



Virginia Department of Rail and Public Transportation

# SPRINGFIELD TO QUANTICO ENHANCED PUBLIC TRANSPORTATION FEASIBILITY STUDY

## *Executive Summary*

*prepared by*

**Cambridge Systematics, Inc. and KFH Group, Inc.**

*with*

Kittelson & Associates, Inc.

PRR, Inc.

LDA Consulting

**November 2021**



# SPRINGFIELD TO QUANTICO ENHANCED PUBLIC TRANSPORTATION FEASIBILITY STUDY

---

## *Executive Summary*

*prepared for*



Virginia Department of Rail and Public Transportation

*prepared by*

**Cambridge Systematics, Inc. and KFH Group, Inc.**

*with*

Kittelson & Associates, Inc.

PRR, Inc.

LDA Consulting

*date*

**November 2021**



# TABLE OF CONTENTS

---

<b>1.</b>	<b>Introduction and Study Purpose .....</b>	<b>1</b>
1.1	Background .....	1
1.2	Study Approach.....	2
1.3	Public and Agency Participation.....	3
<b>2.</b>	<b>Existing and Future Transportation Needs .....</b>	<b>5</b>
2.1	Existing Demographics and Land Use .....	5
2.2	Travel in the Corridor .....	7
2.3	Growth Forecasts .....	8
2.4	Needs Assessment .....	9
<b>3.</b>	<b>Enhanced Transit Alternatives .....</b>	<b>11</b>
3.1	Metrorail—Blue Line Extension .....	11
3.2	Metrorail—Yellow Line Extension.....	12
3.3	Bus Rapid Transit (BRT) .....	13
3.4	VRE Service Improvements .....	14
3.5	Express Bus.....	15
<b>4.</b>	<b>Alternatives Evaluation .....</b>	<b>17</b>
4.1	Goals and Measures .....	17
4.2	Evaluation Results.....	18
	Ridership Potential .....	18
	Congestion Mitigation.....	20
	Regional Accessibility.....	20
	Equity .....	21
4.3	Sensitivity Tests .....	21
	Shortened Alignments .....	22
	Post-Pandemic Telework Changes.....	22
4.4	Land Use Assessment.....	23
<b>5.</b>	<b>Other Considerations and Next Steps.....</b>	<b>25</b>
5.1	Summary of Costs .....	25
5.2	Other Considerations for Metrorail Extensions .....	25
	Next Steps.....	27



# LIST OF TABLES

---

Table 2.1	Change in Study Corridor Population and Employment, 2020 to 2045.....	8
Table 4.1	Evaluation Measures .....	17
Table 4.2	Shortened Alignments Sensitivity Results .....	22
Table 4.3	Telework Impact on Ridership Sensitivity Results .....	23
Table 4.4	Land Use Scenario Results .....	24
Table 5.1	Order of Magnitude Costs (2030 Dollars) .....	25





# LIST OF FIGURES

---

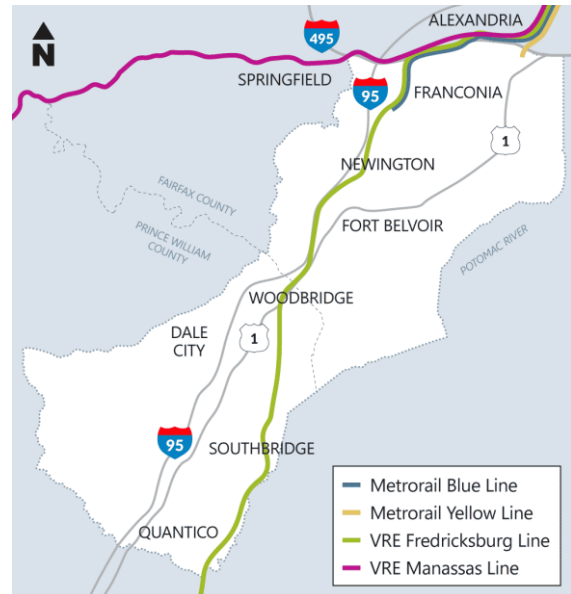
Figure 1.1	Study Approach Flow Chart .....	2
Figure 1.2	On-Line Survey Results: Transit Motivators .....	4
Figure 2.1	Study Corridor Demographics .....	5
Figure 2.2	Activity Centers .....	6
Figure 2.3	Daily Commuting Trip Flows from the Study Area .....	7
Figure 2.4	Baseline Growth: 2020 to 2045 .....	9
Figure 2.5	Key Needs Identified in the Study Corridor .....	10
Figure 4.1	Goals for Enhanced Transit .....	17
Figure 4.2	Summary of Evaluation Results* .....	18
Figure 4.3	Total Transit Boardings in the Study Corridor .....	19
Figure 4.4	New Daily Transit Trips in the Study Corridor .....	19
Figure 4.5	Projected Yellow Line Daily Boardings by Station .....	20
Figure 4.6	Equity Emphasis Areas in the Study Corridor .....	21
Figure 4.7	Place Types Used in Station Area Assessment .....	24
Figure 5.1	Multi-Step Project Development Process .....	27



# 1. INTRODUCTION AND STUDY PURPOSE

## 1.1 Background

The corridor between the Franconia-Springfield Metro Station and Marine Corps Base Quantico is a critical link in the Northern Virginia transportation network. The corridor is served by a range of transit services including Metrorail, Virginia Railway Express (VRE) commuter rail service, express and local bus service provided by multiple operators, as well as vanpool and carpool options that take advantage of the I-95/I-395 express/HOT lanes and a network of park-and-ride lots. Future growth in population and jobs will continue to increase demand for multimodal commuting options.



A number of significant transit improvements are already planned for the corridor including additional express bus services, VRE expansion, and bus rapid transit (BRT) in the Richmond Highway corridor. The Franconia-Springfield and Huntington Metro stations play an important role as major transfer hubs to the region's Metrorail system and previous studies have examined extensions of both the Blue Line and Yellow Line into southern Fairfax and Prince William counties.

Given the importance of this multimodal corridor to the Washington metropolitan region and the entire Commonwealth, the Virginia General Assembly approved a 2020 budget amendment directing the Department of Rail and Public Transportation (DRPT) to conduct a feasibility study for enhanced public transportation services between the Franconia-Springfield Metro station in Fairfax County and the Marine Corps Base Quantico in Prince William County:

"F. The Department of Rail and Public Transportation, in cooperation with Fairfax and Prince William Counties, shall evaluate enhanced public transportation services from the Franconia-Springfield Metro Station to Fort Belvoir, Lorton, Potomac Mills, and Marine Corps Base Quantico in Prince William County, including the cost and feasibility of extending the Blue Line and other multimodal options such as bus rapid transit along Interstate 95 and U.S. Route 1. The Director of the Department of Rail and Public Transportation shall submit a report of its findings to the Chairs of the House Appropriations Committee and the Senate Finance and Appropriations Committee by December 1, 2021."

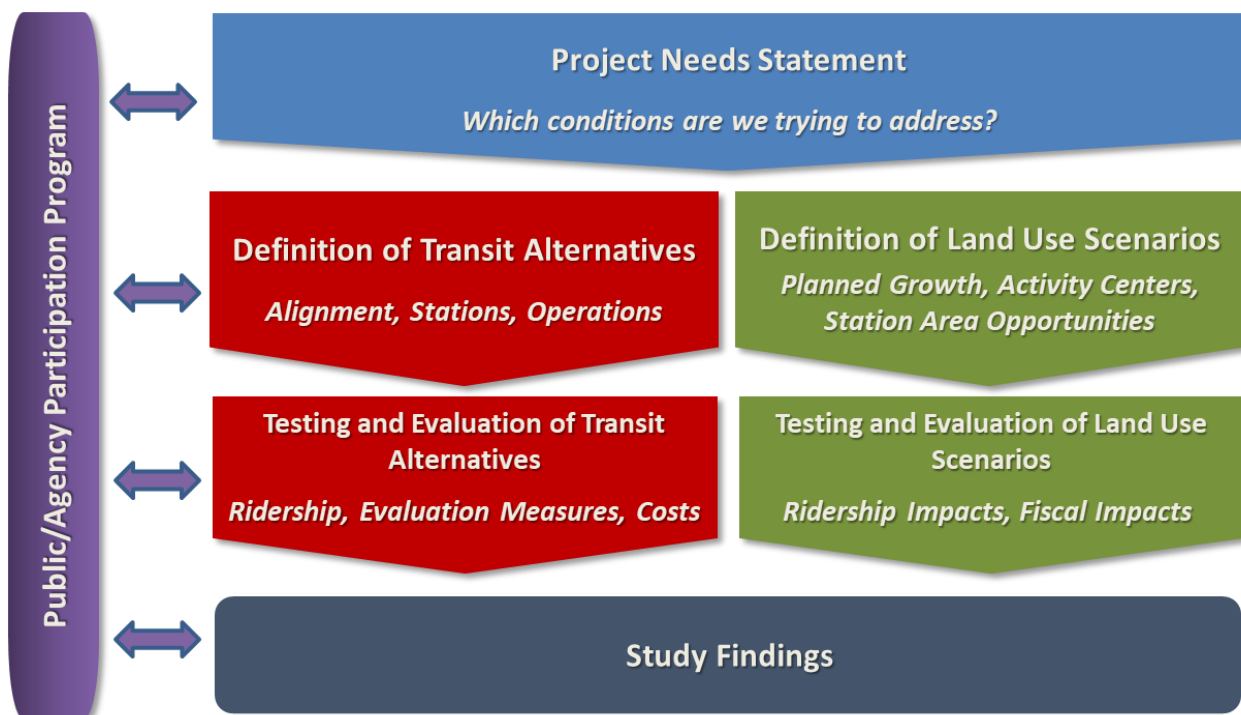
## 1.2 Study Approach

The feasibility study was structured into three primary phases of analysis and an ongoing engagement program (Figure 1.1). Key steps in the study process included defining the transportation needs within the study area, developing and testing a set of transit alternatives, and documenting feasible alternatives. A parallel task included an assessment of land use scenarios to identify potential transit station areas and development opportunities.

### Study Purpose

This study provides a comprehensive, objective evaluation of a range of potential future enhanced transit alternatives that compares the cost, benefits, and impacts of each option to inform recommendations about future investment in the study area.

