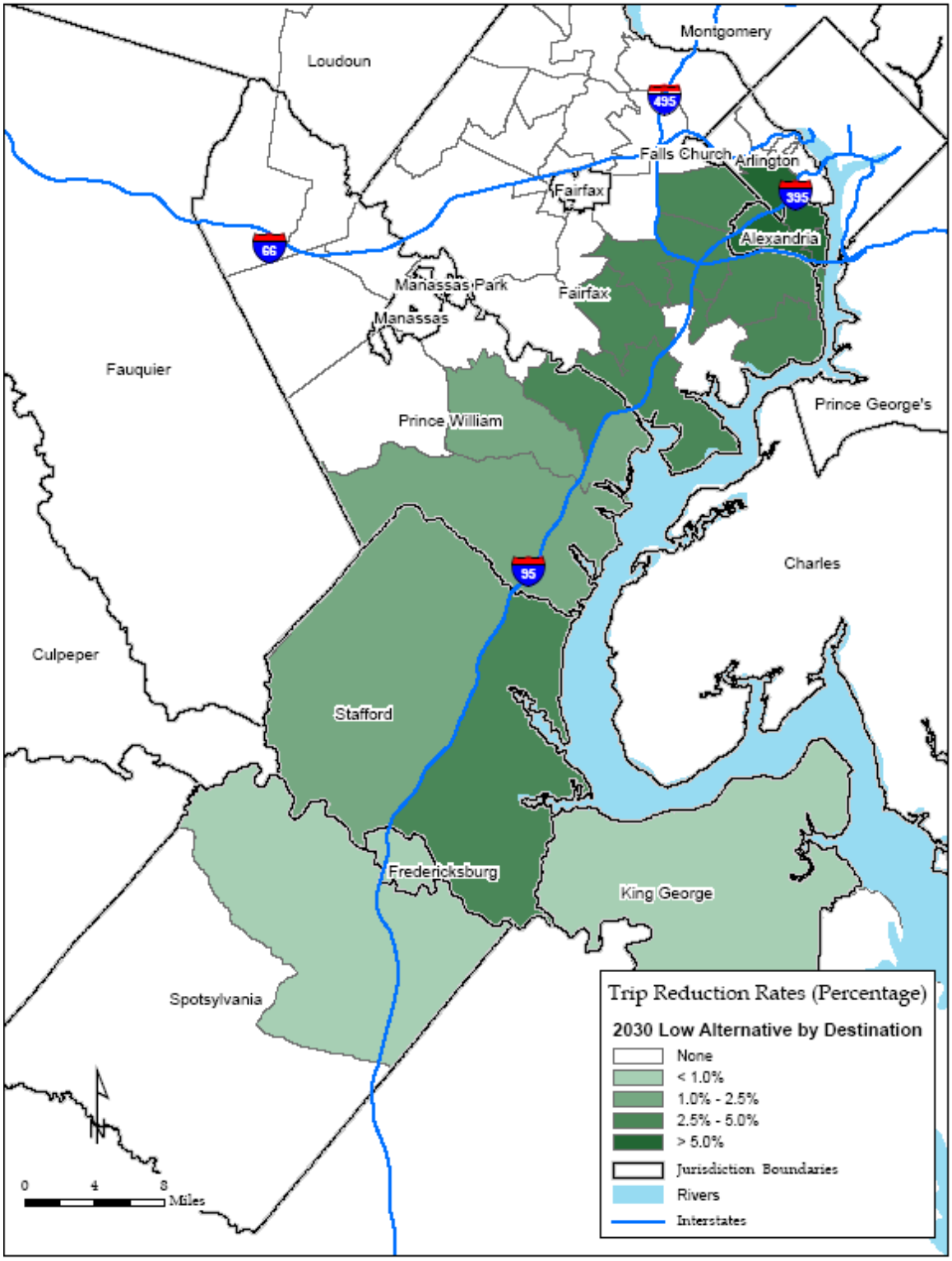


Figure 6-4. Total Trips Reduced for 2030 Low-Alternative Origin Districts

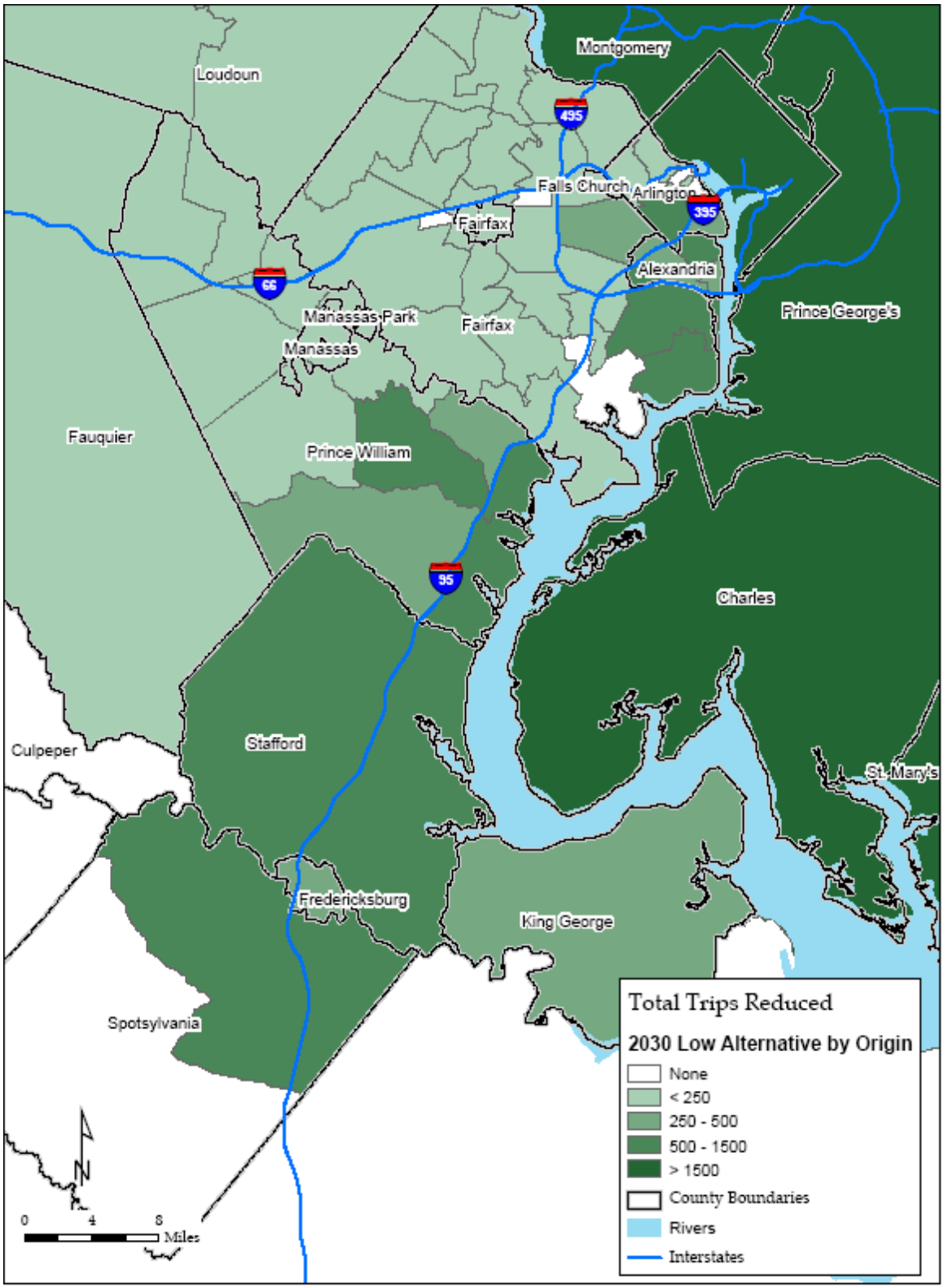


Figure 6-5. Total Trips Reduced for 2030 Low-Alternative Destination Districts

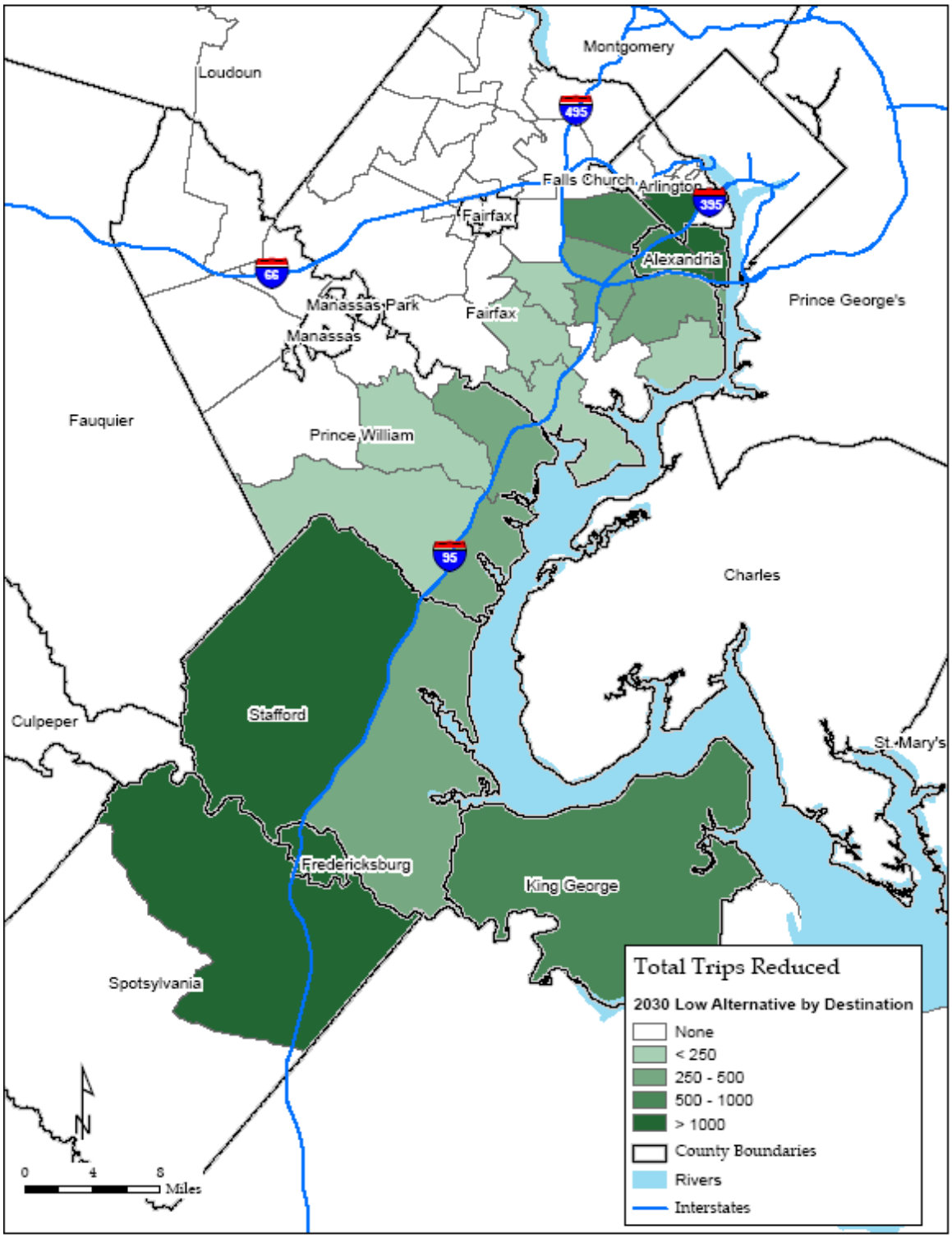


Figure 6-6. Total Trips Reduced for 2030 Medium-Alternative Origin Districts

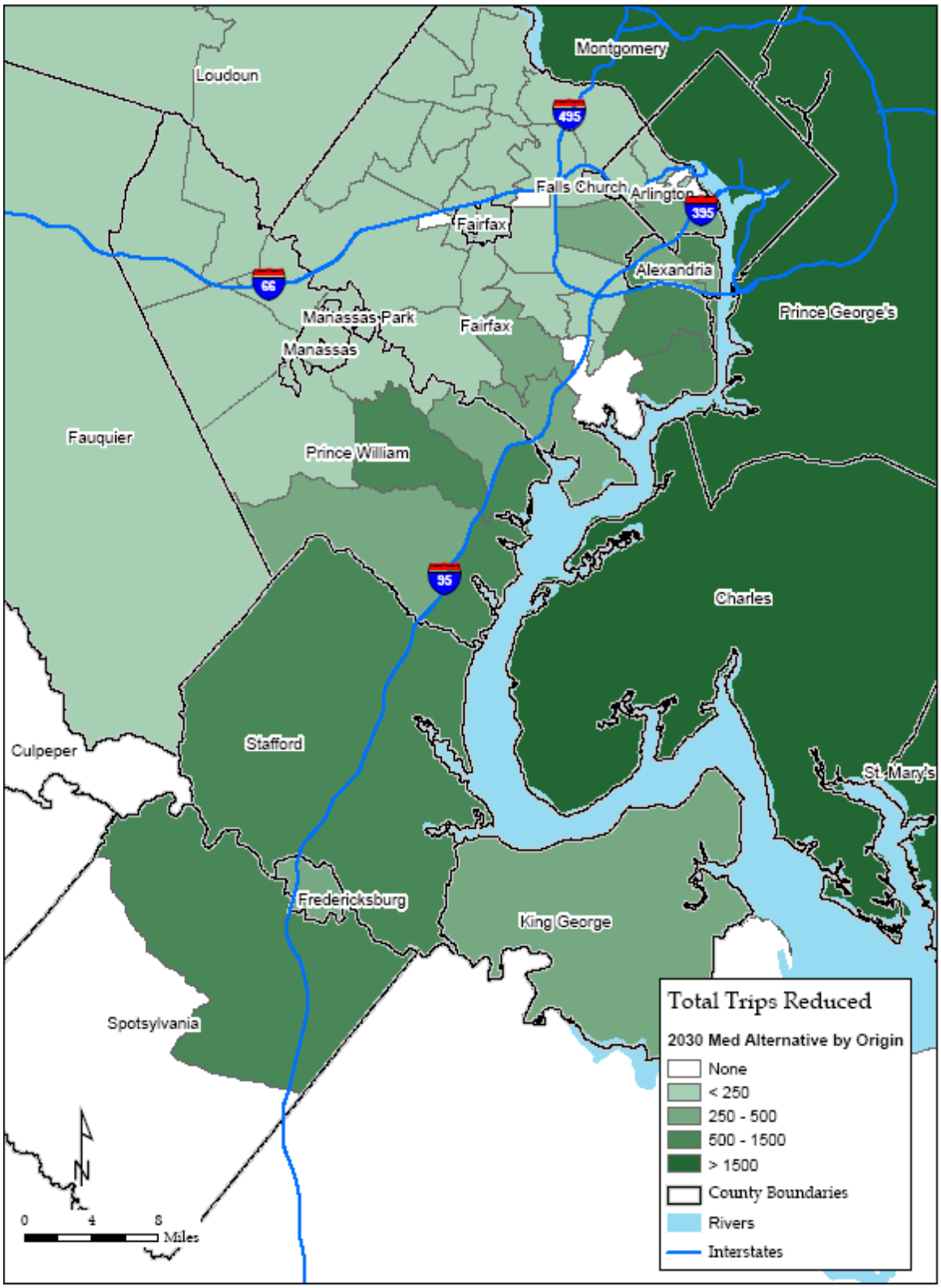


Figure 6-7. Total Trips Reduced for 2030 Medium-Alternative Destination Districts

