# CHAPTER 4

## BRT Operating Scenarios

In order to verify the market demand for BRT services within the corridor, a variety of BRT operating scenarios were developed and modeled using the regional Transportation Planning Board (TPB) travel demand model and the BRT definitions identified in the previous chapter. The goal of the modeling process was to quantify demand for a BRT system at a conceptual level of detail by adding refined transit assignments for the routes proposed. This section describes the findings from this modeling.

As discussed in the previous chapters, the development of the BRT operating scenarios was based on the definition of BRT in the corridor and previous studies. In developing the operating scenarios the study team was careful to build upon the previous work completed in the Transit/TDM Study, while developing more specific transit assignments based on the unique characteristics of the corridor and station locations. Information from the Refined Alternative from the Transit/TDM Study was used to develop the general location of stations, routes under consideration, and operating headways. This information was a starting point for this analysis.

## 4.1 Considerations in Development of Demand Forecasts

This study used the most recent version of the TPB travel model to forecast transit demand in the study area, evaluate scenarios, and analyze traffic and operational performance of the BRT system. TPB recently released version 2.3 of the regional model, which features a mode selection process similar to the method used in the Transit/TDM Study to generate forecasts of station activity. This model also includes significant enhancements with respect to estimating truck traffic, and travel external to the region; and draws upon the latest regional cooperative land use forecasts.

Projections for the Fredericksburg Area Metropolitan Planning Organization (FAMPO) jurisdiction were reviewed as part of the modeling decision making process and for the envisioned level of analysis were deemed acceptable. Although it is acknowledged that the TPB model does not portray transit accessibility in as much detail as the FAMPO model overall for that portion of the study area, the TPB model does sufficiently represent travel times along major routes in the FAMPO area in enough detail to identify preliminary transit demand for use in a policy-level analysis such as this study. These assumptions and the use of the TPB model were presented for discussion to the Transit Operators at the project kick-off meeting. It was also during the coordination process that the use of the TPB model was a first step in determining demand and that full model refinement was outside of the scope of work for this study.

The TPB Version 2.3 model provides features that are mechanically necessary to produce the demand forecasts previously described, as this version:

- ***Provides the ability to "assign" and track BRT (and other modes) demand*** throughout the supporting transit infrastructure. This feature allows the association of demand forecasts with specific parts of the transit infrastructure and is required for forecasting activity associated with any specific transit station by "mode-of-access". The TPB Version 2.2 model only provides transit demand "patterns" based on

***The TPB Version 2.3 model provides***

- The ability to "assign" and track BRT (and other modes) demand
- More accurate descriptions of the levels-of-service
- Reflection of traveler preference for "premium" services
- More accurate descriptions of drive-access times to transit stations

regional geography; thus demand associated with a specific service segment or station cannot be discerned.

• ***More accurately describes the levels-of-service*** between competing transit services and those that will access the BRT stations. Modeled travelers "see" a much larger set of transit choices and are better able to discern the relative advantages between available choices. This feature will improve "mode of access" demand estimates at the BRT stations. While the TPB Version 2.2 model provided only two transit mode choices[1]; the TPB Version 2.3 model includes twelve choices[2], and recognizes "kiss and ride" access behavior of travelers.

• ***Allows reflection of traveler preference for "premium" services*** such as Metrorail, commuter rail, and BRT. The inherent nature of the mode choice process[3] contained in the TPB Version 2.3 model allows for the expression of traveler preference for "premium" services due to comfort, safety, reliability, and level-of-service.

• ***More accurately describes drive-access times to transit stations.*** This improved information allows better estimates of the competitiveness of park and ride/kiss and ride trips to transit stations relative to walking.

Validation of transit demand estimates produced by this model is still evolving and is dependent on available data. Initial comparisons of this model's estimated vs. observed Year 2002 activity at Metrorail stations in Virginia show promise. This comparison reveals that the travel model estimates aggregate Metrorail station activity of Virginia commuters to within approximately 5% of that observed[4]. This accuracy does vary depending on Metrorail line and travel corridor.

It is recognized that there are risks associated with using the TPB Version 2.3 model. Indications are that this model will not be adopted for approximately one year[5] and may reflect changes based on recent survey data and other information made available over that time. However, it is also important to recognize that the objective of demand forecasting for this study is to inform BRT station preliminary design and is not subject to any federally mandated planning processes such as NEPA or FTA requirements for Section 5309 New Starts funding. While from a policy perspective it is always preferred to use the latest adopted model; there are compelling reasons based on the mechanical capabilities of this model as outlined above, that indicate its use in this study to be prudent.

## 4.2 Forecasting Framework

Input assumptions for developing station activity forecasts of the proposed I-95/I-395 BRT, using the TPB Version 2.3 model (in draft format) include:

***Land Use*** - The Version 2.3 model uses Round 7.1 land use forecasts, officially adopted in 2007.

***Highway*** - The highway network assumptions in the Version 2.3 model represent the 2006 CLRP and the FY 2007-2012 TIP, which were documented in the FY-2008 Network Documentation: Highway and Transit Network Development, prepared by MWCOG.

[1]Walk or park-and-ride access to all transit modes

[2]Walk, kiss-and-ride, or park-and-ride to transit modes differentiated by use of commuter rail, Metrorail, and light rail; or bus and BRT.

