Executive Summary

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The I-95/I-395 Bus Rapid Transit (BRT) Study investigates the market for enhanced transit infrastructure, operations, and technology within the I-95/I-395 corridor in northern Virginia. This study follows the I-95/I-395 Transit/Transportation Demand Management (TDM) Study that was conducted to determine how transit could best be enhanced in the corridor. The Transit/TDM Study identified a variety of transit investments for the corridor including a BRT system with stations in the Interstate right of way, or "in-line". This study was conducted to not only verify the recommendation for BRT in the corridor from the Transit/TDM Study by providing additional modeling detail and market analysis overall, but also to develop specific station area infrastructure requirements that were not analyzed in the preliminary work. As such, it uses the Transit/TDM Study as a starting point, but refines the recommendations for a BRT system in the corridor.

Exhibit ES-1 shows an overview of High Occupancy Toll (HOT) lanes in the northern Virginia area, including those currently being studied for I-95 and I-395 and those under construction on the Capital Beltway (I-495). This analysis is related to those projects in two ways: 1) the HOT lanes could potentially provide consistent travel speeds for the BRT system to operate within, and 2) the I-95/I-395 HOT lanes project could be a potential funding source for some of the BRT investments. The purpose of this report is to document, in greater detail than previously conducted, the market demand for a BRT system within the study area and to determine the infrastructure that would be required to support that BRT system.

This study is being sponsored by the Virginia Department of Transportation (VDOT) in coordination with the Virginia Department of Rail and Public Transportation (DRPT). A stakeholder group, referred to as the Transit Operators Committee (TOC), was formed to provide advice and direction to the study. This group consists of transit operators as well as City and County transportation planners.