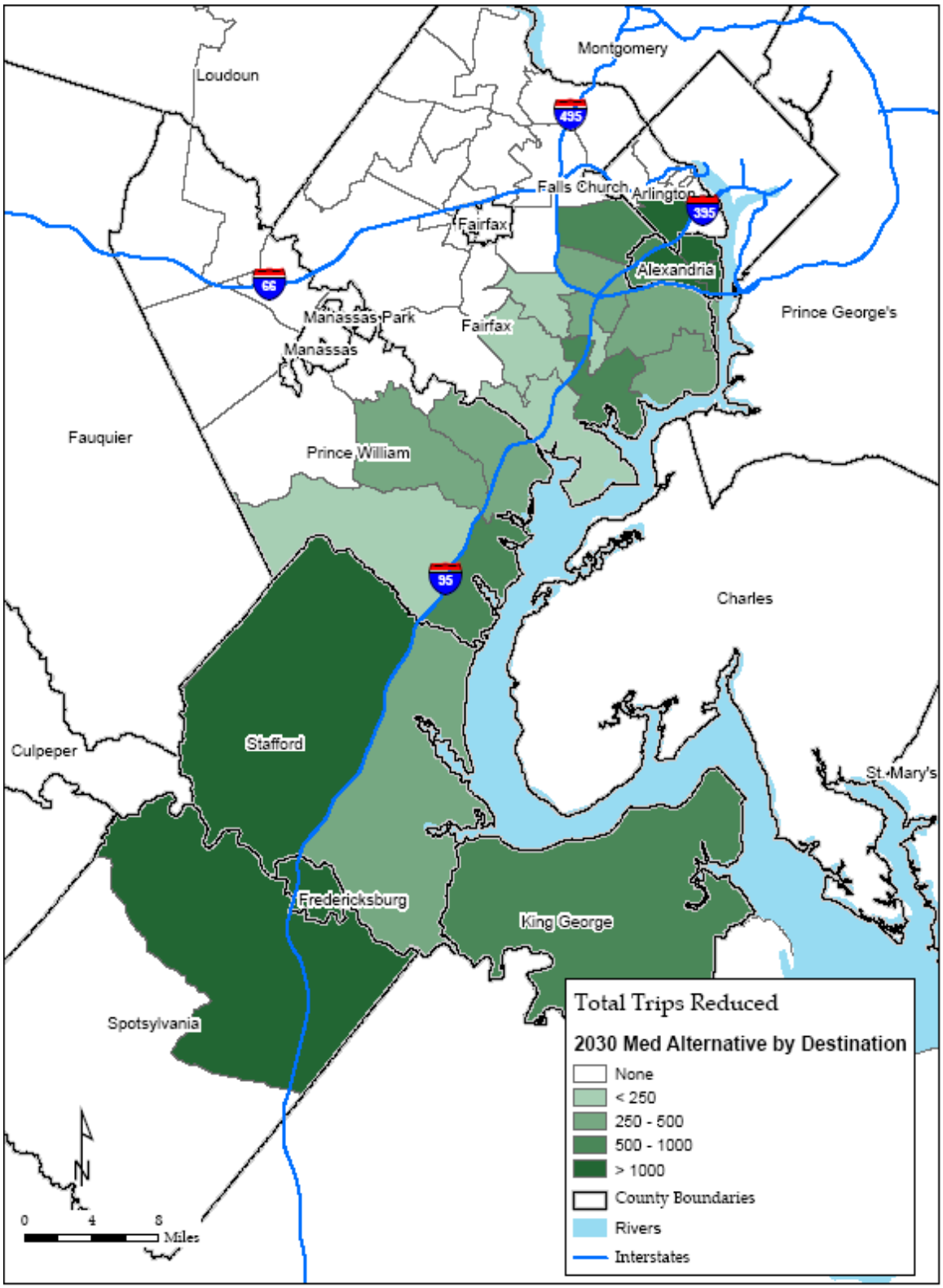


Figure 6-8. Total Trips Reduced for 2030 High-Alternative Origin Districts

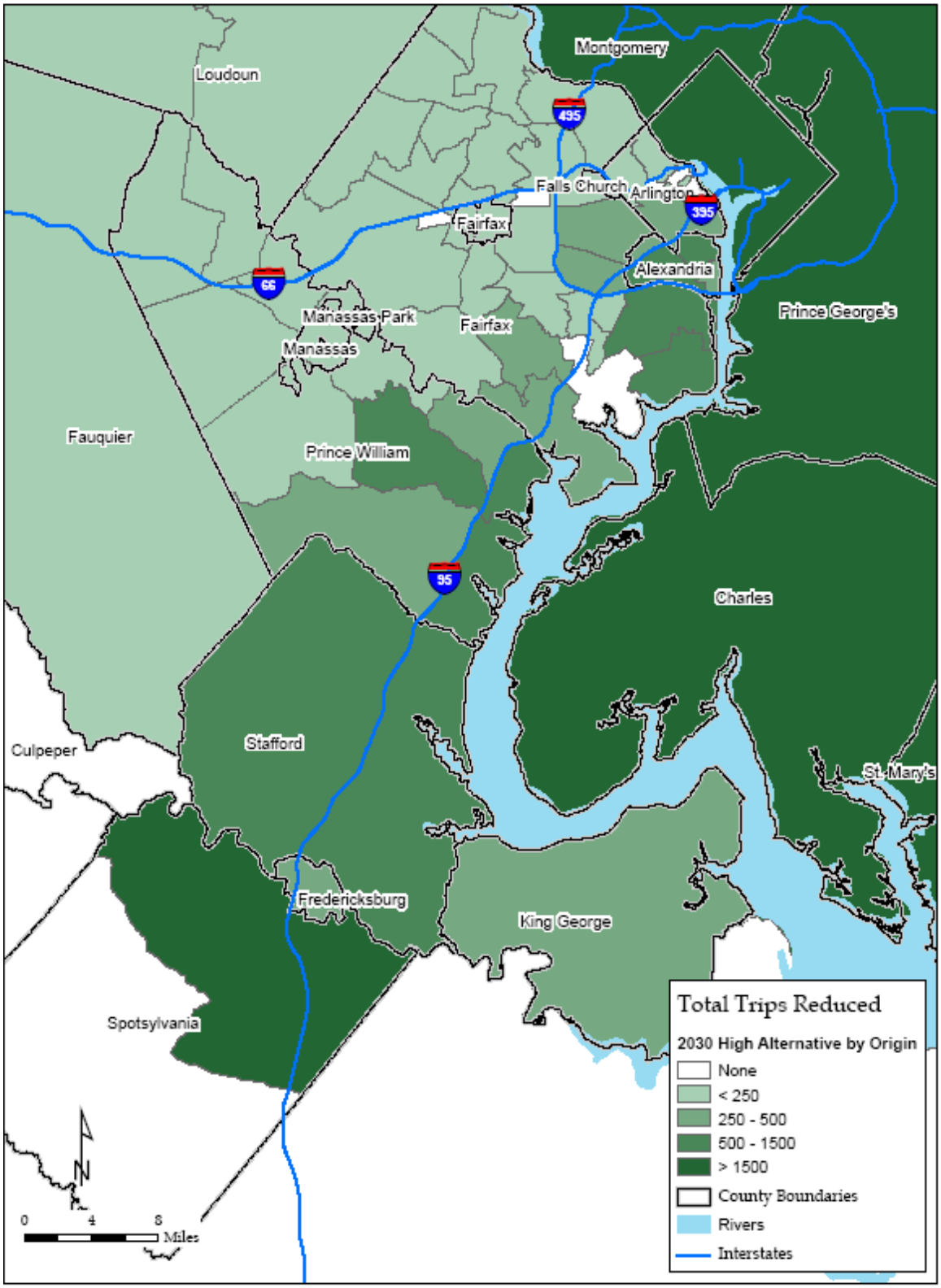
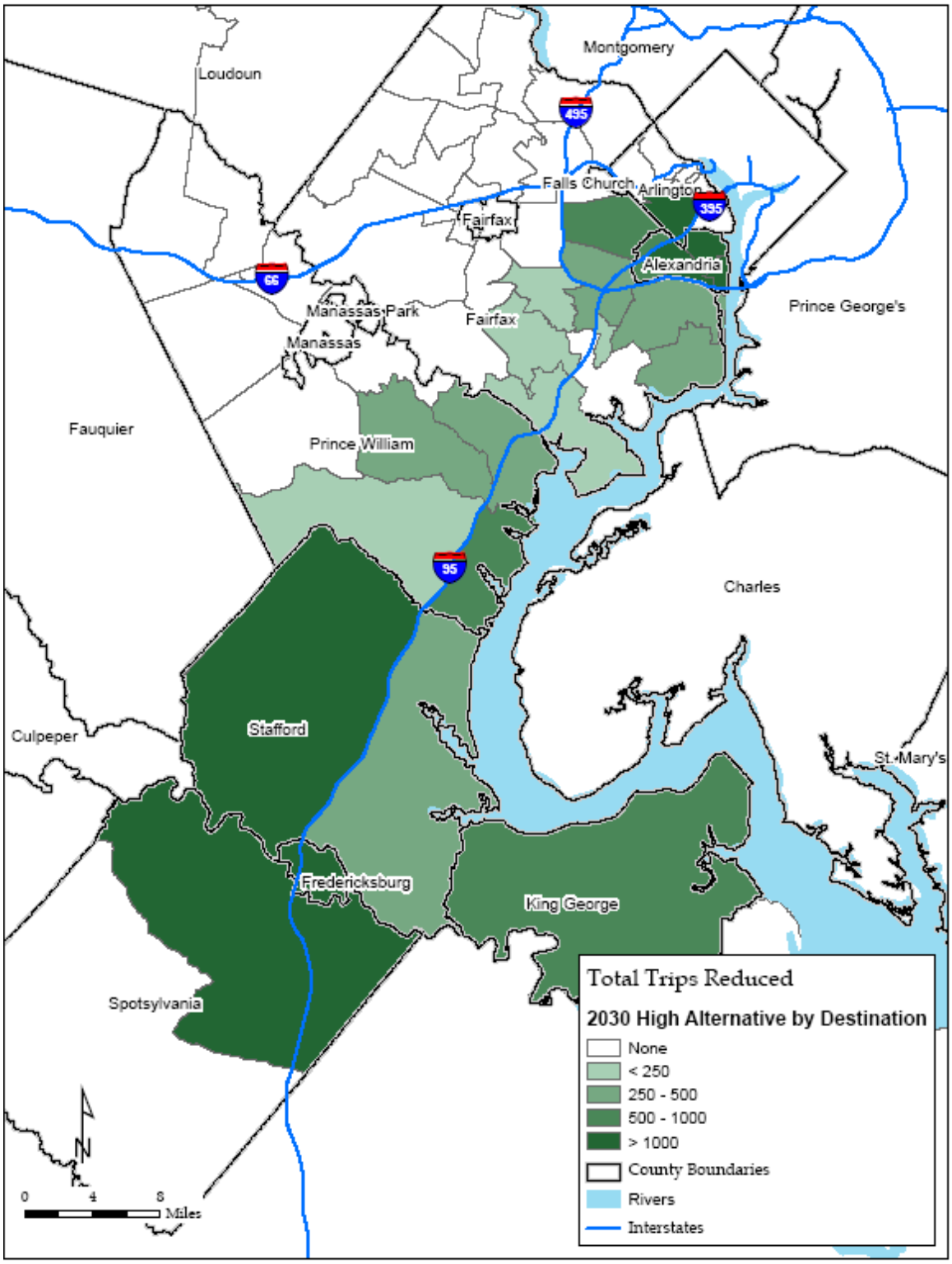


Figure 6-9. Total Trips Reduced for 2030 High-Alternative Destination Districts



6.5 Appendix

A detailed description of the TDM model input assumptions appears in Appendix E.

7.0 Park-and-Ride Analysis

As part of the I-95/I-395 Transit/TDM Study, a comprehensive park-and-ride lot analysis was performed to determine the park-and-ride needs given the proposed HOT lane project for the corridor. This park-and-ride analysis focused on 38 lots in the I-95/I-395 study corridor. Included were bus and VRE-served lots and lots for carpool and vanpool users.

Table 7-1 shows the current utilization of lots in the corridor by lot name. The table reflects figures from a one-day usage count performed in 2006 at nearly all lots in the study area. Data for the Franconia-Springfield Metrorail Station were supplied by WMATA and were based on 2005 ridership data and responses regarding mode of access on the 2002 rail passenger survey. The parking counts and demand forecasts for the Franconia-Springfield Metrorail Station are included for information purposes (this lot was not included in the analysis). The recently opened lot at Backlick Road in Springfield is not included in Table 7-1 as it was not in use when the counts were completed, but the spaces were included in the needs analysis.

The total number of park-and-ride lot parking spaces in the study corridor is approximately 21,000 spaces. The current average utilization of these lots for year 2006 was approximately 86 percent.

Table 7-1. Existing Lots – 2006 Count and Utilization

Park-and-Ride Lots	2006 Count	2006 Capacity	Percentage Utilization
American Legion Post	115	100	115%
Brittany Neighborhood Park	63	85	74%
Brooke VRE	358	431	83%
Dale City Commuter Lot	295	591	50%
Franconia-Springfield Metrorail Station	5,615	5,069	111%
Fredericksburg VRE	767	702	109%
Gambrill Lot	66	157	42%
Hechinger's Old Bridge	505	580	87%
I-95/VA 123 Loop Interchange	115	680	17%
K-Mart at Springfield Plaza	51	50	102%
K-Mart Dale City	62	240	26%
Lake Ridge Commuter Lot	521	600	87%
Leeland Road VRE	606	652	93%
Lorton VRE	237	567	42%
Lorton PNR	14	170	8%
Montclair Commuter Lot	40	50	80%
Potomac Mills Mall	1,057	936	113%
Prince William Parkway (Horner Road)	2,364	2,317	102%
Prince William Square	0	45	
PRTC Transit Center	156	200	78%
Quantico VRE	170	258	66%
Rippon VRE	345	676	51%

Table 7-1. Existing Lots – 2006 Capacity and Utilization (continued)

Park-and-Ride Lots	2006 Count	2006 Capacity	Percentage Utilization
Rolling Valley	482	664	73%
Route 17 and Stanford Drive	688	1000	69%
Route 208 and Houser Drive	435	794	55%
Route 3 at VA 627	452	572	79%
Route 3 at VA 639	607	707	86%
Route 610 on Mine Road	750	750	100%
Route 610 on Stafford Boulevard	827	827	100%
Route 630 at I-95	478	523	91%
Springfield Mall	23	80	29%
Springfield Mall Macy's Parking	285	500	57%
Springfield Methodist Church	69	57	121%
Springfield Plaza	272	254	107%
Sydenstricker Road	181	170	106%
Triangle	29	29	100%
US1/VA 234	395	360	110%
Woodbridge VRE	363	738	49%
Total	**19,850**	**23,181**	**86%**

The lots included in the study are owned mostly by the Virginia Department of Transportation (VDOT), VRE, and the local counties. There are some lots in the corridor that are privately owned and provided to VDOT or to the local county government. These lots are provided as part of proffer agreements or by other arrangements. The park-and-ride lot at the Franconia-Springfield Metrorail Station is owned by WMATA.

7.1 Forecasting Methodology

The methodology used to develop the forecasts for park-and-ride demand for the I-95/I-395 Transit/TDM Study was explicitly linked to the results of the postprocessor mode choice model. Understanding the market shed for trips which drive and park at lots in order to access transit, as well as those trips that drive to lots for carpooling and ridesharing activities, was important for addressing parking lot sizing, location, and the need for additional parking spaces. This approach is straightforward both in concept and application. It utilized the existing park-and-ride lot market shed survey information collected by VDOT as well as the MWCOG regional model, forecast data, and the WMATA postprocessor model choice model. This approach was applied to the park-and-ride lots that serve shared rides and bus modes. Park-and-ride lot demand for the commuter rail stations was developed directly from the results of the mode choice model, and the Franconia-Springfield Metrorail Station parking demand was supplied by WMATA.

The data requirements for this park-and-ride lot forecasting methodology were:

- Parking lot utilization data;
- License plate survey data;
- Forecast year drive access to transit and high-occupancy vehicle (HOV) demand forecasts; and
- Base year drive access to transit access and HOV demand forecasts.

