ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Prepared for

Northern Virginia Transportation Commission

Prepared by

WSP | Parsons Brinckerhoff

NORTHERN VIRGINIA TRANSPORTATION COMMISSION

WSP | PARSONS BRINCKERHOFF

Funded by
Northern Virginia Transportation Authority
January 2017

Table of Contents

Executive Summary

1.0 Introduction ES-1
1.1 The Result of Transit Investment ES-1
1.2 Looking Forward - to Plan Effectively ES-2
1.3 Rapid Transit Principles ES-2

2.0 The Route 7 Corridor ES-3

3.0 Focus of the Project Effort ES-3
3.1 Technical Assessment of Mode, Alignment and Termini ES-4
3.1.1 Alternatives Considered ES-4
3.1.1.1 Mode ES-4
3.1.1.2 Termini ES-4
3.1.1.3 Alignment ES-4
3.2 Input Received from the Public and Stakeholders ES-5
3.3 Forecasting Demand on the Service ES-5
3.3.1 Major Questions Addressed by the Travel Demand Modeling Process ES-6
3.4 Estimated Cost of Building and Operating the Envision Route 7 Corridor ES-7
3.4.1 Capital Costs ES-7
3.4.2 Operating Costs ES-8
3.5 Funding Implementation of the Envision Route 7 Service ES-9
3.5.1 Federal Program Competitiveness ES-10

4.0 The Selected Alternative ES-11

Chapter 1: Study Overview and Travel Demand

1.0 Introduction 1-1
1.1 Project Overview 1-1
1.2 Corridor Setting 1-1

2.0 Summary of Alternatives 1-2
2.1.1 Existing Conditions 1-2
2.1.2 No Build Alternative 1-3
2.1.3 TSM Alternative 1-3
2.1.4 Build Alternative 2: BRT from Tysons to Mark Center via East Falls Church Metro 1-3
2.1.5 Build Alternative 4: BRT from Tysons to Mark Center w/o East Falls Church Metro 1-5
2.1.6 Build Alternative 5: BRT from Tysons to King Street Metro via East Falls Church Metro 1-6
2.1.7 Build Alternative 6: LRT from Tysons to Mark Center via East Falls Church Metro 1-7

3.0 Forecasting Methodology 1-8
3.1 Model 1-8
3.2 Land Use Update 1-8
3.2.1 Conversion from 3,722-TAZ to 2,191-TAZ System 1-8
3.2.2 Seven Corners Comp Plan Update 1-9
3.3 Network Update 1-10
3.3.1 Highway Network Update 1-10
3.3.2 Transit Network Update 1-10

4.0 Existing and Future Conditions 1-11
4.1 Existing Year (2015) Validation 1-11
4.2 Population and Employment Growth 1-12

5.0 Forecast Results 1-14
5.1 Future Trip Characteristics in the Corridor 1-14
5.2 Daily Transit Boardings 1-15
5.3 Travel Time Impacts 1-17
5.4 User Benefits 1-18
5.5 Regionwide VMT and VHT 1-18
5.6 Transit Trips by Travel Market 1-19
5.7 Transfers at East Falls Church Metro Station 1-19

6.0 Summary 1-20

Chapter 2: Service Operations Plan

1.0 Introduction 2-1

2.0 Analysis Methodology 2-1

3.0 TSM Alternative 2-1

4.0 Build Alternatives 2-2
4.1 Build Alternative 1: BRT from Tysons to Van Dorn Metro via East Falls Church Metro 2-8
4.2 Build Alternative 2: BRT from Tysons to Mark Center via East Falls Church Metro 2-11
4.3 Build Alternative 3: BRT from Tysons to Van Dorn Metro w/o East Falls Church Metro 2-14
4.4 Build Alternative 4: BRT from Tysons to Mark Center w/o East Falls Church Metro 2-16
4.5 Build Alternative 5: BRT from Tysons to King Street Metro via East Falls Church Metro. 2-18
4.6 Build Alternative 6: LRT from Tysons to Mark Center via East Falls Church Metro 2-20

5.0 Local Bus Service Modifications 2-22
5.1 Introduction 2-22
5.2 Methodology 2-23
5.3 Previous Relevant Studies 2-23
5.4 Current Level of Service 2-24

5.5 Local Service Plans for Build Alternatives 2-24

6.0 2040 Bus Route Diagrams 2-36

Chapter 3: Capital and Operating Cost Estimates

1.0 Introduction 3-1

2.0 Capital Costs 3-1

2.1 Estimating Methodology 3-1

2.2 Capital Cost Estimates 3-4

3.0 Operating and Maintenance Costs 3-5

3.1 Estimating Methodology 3-5

3.2 Operating and Maintenance Cost Estimates 3-6

Chapter 4: Public Outreach

1.0 Introduction 4-1

2.0 Public Outreach Approach 4-1

3.0 Results of Public Outreach Activities 4-2

3.1 Virtual Public Kick-Off 4-2

3.2 Project Website 4-2

3.3 Crowdsource Map 4-4

3.4 Online Polls 4-5

3.5 Outreach to Community Organizations 4-6

3.6 Newsletters 4-7

3.7 Telephone Comment Line 4-7

3.8 Social Media 4-7

3.9 Public Meetings 4-8

3.9.1 Broadcast Emails and Public Notices 4-8

3.9.2 Flyer Distribution 4-9

3.9.3 Attendance 4-9

3.9.4 Summary of Meetings 4-9

3.9.5 Comments Received 4-10

4.0 Conclusion 4-13

Chapter 5: Alternatives Evaluation

1.0 Introduction 5-1

2.0 Evaluation Methodology 5-1

3.0 Evaluation of Alternatives 5-3

3.1 Effectiveness Measures 5-4

3.1.1 Serves Areas with the Greatest Density of Residences and Jobs 5-4

3.1.2 Minimize Distance between Route 7 Corridor Stations/Stops and Other Transit and Bike Routes 5-5

3.1.3 Ability to Increase Number of Linked Trips on the Transit System 5-5

3.1.4 Increase Transit Mode Share for Work Trips 5-6

3.1.5 Reduce Traffic Congestion 5-6

3.1.6 Reduce the Percentage of Transit Trips that Require a Transfer 5-6

3.1.7 Increase the Average Speed of Transit Vehicles in Revenue Service 5-7

3.2 Economic, Community, and Environmental Impacts 5-7

3.2.1 Provide Convenient and Accessible Transit Service to Areas with Economic Potential 5-7

3.2.2 Provide Convenient and Accessible Transit Service to Existing and Planned Activity Centers 5-8

3.2.3 Reduce Air Pollutant and GHG Emissions 5-8

3.2.4 Enhance the Environment 5-8

3.3 Equity 5-9

3.3.1 Serve Areas with Transit Dependent Populations 5-9

3.4 Cost Effectiveness 5-9

3.4.1 Select Transit Technologies and Corridors that Most Efficiently Serve Transportation Needs in a Cost Effective Manner 5-9