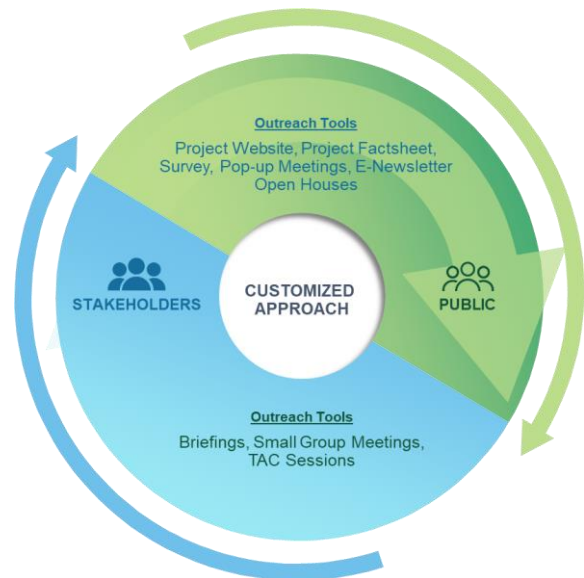
FIGURE 1.1 STUDY APPROACH FLOW CHART



## 1.3 Public and Agency Participation

Throughout the study, the DRPT study team encouraged input from the public and stakeholders, including local organizations and communities along the corridor to identify important and desirable transit improvements. Monthly meetings were held with a Technical Advisory Committee (TAC) consisting of local and regional transportation agencies. State and local elected officials were briefed regularly throughout the study. The engagement process served multiple objectives:

- ▶ Alerting and educating stakeholders about the purpose, scope, and schedule of the study
- ▶ Gathering community and stakeholder input on the transportation needs in the study area and potential transit improvements to address those needs; and
- ▶ Presenting study findings on the costs, benefits, and impacts of each option to inform decisions about future investment in the study area.

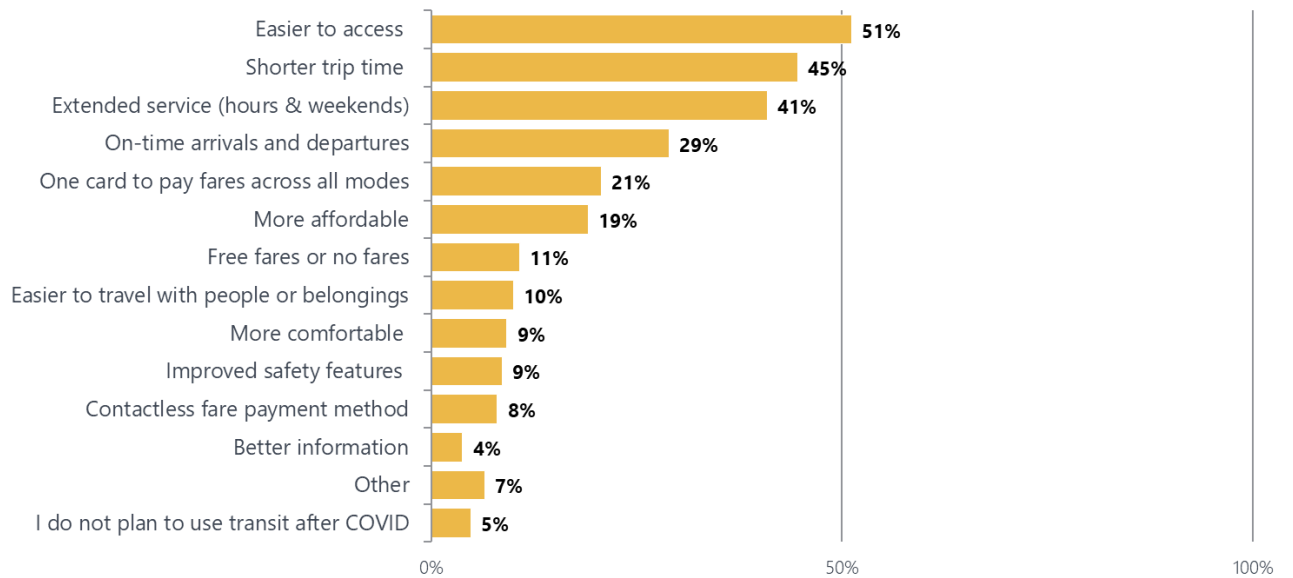


Some of the key outreach activities, conducted in English and Spanish, completed during the study included:

- ▶ Disseminating project information through a DRPT website project page, including a project factsheet, TAC meeting information, and recordings of public meetings and elected officials briefings;
- ▶ Conducting an online survey completed by over 1,300 respondents that gathered input on travel behavior and preferences in the corridor (for example, see Figure 1.2);
- ▶ Hosting three rounds of virtual public meetings (May, July, and September) at key project milestones to discuss study findings and receive feedback;
- ▶ Utilizing social media, email blasts, and two pop-up events to spread awareness of project activities; and
- ▶ Coordinating communications with elected officials, TAC member's public information offices, and community groups.

FIGURE 1.2 ON-LINE SURVEY RESULTS: TRANSIT MOTIVATORS

**What are the top three features that would motivate you to use (or use more often) public transit for your trips along the study corridor when things return to normal after COVID?**



## 2. EXISTING AND FUTURE TRANSPORTATION NEEDS

The Study Corridor defined for this study covers portions of Prince William and Fairfax counties between I-495 and the Stafford County line. Several major highways run through the Study Corridor, including I-95 and Richmond Highway (U.S. 1). Public transit in the Study Corridor includes bus services operated by Fairfax Connector, OmniRide, WMATA Metrobus, and rail services operated by WMATA Metrorail and the VRE Fredericksburg line.

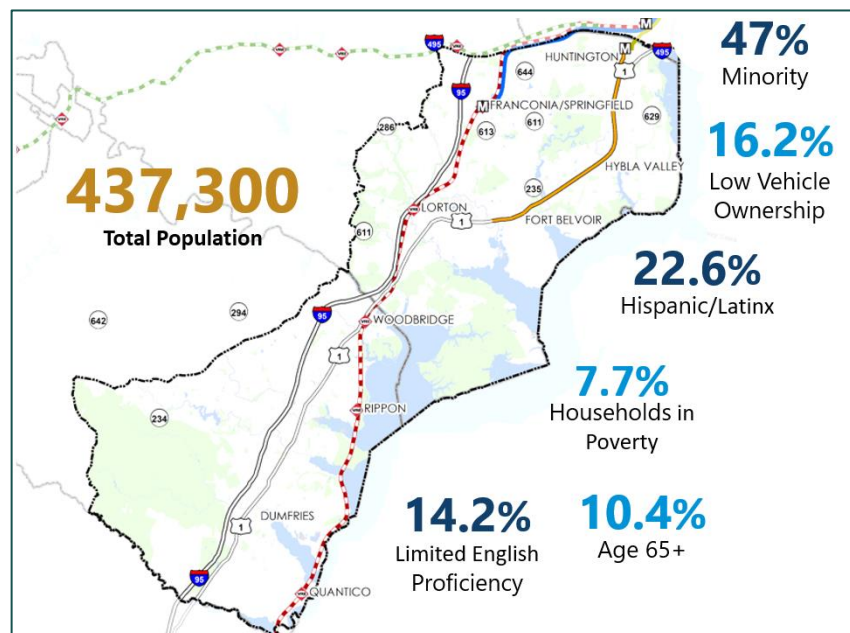
### 2.1 Existing Demographics and Land Use

More than 437,000 people currently (as of 2020) reside in the Study Corridor, representing more than 25 percent of the combined populations of Fairfax and Prince William counties (1.7 million). Population is concentrated along the I-95 and U.S. 1 corridors in both counties, and near the Franconia-Springfield and Huntington Metrorail stations in Fairfax County. Despite significant density across the Study Corridor, there are some notable exceptions, particularly around the Fort Belvoir and Quantico military installations

The study area includes a diverse population base throughout this suburban corridor (**Error! Reference source not found.**).

The population includes 47 percent minority (defined here as Black, Asian, Native American, and Other, or more than one race) and 22.6 percent that identify as Hispanic or Latinx<sup>1</sup> (note that minority and Hispanic/Latinx populations can overlap). About 7.7 percent of the population were living in poverty in 2019, and 16.2 percent of households were associated with low vehicle ownership. Low vehicle