This methodology applies a growth allocation approach based on the model results and the license plate survey data. The model calculates the forecast growth in drive access to transit and HOV trips between the base year and the forecast year from the postprocessor mode choice model. The growth is then applied to the existing parking count data to produce forecasts of drive access to transit and HOV-oriented trips to each park-and-ride lot in the I-95/I-395 study corridor. Figure 7-1 displays an overview flowchart of the process. The park-and-ride lots were aggregated into subareas for the purpose of analyzing future park-and-ride lot needs as well as reporting results. Figure 7-2 shows the subareas and the lots located within these subareas.

For the parking demand forecast, a series of 50 districts (aggregations of traffic analysis zones) in the I-95/I-395 corridor was developed. The park-and-ride lot districts were configured to approximate the likely market or travel shed that the traveler might consider when driving to a park-and-ride lot in the corridor. The districts were based on the data in the license plate survey. The growth factors that were used to grow the existing parking lot counts were calculated at the district level to smooth the variances among zones. This was done to address the issue of small changes in trips over the base creating relatively large factors, thus inflating the forecasts. Each park-and-ride lot in the corridor was assigned to a district for the application of the growth factors. The process developed specific demand estimates for each lot.

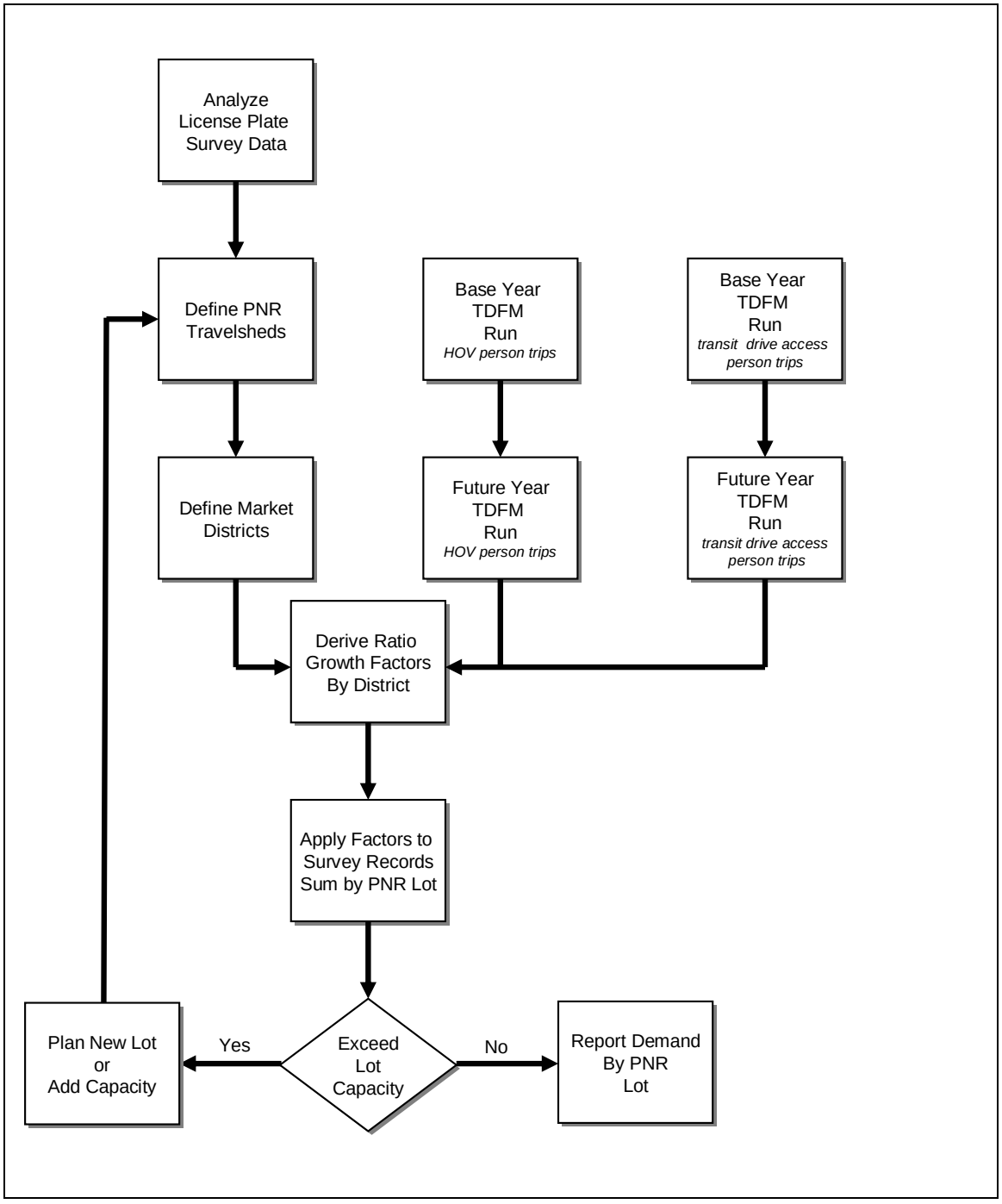
To assign the lots to districts, data from a park-and-ride lot license plate survey was used. The geocoded origin zone park-and-ride lot data from that survey were combined with a 2006 parking lot utilization survey to produce the baseline inputs to which the district-level growth factors were applied. Existing parking utilization for lots in the FAMPO area was provided and the origin zone of lot users was synthesized based on demographic data for the area. This was done because the southern lots were not included in the license plate survey.

The methodology assumed that future drive access and HOV drivers will choose a park-and-ride lot in the same travel shed that they do today. The lots were aggregated into subareas to help address the question of users shifting between lots. The rationale was that users will not shift to lots outside of the subareas they use today. The grouping also allows the study to better address the need for new spaces and lots within each subarea.

In determining the number of parking spaces required based on the forecast demand, it was assumed that future capacity improvements should result in approximately 90 percent maximum utilization of the subarea. Research shows the need to have some surplus at park-and-ride facilities to encourage use and provide some level of reliability. The analysis considered lots in the subareas that were over 90 percent utilization and proposed increasing the number of spaces until there was a 10 percent surplus.

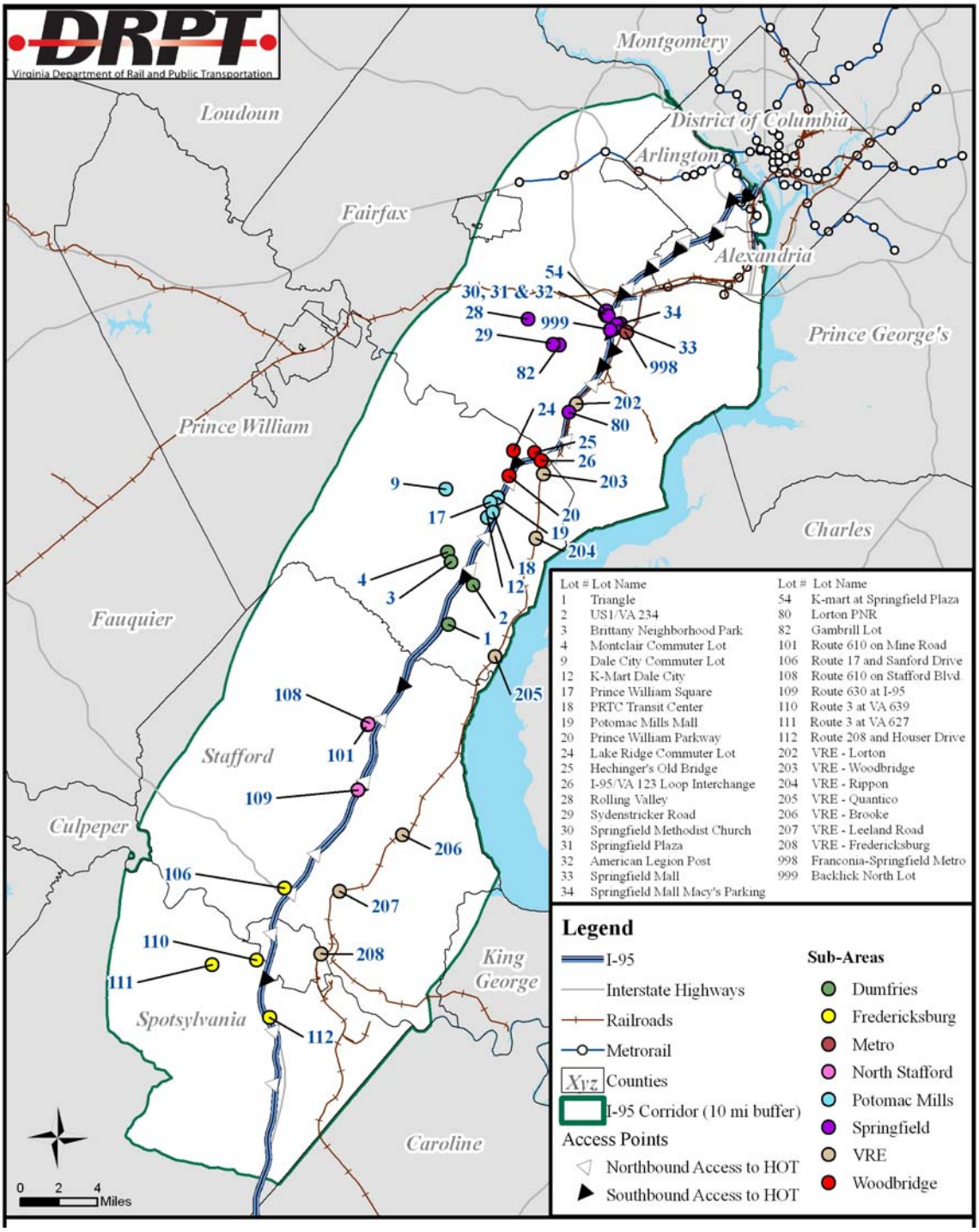
The analysis also recognized that some lots generate a unique synergy given their size and the level of transit service at the lot. This recognition applied to the Prince William Parkway (Horner Road) Lot. The demand for this lot was increased by 20 percent from the original forecast. This increase in demand was a recommendation of the TAC stakeholders. In order to balance this increase in the analysis process, the added 20 percent was assigned from other lots in the Woodbridge subarea to the Prince William Parkway (Horner Road) Lot.

Figure 7-1. Park-and-Ride Forecasting Method Flowchart



Note: TDFM = Travel Demand Forecasting Model
PNR = Park-and-Ride Lot

Figure 7-2. Existing Park-and-Ride Lots by Subarea



Current leased lots which were part of the Springfield Interchange Congestion Management Program (CMP) were not included in the assessment of future available capacity due to the uncertainty associated with their availability in the future. This includes the American Legion Post, Springfield Plaza K-Mart, and the Springfield Macy's Garage. The deletion of the capacity for these lots was done under the recommendation of VDOT staff serving as TAC stakeholders based on the leasing agreements.

An adjustment factor was added to the demand projections for lots in the southern end of the study corridor. The factor was added to address the constraints of the model network and the impact of potential HOV external trips. A 10 percent factor was applied to the demand for these lots. It was derived from knowledge of the historic travel patterns in the area.

This analysis focused on drive to transit for bus service and HOV users. The VRE parking forecast was tied to the growth in the commuter rail home-based work trips represented in the results of the postprocess mode choice model. The forecast for the Springfield Metrorail station was provided by WMATA. This analysis did not focus on the Metrorail parking demands but did list the station parking needs in the results as was recommended by the TAC stakeholders.

7.2 Demand Forecasts

Table 7-2 provides a summary of the parking demand and needs by subareas. The needs shown reflect the difference between forecasted demand and capacity within the subarea (with a 90 percent target utilization and rounded to the nearest 50 spaces) and supplemental recommendations by the TAC. Table 7-3 provides the demand forecast for each lot in the study area by subarea. The table lists the year 2006 usage and utilization as well as the percent of future demand to capacity. Figures 7-3 and 7-4 show the demand for the year 2015 and 2030 by lot.

The current year 2006 total demand for lots in the corridor was 20,014 while the current capacity was 23,351 spaces. This resulted in a corridor lot utilization of 86 percent. The year 2015 demand was estimated at 24,700 spaces and the year 2030 demand was estimated at 27,800 spaces. Figure 7-5 shows the demand in terms of required spaces by subarea by year.

Table 7-2. Summary of Forecast Demand and Recommendations

Subareas	2006 Conditions			Forecast Demand		Future Additional[a]	Future Capacity	Required 2030[b]	Recommendations
	Count	Capacity	Utilization	2015	2030				
Dumfries	527	524	101%	700	700	500	1,024	500	The planned expansion of the U.S. 1 at VA 234 lot addresses the future demand concerns for the Dumfries subarea. VDOT requested an additional 500 spaces due to a potential undercount for the current users at that lot.
Fredericksburg	2,182	3,073	71%	3,000	3,900	–	3,073	1,250	Expand lot at U.S. 17 at Stanford Road – this lot serves HOV and transit commuters from the south headed to northern destinations. There should be an additional 300 spaces added to this lot. The lot will have a future in-line station and corresponding transit service. Add 650 spaces to the lot at VA 3 at VA 627 – there is available land at this location, and this will serve growing demand along VA 3 west of I-95. Add a 300 space lot to the Massaponax area where the HOT facility terminates.
Metrorail[c]	5,615	5,069	111%	5,800	6,300	–	5,069	1,925	This demand is not being addressed as part of this study, but it is noted that there is additional demand for spaces at the Franconia-Springfield Metrorail Station based on WMATA's forecast.
North Stafford	2,055	2,100	98%	2,800	3,800	–	2,100	2,125	Add a new 1,500 space lot in the vicinity of VA 610 at U.S. 1. A park-and-ride lot at this location will match-up with the proposed in-line station and provide connectivity to transit users. It will also serve as a gathering point for ridesharing activities. Also consider the addition of 625 spaces to the existing lot at VA 630 – there is ample land and future demand in that area

[a] "Future Additional" column refers to additional capacity that has been committed to and funded. The information was provided by VDOT and represents VDOT and relevant jurisdiction commitments.

[b] "Required 2030" column represents the subarea need due to demand forecasted through the analysis (a 90 percent utilization target was used) or as determined by the TAC.

[c] Metrorail station park-and-ride usage and demand forecast was provided by WMATA.

Table 7-2. Summary of Forecast Demand and Recommendations (continued)

Subareas	2006 Conditions			Forecast Demand		Future Additional[a]	Future Capacity	Required 2030[b]	Recommendations
	Count	Capacity	Utilization	2015	2030				
Potomac Mills	1,570	2,012	78%	1,700	1,900	–	2,012	500	Add 500 spaces to PRTC Transit Center – this is the future site of an in-line station. Although there is a surplus of spaces at other lots in the subarea, with the proposed in-line station at the PRTC transit center additional parking is needed.
Springfield/ Lorton	1,558	2,202	71%	1,641	1,781	-389	1,813	450	Due to loss of leased lot spaces there is a need for additional spaces in the Springfield CBD area.
VRE	2,846	4,024	71%	4,900	4,900	619	4,643	1,475	VRE station parking needs to be expanded to service parking demand or shuttle services need to be evaluated. Structured parking may be required at some sites due to lack of land availability. Stations with the highest demand are at the southern end of the study corridor. Specific stations have specific needs so demand at one station cannot be serviced by capacity at other.
Woodbridge	3,505	4,177	84%	3,900	4,200	–	3,588	1,500	These spaces should be added at the Prince William Pkwy (Horner Road) lot. There is capacity in the subarea, but because of the activities at the Prince William Pkwy (Horner Road) lot there is a need for spaces there.
Total Demand	**20,014**	**23,351**	**86%**	**24,700**	**27,800**	**730**	**23,492**	**9,700**	

[a] "Future Additional" column refers to additional capacity that has been committed to and funded. The information was provided by VDOT and represents VDOT and relevant jurisdiction commitments.

[b] "Required 2030" column represents the subarea need due to demand forecasted through the analysis (a 90 percent utilization target was used) or as determined by the TAC.

[c] Metrorail station park-and-ride usage and demand forecast was provided by WMATA.