[3]Nested-logit mode choice model

[4]National Capital Region Transportation Planning Board, *TPB Travel Forecasting Model, Version 2.3 – Specification, Validation, and User's Guide*, June 2008, Table 6-25

[5]Schedule released in the November 2008 TPB Travel Forecasting Subcommittee meeting indicates that Version 2.3 model will be ready for the 2010 Long Range Plan Update in the first half of 2010.

The proposed I-95/395 HOT lanes and associated ramp connections were coded in the 2030 highway network between Eads Street in Arlington County and just south of the Town of Dumfries (2 to 3 lanes). The modeling assumes that HOT lanes are in place, which is consistent with the regional CLRP. This study did not alter the configuration of the HOT lanes project as a result, but rather tested demand for transit and station access patterns that could be coordinated.

***Transit*** - The transit network assumptions in the Version 2.3 model represent the 2006 CLRP and the FY 2007-2012 TIP, which were documented in the FY-2008 Network Documentation: Highway and Transit Network Development, prepared by MWCOG.

The Refined Alternatives as detailed in the Table 4-3 in the I-95/I-395 Transit/TDM Study guided coding of related transit services in the study corridor. The Refined Alternative was used to test the market demand for BRT type transit in the corridor instead of the Fiscally Constrained Alternative because the study team did not want to limit the testing of the BRT market due to the availability of funding at this time.

Market demand forecasts developed for this study use the Refined Alternative associated with the previous study as a guide, with the following considerations. In the Transit/TDM Study some of the modified or new routes were coded as "Express Bus" services, for this study they were coded as "BRT" services, yet with the same station locations and headways and similar run times as the previous analyses (evaluated for reasonableness). Private commuter bus services and other bus services that operate in the corridor remain the same as described by the 2006 CLRP. For the sake of terminology, the coding includes three main categories of bus service:

***Categories of bus service for this study***

- New BRT Services
- Modified Services
- New Bus Services

• ***New BRT Services*** – as discussed above, the long distance routes (see **Exhibit 4-2**) from Fredericksburg to various destinations in the corridor (and presented below) were originally coded as new Express Bus Routes; they now serve as the mainline BRT. The BRT services later became identified as the Priority Bus services. In general, they stop at all stations .

• ***Modified Services*** – the Refined Alternative included several existing routes that were modified and these were retained in the coding.

• ***New Bus Services*** – there were a variety of other services proposed in the previous study for the Refined Alternative that were also included in development of the forecasts and were not specifically called "BRT" services. These included such routes as the Kingstowne-Shirlington-Pentagon express route and several routes from Prince William County to be operated by PRTC. These routes were not coded to stop at most of the proposed BRT stations like the BRT defined routes.

In addition to these routes, there are over 60 additional existing and/or planned bus routes that would leverage a portion of the guideway on I-95/I-395 that were programmed in the CLRP and that remained in the development of forecasts. Of these, some of these CLRP routes did make stops at the proposed BRT stations and that demand is included in the planning for the proposed stations. Detailed tables for all services that leverage the BRT guideway (managed lanes) are included in the Appendices and these tables represent the base coding upon which the operating scenarios were developed to test the market for BRT services in the corridor. These programmed services that leverage the guideway, which as described above were developed using the coding of the Refined Alternative, were presented for review to the Operators Committee in April 2009. Comments received were incorporated into the development of the forecasts.

Also, as will be discussed in the development of the operating scenarios, during finalization of the BRT/Priority Bus system, duplicate or similar transit services were eliminated from the coding and market evaluations, since many of the over-lapping routes were competing for ridership (see discussion below).

Alternative service definitions used in this study were reviewed by GEC/VDOT and the Transit Operators Committee, and considered:

- BRT operational characteristics such as station-to-station speed/time.
- Assumptions about competing transit services provided by private commuter service providers.
- Modifications to existing services.
- Park and ride lot locations and access

## 4.3 Development of Forecasts

The development of station activity forecasts, indicated in **Exhibit 4-1**, proceeded as follows:

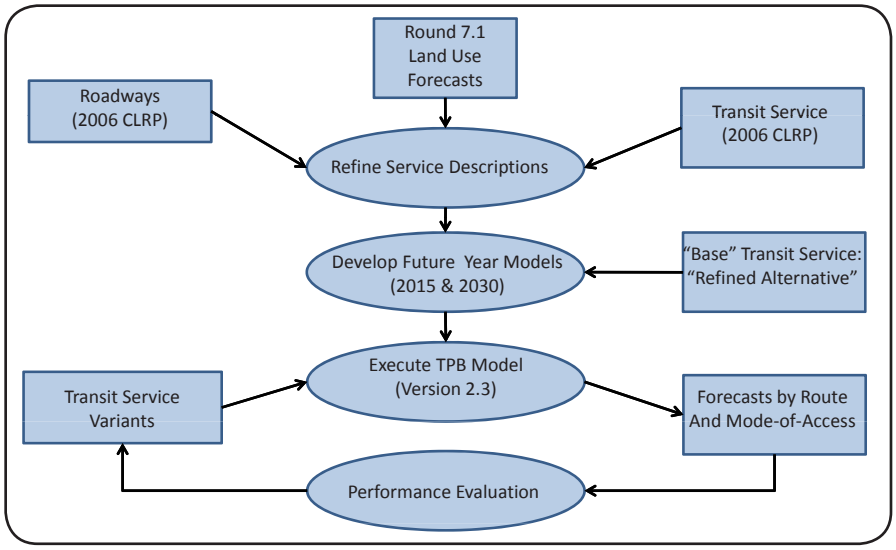


Exhibit 4-1. Forecasting Methodology

• ***Incorporation of refinements to service descriptions.*** Model networks were enhanced and corrected to more accurately represent existing conditions and future plans; the highway network modified to more accurately reflect roadway system and access to transit. Refinement included a review of traffic analysis zones (TAZs) in the study area. Service description refinements incorporated any feeder routes that provide access to the off-line park and ride lots and neighborhoods that use the BRT system.