FIGURE 2.1 STUDY CORRIDOR DEMOGRAPHICS



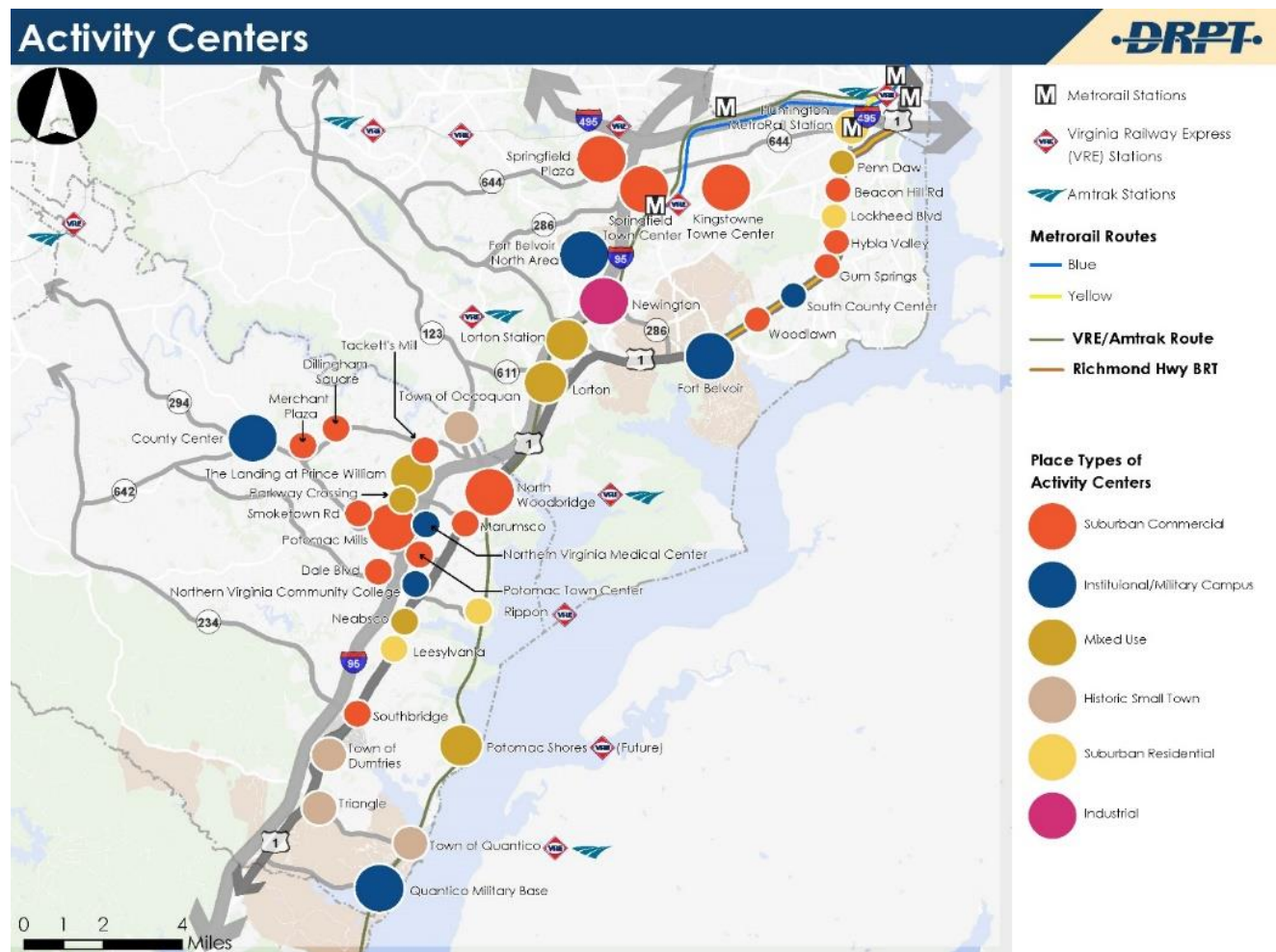
<sup>1</sup> Gender-neutral term for Latino/a or peoples originating from Latin America. Hispanic refer to those who speak Spanish. <https://apastyle.apa.org/style-grammar-guidelines/bias-free-language/racial-ethnic-minorities>

households—those with zero or one vehicle—are more likely to rely on transit for some or all of their transportation needs.

As of 2020, more than 200,000 people work in the Study Corridor. Employment is much more concentrated than population in a few key activity centers. Key employment centers in Prince William County include Quantico at the far south of the Study Corridor, and a cluster of retail and other businesses in and around Potomac Mills. In Fairfax County, employment centers are focused along I-95 and U.S. 1, including Springfield Town Center, Fort Belvoir, and Fort Belvoir North, where the National Geospatial-Intelligence Agency (NGA) is located. Jobs are also concentrated near Hybla Valley, but clustered in the businesses along U.S. 1.

Existing land use is focused around 44 major activity centers (**Error! Reference source not found.**) in the corridor. These activity centers are clusters of employment centers, retail establishments, historic downtowns, high-density residential neighborhoods, existing transit stations, and major park-and-ride locations.

FIGURE 2.2 ACTIVITY CENTERS





## 2.2 Travel in the Corridor

On an average day, more than 1.24 million trips start in the Study Corridor;<sup>2</sup> these trips are destined for areas throughout the National Capital Region (NCR) and represent travel to work, for shopping, and other purposes. Of the trips starting in the Study Corridor:

- ▶ More than 60 percent of total trips (all trip purposes) stay within the Study Corridor;
- ▶ 36 percent of the commute trips that start in the Study Corridor, stay in the Study Corridor;
- ▶ 38 percent of commute trips that start in the Study Corridor (or further south) are heading to points north, including Fairfax County, the District of Columbia (DC), Arlington, and Alexandria;
- ▶ 23 percent of commute trips that start in the Study Corridor (or further south) may be using the corridor to access suburban job centers located along the Capital Beltway corridor.

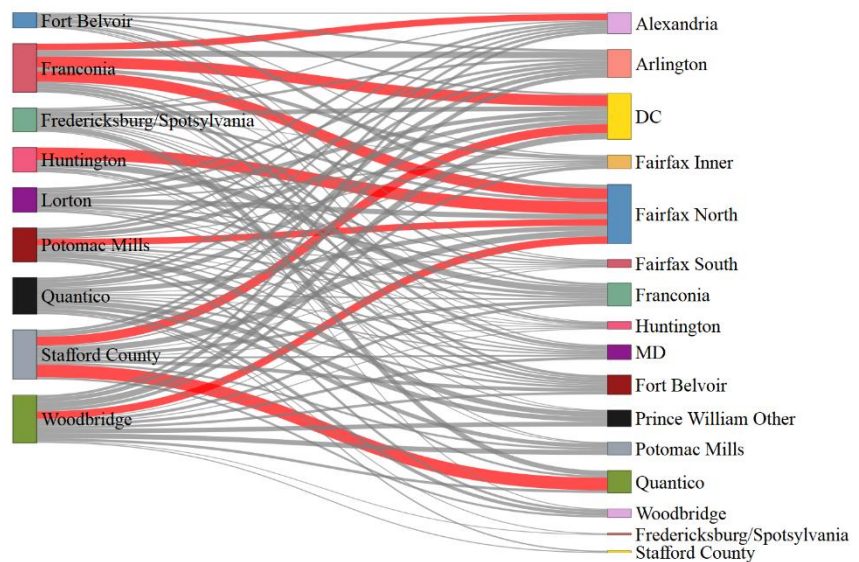
As shown in Figure 2.3, the top commute destinations include job centers within northern Fairfax County at Tysons and Reston, DC, Fort Belvoir and Marine Corps Base Quantico, Arlington, and Alexandria.

Congestion is a major issue in the Study Corridor, particularly on I-95 and U.S. 1, which experience

extremely high volumes, severe congestion, and unreliable travel times. While particularly acute during the morning and evening peak periods, these issues occur frequently during off-peak periods and on the weekends as well. Expansion of roadway capacity, managed lanes, and improved transit options all have been implemented to solve these issues, but growth continues to make congestion a challenge.

Transit accounts for a relatively small amount of total daily travel in the Study Corridor, with a total mode share of less than four percent of all daily trips taken by transit. By far, the largest transit market for trips beginning in the Study Corridor or points further south is the region's core including DC, Arlington, and

FIGURE 2.3 DAILY COMMUTING TRIP FLOWS FROM THE STUDY AREA



<sup>2</sup> Based on the MWCOG/TPB v 2.3.78 2019 Existing Conditions model run.

Alexandria, which together account for more than 77 percent of the Study Corridor’s daily transit travel. Despite the fact that the majority of daily travel stays within the corridor, these intra-corridor trips only account for 15 percent of transit trips.

## 2.3 Growth Forecasts

Population and job growth will continue to increase demand for multimodal commuting options (Table 2.1). Population in the study area is expected to grow by 24 percent to a total of approximately 545,000 by the year 2045. These new residents will place additional demand on a transportation system that is already strained and subject to significant congestion. Jobs in the study area are expected to grow by 34 percent to a total of 270,000 by the year 2045. Growth is expected to be concentrated around the two existing Metrorail stations in the Study Corridor (Huntington and Franconia-Springfield), along U.S. 1 in Fairfax County, and around Potomac Mills in Prince William County.

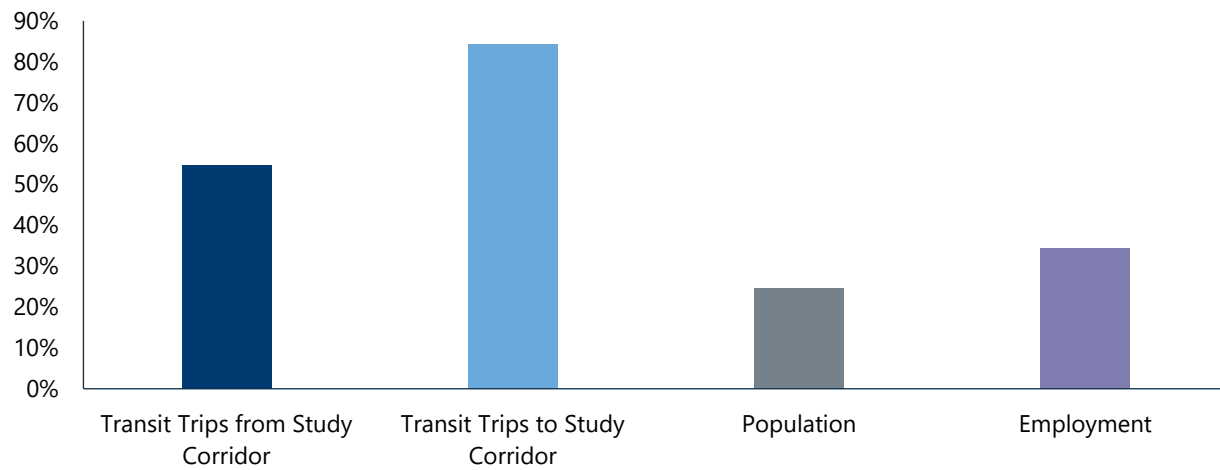
TABLE 2.1 CHANGE IN STUDY CORRIDOR POPULATION AND EMPLOYMENT, 2020 TO 2045

Districts	Existing	2025	2045	Percent Change Existing to 2045
<b>Population</b>	437,300	460,800	544,800	24.6%
<b>Employment</b>	200,500	220,400	269,300	34.3%

Source: MWCOG, Round 9.1a Cooperative Land Use Forecasts.

Fueled by the expected growth in the Study Corridor and the surrounding region, as well as the currently planned improvements to the transit network, transit ridership is expected to grow significantly by 2045. Transit trips from the Study Corridor are expected to grow by 55 percent, while transit trips to the Study Corridor are expected to grow by 85 percent (Figure 2.4). Transit trips to and from the corridor are expected to grow more than the population and employment levels, meaning that a higher proportion of people will be using transit than today, due to increased densities, severe traffic congestion, and planned transit improvements such as the Richmond Highway BRT and VRE improvements included in the future baseline scenario.