Table 7-3. Park-and-Ride Demand Analysis Individual Lot Demand

		2006 Existing		Forecast Demand		Future Capacity	Demand to Capacity		
Subarea	Name	Count	Capacity	2015	2030	2030	2006	2015	2030
Dumfries	Triangle	29	29	40	40	29	100%	138%	138%
	US1/VA 234	395	360	510	570	860	110%	59%	66%
	Brittany Neighborhood Park	63	85	80	80	85	74%	94%	94%
	Montclair Commuter Lot	40	50	50	50	50	80%	100%	100%
Fredericksburg	Route 17 and Stanford Drive	688	1,000	920	1,220	1,000	69%	92%	122%
	Route 3 at VA 639	607	707	840	1,080	707	86%	119%	153%
	Route 3 at VA 627	452	572	620	800	572	79%	108%	140%
	Route 208 and Houser Drive	435	794	610	780	794	55%	77%	98%
Metrorail	Franconia-Springfield Metrorail Station	5,615	5,069	5,770	6,300	5,069	111%	114%	124%
North Stafford	Route 610 on Mine Road	750	750	1,030	1,390	750	100%	137%	185%
	Route 610 on Stafford Boulevard	827	827	1,140	1,530	827	100%	138%	185%
	Route 630 at I-95	478	523	650	870	523	91%	124%	166%
Potomac Mills	Dale City Commuter Lot	295	591	310	320	591	50%	52%	54%
	K-Mart Dale City	62	240	70	80	240	26%	29%	33%
	Prince William Square	0	45	0	0	45	0%	0%	0%
	PRTC Transit Center	156	200	180	190	200	78%	90%	95%
	Potomac Mills Mall	1,057	936	1,180	1,270	936	113%	126%	136%

Table 7-3. Park-and-Ride Demand Analysis Individual Lot Demand (continued)

		2006 Existing		Forecast Demand		Future Capacity	Demand to Capacity		
Subarea	**Name**	**Count**	**Capacity**	**2015**	**2030**	**2030**	**2006**	**2015**	**2030**
Springfield	Rolling Valley	482	664	500	540	664	73%	75%	81%
	Sydenstricker Road	181	170	170	190	170	106%	100%	112%
	Springfield Methodist Church	69	57	70	80	57	121%	123%	140%
	Springfield Plaza	272	254	280	310	254	107%	110%	122%
	American Legion Post	115	100	Closed			115%		
	Springfield Mall	23	80	20	30	80	29%	25%	38%
	Springfield Mall Macy's Parking	285	500	Closed			57%		
	K-Mart at Springfield Plaza	51	50	Closed			102%		
	Lorton PNR	14	170	330	350	340	50%	97%	103%
	Gambrill Lot	66	157	70	80	157	42%	45%	51%
	Backlick North Lot (NEW)	0	0	475	510	261		182%	195%
VRE	Lorton	237	567	400	410	567	42%	71%	72%
	Woodbridge	363	738	620	630	738	49%	84%	85%
	Rippon/Cherry Hill	345	676	590	600	1,176	51%	50%	51%
	Quantico	170	258	290	290	308	66%	94%	94%
	Brooke	358	431	610	620	500	83%	122%	124%
	Leeland Road	606	652	1,030	1,050	652	93%	158%	161%
	Fredericksburg	767	702	1,310	1,330	702	109%	187%	189%
Woodbridge	Prince William Parkway (Horner Road)	2,364	2,317	2,630	3,390	2,317	102%	114%	146%
	Lake Ridge Commuter Lot	521	600	540	340	600	87%	90%	57%
	Hechinger's Old Bridge	505	580	550	360	580	87%	95%	62%
	I-95/VA 123 Loop Interchange	115	680	140	90	680	17%	21%	13%
Total		**20,014**	**23,351**	**24,610**	**27,760**	**24,731**	**86%**	**100%**	**112%**

Figure 7-3. Park-and-Ride Lots Demand – Based on 2015 Refined Alternative

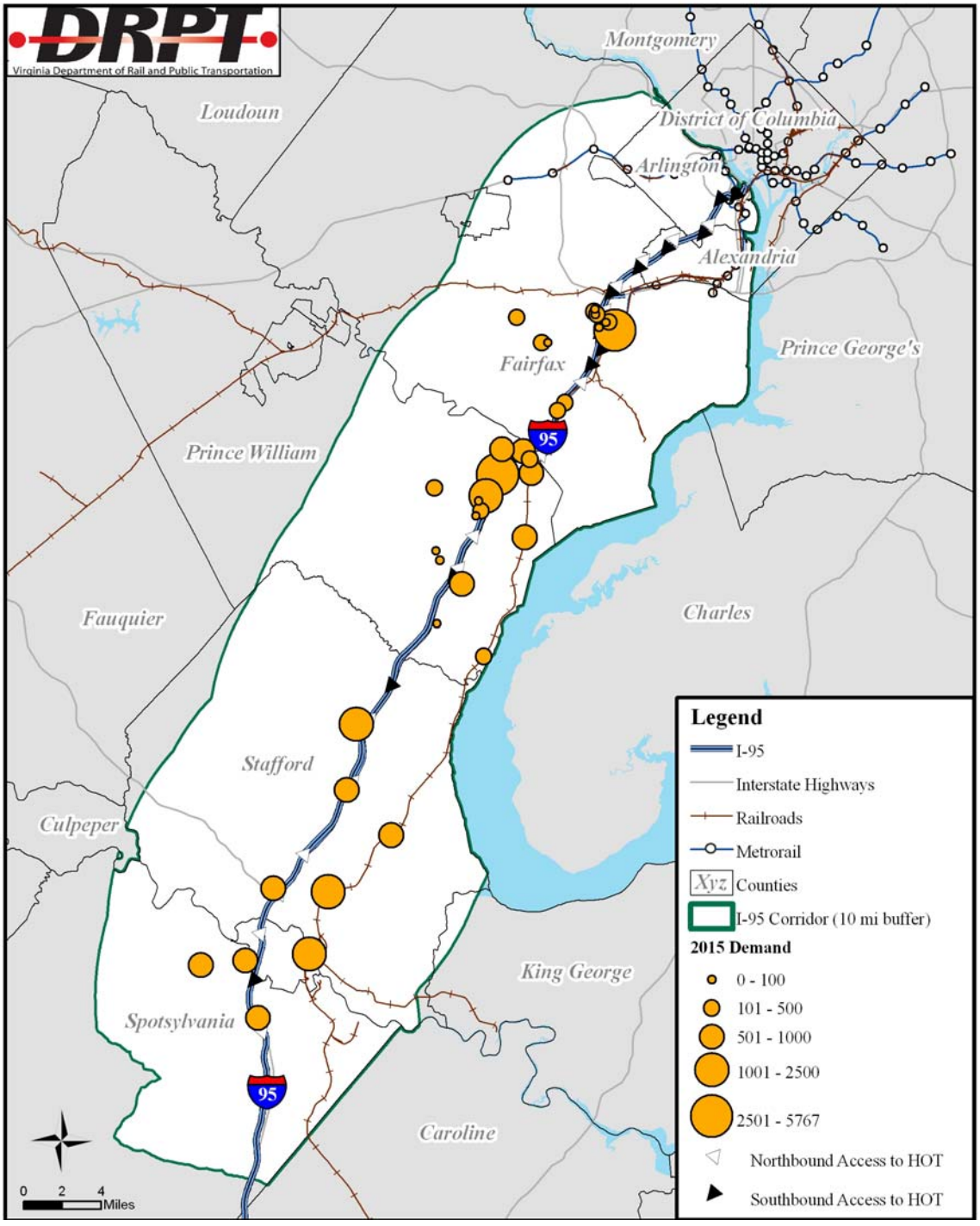


Figure 7-4. Park-and-Ride Lots Demand – Based on 2030 Refined Alternative

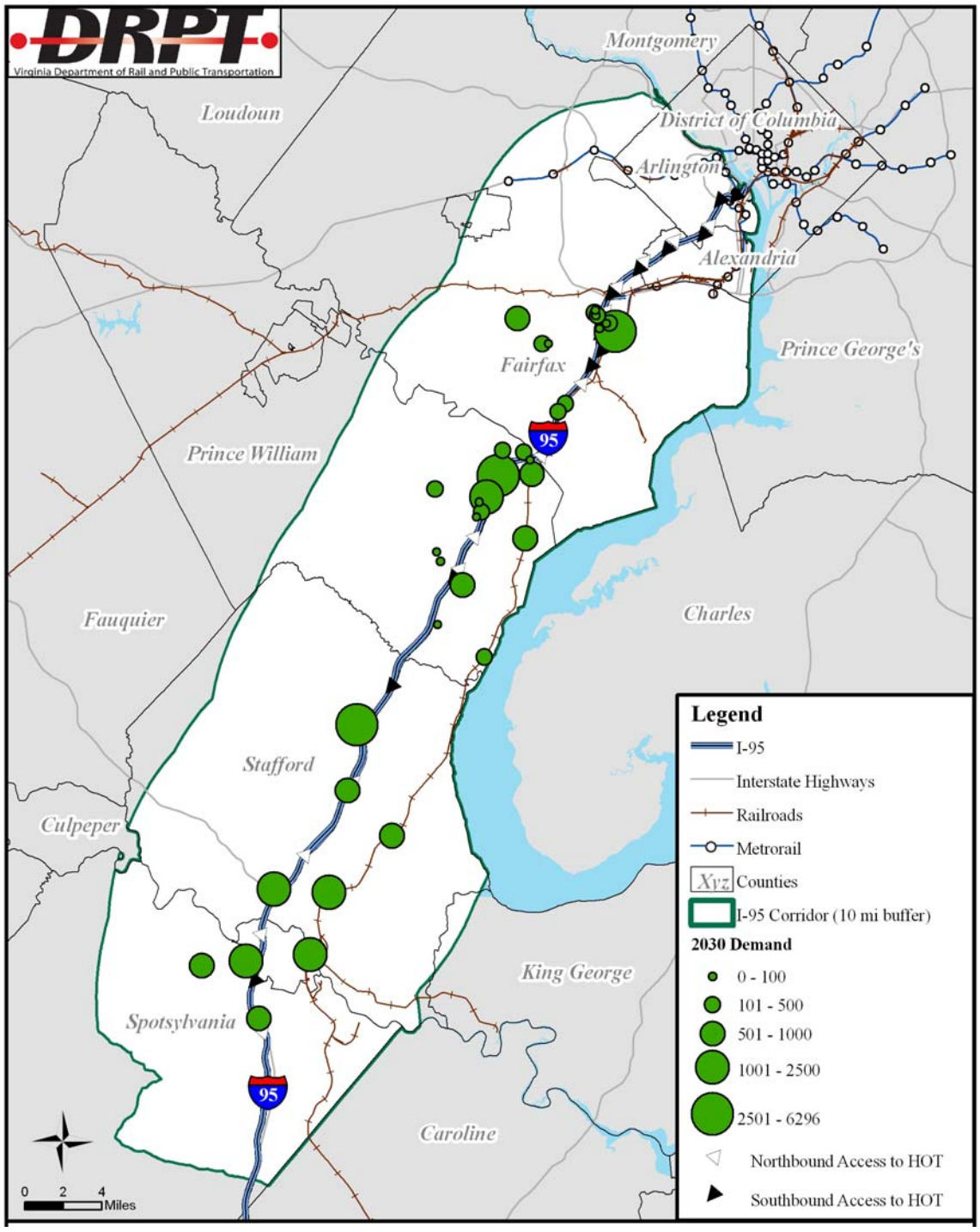
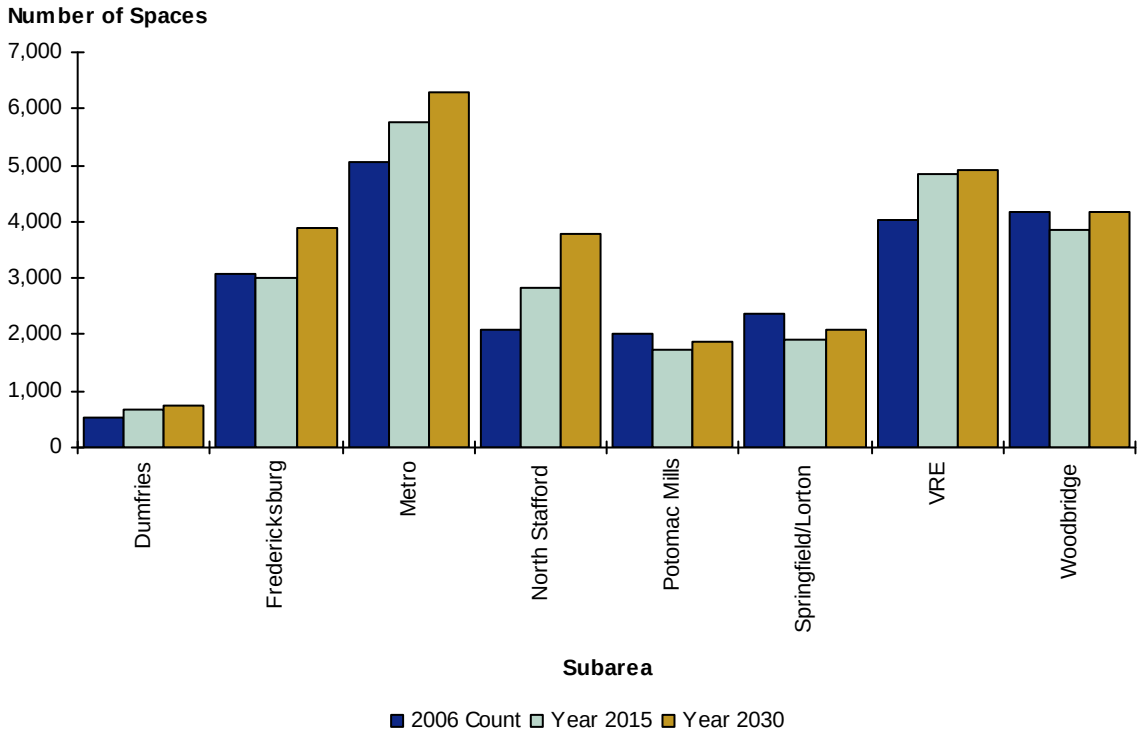


Figure 7-5. Park-and-Ride Lot Demand Forecasts



7.3 Recommendations for Expanded Capacity

The forecast demand for the park-and-ride lots was integrated with the travel demand forecast modeling. The lots were aggregated to park-and-ride subareas. These subareas were based on geography referenced in Figure 7-2. The subareas were:

- **Dumfries –** Southern Prince William County;
- **Fredericksburg –** Southern Stafford County to Spotsylvania County;
- **Metrorail –** Franconia-Springfield Metrorail Station;
- **North Stafford –** South of Quantico to VA 630;
- **Potomac Mills –** The area around Potomac Mills Shopping Center and the PRTC transit center;
- **Springfield/Lorton –** The area of Fairfax County south of the Beltway (I-495/I-95) in the study corridor;
- **VRE –** All VRE stations on the Fredericksburg Line south of Springfield; and
- **Woodbridge –** South of the Occoquan River and north of Dale Boulevard.

The purpose of the subareas was to evaluate the demand for a specific location and allow for that demand to be balanced with available capacity in the surrounding area. If a certain lot was over capacity and there were lots located nearby, then the available capacity could be balanced with the subarea demand needs. This approach allowed for excess capacity in the subarea to service the required demand and fully utilized existing resources in the surrounding vicinity. In some subareas certain lots were recognized by the TAC stakeholders to have greater activity levels that therefore required additional spaces even when the adjacent lots had capacity. Overall the analysis balanced the needs of subarea as a whole with the available capacity. The commuter rail stations were treated differently in that the subarea for commuter rail covered the whole corridor. Station parking demand had to be addressed for each specific station along the line.

In developing recommendations for the Refined Alternative, the first priority in allocation of spaces was to provide parking for the proposed in-line stations. The second priority was to address areas with the largest difference between forecasted demand and forecasted capacity. The third priority was to minimize partial funding of park and ride lots and thereby minimize disruption at the facilities (minimize partial builds on lots). In some subareas there was a need to recommend building new lots to meet demand. Given the characteristics of HOV rideshare users, the goal was not to create a new lot since existing lots have some inherent inertia around the ridesharing and slugging activities. Where new lots are proposed, transit service is programmed for these lots and should provide a backbone for slugging and ridesharing activities. Figure 7-6 shows the year 2030 parking needs by lot. This map represents the demand over the available or future programmed capacity for each lot.