• ***Develop future year models.*** Develop for design years (2015 and 2030), the changes/adjustments and assumptions stated in the previous section. Note that there is no official definition of transit and highway infrastructure associated with the 2006 CLRP. Code a Base Scenario, reflecting the Refined Alternative from the I-95/I395 Transit/TDM Study. Subsequently code variants on the Base Scenario.

• ***Execute the complete TPB model set***. Tabulate demand at transit stations in the study corridor providing demand forecasts by route and mode-of-access for each station.

Forecasts were provided for variants on the Base Scenario to test alternative station locations or changes in access routes for transit; including revised service for the Ft. Belvoir/EPG complex and service to Tysons Corner (defined in the next section in additional operating scenarios). Development of variant service plans were sensitive to performance of the Base Scenario with respect to demand and general cost effectiveness. ***Note that the demand forecasts developed as part of this study are intended to inform station design and facility structure sizing and are not intended to address NEPA or New-Starts analyses requirements.***

## 4.4 BRT Operating Scenarios

In order to test the market for BRT services in the I-95/I-395 corridor, a variety of operating scenarios for 2030 were developed. The first market test, the ***In-Line Station BRT Scenario***, evaluated demand for a high level system with in-line stations that was built upon the routes and station prototypes from the previous Transit/TDM study. The second market test modeled was Tysons Corner which was analyzed by coding service routes to and from the proposed Central 123 station on the Dulles Rail project under construction at RT 123 (the ***Tysons Access BRT Scenario***). Up to this point in the process, the analysis focused on testing the market for in-line transit stations along the corridor and the results indicated that there was demand for BRT services in the corridor, particularly inside the Capital Beltway.

***Market Tests:***

1. In Line Station BRT Scenario
2. Tysons Access BRT Scenario
3. In Line without Lorton Station
4. Priority Bus / BRT Routes

Operating variations were then tested – including alterations to the originally proposed station locations, markets, and prototypes. First a test was done to see how the overall corridor would perform without a key station, the Lorton station (the ***In-Line without Lorton Scenario***). This analysis verified that demand for BRT services was not solely dependent on specific station types or locations. Finally, in continuation of this theme – the final operating scenario tested the market for a BRT service that was more reflective of a priority bus service with all stations moved off-line, thus reducing costs from the initial scenarios. This scenario is the basis for the recommendations in this report and has been named the ***Priority Bus/ BRT Scenario*** and includes coding changes to reflect different markets and shorter run distances than previously analyzed.

### 4.4.1 In-Line BRT Scenario

The BRT routes that were tested for demand in the in-line BRT and Tysons Corner routes are shown in **Exhibit 4-2**. The in-line BRT Scenario was the starting point for the testing of demand for BRT in the corridor and it included five BRT routes between Fredericksburg and destinations in Northern Virginia and Washington D.C. These routes contain five or six station locations and their general locations were identified in the previous Transit/TDM report. In working with representatives from FAMPO, the coding of a station was changed from the area near RT 17 to a location south of the Rappahannock River in the Celebrate, VA development.

The forecasts for an in-line BRT Scenario are shown in **Table 4-1** and demonstrate that in 2030 there would be demand for a BRT service in the I-95/I-395 corridor, particularly north of the Capital Beltway.

As shown in **Table 4-1**, a high-level BRT system that features in-line Stations at Celebrate, RT 610, Lorton, Prince William Parkway, and Seminary Road would attract a demand of over 8,100 boardings during the AM and PM peak periods. This confirms that there is a market for BRT services within the I-95/I-395 corridor (these results do not include connections to Tysons Corner), particularly on routes that provide destinations to Washington D.C. As shown in **Exhibit 4-2** these routes provide a direct connection to a network of stops within the core of the Federal employment triangle in downtown Washington D.C.

| BRT Route Description | HOT Lanes Access Points | Headway (mins) | Run Time (mins) | Total Boardings |
|---|---|---|---|---|
| Fredericksburg to DC | US 17 to Washington DC | 30 | 79 | 3,300 |
| Fredericksburg to EPG to Fort Belvoir | US 17 to Fairfax County Parkway | 30 | 69 | 390 |
| Fredericksburg to Pentagon to Crystal City | US 17 to Pentagon | 30 | 73 | 1,070 |
| Massaponax to DC | US 1 to Washington DC | 30 | 96 | 3,350 |
| TOTAL BOARDINGS FOR IN-LINE BRT STATION SYSTEM | | | | 8,110 |

Table 4-1. In-Line BRT Scenario Demand for Year 2030 Boardings (AM + PM Peak Period)

| Station / Stop | AM Peak Period | | PM Peak Period | |
|---|---|---|---|---|
| | Boardings | Alightings | Boardings | Alightings |
| Massaponax | Negligible (less than 50) | None | None | Negligible (less than 50) |
| Downtown Fredericksburg (Multiple Stops) | 75 | None | None | 75 |
| Celebrate, VA | 50 | None | None | 50 |
| Fredericksburg (Route 17 at Falmouth) | 45 | 75 | 75 | 45 |
| Route 610 | 85 | None | None | 85 |
| Prince William Parkway | 1,225 | 115 | 115 | 1,225 |
| Lorton | 1,050 | 270 | 270 | 1,050 |
| Seminary | 1,450 | 450 | 450 | 1,450 |
| Pentagon | 25 | 125 | 125 | 25 |
| Washington, DC (Multiple Stops) | 50 | 2,815 | 2,815 | 50 |