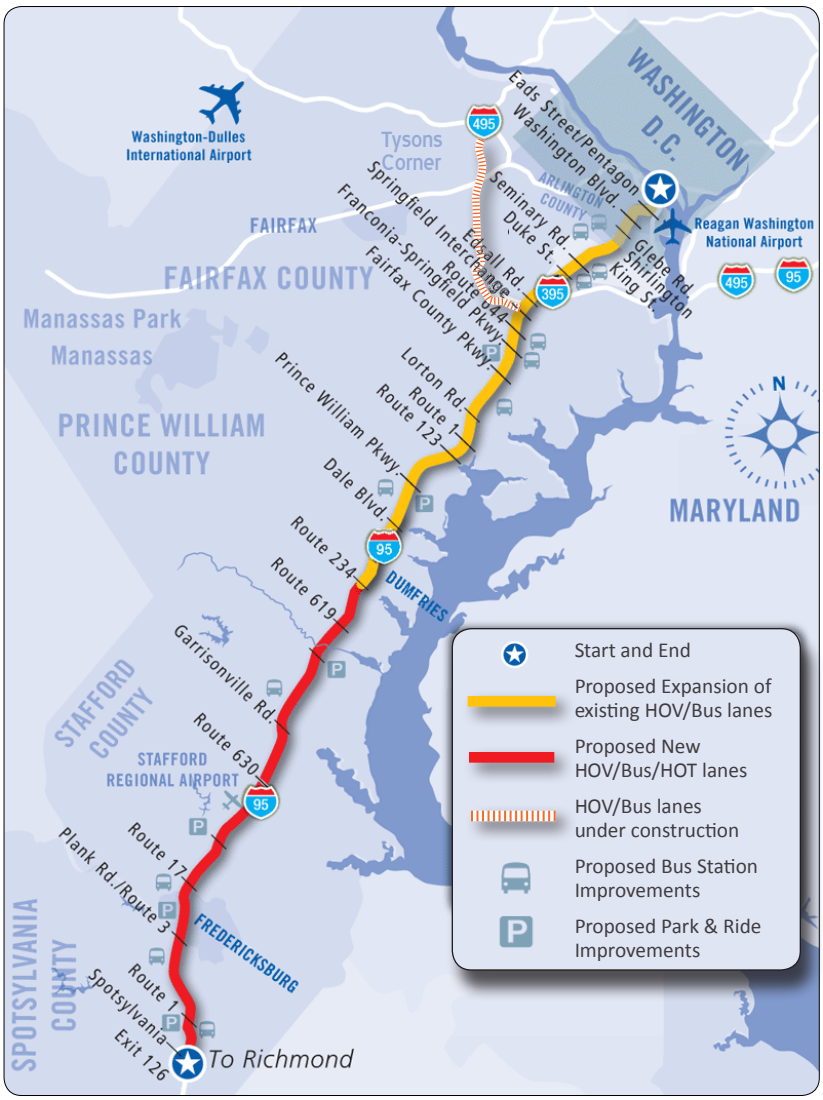

Exhibit ES-1. I-95 / I-395 Study Corridor

Key Findings

The following steps were taken in verifying the market demand for BRT services in the corridor and developing estimates for the transit station infrastructure needed to support a BRT system:

- Operating Conditions Assessment – the most recent plans for the corridor and proposed major developments and land use changes along the corridor were updated.
- BRT Definition – in order to model the BRT system in more detail, station prototypes and operating scenarios were developed for the corridor in consultation with other BRT initiatives in the region.
- Modeling – a variety of operating scenarios were modeled to test the overall market demand for BRT services in the corridor, including scenarios that included in-line stations.
- Station Area Concepts – for each station area under consideration a series of infrastructure improvements that would support BRT were developed and cost estimates prepared.
- Recommendations – based on the modeling conducted and cost estimates prepared, a Priority Bus/BRT System is recommended in the corridor.
- **Exhibit ES-2** shows the Priority Bus/BRT System that is recommended. Service is recommended from the area of Massaponax, Virginia to Washington, DC as well as new routes that provide access to Tysons Corner, Virginia.

Other key findings from the study include:

1. Total AM boardings for bus service using some portion of the corridor will exceed 38,000 in 2030, which represents a significant mode share. This includes over 6,200 AM boardings on the Priority Bus/BRT System which would provide service to stations located off-line at arterials and existing Park and Ride lots.
2. Although boardings for an operating scenario with the in-line stations that were originally envisioned in the Transit/TDM Study would be higher than the Priority Bus/BRT System at 8,110 boardings, they would come at a significantly greater expense than those proposed in the Priority Bus/BRT system. In addition, the physical location of the in-line stations inside the Interstate corridor would be more difficult to access from surrounding feeder networks and not as conducive to transit-supportive land uses.
3. One operating scenario was conducted to determine the effects of removing a key station, the Lorton in-line station, on the market. Although boardings did decrease, over 6,200 AM boardings still used the BRT system.
4. Tyson Corner access increased the daily boardings by 500-600 trips per day when modeled.

Other findings that are not specific to any one operating scenario:

5. Stations south of RT 610 have low ridership, generally less than 100 boardings per day.
6. The closer to Washington D.C. the heavier the ridership. The station with the largest boardings is Seminary Road/Mark Center in all scenarios. Other stations with high boardings include Prince William, Franconia-Springfield, and RT 123/Lake Ridge.
7. Boardings at the Pentagon are low in all scenarios due to the extensive existing and planned competing service.
8. Annualized operating costs, including bus capital costs, are $51 million for the Priority Bus/BRT routes and $48 million for the In-Line scenario modeled. However, the Priority Bus/BRT In-Line Scenario includes seven routes and provides access to fourteen station areas whereas the cost for the in-line system included only three BRT defined routes and access to five stations.
9. The cost for 12 stations used in the Priority Bus/BRT Scenario is $21 Million. This is expected to be comparable to the cost of just one in-line station.