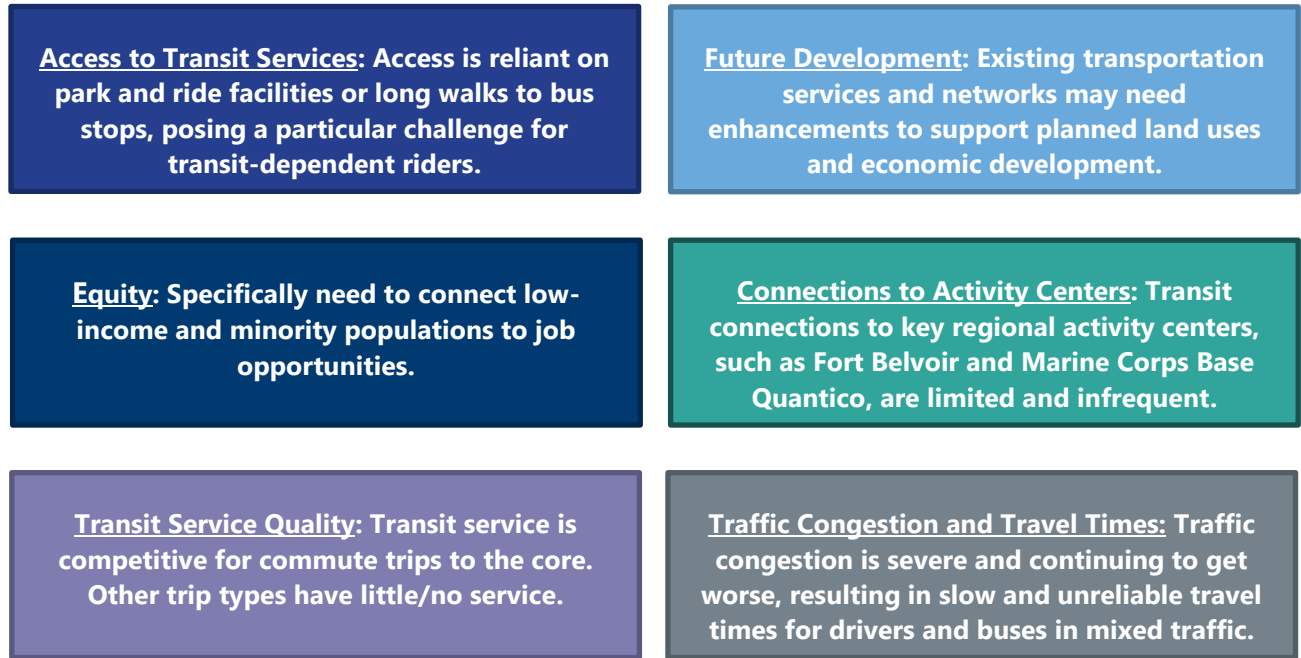
FIGURE 2.4 BASELINE GROWTH: 2020 TO 2045








## 2.4 Needs Assessment

An important step in the feasibility study is the development of a needs statement that concisely states the primary transportation challenges to be addressed in the corridor. The needs statement serves as the basis for defining the project goals and objectives, identifying evaluation measures, and providing a framework for determining which alternatives should be considered as reasonable transportation solutions for addressing the needs. Based on the analysis of existing and future baseline conditions, as well as stakeholder engagement including an online survey, several types of transit needs were identified for the corridor. Six key needs were identified, as outlined in Figure 2.5.

FIGURE 2.5 KEY NEEDS IDENTIFIED IN THE STUDY CORRIDOR



### 3. ENHANCED TRANSIT ALTERNATIVES

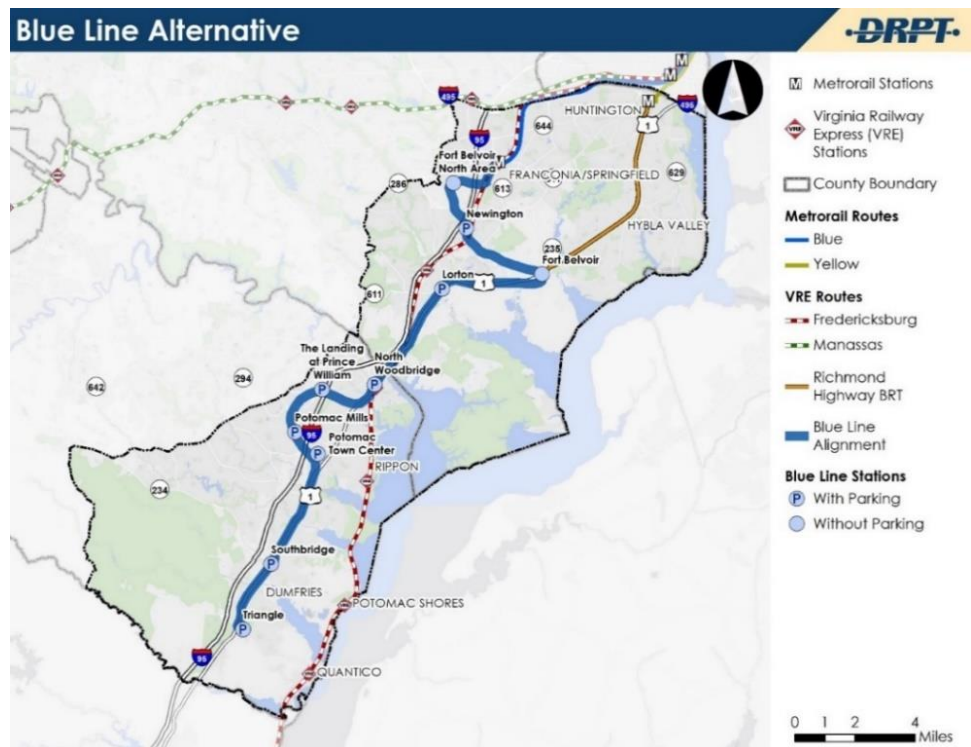
	Metrorail – Blue Line Extension
	Metrorail – Yellow Line Extension
	Bus Rapid Transit
	VRE Service Improvements
	Express Bus Routes

Five transit alternatives were selected and defined for testing and evaluation in the study. A range of modal options was reviewed and screened based on the needs statement with selected transit modes including Metrorail, VRE improvements, BRT, and express bus. A set of potential alignments and stations also was screened based on land use and connections to activity centers in the Study Corridor.

#### 3.1 Metrorail—Blue Line Extension

The Metrorail Blue Line extension alternative would extend the Blue Line from the current terminus at Franconia-Springfield. This extension would have up to 10 Metro stations in Fairfax and Prince William Counties. The northern segment of the alignment would extend south from Franconia-Springfield crossing I-95 to the west to connect to Fort Belvoir North and then running east through Newington to Fort Belvoir. South of Fort Belvoir, the alignment would extend south along the U.S. 1 corridor, crossing I-95 to the west after Woodbridge to serve the Potomac Mills area and then returning east to the U.S. 1 corridor to a new terminus at Triangle.

**Metrorail—Blue Line Extension**  
**Length:** 26.3 mi  
**New Stations:** 10  
**New Stations w/ Parking:** 8  
**Headway (peak):** 8 min  
**Headway (off-peak):** 12 min



## Metrorail—Yellow Line Extension

The Metrorail Yellow Line extension alternative begins at the current Yellow Line terminus at Huntington Station. The alignment would extend south along the U.S. 1 corridor to Fort Belvoir. South of Fort Belvoir, the Yellow Line would follow the same alignment as the Blue Line, crossing I-95 to the west after Woodbridge to serve the Potomac Mills area, then returning east to the U.S. 1 corridor, and south to a new terminus at Triangle. The Yellow Line has two northern stations that differentiate it from the Blue Line — Beacon Hill Road and Hybla Valley.