- - includes transfers

Table 4-2. In-Line BRT Scenario Demand Year 2030 (AM + Peak Period Activity*)

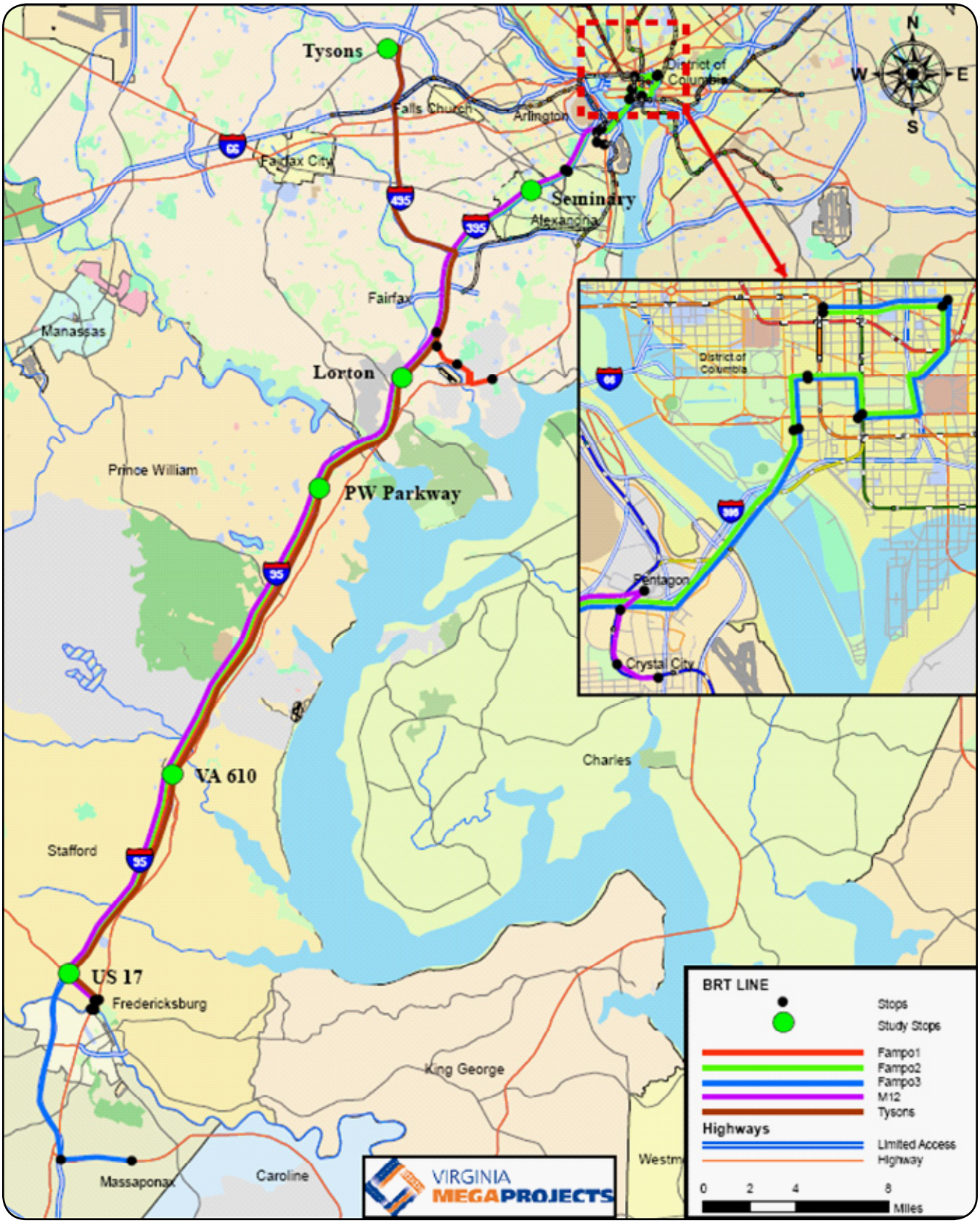


Exhibit 4-2. In-Line BRT and Tysons Corner Routes Tested for Demand

One of the charges of this market study was to determine station infrastructure needs as a result of implementing a BRT system. **Table 4-2** presents the stop or station area demand figures for 2030 if the in-line BRT Scenario were implemented. The results are for all four of the coded BRT Routes, excluding Tysons, as shown in **Exhibit 4-2.**

The demand forecasts for the in-line stations demonstrates high demand for BRT service from several of the stations that are the focus of this study, most notably from Prince William Parkway, Lorton and Seminary Road. Noting that with the exception of the Washington D.C. stations, most station activity consists of passengers boarding during the AM peak period. This indicates that the stations that are the focus of this study primarily provide access on the residential end of travel to the system. There is however some significant turnover or "churn" at the Seminary Road station. It is important to note that since this was a market study, demand is unconstrained at each of these stations. The boardings would be reduced if parking were to be constrained at any station. Also, boardings in other station areas would increase over time as transit-supportive land uses were initiated.