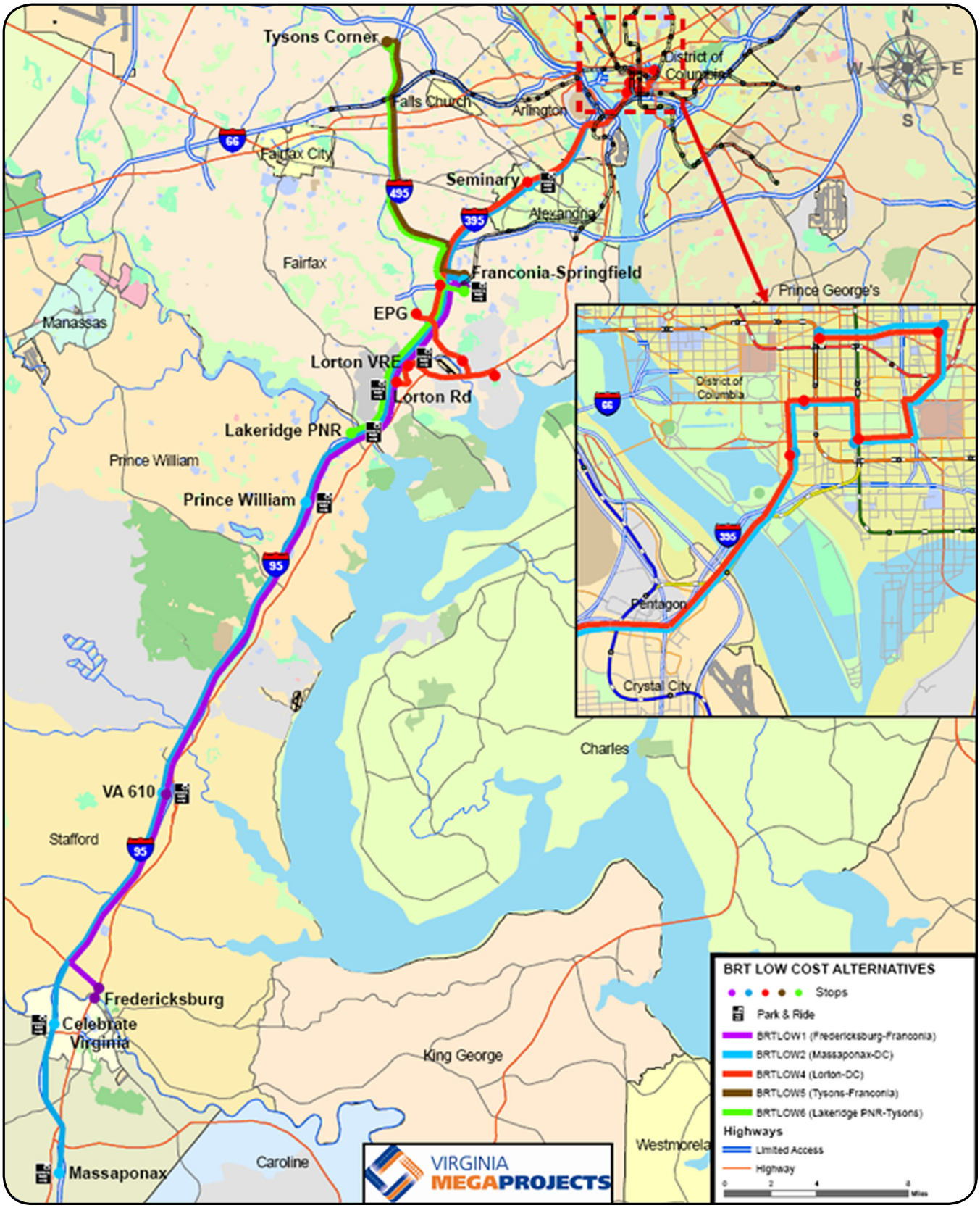

Exhibit ES-2. Priority Bus/BRT System Routes

Key Conclusions

- ***Reliable, uncongested conditions on the I-95/395 facility will result in heavy transit use.*** Transit will continue to provide significant mobility benefits within the corridor.
- The stations have weak interdependence; ***their primary function is to provide access to commuter service to downtown Washington D.C.***
- As such, ***the market for BRT is strong in the north***, closer to the Capital Beltway and Washington D.C. In the south there is light ridership. Ridership in the south could increase with transit oriented land use policies.
- ***The Seminary Road new access creates a significant demand at the Seminary Road/Mark Center Transit Center.***
- Demand for Service to Tysons Corner is good, but not bi-directional. ***There will be strong demand for trips from Prince William County.***
- The Priority Bus/BRT Scenario has similar ridership to the In-Line without Lorton Scenario; 6,200 boardings vs 6,250 boardings. However, the station capital costs for the Priority Bus/BRT Scenario will be significantly less. Furthermore, the ***Priority Bus/BRT stations will generally be located in areas with potential for transit oriented development.***