**Yellow Line Extension**

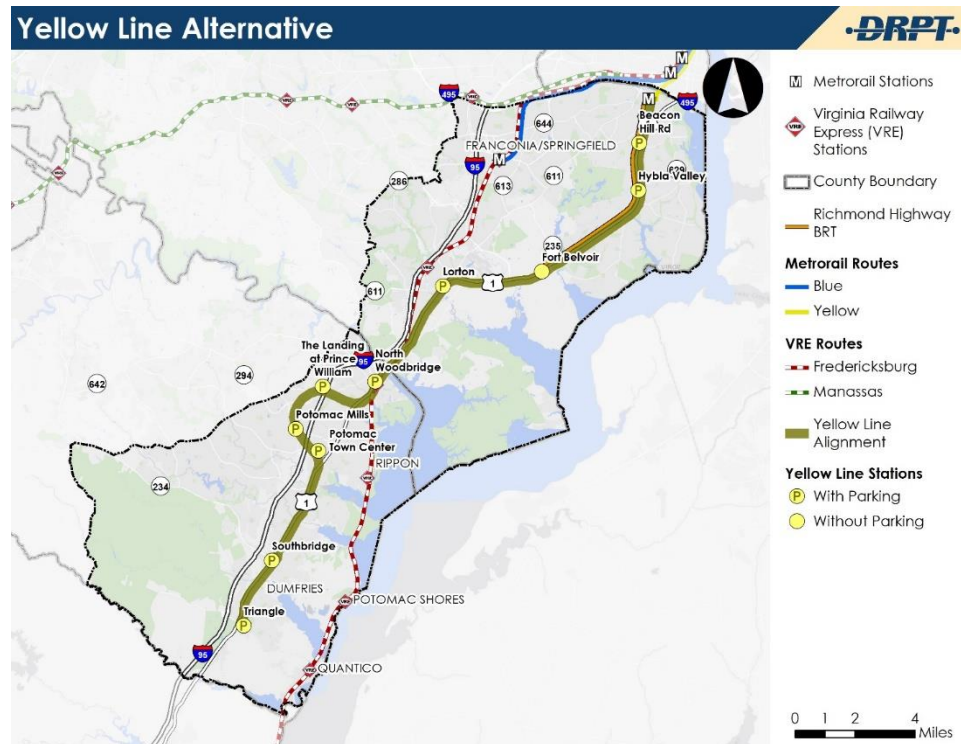
**Length:** 26.6 mi

**No. of Stations:** 10

**No. of New Stations w/ Parking:** 9

**Headway (peak):** 8 min

**Headway (off-peak):** 12 min



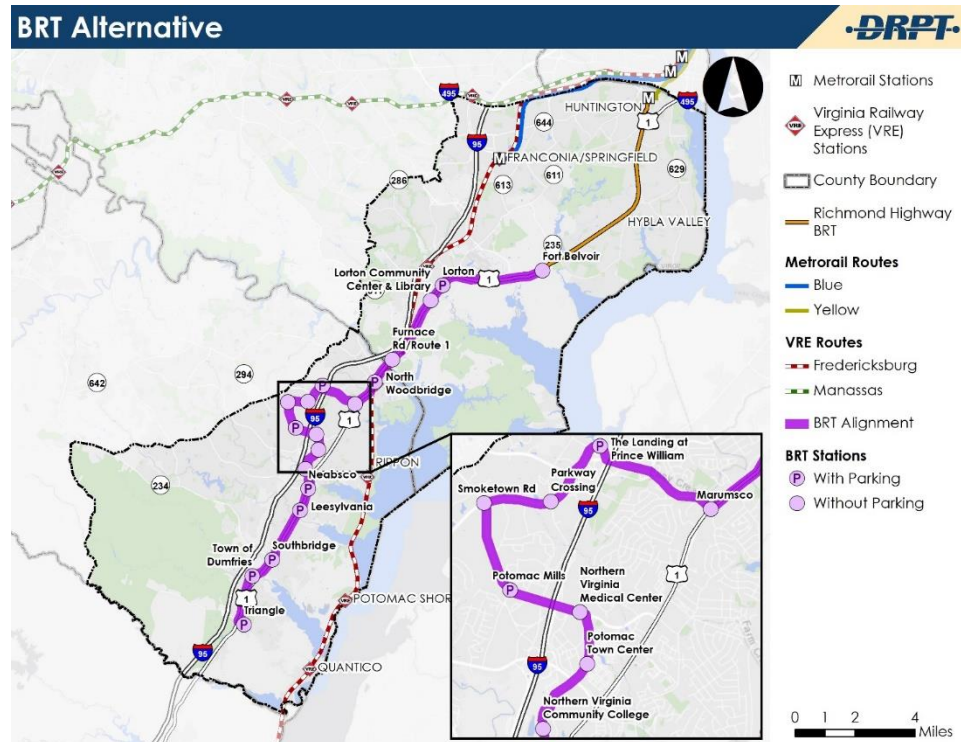


## 3.2 Bus Rapid Transit (BRT)

The BRT alternative would extend south from the terminus of the future Fairfax County Richmond Highway BRT at Fort Belvoir and would then run 20.5 miles south to Triangle, following a similar route to the Metrorail alternatives. BRT has the highest number of proposed new stations of any of the alternatives, resulting in stations that are closer together.

**Bus Rapid Transit**

**Length:** 20.5 mi  
**New Stations:** 18  
**New Stations w/ Parking:** 9  
**Headway (peak):** 6 min  
**Headway (off-peak):** 12 min



### 3.3 VRE Service Improvements

The Transforming Rail in Virginia program will expand and improve passenger, commuter, and freight rail in Virginia and create a vital connection in America’s national rail network between the Northeast and Southeast corridors. Through strategic partnerships, investments, and capital improvements, Transforming Rail in Virginia allows Virginia to nearly double Amtrak state-supported service and VRE Fredericksburg Line service (including first time-ever weekend and late-night service) during the next decade. These investments are

financially committed and, as such, are part of the study’s baseline scenario allowing for significant expansion of VRE service as envisioned in the VRE 2040 System Plan. By 2045, ridership demand at the VRE stations in the Study Corridor is expected to increase 82 percent over existing ridership levels. The tested VRE service alternative would include incremental service improvements beyond those included in the baseline. These improvements would entail reducing the headways (and increasing the frequency of trains) to further expand the capacity of the existing VRE line beyond the significant enhancements that are already planned.

**VRE Service Improvements**

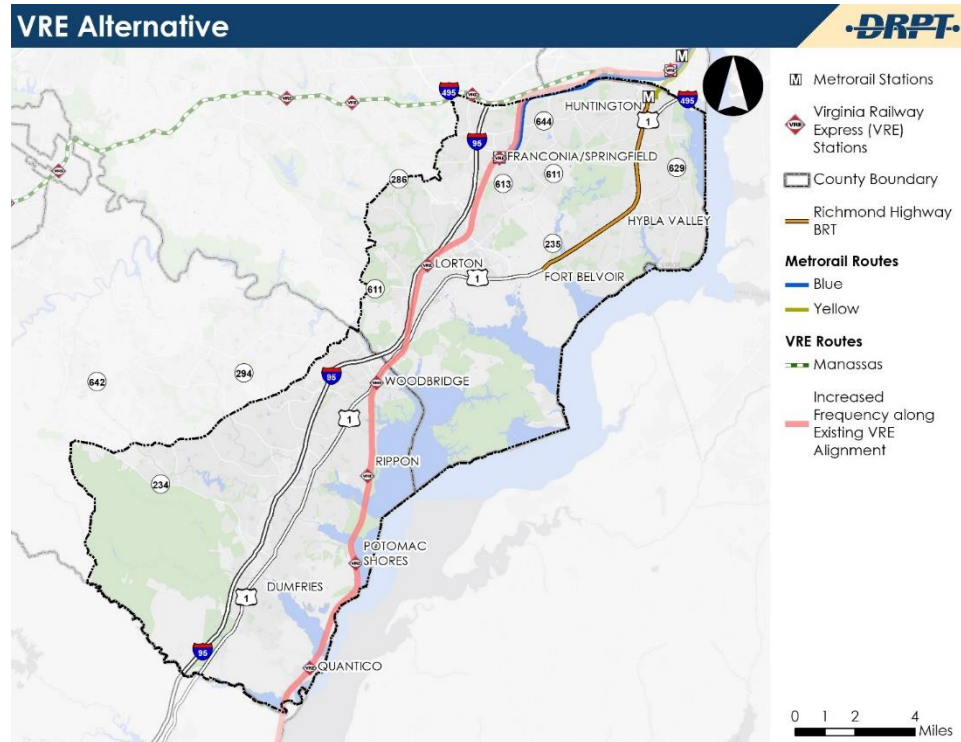
**Length:** 22.7 mi (in corridor)

**No. of New Stations:** n/a

**Headway (peak):** 15 mins (Baseline: 20 mins)

**Headway (peak/reverse):** 30 mins (Baseline: 60 mins)

**Headway (off-peak):** 60 mins (Baseline: 120 mins)





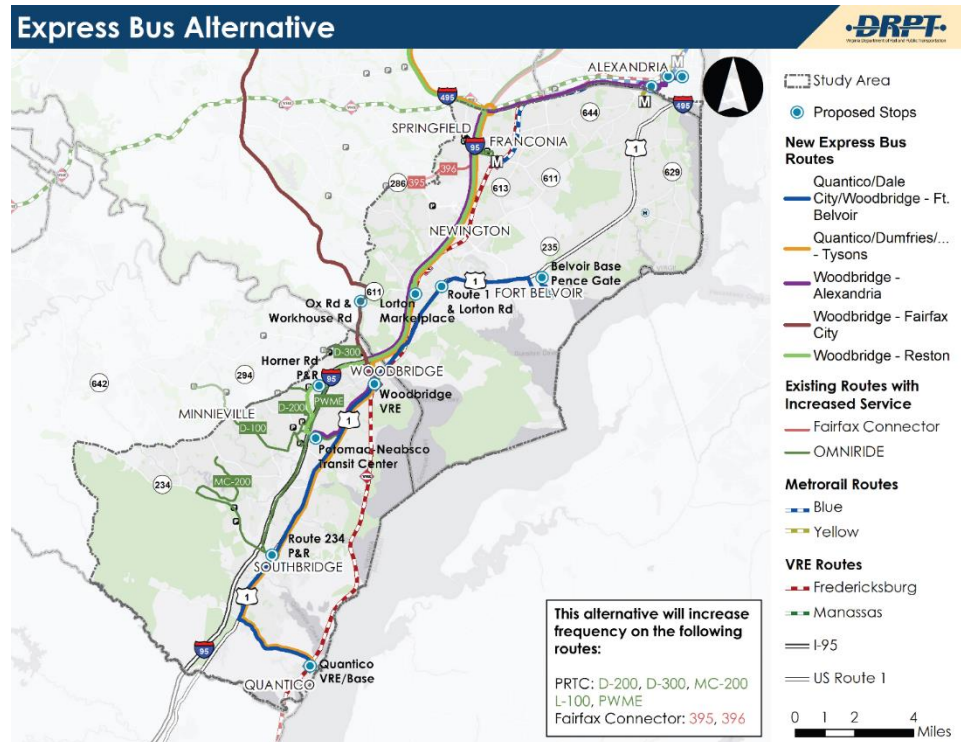
### 3.4 Express Bus

The Express Bus alternative package includes new planned or funded service not already in the baseline, enhancements to existing express bus routes, and the addition of new routes to serve promising but currently unserved activity centers. Headways were reduced for a variety of routes and frequency was increased for routes with high productivity.

**Express Bus**

**New Express Routes: 5**

**Existing Routes with Increased Frequency: 2**





# 4. ALTERNATIVES EVALUATION

## 4.1 Goals and Measures

An evaluation framework was established for testing the potential enhanced transit alternatives to determine overall and relative performance of the different options. Five goals for enhanced transit are summarized in Figure 4.1. A set of evaluation measures aligned with each of the goals is presented in Table 4.1. Alternatives were tested with the latest officially adopted Metropolitan Washington Council of Governments/ Transportation Planning Board (MwCOG/TPB) travel demand forecasting model (Version 2.3.78) and year 2045 cooperative land use forecasts (Round 9.1a).