3.5 Feasibility 5-10

3.5.1 Technical Feasibility 5-10

3.5.2 Financial Feasibility 5-10

4.0 Capital Investment Grant Program Evaluation and Rating 5-11

4.1 Project Justification 5-11

4.1.1 Mobility Improvements 5-12

4.1.2 Cost Effectiveness 5-12

4.1.3 Environmental Benefits 5-12

4.1.4 Economic Development 5-13

4.1.5 Land Use 5-13

4.1.6 Congestion Relief 5-14

4.1.7 Summary Project Justification Ratings 5-14

5.0 Summary of the Evaluation of Alternatives 5-15

5.1 Alternatives 5-15

5.1.1 Alternative 2 5-15

5.1.2 Alternative 4 5-15

5.1.3 Alternative 5 5-15

5.1.4 Alternative 6 5-15

5.2 Recommended Alternative 5-16

Chapter 6: Financial Analysis

1.0 Introduction 6-1

2.0 Capital and Operating Costs 6-1

3.0 Public Sector Funding Sources 6-2

3.1 DRPT Funding Sources 6-3

3.1.1 DRPT Capital Assistance Program 6-3

3.1.2 DRPT Transit Operating Assistance 6-3

3.2 Commonwealth Funding Sources 6-4

3.2.1 SMART SCALE 6-4

3.3 Regional Funding 6-5

3.3.1 NVTC Gas Tax Revenue 6-5

3.3.2 NVTC Transform66: Inside the Beltway Toll Revenues 6-5

3.3.3 NVTA HB 2313 6-5

3.4. Local Funding 6-7

3.4.1 Fairfax County Transit Funding 6-7

3.4.2 City of Alexandria Transit Funding 6-7

3.4.3 Arlington County Transit Funding 6-7

3.4.4 City of Falls Church 6-7

3.5 Federal Funding 6-7

3.5.1 Capital Investment Grant Program 6-7

3. 5.2 Section 5307 Urbanized Area Formula Program 6-8

3.5.3 Section 5339 Bus and Bus Facilities Program 6-8

3.5.4 Section 5337 State of Good Repair Program 6-9

3.5.5 Congestion Mitigation and Air Quality Improvement Program (CMAQ) 6-9

3.5.6 Surface Transportation Block Grant Program (STBGP) 6-9

3.5.7 “TIGER” Program 6-9

4.0 Value Capture, Fees, and Other Revenues 6-10

4.1 Tax Increment Financing (TIF) 6-10

4.1.1 Special Assessment Districts/Transportation Improvement Districts 6-10

4.1.2 Joint Development 6-11

4.1.3 Air Rights 6-11

4.2 Value Capture Assessment of the Route 7 Alternatives 6-11

4.3 Other Fees and Revenues 6-13

4.3.1 Developer Contributions 6-13

4.3.2 Development Impact Fees 6-14

4.3.3 Fare Revenues 6-14

4.3.4 Advertising/Sponsorships/Naming Rights 6-14

5.0 Evaluation of Funding Sources 6-15

5.1 Criteria 6-15

5.2 Evaluation of Candidate Funding Sources 6-15

5.3 Recommended Funding Sources 6-16

Chapter 7: Implementation Strategy

1.0 Introduction 7-1

2.0 Stakeholder Roles and Responsibilities 7-1

3.0 NEPA 7-2

4.0 Project Development 7-4

4.1 New Starts Engineering 7-6

4.2 New Starts v Small Starts 7-7

Appendices

Appendix A: Capital Cost Estimate Worksheets APP-1

Appendix B: TSM and Build Alternative O&M Cost Worksheet APP-15

Appendix C: Website Comments APP-16

Appendix D: Newsletters APP-19

Appendix E: Telephone Line Comments APP-21

Appendix F: November 2015 Meeting Exhibits APP-22

Appendix G: June 2016 Meeting Exhibits APP-31

Appendix H: Flip Chart Comments APP-34

List of Tables

Table ES-1 Construction Cost Estimates for Project Alternatives ES-8
Table ES-2 Potential Sources of Funding for Capital and Operating Costs for the Envision Route 7 Project ES-9
Table ES-3 Alternatives New Starts/Small Starts Ratings ES-11
Table 1-1 Updated SE Data for Seven Corners TAZs 1-10
Table 1-2 Transit Update for 2040 No Build 1-11
Table 1-3 Validation of Daily Boardings for Metrobus Routes in Corridor 1-12
Table 1-4 Household and Population Growth 1-13
Table 1-5 Employment Growth 1-14
Table 1-6 2015 Model Trips Characteristics 1-15
Table 1-7 2040 No Build Model Trip Characteristics 1-15
Table 1-8 Trip Growth between 2015 and 2040 1-15
Table 1-9 Daily Transit Boardings by Mode 1-16
Table 1-10 Daily Boardings for Route 7 Lines 1-16
Table 1-11 Build Alternative Daily Boardings by Station 1-17
Table 1-12 Travel Time and Path Traces for Selected OD Pairs 1-18
Table 1-13 Daily Hours of User Benefit 1-18
Table 1-14 Regionwide Transit Trips, VMT and VHT 1-19
Table 1-15 Daily Transit Person Trips (Unlinked) by Travel Market. 1-19
Table 2-1 Assumptions Used in Build Alternative Travel Time Estimates 2-1
Table 2-2 TSM Alternative Service Characteristics 2-2
Table 2-3 Enhanced Transit Opportunities within Route 7 Right-of-Way 2-5
Table 2-4 Build Alternative 1 Weekday Peak Travel Time: BRT Tysons to Van Dorn Metro via East Falls Church Metro 2-9
Table 2-5 Build Alternative 1 Weekday Service Characteristics 2-9
Table 2-6 Build Alternative 2 Weekday Peak Travel Times: BRT Tysons to Mark Center via East Falls Church Metro 2-13
Table 2-7 Build Alternative 2 Weekday Service Characteristics 2-13
Table 2-8 Build Alternative 3 Weekday Peak Travel Times: BRT Tysons to Van Dorn Metro w/o East Falls Church Metro 2-15
Table 2-9 Build Alternative 3 Weekday Service Characteristics 2-15
Table 2-10 Build Alternative 4 Weekday Peak Travel Times: BRT Tysons to Mark Center w/o East Falls Church Metro 2-17
Table 2-11 Build Alternative 4 Weekday Service Characteristics 2-17
Table 2-12 Build Alternative 5 Weekday Peak Travel Times: BRT Tysons to King Street Metro via East Falls Church Metro 2-19
Table 2-13 Build Alternative 5 Service Characteristics 2-19
Table 2-14 Build Alternative 6 Weekday Travel Times: LRT - Tysons to Mark Center via East Falls Church Metro 2-21
Table 2-15 Build Alternative 6 Weekday Service Characteristics 2-22
Table 2-16 Metrobus Proposed Service Enhancements 2-23