Recommendations

Based on the analysis findings and conclusions and guidance from the Transit Operators Committee, we recommend a Priority Bus/BRT service similar to the service modeled. The routes are shown in the previous **Figure ES-2** and described in the **Table ES-1**.

Route	Implementation Year	Revenue Hours	Vehicle Hours	Vehicle Needs
Lorton PNR to Ft Belvoir to EPG to DC	2015	3600	4320	5
Lake Ridge/RT 123 to Tysons Corner	2015	1900	3800	3
Seminary - Pentagon - DC	2015	3100	3410	5
Dale City (or Lake Ridge) - Seminary - DC	2015	3800	7600	6
Fredericksburg to Franconia-Springfield Metrorail Station	2020	1100	2200	4
Massaponax to DC	2020	2700	5400	3
Tysons Corner to Franconia-Springfield (two directions)	2020	900	990	2

Table ES-1. Proposed Routes for Priority Bus/BRT Scenario

The future Seminary Road/Mark Center Transit Center is projected to attract heavy ridership, both as an origin/destination and as a transfer point. Two additional routes were added to take advantage of this projection. This recommendation requires 12 new or modified stations. The station locations and modifications developed in this report are representative concepts and will need additional study.

Table ES-2 shows the total operating costs and annualized bus costs for the Priority Bus/BRT service. Estimated operating and bus capital costs are $51 million for the Priority Bus/BRT services. The estimate for the three in-line system routes is $48 million (source: I-95/I-395 Transit/TDM Study); the Priority Bus/BRT services provide more coverage at comparable price.

Route	Lifetime O&M Cost (to 2030)	Vehicle Needs	Cost Per Vehicle	Annualized Capital Cost (to 2030)	**Total Cost**
Lorton - EPG - Seminary - DC	$5,622,696	5	$500,000	$3,437,500	$9,060,196
Lake Ridge - Tysons Corner	$4,945,890	3	$500,000	$2,062,500	$7,008,390
Seminary - Pentagon - DC Route	$4,438,286	4	$750,000	$4,125,000	$8,563,286
Dale City to Seminary (+DC)	$9,891,780	6	$500,000	$4,125,000	$14,016,780
Fredericksburg - Franconia-Springfield	$1,908,940	4	$750,000	$2,750,000	$4,658,940
Massaponax - DC	$4,685,580	3	$750,000	$2,062,500	$6,748,080
Tysons Corner - Franconia-Springfield	$859,023	2	$500,000	$916,667	$1,775,690
Total Costs (2010 Dollars)					**$51,831,362**

Table ES-2: Annualized Costs

Location	Basis of Cost Estimate	Cost Estimate ($ Thousands)
1. Massaponax	New station with 2 BRT bays and 100 dedicated BRT parking spaces	$2,516
2. Celebrate Virginia!	New station with 2 BRT bays and 100 dedicated BRT parking spaces	$2,273
3. RT 610/RT 1	New station with 2 BRT bays and 100 dedicated BRT parking spaces	$3,273
4. Prince William PRTC	New BRT station adjacent to PRTC with 200 dedicated spaces	$4,998
5. Lake Ridge Park and Ride	2 BRT bays at adjacent Park and Ride	$500
6. Lorton Park and Ride	2 BRT bays at adjacent Park and Ride	$1,823
7. Fredericksburg Vic RT 17/RT 1	New station with 100 dedicated BRT spaces	$2,273
8. Fort Belvoir Pence Gate	2 BRT bays and BRT features at existing stop	$2,273
9. Engineer Proving Grounds	2 BRT bays and BRT features at future bus transfer area	$530
10. Franconia-Springfield Metro Station	2 BRT bays and features added to Metro/VRE station	$650
11. Tysons Corner	BRT features at future bus transfer area	$500
12. Seminary and Mark Center Transit Center	BRT features at future bus transfer area	$1,010
Total Costs		**$20,846**