The North Stafford subarea showed the largest need for new spaces. This subarea needs a total of 2,125 new spaces to meet the project year 2030 demand. Adding a new 1,500 space lot in the vicinity of VA 610 at U.S. 1 would serve the proposed in-line station needs as well as the growing HOV market in north Stafford County. A park-and-ride lot at this location will provide connectivity to transit and serve future HOV needs. The addition of 625 spaces to the existing lot at VA 630 should also be considered.

VRE shows the second-largest need for spaces given the growth of commuter rail riders in the study corridor. VRE needs a total of 1,500 spaces dedicated to the three stations at the southern end of the Fredericksburg Line. This would include 200 new spaces at the Brooke Station, 500 new spaces at the Leeland Road Station, and 800 new spaces at the Fredericksburg Station. Although there is a surplus of spaces for stations to the north there is still significant need for the southern stations. The proposed addition of a new station between Rippon and Quantico with 550 new parking spaces does help with demand in northern Stafford and southern Prince William Counties. The VRE subarea is different from the other subareas in that users of a specific lot are not likely to shift lots, rather they may shift modes. So, even with demand being met in the northern part of the corridor, there is still a need for improvements to the stations in the southern part of the corridor.

Based on the demand forecast analysis, the Fredericksburg subarea shows the third-largest need for spaces in the study corridor – 1,250 new spaces. Three recommendations result for this subarea. First, expand the lot at U.S. 17 at Stanford Road by 300 spaces as this lot serves HOV and transit commuters from the south headed to northern destinations. This lot will also have a future in-line station and corresponding transit service. Second, there is a substantial need along VA 3 west of I-95. An additional 650 spaces should be built at VA 3 at VA 627. Third, a 300 space lot should be located in the Massaponax area where the HOT facility terminates. This is the proposed location of the future transit center for the area.

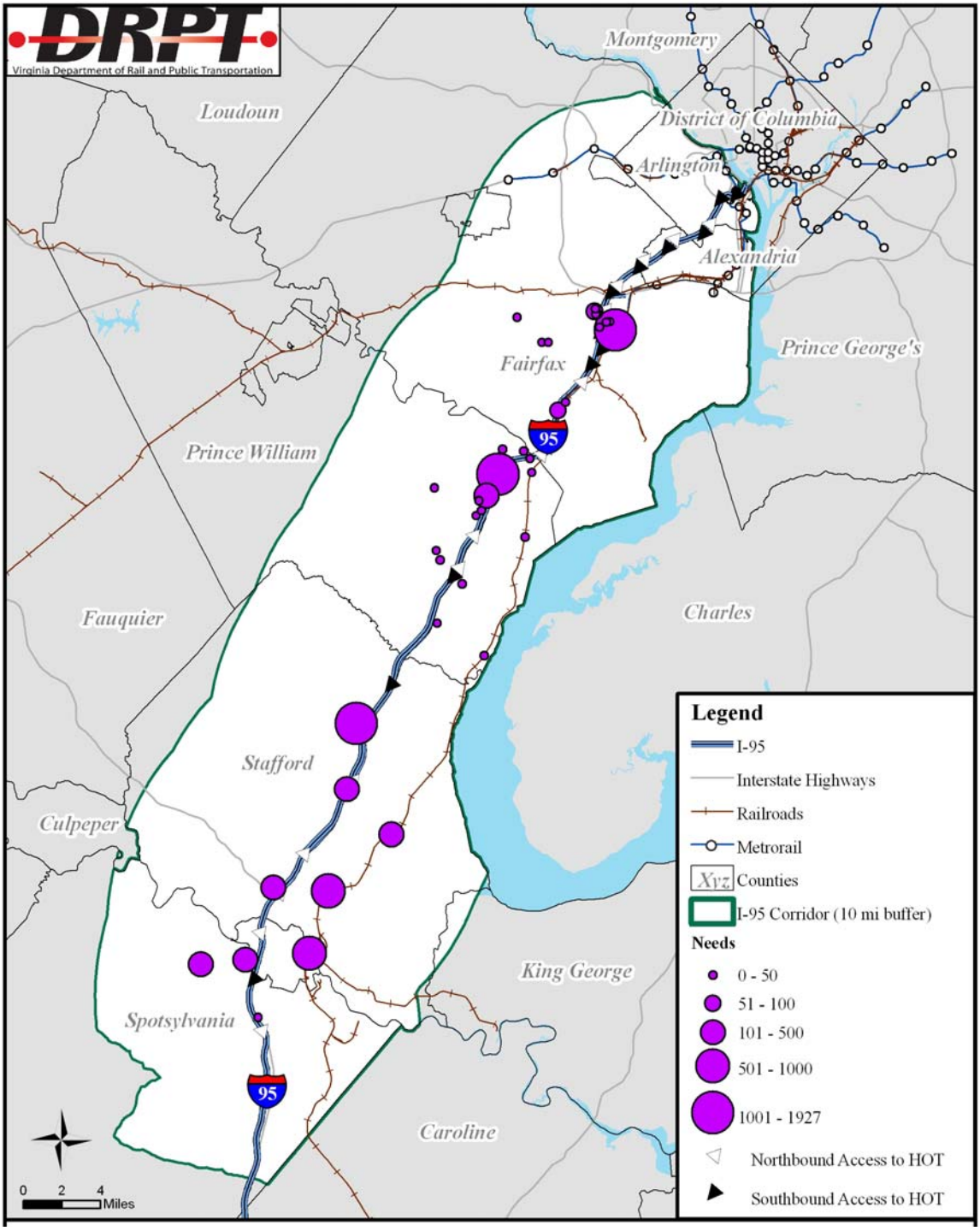
For the Woodbridge subarea there is a need for 1,450 spaces at the Prince William Parkway (Horner Road) lot. The stated need at this lot reflects an adjustment upward to reflect the quality and level of transit service passing through this lot. Given the activity level at the Prince William Parkway (Horner Road) lot it was recommended by the TAC stakeholders that additional demand be assigned there and that the resulting demand for spaces be met. The excess capacity associated with the park-and-ride lot at the I-95 and VA 123 interchange was excluded from the analysis because it has access issues and has historically been underutilized.

The forecasted Dumfries subarea demand can be addressed by the proposed expansion of the lot at U.S. 1 at VA 234. However, there is some question about the accuracy of the utilization of the current lot as it is believed that the count data did not account for all of the users. This lot is currently at capacity and there is some evidence that users may park at off-property locations in the adjacent areas. Under direction from VDOT staff and the TAC, the recommendation is for an additional 500 spaces for this lot. The U.S. 1 at VA 234 lot is a very successful park-and-ride facility and it is expected that the demand will grow for that lot.

The Potomac Mills and Springfield/Lorton areas have the lowest growth in demand among subareas. The Potomac Mills subarea shares demand with the Woodbridge subarea, but for this analysis they have been evaluated separately. The Potomac Mills subarea shows a need for 500 new spaces, and it is recommended to add these spaces to the PRTC Transit Center. This is the future location for the proposed in-line station and will further allow HOV and transit users to take advantage of the transit service through this hub. There is available capacity at other lots in the subarea, but given the location of the proposed in-line station, the transit center provides a convenient location for transit and ridesharing activities.

The Springfield/Lorton area shows a need for 450 spaces in the Springfield CBD. These spaces may have to be structured parking and have been evaluated at that cost for this analysis. There were three lots in this subarea with uncertainty about their availability in the future. The lots that may be closed are American Legion lot, K-Mart lot, and the Springfield Mall Macy's lot. The new lot just completed is the Backlick North lot with 261 spaces was added to the analysis. The other lots in the CBD area, excluding the Metrorail Station, are privately owned and Fairfax County has agreements/proffer for their use. For this analysis it was assumed that these spaces would be available in the future since they have been used for the past several years.

Figure 7-6. Park-and-Ride Lots – 2030 Future Needs



7.3.1 Fiscally Constrained Recommendation

The total spaces needed in the corridor to match the demand and provide the maximum utilization of 90 percent is approximately 9,700, including the WMATA identified need. Under the PPTA proposal, Fluor-Transurban is expected to build 3,000 spaces. The remaining need requires supplemental funding to address the projected demand. The Fiscally Constrained Alternative, presented in Section 9.0, recommends $37.5 million be made available for park-and-ride needs. The recommended allocation was developed, intended to balance multiple factors:

1. Provide parking for the proposed in-line stations;

2. Address areas with the largest difference between forecasted demand and forecasted capacity; and

3. Minimize partial funding of park and ride lots and thereby minimize disruption at the facilities (minimize partial builds on lots).

Table 7-4 shows the resulting recommended needs and the project priority funded spaces under the Refined Alternative and Fiscally-Constrained Refined Alternative.

Table 7-4. Funded Versus Needed Parking Spaces by Subarea

	Forecast Demand		Parking Proposed			
Subarea Districts	**2015 (Spaces)**	**2030 (Spaces)**	**Refined Alternative (Spaces)**	**Fiscally-Constrained Refined Alternative (Spaces)**	**Non-Funded Needs (Spaces)**	**Percentage of Identified Need that is Funded (Spaces)**
Dumfries	700	700	500[a]	0	500	0%
Fredericksburg	3,000	3,900	1,250	475	775	38%
Franconia-Springfield Metro Station	5,800	6,300	1,925[a]	0	1,925	0%
North Stafford	2,800	3,800	2,125	2,125	0	100%
Potomac Mills	1,700	1,900	500	250	250	50%
Springfield/Lorton	1,900	2,100	450	450	0	100%
VRE	4,900	4,900	1,500	1,500	0	100%
Woodbridge	3,900	4,200	1,450	1,200	250	83%
Total Demand	**24,700**	**27,800**	**9,700**	**6,000**	**3,700**	**62%**

[a] Designates additional need that was identified by the TAC beyond rather that shown through the analytical tool.

Overall, the total spaces recommended by the Fiscally Constrained Alternative and proposed for Fluor-Transurban represent 62 percent of the identified need. This figure includes WMATA's stated parking need at the Franconia-Springfield Metrorail Station. Excluding WMATA-stated needs, the total spaces recommended represents 77 percent of the identified need (which includes 90 percent utilization of the supplied spaces as a target). Therefore, much of the subareas' needs are being met under this allocation.

Given that demand for parking at the Franconia-Springfield Metro Station appears to exceed its available supply and given that the sector plan has proposed redevelopment and densification, there could be need for additional spaces in the Springfield Subarea beyond those forecast with our methodology and assumptions. An additional level of analysis would be necessary to evaluate to what extent station parking demand could be satisfied by additional satellite parking in the Springfield subarea. Without such an analysis, it can only be speculated that some percentage of the on-site demand could be satisfied with off-site spaces.

Accepting that additional spaces may be required in the Springfield Subarea, any additional funded spaces allocated to it would have to come at the expense of funding for spaces in other subareas. Given the land use in the Springfield Subarea, the spaces being allocated are assumed, for this analysis, to be structured parking and cost more to construct than surface spaces. Therefore, for every space added to the Springfield Subarea, approximately three surface spaces would need to be taken away elsewhere in the corridor.

The allocation of spaces recommended in the Fiscally-Constrained Refined Alternative in Table 7-4 appears to balance needs in the corridor, particularly when thought is given to the location of the proposed VRE parking enhancements. For example, the Fredericksburg subarea benefits indirectly from the VRE parking allocation in that area. The need ascribed to the Dumfries subarea was not developed through the demand analysis and has therefore was discounted in our prioritization, particularly in light of an already planned 500-space expansion for the area.

As is noted in the Investment Strategy section, the recommendations about parking sizing and location are subject to change based on more rigorous follow-up analysis focused on site opportunities and constraints. For the Woodbridge, Potomac Mills, and Dumfries subareas it is acknowledged that there is some overlap in the markets served among these areas. Due to this overlap, it is noted that refined information may, in the end, warrant allocation among the three sub-areas differently.

The spaces have been further allocated to designate those spaces to be addressed by the Fluor/Transurban pledge and those spaces to be addressed using the additional funding from the fiscally-constrained recommendation. It is recommended that the Fluor/Transurban pledge be used to construct the following:

- 450 spaces in the Springfield/Lorton subarea;
- 300 spaces for the Massaponax transit center in the Fredericksburg subarea;
- 1,050 of the 1,500 spaces at the proposed VA 610 at U.S. 1 lot (North Stafford subarea); and
- 1,200 additional spaces at the Prince William Parkway (Horner Road) lot (Woodbridge subarea).

The $37.5 million allocated for park-and-ride spaces as part of the transit/TDM strategies should be used to build the following spaces:

- 175 spaces for the Fredericksburg subarea;
- The remaining 1,075 spaces recommend for the North Stafford subarea (includes remaining spaces at VA 610 and spaces at VA 630);
- 250 spaces for the Potomac Mills subarea at the PRTC transit center; and
- 1,500 spaces at the VRE stations.

There are additional needs that cannot be addressed under the Fiscally Constrained Refined Alternative. If funds are obtainable, then addressing these needs should be considered. Additional spaces recommended, but unfunded, are:

- 500 spaces for the Dumfries subarea;
- 775 spaces for the Fredericksburg subarea;
- 1,925 spaces for Springfield Metrorail Station;
- 250 spaces for the PRTC transit center in the Potomac Mills subarea; and
- 250 spaces at the Prince William Parkway (Horner Road) lot.

7.4 Additional Analysis Needed

The park-and-ride analysis presented in this section represents a planning document rather than the actual programming of spaces and lots. Further study is needed to detail certain elements of the park-and-ride plan, including:

- Details on the specific location and available land resources;
- The park-and-ride recommendations will require preliminary engineering work to be done in order to provide implementation cost estimates and to identify environmental or other concerns; and
- Further study may be desired of park-and-ride needs as well as other transit and mobility enhancement projects in the corridor beyond the constraints imposed by the availability of funds from the I-95/I-395 HOV/HOT-Lane Project.

8.0 Cost Estimates

The TAC provided important input in developing the cost estimates for the Refined Alternative. Cost data was obtained through the Federal Transit Administration (FTA) National Transit Database (NTD), through a survey of the local operators, and through individual discussions. The objective was to incorporate local costs. This section outlines important assumptions and data used to develop the estimates and presents the summary estimate.

8.1 Assumptions

Assumptions are divided into overall, operating, and capital cost categories and discussed in the following subsections.

8.1.1 Overall Costs

The concept of Present Value guided the development of the cost estimates. That is, costs were stated in terms of a single reference year. The reference year was developed as 2010. For existing costs this meant inflating to 2010 for use as the base year. Based on consumer price index (CPI) data, a three percent annual increase was employed. A 20-year horizon was used for accumulating costs.

8.1.2 Operating Costs

The following operating cost assumptions were applied:

- For the Refined Alternative it was assumed that all services would be operated for the entire 20 years. For the fiscally constrained alternative (described in Section 9.0, Investment Strategy) a phasing plan was developed where some services would operate for shorter time periods.

- A straight cost per hour model (rather than a multiple variable cost model) was used. The level of accuracy is sufficient with this method given that 20-year cost estimates are being developed.

- Incremental/marginal costs were used for public transit operators. Thus, the cost estimates include operating costs, maintenance, and insurance/accidents (but not other administrative costs). To ensure “apples” to “apples” comparisons, the most recent NTD data reports for each system were used. The relevant NTD costs are increased for inflation to bring them to 2010 dollars.

- Cost per ***vehicle*** hour was used. Vehicle hours were used rather than revenue hours since this includes deadhead hours in the estimates. Adjusted to year 2010 dollars, the following incremental cost per vehicle hour figures apply:

  - WMATA = $95.24;
  - Fairfax Connector = $93.82;
  - PRTC = $86.77;
  - FAMPO express routes = $86.77
  - FRED = $53.05;

  - ART = $82.67;
  - DASH = $64.76;
  - Additional costs associated with longer VRE trains represents $300,000/train annually; and
  - To add three additional trains, VRE estimates the operating cost to be $1.4 million per round trip annually (includes railroad access fees).