Table 2-17 ART Proposed Service Enhancements 2-24
Table 2-18 Build Alternative 1 Local Bus Service Recommendations 2-24
Table 2-19 Build Alternative 3 Local Bus Service Recommendations in Addition to Table 18 2-32
Table 3-1 Allocated Contingency Factor Ranges 3-3
Table 3-2 Capital Cost Summary 3-4
Table 3-3 Capital Cost Estimate to Various Future Years (Assuming 3% annual escalation) 3-5
Table 3-4 Operating & Maintenance Cost Summary (2015 Dollars in Millions) 3-7
Table 4-1 Virtual Public Kick-off Techniques 4-2
Table 4-2 Website Sign-ups 4-3
Table 4-3 Social Media Activity 4-7
Table 4-4 Broadcast Emails for Public Meetings 4-8
Table 4-5 Analysis of Comments 4-12
Table 5-1 Study Goals, Objectives, and Evaluation Measures 5-2
Table 5-2 Population and Employment Accessibility Measures 5-4
Table 5-3 Transit and Bike Connection Measures 5-5
Table 5-4 Weekday Boardings 5-5
Table 5-5 Transit Efficiency Measures 5-6
Table 5-6 Work Trips and Transit Mode Share 5-6
Table 5-7 New Workday Boardings and Peak Hour Capacity 5-6
Table 5-8 Reductions in Transfers 5-7
Table 5-9 Average Travel Speed 5-7
Table 5-10 TIF Revenue Potential (in $million) and Share of Capital Cost 5-7
Table 5-11 Existing and Planned Activity Centers 5-8
Table 5-12 Change in VMT 5-8
Table 5-13 Change in GHG Emissions 5-8
Table 5-14 Monetized Environmental Benefits 5-9
Table 5-15 Transit Dependent Mobility Measures 5-9
Table 5-16 Cost Effectiveness Measures 5-9
Table 5-17 Preliminary CIG Project Justification Rating and Resulting Funding Gap (in $millions) 5-10
Table 5-18 Mobility Improvements 5-12
Table 5-19 Cost Effectiveness 5-12
Table 5-20 Environmental Benefits 5-13
Table 5-21 Economic Development 5-13
Table 5-22 Land Use 5-14
Table 5-23 Congestion Relief 5-14
Table 5-24 New Starts (NS) and Small Starts (SS) Project Justification Ratings 5-14
Table 6-1 Summary of Potential Revenue Sources 6-1
Table 6-2 Estimated Route 7 Alternative Capital Costs (Millions) 6-2
Table 6-3 Estimated Route 7 Alternative Operating and Maintenance (O&M) Costs (Millions) 6-2

Table 6-4 Potential Development Revenue over 15 Years by Alternative ($millions) 6-13
Table 6-5 Total Revenue Projections in Year 15 by Alterative ($millions) 6-13
Table 6-6 Route 7 Investment Funding Options 6-16
Table 7-1 New Starts v Small Starts 7-8
Table 7-2 Small Starts v New Starts Funding Requirements 7-8

List of Figures

Figure ES-1 Current / Possible Future Conditions along Route 7 ..... ES-1
Figure ES-2 The General Relationship of Service and Transit Demand ES-1
Figure ES-3 Elements of Rapid Transit Systems - Transit Signal Priority, Off Board Fare Collection, Multiple Doors / Level Platforms ES-2
Figure ES-4 The Envision Route 7 Project Work Flow ES-3
Figure ES-5 Analyzed Mode, Termini, and Alignment ES-4
Figure ES-6 Public Response to Transit Service Need ES-5
Figure ES-7 Alternative Screening Steps ES-12
Figure ES-8 The Selected Alternative and an Integrated Regional Transit System ES-13
Figure 1-1 District Definition 1-2
Figure 1-2 Build Alternative 2 - BRT from Tysons to Mark Center via East Falls Church Metro 1-4
Figure 1-3 Build Alternative 4 - BRT from Tysons to Mark Center w/o East falls Church Metro 1-5
Figure 1-4 Build Alternative 5 - BRT from Tysons to King St Metro via East falls Church Metro 1-6
Figure 1-5 Build Alternative 6 - LRT from Tysons to Mark Center via East Falls Church Metro 1-7
Figure 1-6 TAZs Updated for Seven Corners Redevelopment 1-9
Figure 2-1 Route 7 Corridor Transit Study Phase 2 Build Alternatives 2-3
Figure 2-2 Assumed Station Locations – Route 7 Corridor 2-4
Figure 2-3 Route 7 Running Way Assumptions – Tysons to Seven Corners 2-6
Figure 2-4 Route 7 Running Way Assumptions – Seven Corners to King Street Metrorail Station and Van Dorn Metrorail Station 2-7
Figure 2-5 Proposed Spring Hill Turnaround for Build Alternative 1 2-10
Figure 2-6 Proposed Van Dorn Turnaround for Build Alternative 1 2-11
Figure 2-7 Proposed Mark Center Turnaround for Build Alternative 2 2-12
Figure 2-8 Proposed King Street Turnaround for Build Alternative 5 2-20
Figure 2-9 Route 2T 2-26
Figure 2-10 Route 7C Ridership by Stop 2-27
Figure 2-11 Route 7F 2-28
Figure 2-12 Route 7F Ridership by Stop 2-29
Figure 2-13 Route 28X Ridership by Stop 2-30
Figure 2-14 Route ART 45 2-31
Figure 2-15 Route ART 52 2-33
Figure 2-16 DASH Route AT 6 2-35