FIGURE 4.1 GOALS FOR ENHANCED TRANSIT

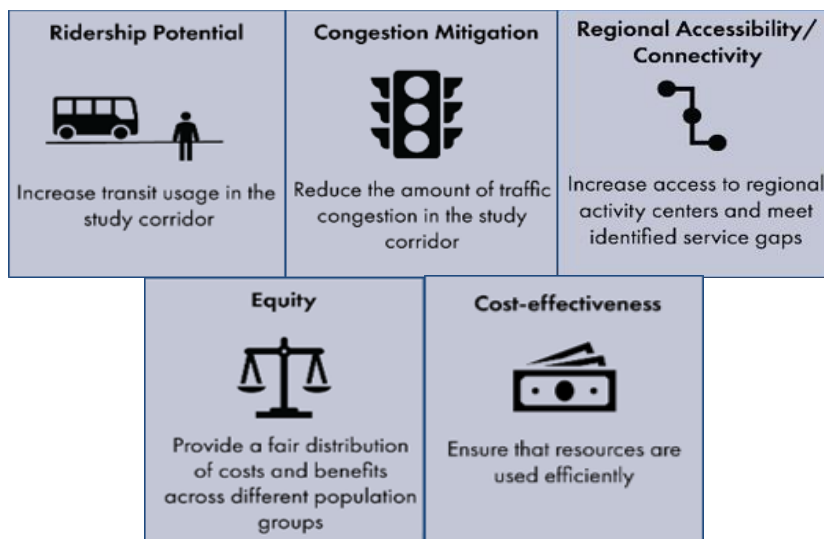


TABLE 4.1 EVALUATION MEASURES

Goal	Measure
Ridership Potential	<ul style="list-style-type: none"> <li>▶ Transit boardings in the Study Corridor</li> <li>▶ New daily transit trips</li> <li>▶ Person miles traveled (PMT) by transit</li> </ul>
Congestion Mitigation	<ul style="list-style-type: none"> <li>▶ Congested vehicle-miles of travel (VMT) in the Study Corridor</li> </ul>
Regional Accessibility/Connectivity	<ul style="list-style-type: none"> <li>▶ Population and jobs within ½ mile of transit</li> <li>▶ Number of jobs accessible within 60 minutes by transit</li> <li>▶ Number of residents able to access key employment centers (within 60 minutes by transit)</li> </ul>
Equity	<ul style="list-style-type: none"> <li>▶ Access to jobs for residents of Equity Emphasis Areas (EEAs) within 60 minutes by transit</li> <li>▶ Total daily transit trips to/from EEAs</li> <li>▶ EEA population within ½ mile of transit</li> </ul>
Cost-Effectiveness	<ul style="list-style-type: none"> <li>▶ Cost per rider</li> <li>▶ Cost per new transit trip</li> <li>▶ Cost per transit person miles traveled (PMT)</li> </ul>

## 4.2 Evaluation Results

Evaluation measures were calculated for each of the five transit alternatives across each of the five goals, as summarized in Figure 4.2. This section provides a brief overview of the key findings in each goal area.

Additional details can be found in the public meeting presentations saved in the project website at:

<http://drpt.virginia.gov/transit/springfield-to-quantico/>.

FIGURE 4.2 SUMMARY OF EVALUATION RESULTS\*

	Additional Express Bus Service	BRT Extension	Additional VRE Service	Metrarail Blue Extension	Metrarail Yellow Extension
<b>Ridership Potential</b>	★★	★★★★	★★	★★★★	★★★★
<b>Congestion Mitigation</b>	★	★★	★	★★★★	★★★★
<b>Regional Accessibility</b>	★★	★★★★	★★	★★★★	★★★★
<b>Equity</b>	★	★★★★	★★	★★★★	★★★★
<b>Cost-Effectiveness</b>	★★★★	★★	★	★	★

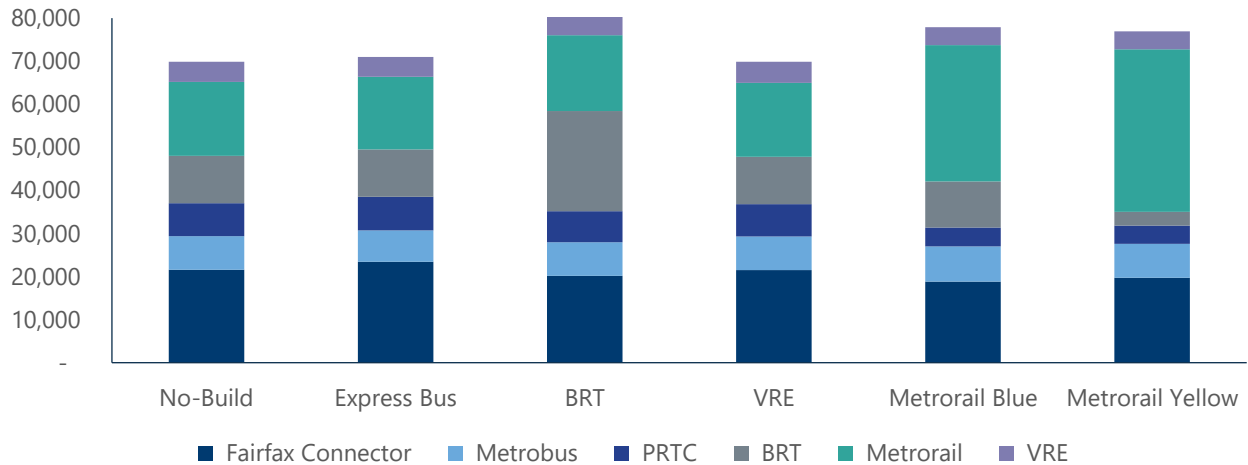
\* Out of three stars.

### *Ridership Potential*

- ▶ Overall, the BRT and Metrorail alternatives performed best on the ridership measures.
- ▶ The BRT alternative had the highest overall number of daily transit boardings in the Study Corridor. A boarding is counted every time someone gets on a transit vehicle. As shown in Figure 4.3, there are some shifts between the types of transit people are using—as the alternative provide faster or more direct service. For example, the two Metrorail alternatives are attracting some riders from VRE and express bus. Note that given the length of the Metrorail and VRE lines, these systems do have additional daily boardings related to the alternative that are outside of the Study Corridor.
- ▶ Although VRE’s ridership gain for the service enhancement alternative is relatively modest, the majority of the ridership increase associated with Transforming Rail in Virginia improvements are included in the

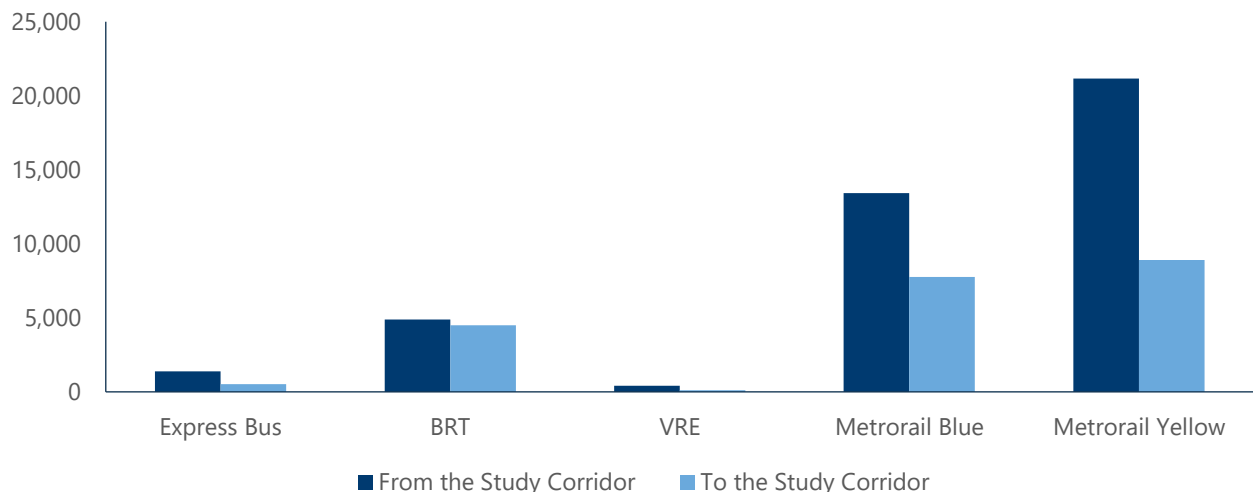
study baseline or No Build scenario. In fact, VRE is expected to have an over 80 percent increase in ridership from today's levels, based on the investment that is committed in the future baseline.

FIGURE 4.3 TOTAL TRANSIT BOARDINGS IN THE STUDY CORRIDOR



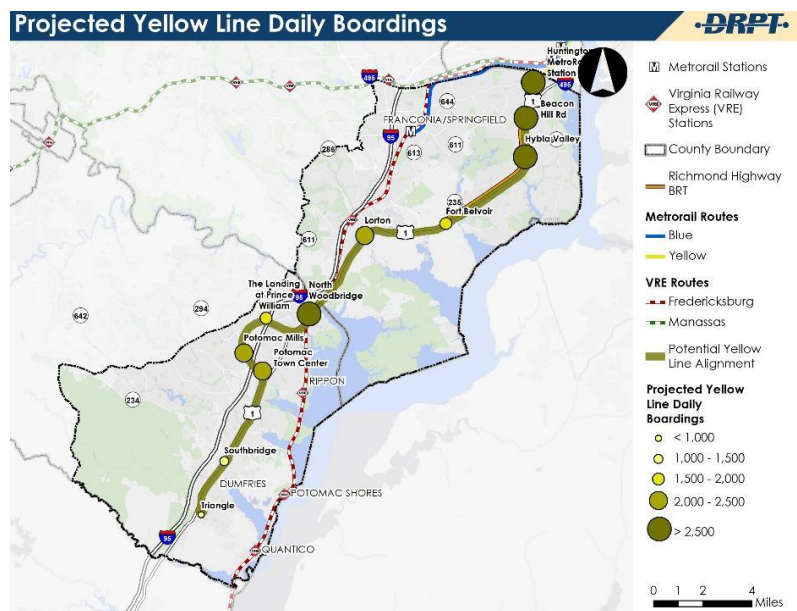
- ▶ The two Metrorail alternatives were best at attracting new transit trips. Unlike boardings, transit trips are only counted once end to end, regardless of how many routes are used. The Yellow Line and Blue Line extensions perform better than the BRT at inducing new transit trips (fewer trips requiring transfers). More new trips are coming from the study area in all alternatives, but BRT and Blue Line have more balanced ridership than other alternatives.
- ▶ Person-miles traveled (PMT) quantifies the distance people are traveling on transit—so longer trips count more in this metric. The Metrorail alternatives carry more people for longer distances in the Study Corridor than the other alternatives.