Table ES-3: Station Infrastructure Requirements and Costs

In comparing total costs for the Priority Bus/BRT system to those included for a BRT System in the Transit/TDM Study it is important to note the following: capital costs for the stations are significantly reduced and operating costs as shown are slightly higher. The higher operating costs can be explained due to the fact that running times are slightly elevated since the Priority Bus/BRT routes include deviation from the mainline, which increases overall revenue hours. However, the most significant difference is that the Priority Bus/BRT system recommended includes substantially greater service and coverage. In the previous report, there were three recommended new BRT routes that started in Frederisckburg and ended in Washington D.C. For the Priority Bus/BRT system the analysis recommends seven routes, more than double the routes in the previous work. In addition, the Priority Bus/BRT system provides new connections to Tysons Corner, the Lake Ridge area of Prince William County, and the Engineer Proving Grounds (EPG) in the route structure that were not included in previous analyses, resulting in far greater geographic coverage for suburb to suburb destinations than previously costed. Also, the total operating costs as shown could be reduced by reconfiguring services that are already planned or that currently exist to serve some of the market demand and eliminate some of the revenue hours documented in this analysis.

The Priority Bus/BRT Routes provide access to 12 stations that will have distinct BRT features. These features include canopies, distinct bays, real time information displays, smart card systems and information kiosks. All of the stops will support other bus service, as such these features will be in addition to traditional bus bays, or will be combined with the other service.

The stations are generally located off arterials with signalized intersections. Signal priority and minor roadway improvements were assumed in the analysis to minimize the time the buses are on local roadways and subject to traffic congestion.

The total cost for the 12 stations is $21 Million, which is similar to the expected cost of one in-line station. The 12 stations and the assumed Priority Bus/BRT improvements are in **Table ES-3**.

Next Steps

This study documents that an investment of just over $70 million for a Priority Bus/BRT system would provide mobility benefits for over 6,000 BRT boardings during the AM and PM peak periods and access to over 38,000 total boardings in the corridor daily.

Additional studies would still need to be completed if funding for the Priority Bus/BRT system were committed to implement this sytem. In addition, the following analyses are recommended:

- ***Continued coordination and participation in planning and design for I-95/I-395 HOT lanes project***, including advocating for inclusion of enhancements that would support Priority Bus/BRT movements in the corridor such as additional slip-ramps and potential bus access ramps as needed to support transit investments.
- ***Continued coordination with the Mark Center Access Study*** currently underway. The potential routing of Priority Bus/BRT services through the rotary on Seminary Road is circuitous and better access to the BRAC site is being considered. Additional coordination with the City of Alexandria will also be required to develop better transit access to Mark Center.
- ***Transit oriented development studies for new Priority Bus/BRT Stations*** to better define access requirements and land use densities that support transit, particularly at Massaponax, Celebrate, RT 610 and Prince William County.

- ***Location or access studies for each of the proposed stations.*** The station concepts developed in this report are representative of how each station will function and the elements of each station. The next step is to plan each station in greater detail with local stakeholders.
- ***Environmental documentation*** will be required for the Priority Bus/BRT system – especially for any off-line stations that require the purchase of right-of-way.
- ***Documentation of parking needs*** unrelated to Priority Bus/BRT system that would support overall goals of the previous Transit/TDM Study.
- ***Detailed study of costs/benefits for various management structures*** that would be required to operate regional Priority Bus/BRT system. Alternatives include the potential for multiple existing operators to use Priority Bus/BRT facilities, development of one managing partner in the region, or development of new regional authority.
- ***Development of detailed implementation plan*** and regional coordination plan for Priority Bus/BRT system in the corridor, including prioritization of investments and detailed phasing plan.
- ***Additional public involvement and coordination with Transit Operators*** in the corridor to explain the benefits of the Priority Bus/BRT system.

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