Figure 2-17 No Build and TSM Alternative 2-37
Figure 2-18 Build Alternative 1 2-38
Figure 2-19 Build Alternative 2/6 2-39
Figure 2-20 Build Alternative 3 2-40
Figure 2-21 Build Alternative 4 2-41
Figure 2-22 Build Alternative 5 2-42
Figure 3-1 Route 7 Corridor Transit Study Phase 2 Build Alternatives 3-2
Figure 4-1 Study Timeline 4-1
Figure 4-2 Outreach Strategy 4-1
Figure 4-3 Categories of Website Comments 4-3
Figure 4-4 Crowdsource Map 4-4
Figure 4-5 Comments from Crowdsource Map 4-4
Figure 4-6 Online Community Poll 4-5
Figure 4-7 Results of Online Poll 1 4-5
Figure 4-8 Results of Online Poll 2 4-5
Figure 4-9 Project Newsletter 4-7
Figure 4-10 Newsletter Distribution List 4-7
Figure 4-11 Public Meeting November 2015, Falls Church 4-8
Figure 4-12 Public Meeting Flyer 4-9
Figure 4-13 Public Meeting November 2015, Alexandria 4-9
Figure 4-14 Public Meeting November 2015, Fairfax 4-10
Figure 4-15 Public Meeting November 2015, Falls Church 4-10
Figure 4-16 Flip Chart Comments 4-10
Figure 4-17 Public Meeting Map Exercise, November 2015 4-11
Figure 4-18 Map Exercise Comments 4-11
Figure 4-19 Public Meeting November 2015, Falls Church 4-12
Figure 4-20 Analysis of Comments 4-12
Figure 6-1 HB2313 Regional Revenue Evaluation Measures 6-6
Figure 7-1 Capital Investment Program (CIG) Processes 7-5

ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Executive Summary

1.0 Introduction

The Northern Virginia Transportation Commission (NVTC) has conducted the *Envision Route 7 Transit Study* to assess the potential for transit service along Route 7, connecting Tysons and the City of Alexandria. This executive summary summarizes the project findings and highlights the results of the technical analyses. The executive summary provides an overview of the key information supporting the project recommendations. More detailed technical information on project efforts and analysis methodologies is presented in the following chapters. This study was funded by NVTA.

Figure ES-1 *Current / Possible Future Conditions along Route 7*

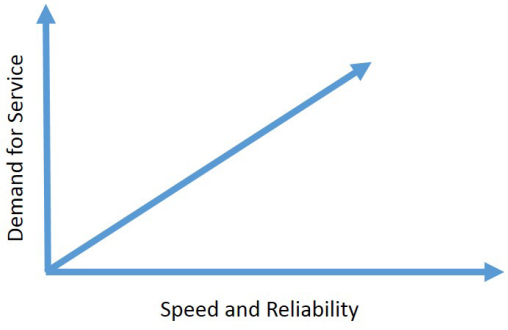
The introductory material presented in the following pages has been included to provide an elementary basis for understanding the broader dialogue on transit infrastructure investment and how high capacity transit corridors fit into the larger context of a viable Washington region. Transit investments are often made in response to growth that has already occurred in the corridor, or in areas where more rapid growth is to be expected, and both conditions exist within the Route 7 corridor. Transportation investments need to be considered in the context of the broader growth plans for the communities they will serve, contributions to the regional systems, and whether and how this project fits into that broader context over the coming decades.

The study effort included a series of technical tasks to define the viability of the project as a high capacity transit service. Major capital investment projects similar to this, if they advance past the development phase, are like all major capital investment projects subjected to a particularly rigorous and critical review process. The project will need to illustrate how benefits and costs compare to other regional initiatives, like a new Metro tunnel connecting the District of Columbia (DC) and Virginia, or improvements to the American Legion Bridge. It is thus important to advance this project in stages, with early assessments to ensure that the project compares favorably with other regional projects and is one that is competitive for state and federal funds.

A major project like that envisioned for Route 7 also requires strong political and community support, in part due to the fact that regional funding is limited and successfully advancing the project in the prioritization process will require project champions. The process from here forward includes what will be a complex dialogue on corridor design, property impacts, interactions with auto traffic, and methods to pay for the system, which may include comparisons to other priority projects in the region. Regional political leaders, corridor land-owners, residents and business owners, and potential system riders will all likely have input on project implementation. In recognition of this reality, an outreach process to identify public concerns and issues with the project was also part of this study with the results summarized later in this document. The project team analyzed multiple alternative alignments and various transit modes to identify the alternative that best represented, in part, the public and stakeholder input to date. The goal was to identify an alternative that best addressed public concerns, was cost effective, and proved competitive across a set of defined measures.

1.1 The Result of Transit Investment

Figure ES-2 *The General Relationship of Service and Transit Demand*



Investing in high capacity transit service in a corridor can result in long-term transformation of the corridor's character. Station areas can become desirable locations for mixed-use communities and for residents and business employees who desire activity centers that provide for multiple needs and reduce the requirements for auto-oriented travel in a congested region like Northern Virginia. Transit investment does not create economic development, but instead it can focus regional growth in areas made more attractive by making connections to a regional transit system.

An investment in transit in the Route 7 corridor follows the same general transportation planning theory as planned regional highway improvements – which is that making travel more efficient will increase the demand for travel along the corridor. Transit investment along Route 7 could therefore potentially enhance the desirability of those areas of the corridor that are appropriate for new development and contribute to development into livable mixed-use centers. In addition, providing reliable transit travel times via dedicated lanes can be of great

interest to many people who would travel the corridor for other purposes, a travel benefit familiar to many in the Washington DC core, or along the Ballston to Rosslyn corridor where transit is a facilitator for travel.