FIGURE 4.4 NEW DAILY TRANSIT TRIPS IN THE STUDY CORRIDOR



- ▶ Transit boardings were highest in the northern portion of the corridor. For the Yellow Line alternative, new stations at Beacon Hill, Hybla Valley, and North Woodbridge are expected to exceed 2,500 boardings per day. Boardings at stations in the Potomac Mills area are expected to be in the 1,500 to 2,500 range, but stations south of Potomac Town Center are expected to be much lower in ridership.

FIGURE 4.5 PROJECTED YELLOW LINE DAILY BOARDINGS BY STATION



## Congestion Mitigation

- ▶ In all cases, total vehicle-miles of travel (VMT) goes down compared to the No-Build scenario—but by less than two percent.
- ▶ All of the alternatives decrease congested VMT on roads in the Study Corridor compared with the No-Build scenario. The Yellow Line alternative had the largest decrease in congested VMT of about four percent.

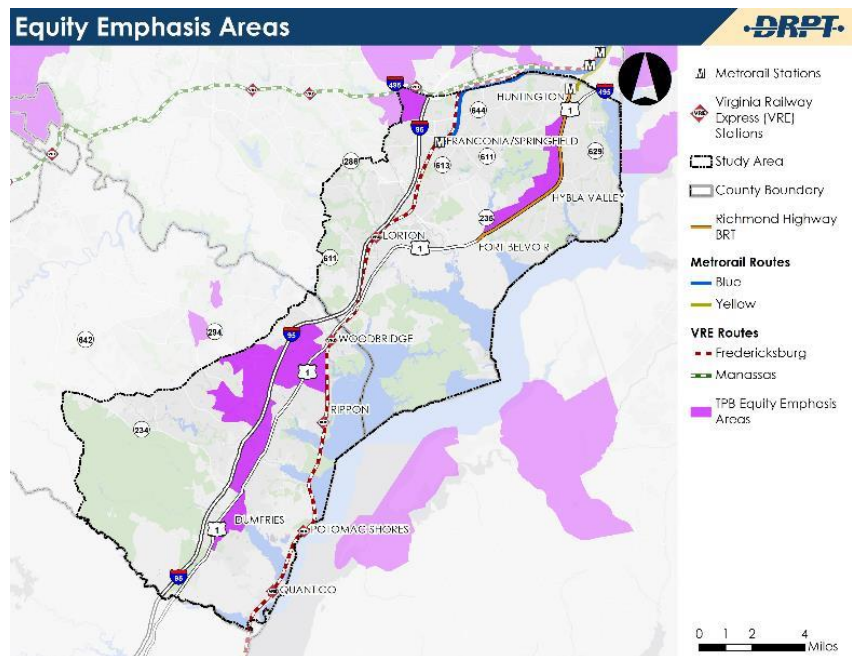
## Regional Accessibility

- ▶ The Yellow Line and BRT alternatives have the most residents with walk access, (i.e., within half-mile of a new station in the Study Corridor), with 72,000 and 62,000 residents with walk access, respectively. The Blue Line Alternative will have the most jobs within a half-mile of transit, a total of over 40,000 jobs.
- ▶ The MetroRail alternatives provide a significantly higher increase in accessibility to regional jobs by transit within 60 minutes for Study Corridor residents, relative to the other alternatives. The Yellow Line alternative would increase access to almost 130,000 jobs, the Blue Line would increase access to roughly 50,000 jobs, and the BRT alternative would increase access to around 8,000 jobs.

## Equity

- ▶ MWCOG/TPB have identified Equity Emphasis Areas (EEA) throughout the region based on concentrations of low-income and minority residents. Figure 4.6 shows the EEAs within the Study Corridor.
- ▶ For the BRT alternative, more than 45 percent of residents with walk access to a transit station (within ½ mile), reside within an EEA, the highest share of the five alternatives.
- ▶ The Yellow Line alternative has the biggest gain in new daily trips and job accessibility for residents of EEAs.

FIGURE 4.6 EQUITY EMPHASIS AREAS IN THE STUDY CORRIDOR



## Cost-Effectiveness

- ▶ The Express Bus and BRT alternatives are significantly more cost effective than the rail alternatives. Despite lower ridership, the Express Bus alternative has low costs, making it the most cost-effective alternative tested.
- ▶ The BRT alternative has higher costs than the Express Bus alternative, but does increase ridership, making it 2-3 times more cost-effective than the MetroRail alternatives which have high ridership, but significantly higher costs.

## 4.3 Sensitivity Tests

In addition to the evaluation of the five alternatives, the study team performed additional sensitivity tests to address key questions:

- ▶ Can alternatives be made more cost-effective by *shortening the alignments*?
- ▶ Given uncertainty related to the current COVID-19 pandemic impacts, what might happen to ridership forecasts if people keep *teleworking at enhanced levels*?

## Shortened Alignments

Ridership forecasts indicate that transit stations south of Potomac Town Center are expected to have much lower ridership than stations to the north. For the BRT and Metrorail alternatives, less than 700 daily boardings are predicted at stations south of Potomac Town Center. Additional tests were run on the BRT and Metrorail alternatives to assess the impact on ridership of truncating lines with a southern terminus at Potomac Town Center (Table 4.2). BRT is impacted more than the two Metrorail lines in terms of ridership loss due to shortening the alignment. The cost-effectiveness of the two Metrorail lines would improve since the costs are reduced without losing significant ridership. Overall, the sensitivity results suggest that it would be worthwhile to truncate both Metrorail lines, but not BRT at this location.

TABLE 4.2 SHORTENED ALIGNMENTS SENSITIVITY RESULTS

	BRT	Metrorail Blue Line	Metrorail Yellow Line
Total Corridor Transit Boardings	-4%	0%	0%
New Transit Trips in Study Corridor	-32%	-10%	-6%
Cost per New Trip	0%	-15%	-19%

## Post-Pandemic Telework Changes

While telework had recently already become a more common option, the COVID-19 pandemic saw an unprecedented amount of telework that will have impacts on commute patterns for years to come. In 2019, 35 percent of Washington-area workers teleworked regularly or occasionally, up from 19 percent in 2007.<sup>3</sup> On a typical day in 2019, about 8.6 percent of Washington-area workers teleworked. Telework increased substantially during the pandemic and it is estimated that 60-65 percent of regional workers worked at home during the pandemic in 2020. Table 4.3 shows two scenarios for potential telework utilization in 2045—a “low” scenario where 45 percent of the workforce is teleworking an average of 1.1 days per week and a “high” scenario where 55 percent of the workforce is teleworking an average of 1.5 days per week. Table 4.3 shows how each of these scenarios would affect ridership for the BRT and Metrorail alternatives. Metrorail would be impacted more significantly by changing telework because of the higher percentage of office-based work trips, as compared with BRT.

<sup>3</sup> Metropolitan Washington Council of Governments, 2019. <https://www.mwcog.org/documents/2020/06/17/state-of-the-commute-survey-report--carsharing-state-of-the-commute-travel-surveys/>.



TABLE 4.3 TELEWORK IMPACT ON RIDERSHIP SENSITIVITY RESULTS

	Future Telework Assumption	BRT Alternative Ridership Impact	Metrorail Alternatives Ridership Impact
Low	45% telework an average 1.1 days/wk	-8%	-12%
High	55% telework an average 1.5 days/wk	-17%	-26%

## 4.4 Land Use Assessment

A comprehensive land use assessment was conducted in parallel with the screening and evaluation of potential transit improvements. The goal of the land use assessment was to identify the opportunities in the corridor for placemaking and network connectivity necessary for transit to be successful and to assess the potential for changes to land use that might result with major transit investment.

Eight stations south of Fort Belvoir were selected for a detailed review of existing and planned land use and potential for Transit Oriented Development (TOD). These stations include Newington, Lorton, North Woodbridge, The Landing at Prince William, Potomac Mills, Potomac Town Center, Southbridge, and Triangle. Fort Belvoir and Fort Belvoir North stations were not reviewed since they are located adjacent to the military bases with limited potential for TOD. Beacon Hill and Hybla Valley stations on the Yellow Line were also not reviewed since Fairfax County has done significant TOD planning around these stations as part of the Richmond Highway BRT project.

Two land use development scenarios were tested. This sensitivity analysis looked at two different land use scenarios that added TOD by increasing densities around the proposed station areas:

1. Metrorail-focused TOD
2. BRT-focused TOD

Land use place types were adjusted around the eight station areas based on TOD potential using a tool called Urban Footprint. The characteristics of the place types were defined in the DRPT Multimodal System Design Guidelines (2020). Population and job totals were adjusted from the baseline 2045 inputs (MWCOC Round 9.1a Cooperative Land Use Forecasts). The land use scenarios tested assumed dramatic increases to the population and jobs in the Study Corridor. The results of the land use scenario tests are shown in

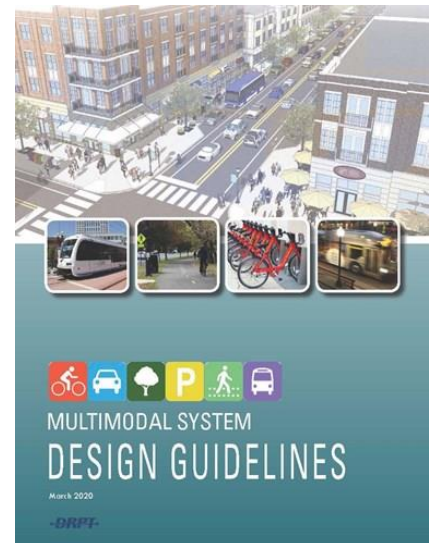


Table 4.4 and indicate that significant increases in ridership ranging from 30 to 50 percent are possible with increased, dense development in the station areas.