Demand was also forecasted for the modified services and the new bus services recommended in the Transit/TDM Study that would operate in the corridor and access some of the BRT stations. These routes, which would also leverage the guideway, would add an additional 8,225 AM and PM peak boardings. Finally, the already existing or planned services coded in the CLRP would add an additional 21,675 AM and PM peak boardings in the I-95/I-395 corridor under this operating scenario, resulting in total boardings of 38,010 AM and PM peak boardings for all bus routes that leverage a portion of the proposed HOT lane project. (See Appendix A).

## *4.4.2 Tysons Access BRT Scenario*

One of the significant changes from the Transit/TDM Study was to determine if there was demand for service into Tysons Corner that would operate within the HOT lanes along the Capital Beltway (I-495). Forecasts were developed for two operating scenarios to test demand in this market. One scenario tested demand for BRT services that would operate within the I-495 HOT lanes only in the peak period direction and the other tested running BRT service in both directions on I-495 between the Franconia-Springfield Metrorail Station and Tysons Corner.

**Tables 4-3 and 4-4** show the demand estimates when BRT service is provided from Fredericksburg to Tysons Corner. Note that the stations were assumed to operate in-line with the exception of Tysons Corner, located at the Tysons Central 123 Station under construction as part of the rail extension to Dulles.

| BRT Route Description | HOT Lanes Access Points | Headway (mins) | Run Time (mins) | Total Boardings |
|---|---|---|---|---|
| Fredericksburg to DC | US 17 to Washington DC | 30 | 79 | 3,380 |
| Fredericksburg to EPG to Fort Belvoir | US 17 to Fairfax County Parkway | 30 | 69 | 350 |
| Fredericksburg to Pentagon to Crystal City | US 17 to Pentagon | 30 | 73 | 1,180 |
| Massaponax to DC | US 1 to Washington DC | 30 | 96 | 3,430 |
| Fredericksburg to Tysons Corner | US 17 to Tysons Corner | 30 | 65 | 420 |
| TOTAL BOARDINGS FOR SYSTEM | | | | 8,660 |

Table 4-3. Tysons Access BRT Scenario Demand
(One Direction Only - to Tysons Corner)
Year 2030 Boardings (AM + PM Peak Period)

| BRT Route Description | HOT Lanes Access Points | Headway (mins) | Run Time (mins) | Total Boardings |
|---|---|---|---|---|
| Fredericksburg to DC | US 17 to Washington DC | 30 | 79 | 3,380 |
| Fredericksburg to EPG to Fort Belvoir | US 17 to Fairfax County Parkway | 30 | 69 | 350 |
| Fredericksburg to Pentagon to Crystal City | US 17 to Pentagon | 30 | 73 | 1,080 |
| Massaponax to DC | US 1 to Washington DC | 30 | 96 | 3,430 |
| Fredericksburg to Tysons Corner | US 17 to Tysons Corner | 30 | 65 | 500 |
| TOTAL BOARDINGS FOR SYSTEM | | | | 8,740 |

Table 4-4. Tysons Access BRT Scenario Demand
(Two Directions - to/from Tysons Corner)
Year 2030 Boardings (AM + PM Peak Period)

The provision of a BRT service to Tysons corner would increase demand by over 500 boardings in the AM and PM Peak periods if one direction service was provided and by over 600 boardings if service were to be provided in both directions. The results do show a minimal increase beyond just the route to Tysons Corner, indicating potential transfer demand from the other BRT/bus routes to the Tysons Corner routes. Overall by providing a one-way connection to Tysons Corner, AM and PM Peak boardings for all bus routes increases very slightly by 550 boardings, of which 420 boardings are on the route itself.

The only effect of providing two-way service on I-495 would be to increase the boardings on the Fredericksburg to Tysons route by 80 AM and PM Peak period boardings. As shown in the demand forecasts included in the appendix, there is no effect on either the other new services proposed in the Transit/TDM Study or the services coded in the CLRP. This indicates a more limited market for BRT service from Tysons Corner headed to the Franconia-Springfield area based on programmed service assumptions in the corridor.

## 4.4.3 In Line BRT Sceranio without Lorton Station

The preceding analysis indicates that there is a market for high-level BRT services in the corridor using In-line stations and a connection to Tysons Corner. As the study team coordinated with the GEC, an additional scenario to test developed in which the Lorton in-line station was not included in the BRT system and would be deferred as an investment in the corridor. Cost estimates prepared as part of the Fluor-Transurban proposal for the HOT Lanes project indicated that the inclusion of the Lorton in-line station would increase overall project costs by between $10-$15 million for the actual station and another $20 million to create the footprint needed for the proposed in-line station design.

By removing the Lorton station from the BRT route structure, the study team was able to determine whether the market demand for the BRT services was limited to the specific key stations or whether this demand existed more for the mode within the corridor as a whole. As presented below, the demand estimates indicate that even without this key in-line station, there would still be demand for the BRT system as a whole. **Table 4-5** presents the results of demand forecasts without the Lorton station. Note that this analysis did not include the Tysons Corner route as part of the network.

| BRT Route Description | HOT Lanes Access Points | Headway (mins) | Run Time (mins) | Total Boardings |
|---|---|---|---|---|
| Fredericksburg to DC | US 17 to Washington DC | 30 | 79 | 2,500 |
| Fredericksburg to EPG to Fort Belvoir | US 17 to Fairfax County Parkway | 30 | 69 | 480 |
| Fredericksburg to Pentagon to Crystal City | US 17 to Pentagon | 30 | 73 | 720 |
| Massaponax to DC | US 1 to Washington DC | 30 | 96 | 2,550 |
| TOTAL BOARDINGS FOR SYSTEM | | | | 6,250 |