The success of transit investment is directly related to the efficiency, reliability, and ease of use of the system. Figure ES-2 is an oversimplification and more linear representation of the relationship between system efficiency and overall rider demand. However, the relationship does exist. The assumptions on which the technical analysis presented in this report are based include that a majority of the system will exist in efficient dedicated guideways. There will likely be pressures, as there typically are, to eliminate dedicated guideways in some sections of the corridor as this project progresses due to a range of factors, including ease of implementation and possible property impacts. This dialogue should include a discussion of the trade-offs and the benefits of the travel speeds that are only possible through a fully dedicated system before any final decisions are made.

1.2 Looking Forward - to Plan Effectively

Transportation planning is based in part on looking into the future to plan for infrastructure investments whose full viability might not be realized until it is being utilized by a growing number of residents and other system users. Planning for corridor projects such as Route 7 typically use a horizon year 20 to 25 years in the future; for this project, the year 2040 was used. Looking forward to 2040 allows one to consider long term infrastructure investments as well as key factors in transit system viability including ongoing master planning processes, future population and employment in the corridor, and also the performance of the transportation system given expected growth in travel demand.

For this study, all future conditions were estimated for 2040. In addition to population and employment growth assumed in the region, the study assumed all other future transportation project improvements identified to be in place by the year 2040. The Metropolitan Washington Council of Governments (MWCOG), as a part of its mission, regularly updates a regional long range transportation plan (Financially Constrained Long-Range Transportation Plan (CLRP)) to include those projects assumed to be completed within the next 25-30 years. This baseline data was used to determine how proposed transit service along Route 7 will perform given other roadway and transit projects planned for the region. By looking forward, the planning process can determine project performance, which is a critical metric for project viability and in understanding how the project fits into the broader vision of improving transportation system performance for Northern Virginia

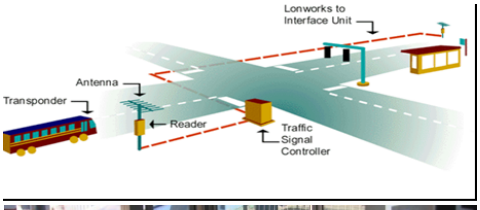
1.3 Rapid Transit Principles

Several principles guide planning and design of a high quality transit system, whether considering Light Rail Transit (LRT) or Bus Rapid Transit (BRT) modes. They are used to provide consistency in ensuring the speed and reliability of transit service, which makes the service more attractive to riders. These strategies include:

- Dedicated Rights of Way – High quality transit systems are built to provide reliable and relatively fast travel speeds and therefore it is more desirable to have vehicles operate in their own space, separated from automobile traffic.
- Station Spacing – Typically high quality transit stations are spaced farther apart than traditional transit services, which limits delays associated with more regular stopping.
- Limited Headways – A headway is the amount of time between transit vehicles. Keeping this value low provides more opportunities for transit users to use transit service.
- Other System Enhancements – high quality transit systems also adopt other strategies to help facilitate a faster transit trip, including off-board fare collection, vehicles with multiple doors for entry/exit, level boarding platforms, and transit signal priority measures that limit delay to transit vehicles at intersections.

These principles have been outlined here in the report to identify the components of a typical rapid transit system – elements that all contribute to the speed, reliability and desirability of a transit system due to the focus on creating travel time benefits, limiting delay, and enabling the rider with information needed on vehicle arrivals. They are critical to an effective system but are not specified beyond this section of the report. They are assumed conditions applied for the purposes of conducting this planning study, which is at a higher level than one which defines the drawbacks or benefits of system elements at the station level.

Figure ES-3 *Elements of Rapid Transit Systems - Transit Signal Priority, Off Board Fare Collection, Multiple Doors / Level Platforms*



2.0 The Route 7 Corridor

Route 7 in Northern Virginia is a historic and critical corridor in the region, providing regional transportation connectivity among communities, commercial centers, places of worship, downtowns, major employment areas, service centers, and schools, and importantly providing access to Metrorail. It serves the needs of the residents and businesses of the region, making connections to the larger regional network and to points beyond the areas surrounding the roadway. It is both a destination and a daily experience for many of those that call the area home.

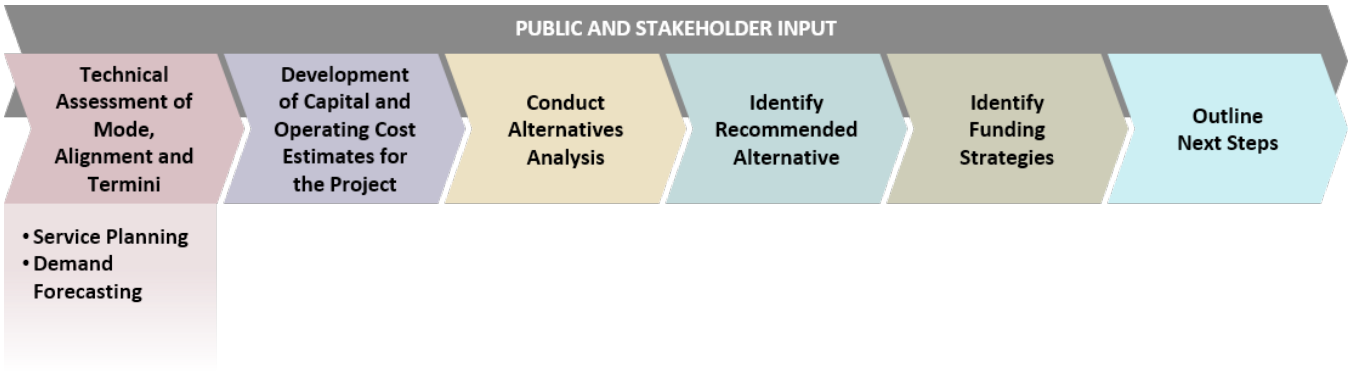
Route 7, like many similar corridors in the DC region, has grown and developed over time with roadway improvements made to accommodate local travel patterns and improve traveler options. It does not have a consistent design across the length of the corridor; instead, the road design has been adjusted to fit the context of what surrounds it.

The land uses along the corridor have also changed over time, from a corridor lined primarily with households and shopping centers at key crossroads to one with significant commercial development at both ends, and higher density development in neighborhoods like Tysons, Seven Corners, Bailey's Crossroads, and the Southern Towers and Mark Center area in the City of Alexandria. As the corridor has attracted more residents and businesses, it has increased in potential for supporting high capacity transit service, including LRT and BRT. These options become desirable travel alternatives for enhancing corridor mobility and, as the corridor continues to evolve, it could become even more conducive to transit service that can support the long-term viability of a transit investment in the corridor.