FIGURE 4.7 PLACE TYPES USED IN STATION AREA ASSESSMENT

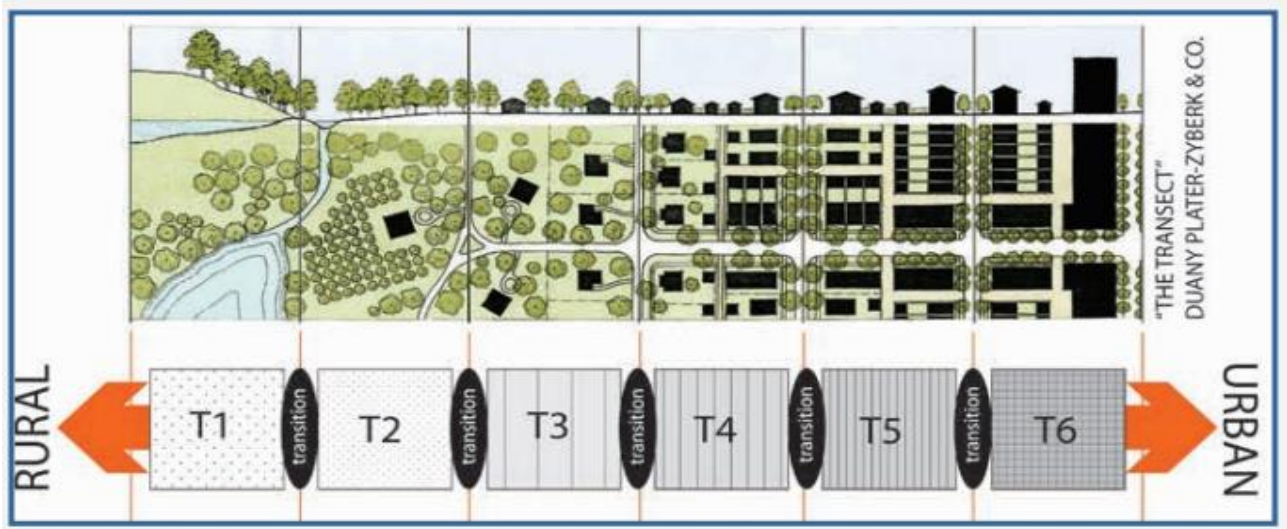


TABLE 4.4 LAND USE SCENARIO RESULTS

	BRT	Metrorail Blue Line	Metrorail Yellow Line
Residents Added to Station Areas	134,000 (+80%)	116,000 (+69%)	118,000 (+76%)
Jobs Added to Station Areas	45,000 (+53%)	59,000 (70%)	56,000 (+102%)
Ridership Increase	+29%	+50%	+32%

Both Fairfax and Prince William counties are expected to add a significant population and jobs in the next 25 years. TOD planning within the Study Corridor that enhances transit ridership will be critical to leverage investments in premium transit. Successful TOD planning can result in more people choosing to ride transit or walk/bike to nearby destinations. TOD planning will assist the Study Corridor to grow more sustainably and reduce the future vehicular transportation impacts on existing roadways.

Transit readiness describes the degree to which a place has or planned for the land uses, the transit-access infrastructure, the inviting environment, and the concentrations of people and activity that generate transit demand and allow people to access transit service comfortably and directly. Realizing the potential for TOD in the corridor will require planning processes and policies related to land use, zoning, multimodal transportation infrastructure, street and site design, and implementation.

## 5. OTHER CONSIDERATIONS AND NEXT STEPS

### 5.1 Summary of Costs

Each of the transit alternatives require unique levels of planning and implementation, as reflected in their costs, which are shown in Table 5.1. The Express Bus and VRE alternatives do not require new construction of facilities or fixed-guideway, just vehicles required to provide improved services, so these are the least expensive alternatives. BRT would require funding for station construction, buses, and running-way improvements. Both Metrorail lines would require large construction efforts, including stations and parking, rail infrastructure and systems, a new rail yard and other facilities, right-of-way, and acquisition of new trains, making these the highest cost options.

TABLE 5.1 ORDER OF MAGNITUDE COSTS (2030 DOLLARS)

Transit Alternative	Total Capital Cost*	Annual O&M Cost	Annual Net Cost: Capital and O&M - Fare Revenue
Express Bus	\$37 M – \$54 M	\$7 M	\$8 M
VRE**	\$116 M – 174 M	\$80 M	\$46 M
BRT	\$2.4 B – 3.6 B	\$19 M	\$133 M
Short BRT	\$1.6 B – 2.4 B	\$15 M	\$90 M
Blue Line	\$18.1 B – \$27.2 B	\$168 M	\$764 M
Short Blue Line	\$13.6 B – \$20.5 B	\$135 M	\$579 M
Yellow Line	\$18.3 B – \$27.5 B	\$168 M	\$771 M
Short Yellow Line	\$13.8 B – 20.8B	\$135 M	\$587 M

\* Capital costs include contingency.

\*\* Additional service above Transforming Rail in Virginia improvements included in future baseline.

### 5.2 Other Considerations for Metrorail Extensions

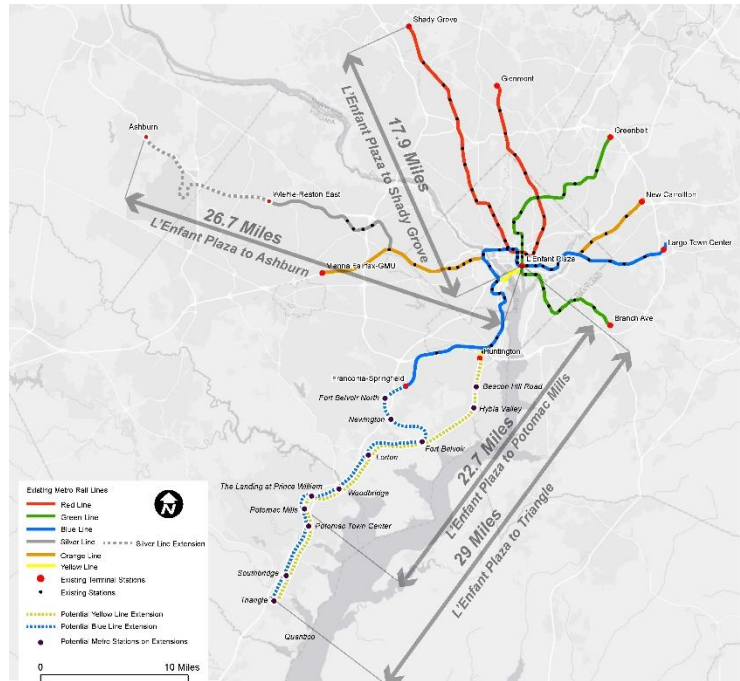
A Metrorail extension into Prince William County would be a significant addition to the Metro system, particularly for the alternatives that extend down to the Triangle/Quantico area. The straight-line distance from Triangle to L'Enfant Plaza is 29 miles, but would require roughly a 45-mile trip on the Blue Line.

WMATA has prioritized maintaining the current system in a state-of-good repair and addressing core capacity needs first, prior to consideration of an extension. Core capacity projects identified in Metro's plans

include investments in rail cars and infrastructure needed to achieve 100 percent 8-car trains on the system, core station capacity improvements, and relief for the Rosslyn bottleneck where the Blue, Orange, and Silver (BOS) lines merge together. Options for addressing the capacity and reliability needs of the BOS corridor are currently being studied by WMATA.

Extending Metrorail Service to Prince William County also has unique legal and governance ramifications. A review of the legal and governance actions and requirements is summarized below:

- ▶ *Extending Metrorail service into Prince William County does not require amending the WMATA Compact.* It does require Prince William County to become a member of the Northern Virginia Transportation District (District) and the Washington Metropolitan Area Transit Zone (Zone).



- ▶ *Enlarging the District to include Prince William County*—The Northern Virginia Transportation Commission (NVTC) would control the process by which the NOVA District is enlarged to include Prince William County, as well as Prince William County’s obligations as they relate to NVTC members’ responsibilities.
- ▶ *Enlarging the Zone to include Prince William County* —NVTC would notify WMATA that the District has been enlarged, delivering the terms of Prince William County’s financial commitment to Metro services as part of this notification, and the WMATA Board would need to approve an action to add Prince William County to the Zone.
- ▶ Terms of the service to be provided to Prince William County through WMATA would need to be negotiated, (e.g., whether bus services will be provided by WMATA, etc.).
- ▶ Prince William County’s financial commitments would extend beyond the construction costs of the Metrorail extension to include a share of the annual operating and capital subsidy (by formula), annual obligations to Virginia’s Metro Capital Fund, and other negotiated financial obligations.
- ▶ The potential impacts on the Potomac and Rappahannock Transportation Commission (PRTC) as a result of Prince William County membership in the NOVA District would need to be resolved.

The annual operating budget subsidy contributions for WMATA member jurisdictions is determined through a formula that factors in the population (weighted by density), ridership, and station count within each jurisdiction, plus a “max fare” subsidy is added for longer trips. On the basis of these factors, it is estimated that Prince William County would be responsible for over five percent of the annual operating subsidy of the Metro system. Fairfax County’s share of the Metrorail subsidy requirements would also increase as a result of the additional stations and ridership. All of the WMATA jurisdictions, including DC and Maryland, would face some increased operating costs resulting from a Metrorail extension.

## Next Steps

This study has confirmed that there are significant transportation needs and issues in the corridor between the Franconia-Springfield Metro station and Marine Corps Base Quantico. The purpose of this study was to analyze and present the performance of a range of transit investment options, in order to highlight strengths and weaknesses. This analysis has also identified some potential costs and constraints of the various alternatives.

A feasibility study is typically a first step in the planning and project development process leading to a major capital investment. For major capital projects, such as the BRT and Metrorail alternatives that were evaluated, seeking funding through the Federal Transit Administration (FTA) New Starts/Small Starts capital investment grants would add significant steps to the project development and approval process as indicated in Figure 5.1. As noted in the previous section, a Metrorail extension would also require additional local and regional decisions and actions needed to move forward.

Given the conceptual level of planning conducted in this study, additional analysis and refinement of the alternatives is warranted and would need to be conducted prior to the selection of a locally preferred

FIGURE 5.1 MULTI-STEP PROJECT DEVELOPMENT PROCESS



alternative. This study determined that all five alternatives that were tested—and the two shorter Metrorail extensions—are feasible; However, no recommendation is being made regarding selection of a preferred alternative in this study. Further detailing of the design and operating characteristics would be needed to improve the estimates of costs and benefits. Future investment in public transportation is already planned for the Study Corridor, as evidenced by the Transforming Rail in Virginia initiative and the Richmond Highway BRT project. The importance of the corridor as a growing, diverse community that includes regionally significant job centers supports further investigation of transit enhancement options.