Table 4-5. In-Line BRT Scenario without Lorton Station Demand
(Without Lorton Station) Year 2030 Boardings (AM + PM Peak Period)

The removal of the Lorton station reduces demand on the BRT defined service routes shown above by 1,860 boardings. This is less than the 2,100 boardings contributed by Lorton Station over the length of all routes in the AM and PM peak periods.[6] This indicates that some boardings are shifting to other stations in the corridor. The results indicate that even without the Lorton station there is demand for BRT services and that this market is not specifically tied to the presence of a station at Lorton. The removal of Lorton would affect several of the modified and proposed routes included in the Refined Alternative in the Transit/TDM Study (see Appendix A). An additional 870 boardings would be lost from these routes that were coded to access the Lorton station as well. The total AM and PM peak boardings would be reduced by over 3,300 boardings for all routes in the corridor, at 34,625 boardings compared to the 2030 in-line BRT Scenario.

In order to compensate for some of these ridership decreases, an effort was initiated to develop alternative services to Lorton. The result of that effort was the final operating scenario coded, the Priority Bus/BRT Scenario, which was also designed to test whether there was a market for a lower cost BRT service in the corridor.

## 4.4.4 Priority Bus/BRT Scenario

For the Priority Bus/BRT Scenario all stations were moved from in-line locations to off-line locations and the route structure was revised. In general, the strategy was to test less costly infrastructure investments in the corridor by having the Priority Bus/BRT service use existing facilities such as park and ride lots and Metrorail stations like Franconia Springfield and to eliminate the need for such expensive investments as fly-over access ramps, major in-line Station designs, and significant structures. Also, based on the results of the previous demand forecasts, the routes were refined to provide access to the strongest markets (Washington D.C.) in a more direct fashion.

**Exhibit 4-3** shows the routing in the Priority Bus/BRT Scenario. **Table 4-6** describes the route structures modeled for the BRT market.

[6]This can be derived from Table 4-2 by summing passengers who board in the AM at Lorton, and those passengers that will alight at Lorton in the PM (thus having boarded at other stations along the routes).