3.0 Focus of the Project Effort

The *Envision Route 7* project was conducted to better define the viability of high capacity transit along the Route 7 corridor. The project included a number of technical elements that were completed to answer a series of technical questions, and also make recommendations on a project to carry forward, how it could be funded, and what then next steps would be toward implementation. The diagram below identifies how each element of the project was completed to address a specific need of the project.

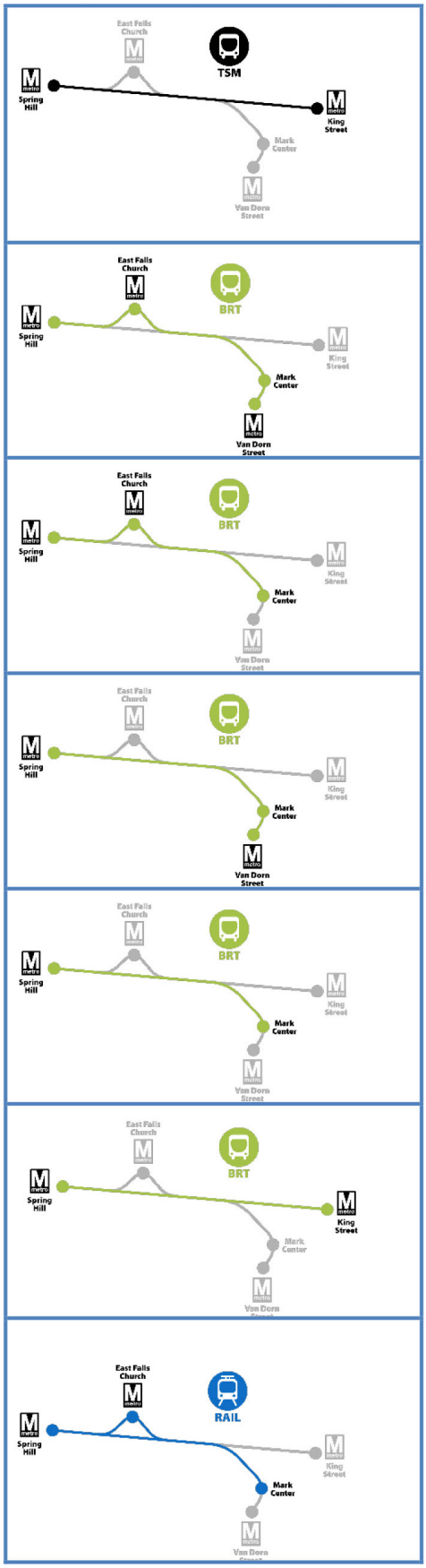
Figure ES-4 *The Envision Route 7 Project Work Flow*



As noted above, the work effort for this project included technical analyses focused on determining the viability of the proposed services. The sections in this report which document the results of the technical work include:

- Outreach Summary Report – identifies the results of the input received on the project from various media sources and at the project community presentation and project public meetings;
- Service Operations Plan Technical Report – outlines how the service would function, service headways and also vehicle requirements for project alternatives;
- Travel Demand Forecasting Report – presents the methodology employed to estimate future traveler demand for service in the corridor for the project alternatives;
- Capital and Operating Cost Estimates Report – estimates the costs to build and operate the system given the parameters of the project alternatives;
- Alternative Evaluation Report – presents the results of the comparative assessment of the project alternatives, applying federal grant funding measures;
- Funding and Financial Strategies Report – identifies potential funding sources and also potential local funding requirements for the services outlined by the project alternatives; and
- Project Development and Implantation Plan Report – provides recommendations on next steps and identifies how the project can advance from this stage through project development and operation.

Figure ES-5 Analyzed Mode, Termini, and Alignment



The summary information presented below is meant to provide an overview of the technical findings and decision-making efforts completed for the study to provide information to the reader on the rationale for the selected alternative, and also recommended actions toward implementation.

3.1 Technical Assessment of Mode, Alignment and Termini

3.1.1 Alternatives Considered

The alternatives considered for the project include combinations of mode, alignment, and termini that represent community and stakeholder input received since project inception. Input on potential alternatives for the project included:

3.1.1.1 Mode

TSM – Transportation Systems Management – Comprised of a set of improvements to the corridor with the intent of improving system performance without requiring major capital investment in rights of way or construction. These improvements would include strategies like off-board fare collection, transit signal priority, and queue jump lanes.

Light Rail – A transit mode made up of rail tracks, steel wheeled vehicles and overhead electrical power infrastructure to power the vehicles. This mode is typically built in dedicated rights of way in most sections, limiting interaction with automobiles and with transit stations providing the option to purchase tickets.

Bus Rapid Transit – A transit mode made up of wheeled vehicles, often stylized or branded to be specific to the corridor. The most effective BRT would be in dedicated rights of way, but other treatments have been used including operating in lanes with other limited uses (HOV, or turning only lanes), as well as operation in mixed traffic.

3.1.1.2 Termini

The Springhill Metrorail Station, because of the planned development along Route 7 in Tysons, has been the identified western end of the service from the beginning, with the primary question being where the service should terminate in the City of Alexandria. Options carried forward for consideration included:

- King Street Metrorail Station
- Mark Center Transit Station
- Van Dorn Street Metrorail Station

These optional termini in the City of Alexandria were analyzed to determine the benefits and drawbacks of each, assessing ridership, whether the access to the stations along area roadways was consistent with master plans, and how the service would be integrated into rapid transit initiatives underway in the City.

3.1.1.3 Alignment

The primary question on alignment was whether to deviate from Route 7 in the City of Falls Church to make the connection to East Falls Church Metrorail station, or whether the service should continue on through the city and remain on Route 7 in that area. There were benefits to potential riders of both options, with the connection to East Falls Church providing access to the Metrorail system, while an alignment traveling more directly through Falls Church provided less of a delay for those traveling through the city to points beyond. A technical analysis of the comparable benefits from the perspective of traveler demand was completed to determine which alignment option would be more desirable.