- Assumed deadhead of 10 percent for services that are not commuter/one-way based on 2006 NTD data on vehicle hours/revenue hours. For commuter services, it was assumed that they deadheaded back to PRTC or Stafford/Fredericksburg.

8.1.3 Capital Costs

The following capital cost assumptions were applied:

- Vehicles – for the refined alternative, the cost of purchases required during the 20 year period was assumed. For the fiscally constrained alternative, the phasing plan for each service was used to determine the cost of purchases during the applicable period. The following schedule of costs was used for purchased equipment in 2010 dollars:
  - Bus – 12-year life – 40-foot Low Floor $500,000;
  - Bus – 12-year life – 30-foot Low Floor $325,000;
  - Commuter Rail Cars – $2.1 million; and
  - Commuter Rail Locomotives – $4 million.
- In-Line Stations – $10 million per station – not including parking. Parking at in-line stations was budgeted separately using the parking space allotment (below).[1]
- Parking – $10,000 per surface space for VDOT (VRE uses $15,000 per surface space construction cost and $30,000 per structured space construction cost).
- Other station improvement estimates come from operators (VRE platform extensions, Metrorail transit center improvements).
  - Metrorail bus transit center improvements – rough estimate of $2.5 million per transit center;
  - Massaponax transit center – $1.5 million;
  - VRE platform extensions – $1 million for 300-foot extension; and
  - VRE Crossroads yard extension *(end of Fredericksburg line)* – $1.35 million

8.2 Detailed Estimate

Total capital costs for the Refined Alternative, unconstrained by revenue limitations, were estimated at $230 million in year 2010 dollars. Cumulative operating and maintenance costs in 2010 year dollars were estimated at $417 million. The total 20-year program cost for the Refined

[1] The unit cost figure is intended as a planning estimate inclusive of reasonable project-induced elements except parking and transit service provisions. The planning figure for parking facilities similarly is a planning estimate with some embedded allowances for access costs. The conceptual engineering phase of project planning will provide more robust cost estimates.

Alternative in year 2010 dollars is therefore $647 million. In year-of-expenditure dollars, these figures are approximately $595 million for cumulative operating and maintenance costs, $267 million for capital costs, and $862 million in total. Exhibit 8-1 presents a summary of the cost estimates and assumptions for each project element in the Refined Alternative.

Exhibit 8-1

Service Modifications			Service Hours		Operating Costs (2010 Dollars)			Capital Costs (2010 Dollars)				Total Cost
Originating Area	Operator	Description	Additional Annual Revenue Hours	Additional Annual Vehicle Hours	Operating Cost/Vehicle Hour	Total Annual Operating Costs	20-Year Operating & Maintenance Cost	Vehicle Needs	Potential Vehicle Costs	Vehicle Assumptions	20-Year Capital Cost	20-Year Total Costs (2010 Dollars)
Arlington/ Alexandria/DC	ART	**ART 41** -Add 5th bus to ART 41 on weekdays	3,640	4,004	$82.67	$331,011	$6,620,214	1	$325,000	12 yr - 30' Low Floor - $325K	$650,000	$7,270,214
Arlington/ Alexandria/DC	WMATA	**WMATA 7B -** Decrease headway on 7B from 35 minute to 17/18 minute by adding one bus	1,560	1,716	$95.24	$163,432	$3,268,637	1	$500,000	12 yr - 40' - $500K	$1,000,000	$4,268,637
Prince William	PRTC	**Dale City - Navy Yard -** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds 2 additional trips per peak period	1,820	3,640	$86.77	$315,843	$6,316,856	1	$500,000	12 yr - 40' - $500K	$1,000,000	$7,316,856
Prince William	PRTC	**OmniRide North Route 1 (Dale City/Woodbridge - DC)** - Increase Frequency on OmniRide North Route 1 by adding 3 additional trips in each peak period, one in midday and late evening	3,467	6,933	$86.77	$601,605	$12,032,107	3	$1,500,000	12 yr - 40' - $500K	$3,000,000	$15,032,107
Prince William	PRTC	**OmniLink Route 1** - Extend OmniLink Route 1 to Ft. Belvoir during peak periods	2,080	2,288	$86.77	$198,530	$3,970,595	1	$325,000	12 yr - 30' Low Floor - $325K	$650,000	$4,620,595
Prince William	PRTC	**Prince William MetroDirect** - Modify MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours	1,040	1,144	$86.77	$99,265	$1,985,298	1	$500,000	12 yr - 40' - $500K	$1,000,000	$2,985,298
Corridor-wide	VRE	**VRE Train Size** - Increase train size so that 3 of the Fredericksburg trains have 8 cars and 4 have six cars			VRE estimated add'l cost associated with longer trains - 2 add'l 8 car trains @ $300,000/year	$600,000	$12,000,000	6	$12,600,000	$2.1M/car	$12,600,000	$24,600,000
		TOTAL	**13,607**	**19,725**		**$2,309,685**	**$46,193,706**	**14**	**$16,250,000**		**$19,900,000**	**$66,093,706**

New Shuttle/Feeder Bus Services			Service Hours		Operating Costs (2010 Dollars)			Capital Costs (2010 Dollars)				Total Cost
Originating Area	Operator	Description	Additional Annual Revenue Hours	Additional Annual Vehicle Hours	Operating Cost/Revenue Hour	Total Annual Operating Costs	20-Year Operating & Maintenance Cost	Vehicle Needs	Potential Vehicle Costs	Vehicle Assumptions	20-Year Capital Cost	20-Year Total Costs (2010 Dollars)
Alexandria	Alexandria - DASH	**Seminary Road Shuttle -** New shuttle from Seminary Road In-line stations to jobs at Mark Center and Skyline	1,560	1,716	$64.76	$111,128	$2,222,563	1	$325,000	12 yr - 30' Low Floor - $325K	$650,000	$2,872,563
Fairfax/ Springfield	Fairfax Connector	**Franconia-Springfield Metro-EPG-Ft. Belvoir Shuttl**e - New shuttle service between the Springfield Metro - EPG - Ft. Belvoir via Franconia-Springfield Parkway and Fairfax County Parkway	4,680	5,148	$93.82	$482,985	$9,659,707	3	$1,500,000	12 yr - 40' - $500K	$3,000,000	$12,659,707
Fairfax/ Springfield	Fairfax Connector	**Lorton VRE-EPG -Ft. Belvoir Shuttl**e - New "meet the train" shuttle or subscription service between the Lorton VRE Station - EPG/Ft. Belvoir via Telegraph Rd, Fairfax County Parkway and Rolling Rd/Pohick Rd.	2,600	2,860	$93.82	$268,325	$5,366,504	2	$1,000,000	12 yr - 40' - $500K	$2,000,000	$7,366,504
		TOTAL	**8,840**	**9,724**		**$862,439**	**$17,248,774**	**6**	**$2,825,000**		**$5,650,000**	**$22,898,774**

New Bus/Rail Services			Service Hours		Operating Costs (2010 Dollars)			Capital Costs (2010 Dollars)				Total Cost
Originating Area	Operator	Description	Additional Annual Revenue Hours	Additional Annual Vehicle Hours	Operating Cost/Revenue Hour	Total Annual Operating Costs	20-Year Operating & Maintenance Cost	Vehicle Needs	Potential Vehicle Costs	Vehicle Assumptions	20 yr Capital Cost	20-Year Total Costs (2010 Dollars)
Arlington/ Alexandria/DC	ART	**Shirlington - Rossyln** - New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area)	3,120	3,432	$82.67	$283,723	$5,674,469	2	$650,000	12 yr 30'- $325K	$1,300,000	$6,974,469
Fairfax/ Springfield	WMATA	**Lorton/Laurel Hill -EPG - Pentagon** - New express bus route from Lorton - EPG-Pentagon.	4,680	9,360	$95.24	$891,446	$17,828,928	6	$3,000,000	12 yr - 40' - $500K	$6,000,000	$23,828,928
Prince William/Fairfax	PRTC	**Woodbridge - Lorton - Tysons Corner - Merrifield -** New peak period OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons Corner and Merrifield.	3,120	6,240	$86.77	$541,445	$10,828,896	4	$2,000,000	12 yr - 40' - $500K	$4,000,000	$14,828,896
Prince William	PRTC	**Dale City/Lake Ridge - EPG** - New OmniRide route from Dale City/Lake Ridge to EPG (BRAC EIS proposed 30 minute headway).	1,560	3,120	$86.77	$270,722	$5,414,448	2	$1,000,000	12 yr - 40' - $500K	$2,000,000	$7,414,448
Prince William	PRTC	**Woodbridge - EPG** - New OmniRide route from Woodbridge to EPG (proposed 30 minute headway peak only).	1,040	2,080	$86.77	$180,482	$3,609,632	2	$1,000,000	12 yr - 40' - $500K	$2,000,000	$5,609,632
Stafford/ Fredericksburg	FAMPO	**Fredericksburg - EPG/Ft. Belvoir** - New Express/BRT route from Fredericksburg to EPG and Ft. Belvoir (proposed as 30 minute headways peak hour service only)	4,680	9,360	$86.77	$812,167	$16,243,344	6	$3,000,000	12 yr - 40' - $500K	$6,000,000	$22,243,344
Stafford/ Fredericksburg	FAMPO	**Fredericksburg - DC** - New Express/BRT route from Fredericksburg to DC core (when combined with Massaponax, services would operate alternating 15 min)	6,240	12,480	$86.77	$1,082,890	$21,657,792	6	$3,000,000	12 yr - 40' - $500K	$6,000,000	$27,657,792
Stafford/ Fredericksburg	FAMPO	**Massaponax - DC** - New Express/BRT route from Massaponax to DC core (when combined with Fredericksburg, services would operate alternating 15 min)	6,240	12,480	$86.77	$1,082,890	$21,657,792	6	$3,000,000	12 yr - 40' - $500K	$6,000,000	$27,657,792
Fairfax/ Springfield	WMATA	**Kingstowne - Shirlington - Pentagon** - New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria.	18,200	20,020	$95.24	$1,906,705	$38,134,096	5	$2,500,000	12 yr - 40' - $500K	$5,000,000	$43,134,096
Prince William	PRTC	**Central Prince William - Downtown Alexandria -** New OmniRide Route along I-95 corridor serving East Eisenhower Valley and Downtown Alexandria west of Washington Street	3,120	6,240	$86.77	$541,445	$10,828,896	4	$2,000,000	12 yr - 40' - $500K	$4,000,000	$14,828,896
Prince William	PRTC	**Central PW - Pentagon - DC -** New OmniRide Route to start near Hoadley Rd, run express down PW parkway to the HOV lanes then to Pentagon and DC	3,120	6,240	$86.77	$541,445	$10,828,896	4	$2,000,000	12 yr - 40' - $500K	$4,000,000	$14,828,896

New Bus/Rail Services			Service Hours		Operating Costs (2010 Dollars)			Capital Costs (2010 Dollars)				Total Cost
Originating Area	Operator	Description	Additional Annual Revenue Hours	Additional Annual Vehicle Hours	Operating Cost/Revenue Hour	Total Annual Operating Costs	20-Year Operating & Maintenance Cost	Vehicle Needs	Potential Vehicle Costs	Vehicle Assumptions	20-Year Capital Cost	20-Year Total Costs (2010 Dollars)
Prince William	PRTC	**Dale City - Seminary Road Area -** New OmniRide Express Route serving Skyline, Bailey's Crossroads and Mark Center via Seminary Road	2,080	4,160	$86.77	$360,963	$7,219,264	3	$1,500,000	12 yr - 40' - $500K	$3,000,000	$10,219,264
Prince William	PRTC	**Lake Ridge - Seminary Road Area -** New OmniRide Express Route serving Skyline, Bailey's Crossroads and Mark Center via Seminary Road	2,080	4,160	$86.77	$360,963	$7,219,264	3	$1,500,000	12 yr - 40' - $500K	$3,000,000	$10,219,264
Stafford/ Fredericksburg	FAMPO	**Fredericksburg - Tysons Corner - Merrifield** - Extension of new Woodbridge - Lorton - Tysons Corner -Merrifield route to serve Fredericksburg area	3,120	6,240	$86.77	$541,445	$10,828,896	2	$1,000,000	12 yr - 40' - $500K	$2,000,000	$12,828,896
Stafford/ Fredericksburg	FAMPO	**Fredericksburg - Pentagon/Crystal City** - New Express/BRT route from Fredericksburg to Pentagon/Crystal City (proposed as 30 minute headways peak hour only)	6,240	12,480	$86.77	$1,082,890	$21,657,792	6	$3,000,000	12 yr - 40' - $500K	$6,000,000	$27,657,792
Corridor-wide	VRE/Amtrak	Increase number of VRE trains on the Fredericksburg Line from 14 to 20 per day (10 North/10 South). Assume mix of 6 and 8 car trains.	2,340	2,574	This would have three additional trains - VRE estimates the operating cost for those trains of $1.4M per round trip annually	$4,200,000	$84,000,000	7 add'l cars above the "low" plus 3 add'l locomotives	$26,700,000	$2.1M/car -and $4M/ locomotive	$26,700,000	$110,700,000
		TOTAL	**70,980**	**120,666**		**$14,681,620**	**$293,632,405**	**68**	**$56,850,000**		**$87,000,000**	**$380,632,405**

Fixed Facilities			Capital Costs (2010 Dollars)			Total
Originating Area	Operator	Description	Capital Need	Potential Capital Costs	Capital Assumptions	20-Year Total Costs (2010 Dollars)
Arlington/ Alexandria/DC	WMATA	**Pentagon Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security)	Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements	$2,500,000	$2.5M per station	$2,500,000
Fairfax/ Springfield	Fairfax Connector	**Franconia-Springfield Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security)	Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements	$2,500,000	$2.5M per station	$2,500,000
Fairfax/ Springfield	Fairfax Connector	**Transit Center** near Ft. Belvoir/EPG		$10,000,000	$10M per center	$10,000,000
Fredericksburg	FAMPO	**Transit Center** at Massaponax		$1,500,000	$1.5M per center	$1,500,000
Corridor-wide		**Additional park-and-ride lot capacity** at various locations (new and/or existing lots): 500 spaces for Dumfries subarea; 1,250 spaces for the Fredericksburg subarea; 2,125 spaces for the North Stafford subarea; 500 spaces for the Potomac Mills subarea; 450 spaces for Springfield/Lorton subarea; 1,500 spaces for VRE stations; 500 spaces for the Woodbridge subarea.	Allowance for additional spaces beyond those currently proposed by Fluor/Transurban at specific locations to be determined		$10,000 per VDOT space; $15,000 per VRE space	$54,000,000
Corridor-wide		**BRT in-line transit stations** considered along the corridor - 5 stations but 4 in-line stations included in cost		$40,000,000	$10M per station (not including parking)	$40,000,000
Corridor-wide	ITS Improve-ments	**IT projects** to improve integration of information on HOT lanes/parking lots/bus/rail - NEXT Bus				$2,000,000
Corridor-wide	VRE	**Overnight Storage in Fredericksburg**		$1,350,000		$1,350,000
Corridor-wide	VRE	**Platform Extensions** at selected stations	Four stations on Fredericksburg Line would need platform extensions for "low" or "medium" alternatives	$4,000,000	$1M to extend 300' including canopy	$4,000,000
					TOTAL	**$117,850,000**

TDM Program Elements			Total
Originating Area Operator	Description		20-Year Total Costs (2010 Dollars)
Corridor-wide	**Capital Assistance For Vanpools -** Provide financial assistance for the purchase or lease of vans for vanpools. Incentives, IT monitoring and reporting of vanpool mileage, and promotion of Capital cost of Contracting for vanpools. Provide free electronic toll transponders to vanpools.		$10,035,000
Corridor-wide	**Carpool Incentives -** Rewards and incentives for carpoolers.		$3,000,000
Corridor-wide	**Enhanced Guaranteed Ride Home -** Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday.		$2,500,000
Corridor-wide	**HOVER Pilot Program -** HOVER is a facilitated 'park and ride-share' system that involves tracking of all participants usage, and sharing of costs and benefits through a combination of financial and 'HOVER Ride Credit' accounts. Members earn credits for picking up passengers and passengers use their credits to ride. Ride credits are tracked electronically. A park-and-ride lot with 150 - 200 spaces is needed		$3,000,000
Corridor-wide	**Rideshare Program Operational Support -** Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.		$15,000,000
Corridor-wide	**TDM Programs Marketing -** Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets. Provide new signage to promote TDM programs.		$10,550,000
Corridor-wide	**Telework Program Assistance -** Financial incentives and assistance to increase the number of workers teleworking.		$9,500,000
Corridor-wide	**Vanpool Tracking for NuRide -** Develop a tracking mechanism (GPS, cell phone) to track vans used for vanpools and vanpool riders for NuRide.		$200,000
Corridor-wide	**Vanpool Driver Incentives -** Provide incentives to get new drivers and retain existing drivers for vanpools.		$750,000
Corridor-wide	**Vanpool Insurance -** Increase vanpool insurance premium pool buy-down for vanpools.		$4,000,000
Corridor-wide	**VanStart/VanSave -** Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats.		$1,300,000
		TOTAL	**$59,835,000**

	Operating	Capital	TOTAL
Total	**$416,909,885**	**$230,400,000**	**$647,309,885**

9.0 Investment Strategy

9.1 Purpose of the Investment Strategy

This section details the Fiscally Constrained Alternative which includes transit/TDM services and park-and-ride improvements for the corridor. Funding is not currently available for all of the services and programs detailed in the Refined Alternative and Park-and-Ride Analysis. The purpose of this investment strategy is to prioritize and phase recommendations from the Refined Alternative and Park-and-Ride Analysis with estimates of reasonably available revenues and develop a phased transit/TDM project proposal for the corridor. The improvements and investment strategy outlined below would also substitute for the I-95/I-395 HOT lane transit improvements approved in the 2007 MWCOG CLRP and potentially guide the development of the FAMPO CLRP. Costs and revenues within this section are expressed in year 2010 dollars unless otherwise noted.