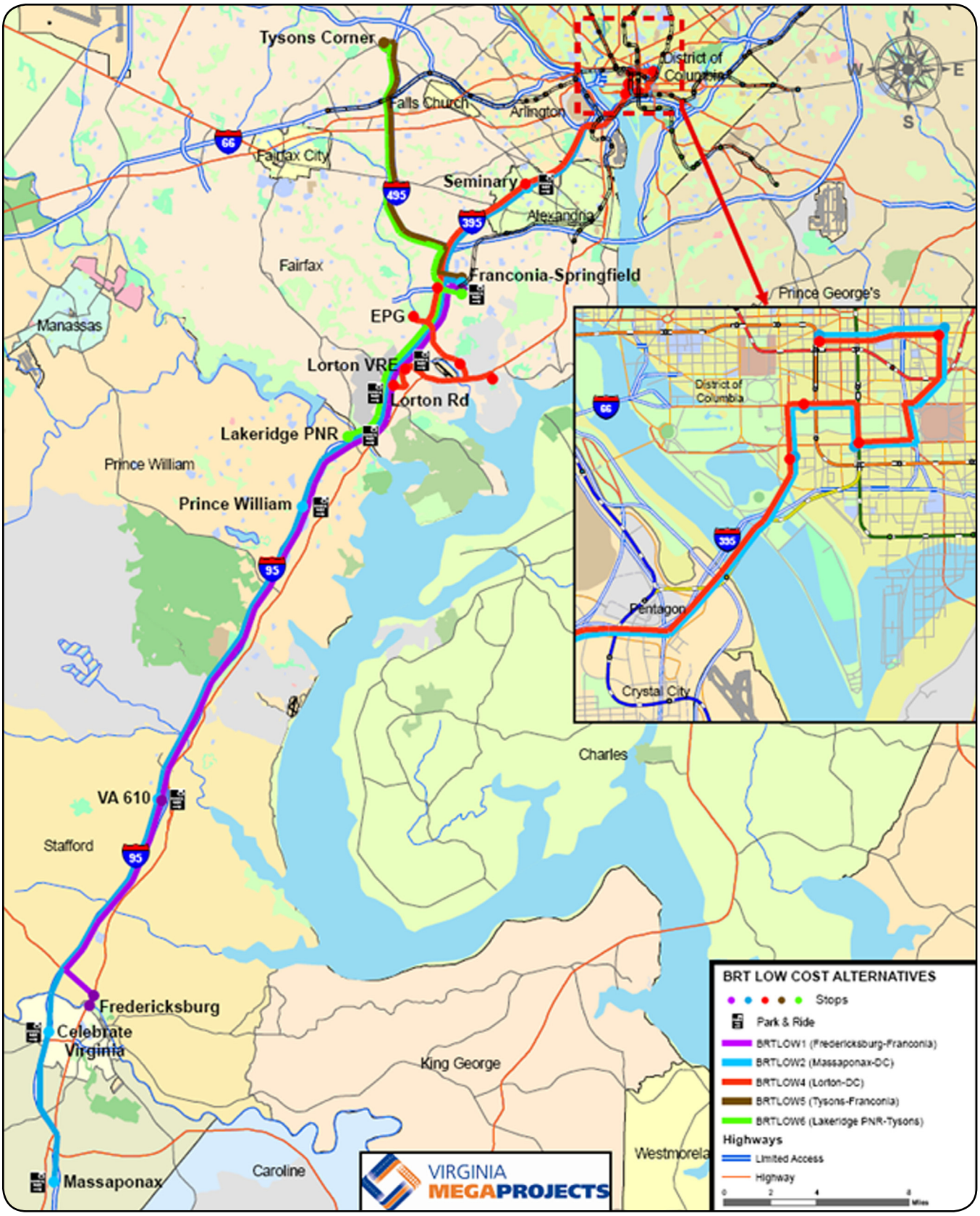


Exhibit 4-3. Routing in the Priority Bus / BRT Scenario

| Route | From / To | Markets Served/Description | Stops |
|---|---|---|---|
| BRTLow1 | Fredericksburg to Franconia Springfield | Shorter distance commutes from downtown Fredericksburg – can access WMATA, VRE or BRTLow5 to Tysons Corner | Fredericksburg, Route 610 and Franconia-Springfield |
| BRTLow2 | Massaponax to DC | Longest distance route – provides comparison to longer distance routes modeled with in-Line stations (test effects of route diversions to off-line stations) | Massaponax, Celebrate, Route 610, Prince William, Country PRTC, Franconia-Springfield, Mark Center, and DC |
| BRTLow4 | Lorton PNR to DC | Connects major BRAC facilities to DC – tests shorter distance market than previous modeling | Lorton Road PNR, Lorton VRE Station, Pence Gate at Ft. Belvoir, EPG, Backlick Road North, Mark Center and DC |
| BRTLow5 | Tysons to Franconia Springfield | Both directions – can be combined with other routes that access Franconia-Springfield, tests suburb to suburb market on Beltway HOT lanes | Franconia-Springfield and Tysons Corner |
| BRTLow6 | Lake Ridge to Tysons | Tests intermediate market to Tysons (longer distance routes not attracting ridership in previous runs) | Route 123 / Lake Ridge, Franconia-Springfield and Tysons Corner |

Table 4-6. Priority Bus / BRT Routes Modeled

Demand forecasts for the Priority Bus/BRT Scenario are presented in **Table 4-7 and Exhibit 4-4.** The primary conclusion is that demand exists for the BRT service within the corridor at a much lower cost level than previously tested and that moving the stations off-line, in conjunction with better targeting of markets, does not have a significant effect on over all demand. Thus, forecasts for every operating scenario, confirm that there is market demand for BRT service, particularly to Washington D.C. As will be discussed below, the Priority Bus/BRT Scenario also uncovered greater demand for services to Tysons Corner than previously documented in the process.

The lower cost, off-line Priority Bus/BRT Scenario maintains over 70% of the market demand of the higher cost BRT operating scenario. The Massaponax to Washington D.C. route loses over 1,000 boardings (2,210 compared to 3,350) when compared to the in-line BRT Scenario, which is logical due to the time added to the route while accessing the off-line stations. In comparing the time required to access the off-line stations, the Massaponax to Washington D.C. route using in-line stations as opposed to off-line stations, adds ten minutes to the overall run time in the corridor. However, the table shows a strong market demand for the routes that connect Lorton to Fort Belvoir and then into Washington D.C. and the route connecting the Lake Ridge/RT 123 area near Occoquan to Tysons Corner. These forecasts do not indicate a strong market for a connection between Fredericksburg and Franconia-Springfield and some of the market between Tysons and Franconia-Springfield transfers to the route starting at RT 123.

**Exhibit 4-4** shows where commuters are boarding and alighting during the AM peak period for the Priority Bus/BRT Scenario. The major boarding stations are Seminary Road, the RT 123 Park and Ride, and Franconia-Springfield Metrorail station. The major destinations are Washington, DC and Tysons Corner. For the Priority Bus/BRT Scenario there is a demand for 33,610 boardings in the AM and PM Peak Hours as shown in the appendix for all bus routes that leverage the corridor.

| BRT Route Description | HOT Lanes Access Points | Headway (mins) | Run Time (mins) | Total Boardings |
|---|---|---|---|---|
| Fredericksburg to Franconia Springfield Metrorail Station | Route 610 to Franconia Springfield Parkway | 30 | 44 | 100 |
| Massaponax to DC | Fall Hill Avenue to DC | 30 | 106 | 2,210 |
| Lorton PNR to Ft Belvoir to EPG to DC | Franconia-Springfield Parkway to DC | 30 | 70 | 2,510 |
| Tysons to Franconia Springfield (two directions) | Tysons to Franconia Springfield Parkway | 30 | 17 | 300 |
| Lake Ridge / Route 123 to Tysons Corner | Route 123 to Tysons Corner | 30 | 28 | 1,080 |
| TOTAL BOARDINGS FOR STATION SYSTEM | | | | 6,200 |

Table 4-7. Priority Bus/BRT Scenario Demand
Year 2030 Boardings (AM + PM Peak Period)