Figure ES-5 to the right identifies the combination of mode, alignment, and termini that were reflected in the project alternatives analyzed for this project. These alternatives

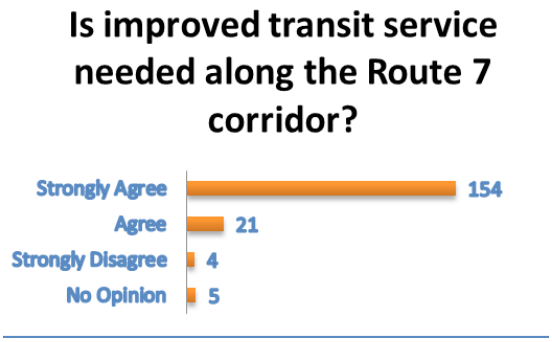
were brought forward from Phase I of the project and technically analyzed to determine the final selected alternative. They include:

- Transportation System Management – Tysons to King Street
- BRT Tysons to Van Dorn Metro with EFC Metro Connection
- BRT Tysons to Mark Center with EFC Metro Connection
- BRT Tysons to Van Dorn Metro without EFC Metro Connection
- BRT Tysons to Mark Center without EFC Metro Connection
- BRT Tysons to King Street Metro with EFC Metro Connection
- LRT Tysons to Mark Center with EFC Metro Connection

3.2 Input Received from the Public and Stakeholders

As noted in the introductory section above, the implementation of a high capacity transit project requires public and stakeholder support to be implemented successfully. It is therefore important at every stage of project planning and development to conduct a public outreach effort to define whether the level of community and stakeholder support in the corridor is sufficient enough so that the project can be expected to advance once questions of funding and potential constructing impacts become more defined.

Figure ES-6 Public Response to Transit Service Need

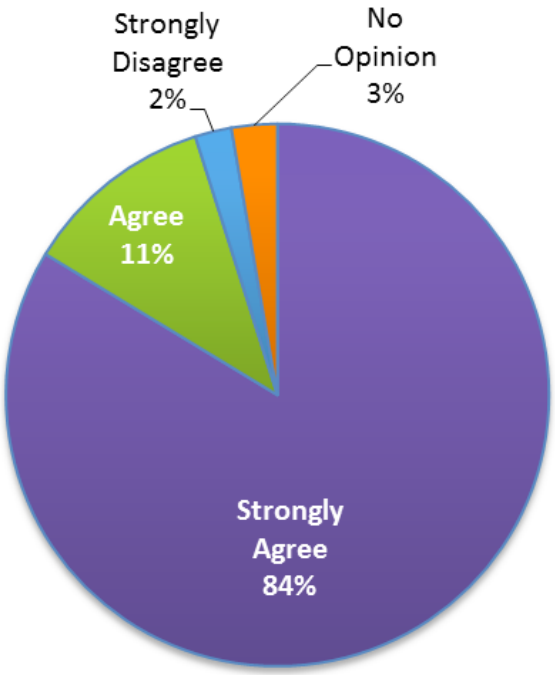


Initially, public input is critical with regards to the primary questions of this project, including mode, alignment and termini, to help point the project toward recommendations on the final recommended alternative identified during this project phase. Recognizing the importance of public input as a part of any major capital improvement study like the *Envision Route 7* project, NVTC conducted a fairly extensive public outreach effort to collect information on these issues.

The outreach effort for the project included hosting a series of public meetings for the project, conducting on-line surveys, maintaining a project web site with a comment function, and holding an extended series of neighborhood or community group meetings to provide an opportunity for participants to give feedback on the project and any recommendations.

The public outreach process provided important insights on several primary issues for this project.

Figure ES-6 Public Response to Transit Service Need



1. Something needs to be done along Route 7 – there was a general sentiment that the corridor needs an overhaul to address traffic, accessibility and travel concerns along its length.
2. Transit is supported – a significant number of respondents noted that improvements to transit along Route 7 would be desirable.
3. There is no strong transit mode preference – responses were supportive of high quality and capacity transit improvements, but the mode (BRT or LRT) was not of significant concern.
4. There is no strong preference for a termini in Alexandria – transit service along Route 7 was noted as a desired outcome, but where the service ends in Alexandria was not identified as a clear preference.

The public input provided was used to help reduce the potential alternatives and refine the final selected alternative. Specifically, the TSM alternative was dismissed due to the desire for a high capacity system, and the fact that there was no preference for a mode meant the project team could assess each alternative based on technical scoring criteria for project efficiency.

3.3 Forecasting Demand on the Service

A technical process called travel demand forecasting (or demand modeling) was used to estimate demand for transit service in the Route 7 corridor. This analysis allowed a comparison among the different alternatives such as

whether changes in termini or alignment options have an effect on the overall effectiveness of the service. The processes summarized below are outlined in more detail in the Travel Demand Forecasting section of this report.

Travel demand forecasting is a process relying on statistical analysis and an understanding of traveler preferences. It is a process with a long history of research and development, and is the focus of ongoing research to refine the basic parameters on which decisions are made.

Forecasting primarily relies on some key inputs, including:

- Existing travel patterns – The US Census Bureau and the National Capital Transportation Planning Board (TPB) both conduct regular surveys of household travel in the region. These data sources help paint a picture of who goes where, and when in the region. These data sets help establish the basic understanding of start and end points for regional trips and are the baseline information used to build the travel model platform.
- Modal preference – Part of the surveys described above seek to define the preferences that travelers have for different travel modes – like driving, walking or bicycling, and riding transit -- for certain trips. As transit does not represent the mode of choice for a majority of trips in the DC region, additional analysis focused specifically on transit riders is also completed to determine the start and end points for transit users. This survey often includes questions about how travelers make their choice of mode and how that choice may change if transit were more regular, faster, or charged a different fare. This survey data is also used to build the baseline understanding of trips in the region and to understand how transit users make travel decisions.
- Regional economic growth – The final significant input into the forecasting process is an estimate of regional growth for jobs and businesses. The forecasts for growth are based on regional estimates developed by economists and then estimated for each jurisdiction. These forecasts are then assigned to various areas of the county depending on whether they have approved development master plans and can expect to have development in these areas.

Developing ridership forecasts is often a critical input into the transit planning process in that they determine one of the most important measures of the service success. Research on travel behavior and data development were used to build computer-based models to define transit system demand along Route 7. A model developed and applied to other regional transit projects was applied to determine potential use of the service alternatives. The model – termed the MDAA II model – has been applied in Maryland and Northern Virginia to estimate the number of potential riders on other projects. As with other models of this type it was developed to incorporate the results of survey data collected for the DC region, a process that required significant resources to collect, compile and analyze.