9.2 Objectives of the Investment Strategy

The proposed I-95/I-395 transit improvements and investment strategy are intended to serve the following objectives:

1. Protect and respect currently planned and programmed transit improvements and associated funding sources;
2. Identify all reasonably available funding sources for the proposed improvements;
3. Prioritize and phase the proposed improvements to satisfy multiple objectives that serve to implement the "best" improvements first; and
4. Leverage reasonably available funding to maximize resources available for the proposed improvements.

9.3 Reasonably Available Revenues for I-95/I-395 Transit/TDM Improvements

The region as a whole, as well as local jurisdictions in the study area, have both a short- and long-term stake in the effort to enhance transit and TDM services in parallel with the proposed implementation of HOT lanes in the I-95/I-395 corridor. In the short-term, enhanced transit/TDM services will serve trips originating along the corridor but with destinations throughout the region, including the Washington downtown core. In the long-term, enhanced transit services in the corridor are likely to become a key part of an expanded regionwide network of high-capacity services operating in major corridors that are already experiencing high levels of congestion.

Historically, regional transportation needs have out-stripped the combined resources available from the Federal, state, and local levels. This remains true today despite recent and continuing major commitments of Federal funds to projects and services of vital importance, e.g., the Woodrow Wilson Bridge and the Springfield Interchange. Looking ahead to the implementation of additional transit improvements in the I-95/I-395 corridor as part of HOT lane project, there continue to be constraints on reasonably available revenues, as noted below, such that the entire program of proposed improvements cannot be completed without additional funding. As a result, prioritization and phasing of proposed improvements is required and an approach to doing so is defined as part of the investment strategy.

In addition to revenue constraints, the intergovernmental complexity of the region poses a challenge. Varied philosophies of governance, unique budgeting and negotiated fund allocation arrangements among local jurisdictions and the State, and the presence of multiple transit operating agencies serving varied portions of the study area contribute to the complexity of funding and instituting new transit services in the I-95/I-395 corridor.

With these contextual challenges noted, the estimate of reasonable available revenues for the I-95/I-395 transit improvements is provided below.

9.3.1 HOT Lane Project Funding Contribution: $195 Million

Project sponsors have proposed that the project will provide a ***lump sum payment of $195 million*** to support additional transit capital and operating improvements beyond those already specified in the original I-95/I-395 HOT Lane proposal (e.g., extension and expansion of the HOV facility, construction of the Lorton in-line station related facilities, and three thousand parking spaces). It is anticipated that these funds would be ***available at the time that the Fluor-TransUrban-VDOT Master Agreement for the HOT lanes project is signed,*** currently projected to be in late calendar 2008. Availability of these funds at that time will allow for priority investments to be undertaken expeditiously, particularly those that may require synchronization with implementation of the northern segment of the HOT lanes.

9.3.2 Additional Farebox Revenues: $63 Million

As new transit services are brought on line, ***additional farebox revenues*** will be available over time to support a portion of the operating cost of the added services. The farebox recovery ratio appropriate for each operator and/or type of services was assumed, based on local data reported in the National Transit Database (NTD). PRTC provided further information on the difference in farebox recovery for their local versus commuter services. Farebox cost recovery among systems and services operating in the study area ranges from a low of 20 percent to a high of 50 percent:

- Local Services:
  - **WMATA –** 30 percent;
  - **PRTC –** 38 percent
  - **Alexandria – DASH** – 26 percent;
  - **Fairfax Connector –** 20 percent;
  - **ART –** 25 percent; and
  - **VRE –** 47 percent.
- Commuter Service – 50 percent.

Based on a weighted average, farebox recovery is approximately 37 percent among relevant providers. That means that for every $1 in operating cost incurred by new services, an average of 37 cents will be contributed by riders and another 63 cents will have to be provided from the HOT lane project contribution or other sources to cover operating costs. Subsidy levels have been estimated for planning purposes. The actual performance of specific services will not become known until after services (and capital investments) have been implemented.

9.3.3 Federal Funding: $40 Million

The current Federal authorization for transit and highway programs (SAFETEA-LU) ends with the 2009 fiscal year. For the purpose of I-95/I-395 transit improvements, it is assumed that ***limited additional Federal funding, formula, or discretionary,*** will be made available from traditional programs to the region for I-95/I-395 transit improvements through this period. The FTA designated recipients in the Washington D.C. urbanized area determine how Federal transit funds are spent in that urbanized area, which encompasses northern Stafford County. For example, a portion of FTA funding to the region from Sections 5307 (Urban Formula), is currently suballocated by WMATA to VRE and PRTC on a formula basis by standing agreement. Essentially, local and regional programming and priorities already dictate the use of funds to the region from presumed 2008 and 2009 Federal appropriations. Therefore, funds from these programs are not anticipated to be reassigned or reallocated for use in the I-95/I-395 corridor.

The exception in the short term is the U.S. DOT Congestion Initiative/Congestion-Reduction Demonstration Initiatives program, for which a proposal solicitation was issued in the *Federal Register* on November 13, 2007. It is the purpose of the program to support efforts that "integrate innovative transit strategies, new transportation technologies, and direct highway pricing during congested periods."[1]

Funding for the approved projects under the Congestion initiative is intended to be provided by a combination of U.S. DOT highway and transit programs at the discretion of the U.S. DOT and modal administrations. This Investment Strategy assumes that VDOT/DRPT intends to apply and will be successful in gaining an additional $40 million to support I-95/I-395 transit capital improvements in concert with the HOT lane project from this initiative or other present or future FTA programs.[2]

Out-Year Federal Funding

Reauthorization of current Federal transit and highway programs is expected over the next two years. This action will determine the scope and focus of Federal transit programs and the level of Federal transit investments for what is expected to be a six-year authorization period. Both in the immediate upcoming reauthorization and certainly in subsequent reauthorizations, several factors mitigate against presuming additional (or continuing) Federal funding for I-95/I-395 transit improvements through subsequent reauthorizations:

- It is impossible to forecast the size, scope, and nature of Federal programs or actual legislative timetables for their enactment;
- The region already has successfully claimed enormous amounts of *discretionary* Federal funding for the major projects noted earlier, some of which remain ongoing and/or are yet to begin;
- Federal *formula* transit funds apportioned to FTA designated recipients in the region are critical to continue these services throughout the region. Availability of formula funds for transit improvements in the corridor will depend largely on how closely they may match FTA designated recipient priorities. Any reallocation of formula funding away from those priorities would necessitate increases in local jurisdictions' support, an unlikely and undesirable consequence, politically, and financially.

[1] Federal Register, Volume 72, Number 218, November 13, 2007, pp. 63951-63956.

[2] The Omnibus Appropriations Bill enacted by Congress in late December 2007 severely limits the Administration's latitude to divert Federal bus discretionary funding for 2008.

Should FAMPO be apportioned formula funds from FTA in the future, it is possible that FAMPO priorities might result in corridor improvements receiving some additional support from FTA formula funding;

- The gap between regional transportation needs, priority investments, and reasonably anticipated Federal funds is such that no other Federal programs, highway, transit, or flexible funds are likely sources for additional transit investment in the I-95/I-395 corridor; and

- Programming and priority-setting for transit and transportation investment in the region are, to a considerable extent, "bottoms-up" processes with local jurisdictions exercising considerable authority in prioritizing investments. It is unlikely that short- or long-term local priorities and associated funding flows will be altered to accommodate any of the I-95/I-395 transit investment, except in cases where proposed corridor investments directly match local priorities.

9.3.4 State Funding: None

Transit Operations. Enactment of HB 3202 allows for an increase in the ratio of state assistance for transit operations. With increasing demand and costs, however, it is unlikely that additional state funding for transit operations will be forthcoming generally or explicitly for transit improvements in the I-95/I-395 corridor.

Transit Capital. HB 3202 includes $300 million in new state bonding authority for transportation capital investment, statewide. Of that, $60 million is explicitly available for transit, including new services. Corridor projects must compete statewide for these funds. It is impossible to estimate, therefore, what portion of these funds might ultimately come to Northern Virginia, or if available in the region, if any would be directed to the proposed I-95/I-395 transit improvements as a reflection of local priorities.

Given current discussions about the potential vulnerability of the provisions of HB 3202 in the Virginia legislature, it is assumed that ***no additional state funding will become available to I-95-395 transit improvements.***

9.3.5 Regional Funding: None

Enactment of HB 3202 provided Northern Virginia, through member jurisdictions of NVTA, the authority to raise new revenues for transportation from five tax sources, approval for which has been achieved by the jurisdictions. The yield from all five "self-help" sources is estimated to be approximately $290 million annually. Revenue collection is to begin January 1, 2008, assuming resolution of pending legislative discussion in favor of the continued implementation of HB 3202 as it was enacted. Funding priorities and programming for the first two years of revenues from these sources already has been determined. A six-year program of priority investments is expected to follow. Given the gap between needs and resources, and the nature of priorities among local jurisdictions, it is ***unlikely that funding from these sources will flow to the proposed I-95/I-395 transit improvements.***

9.3.6 Local Funding: None

HB 3202 provided authority for enactment of three new local option taxes to support priority transportation investments, presumably on a local scale. The Investment Strategy presumes that the proposed I-95/I-395 transit improvements will rarely, if ever, displace the priorities of local jurisdictions, should they choose to enact local option taxes.

9.3.7 Reasonably Available Revenue Summary

For the purpose of supporting presentation and adoption of a new CLRP proposal on transit improvements in the I-95/I-395 corridor, reasonably available revenues are estimated to include:

HOT Lane Project Contributions	**$195 million**
Transit Farebox Revenues	**63 million**
Federal Discretionary Funds	**40 million**
	$298 million

9.4 Funding Flows

Funding flows, cash management, and risk management are important elements of the investment strategy. From the discussion above, several key assumptions and implications can be drawn.

Assumption 1

Receipt of a cash payment as a lump sum ($195 million) from the HOT lanes sponsor.

Implication

a. I-95/I-395 transit investments will be made on a "pay-go" basis since no regular flow of funds is anticipated to bond against, except possibly the added increment of farebox revenues, which will likely be insufficient to reasonably support debt on their own.

b. The lump sum should be invested to maximize interest earnings within the normal accepted level of risk for local governments. The interest rate earnings must be at least equal to the inflation rate applied in the year of expenditure calculations (i.e., three percent).

Assumption 2

For projects and improvements that best compete for Federal funds, the necessary match will come from reasonably available funds, as highlighted above, on a priority basis.

Implication

a. Successful application for additional discretionary Federal funds will create a separate subprogram of investments and improvements potentially outside the expressed priorities of local and regional agencies.

b. After satisfying match requirements should additional Federal discretionary funds be granted, remaining reasonably available revenues will be expected to support 100 percent of successive I-95/I-395 transit improvement costs in combination with farebox revenues for all operating agencies whose improvements are implemented.

Assumption 3

Reasonably available funds, as highlighted above, would be fully committed to an initial program of corridor transit improvements in the period 2010 to 2020 to maximize the impact of available funds and to provide a service base and performance that has the best chance of attracting future funding to support continued implementation of the full program.

9.5 Prioritization and Phasing

9.5.1 Phasing

Regardless of the amount of funding that is projected to be reasonably available to implement the improvements in the Refined Alternative, actual implementation will have to be phased, with priorities established for which improvements are to proceed first. Moreover, given that the funding required to implement all elements of the Refined Alternative is not available, some elements must be set aside.

The regional modeling and analytical processes used in the project are not capable of supporting detailed cost-benefit, Return on Investment (ROI), or similar econometric analysis of individual or route-specific improvements proposed. Analysis at this level will need to be considered, however, for subsequent programming purposes.

For planning purposes, however, conclusions can be drawn as to the relative performance of proposed improvements in the interest of identifying a general package or subset of improvements that should go forward using the $298 million in funding considered reasonably available.

The criteria for making these judgments in order of importance include:

- ***Productivity –*** How much travel demand is being accommodated or how much of the new capacity is being used and at what cost for each of the prospective improvements, i.e., investment in the "best" services first from a utilization and cost-effectiveness standpoint. Specifically, attention was given to trips per revenue hour, cost per trip, and subsidy per trip.

- ***Rapid impact –*** How quickly forecast utilization of service improvements can be realized to maximize impact on travel markets and to reduce subsidy costs, i.e., investment in the best performing improvements in the existing services.

- ***Ease of Implementation –*** How quickly and easily service improvements can be introduced in view of existing priorities and required operational and budgeting processes or procedures?

- ***Leveraging –*** Commitments of funds early to specific service improvements could lead to contributions from funding sources not otherwise likely to be available, e.g., DOD funding for some portion of BRAC-related services.

- ***Long-Term Regional Network Effects –*** Which projects or improvements have the greatest potential to enhance the future regional network, or may undercut long-term network plans if not pursued in the short-term, e.g., HOT lane or BRT networks?

Given the elements in the Refined Alternative, the following program-specific prioritization principles were applied to constrain and phase the program:

- Start with funding of $235 million net of farebox recovery;
- Fund significant level of TDM and additional park-and-ride spaces, but reduce the amount of funding assumed from Refined Alternative levels;
- Invest in fixed facility improvements (e.g., in-line BRT stations, transit centers) that could support new transit improvements and could also stand alone based on the higher level of service already planned in the CLRP;
- Increase number of VRE rail cars in 2015;
- Improve bus services by phasing in services by year with the most productive services earlier in the program. Start with the expansion of existing services, a strategy supported by the market research element of study. Include BRAC-related services that are most productive;
- Set aside routes in the Refined Alternative if reasonably comparable service is included in the CLRP; and
- No fare buy-down since it appears to mostly shift people out of HOV, rather than making a large impact on current LOV users.

9.5.2 Cost Summary

The resulting Fiscally Constrained Refined Alternative can be summarized in year 2010 expenditures in Table 9-1.

Table 9-1. Program Summary of the Fiscally Constrained Recommendation

Element	Element Cost (Millions)	Total Cost (Millions)
Transit Services		*$188.9*
Bus Service Modifications	$29.6	
New Shuttle Bus	$7.4	
New Bus Services	$130.3	
VRE	$21.6	
TDM		*$20.0*
Park-and-Ride Lots		*$37.5*
Fixed Facilities		*$51.8*
Metrorail Station Improvements	$5.0	
BRT Stations	$40.0	
Other Transit Centers	$1.5	
VRE Platform Extensions and Yard Facilities (with Longer Trains)	$5.3	
Grand Total		**$298.2**

9.6 Recommended Investment Program

Exhibit 9-1 details the program elements and implementation timetable for the Cost-Constrained Refined Alternative in year 2010 dollars and year-of-expenditure dollars. The year-of-expenditure calculations assume a three percent inflation rate.