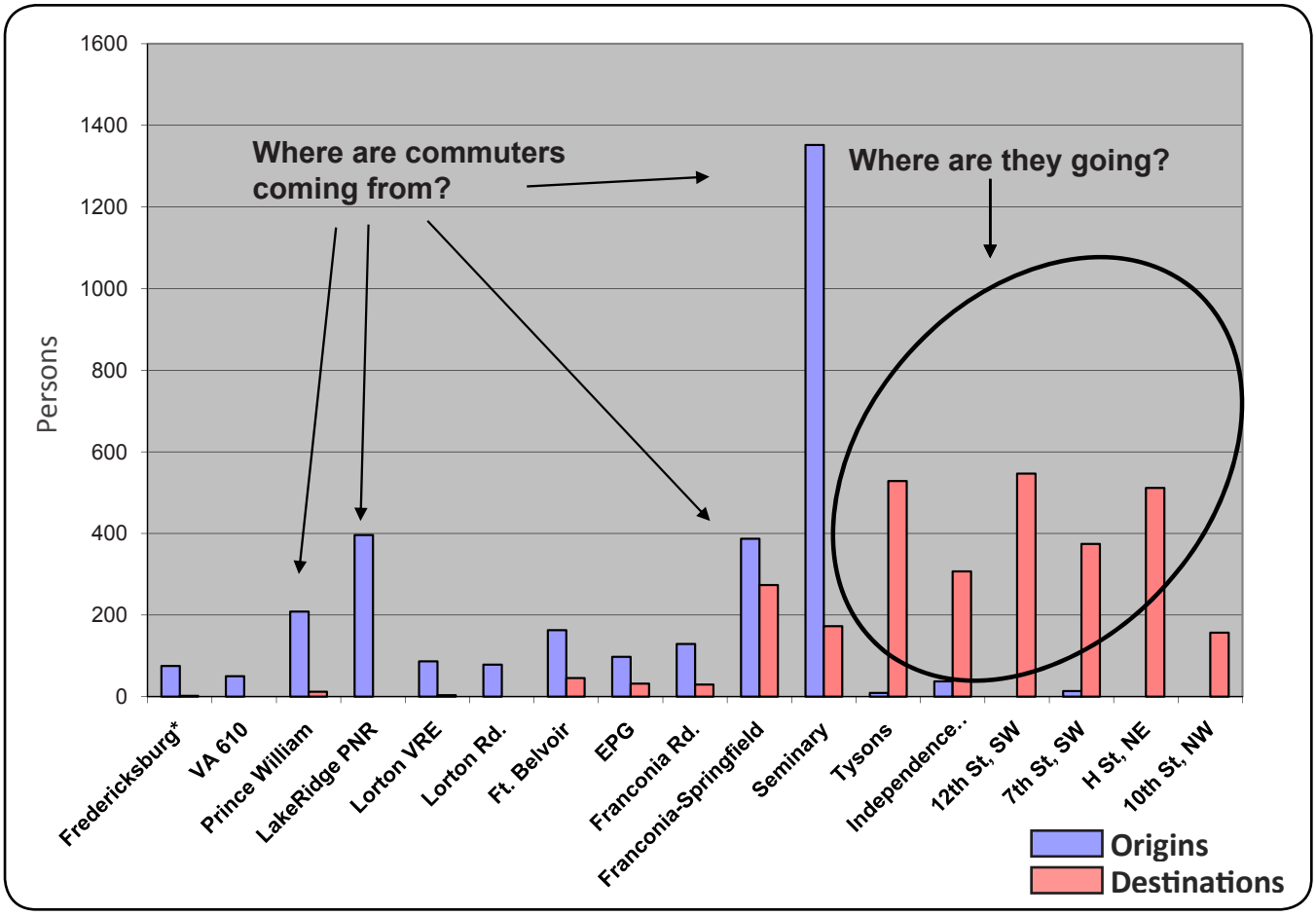


Exhibit 4-4. Origins and Destinations

## 4.5 Findings

The modeling conducted for testing the BRT market shows the following:

• There are at least ***6,200 daily boardings for Priority Bus/BRT services*** in the corridor – forecasts range from 6,200 boardings in a Priority Bus/BRT Scenario to over 8,000 boardings in an in-line BRT Scenario concept.

• All operating scenarios have demand of at least ***33,000 daily boardings within the corridor***, either as part of the "BRT" branded system, or as included as new, improved, or previously existing routes.

• The ***highest demand for boardings exists at Seminary Road*** in all operating scenarios, with demand remaining relatively flat at around 1,400 AM boardings no matter which operating scenario was tested. These boardings would be reduced if parking is constrained. The model showed a mode share for walk-access boardings of 5% for population centers within ½ mile of this station in all model runs, which is a reasonable result. Also, it is noted that in the 2000 Census data the average transit mode share is approximately 16% in Alexandria over all markets. This information suggests that the developments contributing demand for walk access to the station do not command an unreasonable transit share.

• ***Lowest demand is seen at Massaponox and Celebrate stations***. Boardings would most likely increase with additional transit-oriented development and a more robust transit system at these locations.

• ***Demand is greatest*** for routes with destinations within the ***District of Columbia,*** followed by routes that provide access to Tysons Corner.

• Providing service from, as well as to, Tysons Corner increases demand by less than 100 boardings.

• ***There is less demand for routes that provide access to destinations other than Washington D.C. in the corridor, such as Franconia-Springfield and the military facilities***. In many cases, existing transit services are already provided at Franconia-Springfield and to military bases. In order to increase ridership at these locations, route re-structuring of both the local services and the Priority Bus/BRT Scenario could increase usage. For the military bases, additional transit-supportive policies such as parking restrictions could also increase transit patronage.

• ***There is BRT demand seen whether the station is located in-line or off-line***, although the addition of travel time does decrease demand.

• The Priority Bus/BRT Scenario provides access to markets in Lake Ridge (1,080 boardings) that are not captured as directly in other scenarios.

• ***The Priority Bus/BRT Scenario achieves 70% of the boardings as the in-line BRT Scenario and thus, is recommended for further analysis.***