9.7 Additional Analysis Needed

The Investment Strategy proposed in this section represents a planning document rather than the actual programming of projects. Further study is needed to detail certain elements of the Investment Strategy plan, including:

- Details on the specific location and function of the proposed BRT in-line stations is needed to better explain the issues and opportunities associated with them and to identify any potential fatal flaws which may exist;

- Detailed traffic simulation needs to be performed to determine the potential for adverse impacts to traffic from increased bus operations at selected locations. Specifically, the City of Alexandria has expressed its concern/objection to the proposed facility access ramp at Seminary Road. The impact of this ramp and alternative locations in the northern section of the corridor need to be explored;

- Design standards need to be established for the in-line stations and the park-and-ride lots. The BRT stations and park-and-ride recommendations will require preliminary engineering work to be done in order to provide implementation cost estimates and to identify environmental or other concerns.

- Further study may be required for transit and other mobility enhancement projects in the corridor beyond the constraints imposed by the availability of funds from the I-95/I-395 HOV/HOT Lane Project. For example, further study of the extension of VRE south of Fredericksburg or the extension of Metrorail toward Potomac Mills Mall may be desirable.

- The Fiscally Constrained Refined Alternative serves as the basis for submitting a revision to the transit and TDM elements of the MWCOG CLRP project for the I-95/I-395 HOT Lane Project. The submission can include all of the indicated project elements except the southern-most in-line BRT station to maintain compatibility with the limits of the HOT Lane Project.

Exhibit 9-1

Service Modifications				Service Hours		Operating Costs (2010 Dollars)			Capital Costs (2010 Dollars)				Summary Costs (2010 Dollars)			Summary Costs (Year of Expenditure)		
Originating Area	Operator	Description	Imple-menta-tion Year	Additional Annual Revenue Hours	Additional Annual Vehicle Hours	Operating Cost/Vehicle Hour	Total Annual Operating Costs	20-Year Operating & Maintenance Costs	Vehicle Needs	Potential Vehicle Costs	Vehicle Assumptions	Capital Cost	Total Costs (2010 Dollars)	Projected Farebox Revenue (2010 Dollars)	Net Total Costs (2010 Dollars)	Total Costs	Projected Farebox Revenue	Net Total Costs
Arlington/ Alexandria/DC	ART	**ART 41** -Add 5th bus to ART 41 on weekdays	2010	3,640	4,004	$82.67	$331,011	$6,620,214	1	$325,000	12 yr - 30' Low Floor - $325K	$650,000	$7,270,214	$1,655,053	$5,615,160	$10,280,595	$2,373,056	$7,907,540
Arlington/ Alexandria/DC	WMATA	**WMATA 7B -** Decrease headway on 7B from 35 minute to 17/18 minute by adding one bus	2010	1,560	1,716	$95.24	$163,432	$3,268,637	1	$500,000	12 yr 40' - $500K	$1,000,000	$4,268,637	$980,591	$3,288,046	$5,899,531	$1,405,995	$4,493,536
Prince William	PRTC	**Prince William MetroDirect** - Modify MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours	2015	1,040	1,144	$86.77	$99,265	$1,488,973	1	$500,000	12 yr 40' - $500K	$1,000,000	$2,488,973	$744,487	$1,744,487	$3,725,618	$1,159,779	$2,565,839
Prince William	PRTC	**Dale City - Navy Yard -** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds 2 additional trips per peak period	2015	1,820	3,640	$86.77	$315,843	$4,737,642	1	$500,000	12 yr 40' - $500K	$1,000,000	$5,737,642	$2,368,821	$3,368,821	$8,786,470	$3,690,205	$5,096,265
Prince William	PRTC	**OmniRide North Route 1 (Dale City/Woodbridge - DC)** - Increase Frequency on OmniRide North Route 1 by	2020	3,467	6,933	$86.77	$601,605	$6,016,053	3	$1,500,000	12 yr 40' - $500K	$1,500,000	$7,516,053	$3,008,027	$4,508,027	$12,371,070	$5,177,598	$7,193,472
Prince William	PRTC	**OmniLink Route 1** - Extend OmniLink Route 1 to Ft. Belvoir during peak periods	2020	2,080	2,288	$86.77	$198,530	$1,985,298	1	$325,000	12 yr - 30' Low Floor - $325K	$325,000	$2,310,298	$754,413	$1,555,885	$3,853,987	$1,298,542	$2,555,446
Corridor-wide	VRE	**VRE Train Size** - Increase train size so that 3 of the Fredericksburg trains have 8 cars and 4 have six cars	2015			VRE estimated add'l cost associated with longer trains - 2 add'l 8 car trains @ $300,000/year	$600,000	$9,000,000	6	$12,600,000	$2.1M/car	$12,600,000	$21,600,000	$9,000,000	$12,600,000	$28,627,263	$14,020,410	$14,606,853
		TOTAL		**13,607**	**19,725**		**$2,309,685**	**$33,116,817**	**14**	**$16,250,000**		**$18,075,000**	**$51,191,817**	**$18,511,392**	**$32,680,425**	**$73,544,536**	**$29,125,584**	**$44,418,952**

New Shuttle/Feeder Bus Services				Service Hours		Operating Costs (2010 Dollars)			Capital Costs (2010 Dollars)				Summary Costs (2010 Dollars)			Summary Costs (Year of Expenditure)		
Originating Area	Operator	Description	Imple-menta-tion Year	Additional Annual Revenue Hours	Additional Annual Vehicle Hours	Operating Cost/Vehicle Hour	Total Annual Operating Costs	20-Year Operating & Maintenance Costs	Vehicle Needs	Potential Vehicle Costs	Vehicle Assumptions	Capital Cost	Total Costs (2010 Dollars)	Projected Farebox Revenue (2010 Dollars)	Net Total Costs (2010 Dollars)	Total Costs	Projected Farebox Revenue	Net Total Costs
Fairfax/ Springfield	Fairfax Connector	**Lorton VRE-EPG -Ft. Belvoir Shuttl**e - New "meet the train" shuttle between the Lorton VRE Station - EPG/Ft. Belvoir via Telegraph Rd, Fairfax County Parkway and Rolling Rd/Pohick Rd.	2010	2,600	2,860	$93.82	$268,325	$5,366,504	2	$1,000,000	12 yr 40' - $500K	$2,000,000	$7,366,504	$1,073,301	$6,293,203	$10,120,385	$1,538,925	$8,581,460
		TOTAL		**2,600**	**2,860**		**$268,325**	**$5,366,504**	**2**	**$1,000,000**		**$2,000,000**	**$7,366,504**	**$1,073,301**	**$6,293,203**	**$10,120,385**	**$1,538,925**	**$8,581,460**

New Bus/Rail Services				Service Hours		Operating Costs (2010 Dollars)			Capital Costs (2010 Dollars)				Summary Costs (2010 Dollars)			Summary Costs (Year of Expenditure)		
Originating Area	Operator	Description	Imple-mentation Year	Additional Annual Revenue Hours	Additional Annual Vehicle Hours	Operating Cost/Vehicle Hour	Total Annual Operating Costs	20-Year Operating & Maintenance Costs	Vehicle Needs	Potential Vehicle Costs	Vehicle Assumptions	Capital Cost	Total Costs (2010 Dollars)	Projected Farebox Revenue (2010 Dollars)	Net Total Costs (2010 Dollars)	Total Costs	Projected Farebox Revenue	Net Total Costs
Arlington/ Alexandria/DC	ART	**Shirlington - Rossyln** - New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area)	2010	3,120	3,432	$82.67	$283,723	$5,674,469	2	$650,000	12 yr 30'- $325K	$1,300,000	$6,974,469	$1,418,617	$5,555,852	$9,712,936	$2,034,048	$7,678,888
Prince William	PRTC	**Central Prince William - Downtown Alexandria -** New OmniRide Route along I-95 corridor serving East Eisenhower Valley and Downtown Alexandria west of Washington Street	2010	3,120	6,240	$86.77	$541,445	$10,828,896	4	$2,000,000	12 yr 40'- $500K	$4,000,000	$14,828,896	$5,414,448	$9,414,448	$20,378,256	$7,763,367	$12,614,889
Fairfax/ Springfield	WMATA	**Kingstowne - Shirlington** - **Pentagon** - New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria.	2010	18,200	20,020	$95.24	$1,906,705	$38,134,096	5	$2,500,000	12 yr 40'- $500K	$5,000,000	$43,134,096	$11,440,229	$31,693,867	$60,741,995	$16,403,278	$44,338,717
Prince William/Fairfax	PRTC	**Woodbridge - Lorton - Tysons Corner** - **Merrifield -** New peak period OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons Corner and Merrifield.	2015	3,120	6,240	$86.77	$541,445	$8,121,672	4	$2,000,000	12 yr 40'- $500K	$4,000,000	$12,121,672	$4,060,836	$8,060,836	$18,276,374	$6,326,065	$11,950,308
Prince William	PRTC	**Lake Ridge - Seminary Road Area -** New OmniRide Express Route serving Skyline, Bailey's Crossroads and Mark Center via Seminary Road	2020	2,080	4,160	$86.77	$360,963	$3,609,632	3	$1,500,000	12 yr 40'- $500K	$1,500,000	$5,109,632	$1,804,816	$3,304,816	$8,228,992	$3,106,559	$5,122,433
Stafford/ Fredericksburg	FAMPO	**Fredericksburg - Pentagon/Crystal City** - New Express/BRT route from Fredericksburg to Pentagon/Crystal City	2020	5,200	10,400	$86.77	$902,408	$9,024,080	6	$3,000,000	12 yr 40'- $500K	$3,000,000	$12,024,080	$5,414,448	$6,609,632	$19,564,543	$7,766,397	$11,798,146
Stafford/ Fredericksburg	FAMPO	**Fredericksburg - DC** - New Express/BRT route from Fredericksburg to DC core (when combined with Massaponax in 2020, services would operate alternating 15 min)	2015	6,240	12,480	$86.77	$1,082,890	$16,243,344	6	$3,000,000	12 yr 40'- $500K	$6,000,000	$22,243,344	$8,121,672	$14,121,672	$33,740,625	$12,652,130	$21,088,495
Stafford/ Fredericksburg	FAMPO	**Massaponax - DC** - New Express/BRT route from Massaponax to DC core (when combined with Fredericksburg, services would operate alternating 15 min)	2020	6,240	12,480	$86.77	$1,082,890	$10,828,896	6	$3,000,000	12 yr 40'- $500K	$3,000,000	$13,828,896	$5,414,448	$8,414,448	$22,671,102	$9,319,676	$13,351,425
		TOTAL		**47,320**	**75,452**		**$6,702,468**	**$102,465,085**	**36**	**$17,650,000**		**$27,800,000**	**$130,265,085**	**$43,089,514**	**$87,175,571**	**$193,314,822**	**$65,371,520**	**$127,943,302**

Fixed Facilities					Capital Costs (2010 Dollars)			Summary Costs (2010 Dollars)			Summary Costs (Year of Expenditure)		
Originating Area	Operator	Description	Imple-menta-tion Year		Capital Needs	Potential Capital Costs	Capital Assumptions	Total Costs (2010 Dollars)	Projected Farebox Revenue (2010 Dollars)	Net Total Costs (2010 Dollars)	Total Costs	Projected Farebox Revenue	Net Total Costs
Arlington/ Alexandria/DC	WMATA	**Pentagon Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security)	2010		Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements	$2,500,000	$2.5M per station	$2,500,000	NA	$2,500,000	$2,500,000	NA	$2,500,000
Fairfax/ Springfield	Fairfax Connector	**Franconia-Springfield Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security)	2010		Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements	$2,500,000	$2.5M per station	$2,500,000	NA	$2,500,000	$2,500,000	NA	$2,500,000
Corridor-wide		**Additional park-and-ride lot capacity** at various locations (new and/or existing lots); 175 spaces for the Fredericksburg subarea; 1,075 spaces for the North Stafford subarea; 250 spaces for the Potomac Mills subarea; and 1,500 spaces for the VRE stations	2010		3,000 additional spaces beyond 3,000 currently proposed by Fluor/Transurban		$10,000 per VDOT space; $15,000 per VRE space	$37,500,000	NA	$37,500,000	$37,500,000	NA	$37,500,000
Corridor-wide	VRE	**Platform Extensions** at selected stations	2015		4 stations on Fredericksburg Line would need platform extensions for "low" or "medium" alternatives	$4,000,000	$1M to extend 300' including canopy	$4,000,000	NA	$4,000,000	$4,637,096	NA	$4,637,096
Fredericksburg	FAMPO	**Transit Center** at Massaponax	2020			$1,500,000		$1,500,000	NA	$1,500,000	$2,015,875	NA	$2,015,875
Corridor-wide		**BRT in-line transit stations** along the corridor - 5 stations but 4 in-line stations included in cost (Lorton is being paid for by Fluor/TransUrban as part of the HOT Lanes project)	2020			$40,000,000	$10M per station (not including parking)	$40,000,000	NA	$40,000,000	$53,756,655	NA	$53,756,655
Corridor-wide	VRE	**Overnight Storage in Fredericksburg**	2015			$1,350,000		$1,350,000	NA	$1,350,000	$1,565,020	NA	$1,565,020
							TOTAL	**$89,350,000**	**NA**	**$89,350,000**	**$104,474,646**	NA	**$104,474,646**

TDM Program Elements			Summary Costs (2010 Dollars)			Summary Costs (Year of Expenditure)		
Originating Area	Description		Total Costs (2010 Dollars)	Projected Farebox Revenue (2010 Dollars)	Net Total Costs (2010 Dollars)	Total Costs	Projected Farebox Revenue	Net Total Costs
Corridor-wide	**Capital Assistance For Vanpools -** Provide financial assistance for the purchase or lease of vans for vanpools. Incentives, IT monitoring and reporting of vanpool mileage, and promotion of Capital cost of Contracting for vanpools. Provide free electronic toll transponders to vanpools.		$5,000,000	NA	$5,000,000	$7,169,121	NA	$7,169,121
Corridor-wide	**Enhanced Guaranteed Ride Home -** Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday.		$200,000	NA	$200,000	$286,765	NA	$286,765
Corridor-wide	**Carpool Incentives -** Rewards and incentives for carpoolers.		$3,000,000	NA	$3,000,000	$4,301,473	NA	$4,301,473
Corridor-wide	**Rideshare Program Operational Support -** Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.		$600,000	NA	$600,000	$860,295	NA	$860,295
Corridor-wide	**TDM Programs Marketing -** Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets.		$5,000,000	NA	$5,000,000	$7,169,121	NA	$7,169,121
Corridor-wide	**Telework Program Assistance -** Financial incentives and assistance to increase the number of workers teleworking.		$4,000,000	NA	$4,000,000	$5,735,297	NA	$5,735,297
Corridor-wide	**Vanpool Driver Incentives -** Provide incentives to get new drivers and retain existing drivers for vanpools.		$700,000	NA	$700,000	$1,003,677	NA	$1,003,677
Corridor-wide	**Vanpool Insurance -** Increase vanpool insurance premium pool buy-down for vanpools.		$500,000	NA	$500,000	$716,912	NA	$716,912
Corridor-wide	**VanStart/VanSave -** Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats.		$1,000,000	NA	$1,000,000	$1,433,824	NA	$1,433,824
		TOTAL	**$20,000,000**	**NA**	**$20,000,000**	**$ 28,676,486**	**NA**	**$28,676,486**

	Operating	Capital	Total	Farebox	NET COST	Total	Farebox	NET COST
Total	**$160,948,405** (includes TDM)	**$137,225,000**	**$298,173,405**	**$62,674,207**	**$235,499,199**	**$410,130,874**	**$96,036,028**	**$314,094,846**