Travel demand modeling is a process that can include a series of significant data refinements to help improve the relative accuracy of project findings. Efforts to develop final ridership estimates for major capital investments projects as they advance through the federal funding process can require funding levels much beyond those available for the *Envision Route 7* planning study. The analysis conducted for this study was done to answer some key project questions outlined below, and the presentation of project results recognizes there are uncertainties in these results. Further refinements to forecast demand in the corridor to arrive at a more specific figure would have to occur should the project advance into later planning phases.

3.3.1 Major Questions Addressed by the Travel Demand Modeling Process

The forecasting model was developed and applied to help address a few primary planning focus areas for the project:

- Would construction of a high capacity transit system along Route 7 be utilized? And, would it be utilized enough to be a viable and competitive project?
- What are the differences in ridership estimated between the LRT and BRT modes?
- Are there any differences in ridership forecasted depending on where the service terminates in Alexandria?
- What are the benefits to potential riders of service connecting to East Falls Church Metro as compared to one which instead travels along Route 7 through Falls Church?

To determine the answers to these questions a set of forecasting runs for so-called build alternatives were completed using various alignment and termini options. Project resources were limited so an extended series of alternative assessments could not be completed so a set of alternatives were developed that helped to answer the primary project questions outlined above.

The alternatives tested specifically included:

- BRT Connecting Tysons and Mark Center via East Falls Church Metro
- BRT from Tysons to Mark Center w/o East Falls Church Metro
- BRT from Tysons to King Street Metro via East Falls Church Metro
- LRT from Tysons to Mark Center via East Falls Church Metro

The linkage between the planning focus areas and the alternatives occurs by:

- Determining the number of riders in the corridor for all alternatives (will high capacity transit be utilized?);
- Comparing the first alternative (BRT Tysons to Mark Center via EFC) with the fourth alternative (LRT – Tysons to Mark Center via EFC) to determine any differences in ridership estimated for the two alternatives;
- Looking at different terminus options in Alexandria (BRT – Tysons to Mark Center vs BRT Tysons to King Street); and
- Assessing the desirability of a connection to East Falls Church (BRT Tysons to Mark Center with a connection at EFC vs BRT Tysons to Mark Center without a connection to EFC).

The results of conducting this exercise are as follows:

- Transit service along Route 7 and providing access to these communities is a viable project focus, with an estimated six to seven thousand new transit trips per day taking place in the corridor if the service were to be implemented.
- LRT and BRT are relatively comparable in terms of ridership, with LRT showing approximately eight percent higher ridership when comparing the two modes, mostly attributable to travel time benefits that result from grade separated infrastructure in some areas.
- BRT to either King Street Metrorail Station or Mark Center are also relatively comparable, with access to King Street resulting in an approximately eight percent increase in ridership over connecting to Mark Center.
- Access to East Falls Church was shown to be very desirable with an estimate increase of over 40 percent in trips when comparing the two services with and without this access. The vast majority of trips

Travel demand forecasting provides important information in assessing transit projects as it provides some context on which to make important policy decisions as a result of a corridor project like this one. The results noted above were combined with other technical analyses completed for this effort to help in the selection of the recommended alternative to carry forward for further consideration.

3.4 Estimated Cost of Building and Operating the *Envision Route 7* Corridor

Implementing any high capacity transit service obviously comes with costs, including the costs of constructing the system and the cost of operating the service once completed. Both of these costs are critical to the development of a successful transit system and while design and construction costs are typically the higher profile costs cited when referring to a new project, operations and maintenance costs are equally important to ensuring the long-term viability of the system. This is a known requirement to any transit rider in the DC area, with Metro's recent work in conducting an extensive system upgrade after decades of operation. Implementing high capacity transit systems therefore assumes a commitment to appropriate long term operational costs for the system.

3.4.1 Capital Costs

Defining capital costs in advance of the development of the system is important to identify the levels of monetary commitment needed from participating agencies to make the system a reality. The costs estimated for each alternative were developed based on a review of industry assembled costs for building a system in other areas of the country. It should be noted that only a cursory engineering review was completed on this project, and as a result a set of contingencies were assumed, so the final cost estimate could vary from that shown in this report.

The development of capital costs includes estimating costs for all activities associated with building a high capacity transit system – more than just the construction itself. The list below identifies those elements included in the estimate:

- Guideway & Track Elements
- Stations & Stops
- Support Facilities: Yards, Shops, Admin. Bldgs.
- Sitework & Special Conditions
- Systems
- Right of Way Purchase
- Vehicles
- Professional Services (Engineering, Legal, etc)

Table ES-1 Construction Cost Estimates for Project Alternatives

Alt.	Description		Capital Cost Estimate (2015 Dollars in Millions)	
			Low	High
1	BRT Tysons to Van Dorn Metro with EFC Metro Connection	Total	$284.32	$307.78
		Per Mile	$18.56	$20.10
2	BRT Tysons to Mark Center with EFC Metro Connection	Total	$246.90	$267.30
		Per Mile	$19.62	$21.24
3	BRT Tysons to Van Dorn Metro without EFC Metro Connection	Total	$248.91	$269.40
		Per Mile	$18.85	$20.41
4	BRT Tysons to Mark Center without EFC Metro Connection	Total	$211.49	$228.92
		Per Mile	$20.20	$21.86
5	BRT Tysons to King Street Metro with EFC Metro Connection	Total	$274.66	$297.31
		Per Mile	$18.69	$20.23
6-AG	LRT Tysons to Mark Center with EFC Metro Connection at grade	Total	$874.34	$946.08
		Per Mile	$69.55	$75.25
6-ELV	LRT Tysons to Mark Center with EFC Metro Connection with elevated sections	Total	$921.90	$997.44
		Per Mile	$73.33	$79.34

It is important to reiterate that the cost estimates developed for this project were completed without the development of engineering designs for the corridor, an effort that is typically completed during the planning phase of projects and will be the focus of work should the project progress into later phases. So, these costs could vary from what is shown in Table ES-1 depending on a set of factors, including the assumptions made on designs as the corridor design develops. The estimated cost for constructing this project will be further refined if the project advances to later stages.

Upon review, it can be noted that the costs of constructing a LRT system are approximately $75+/- million dollars per mile, while the costs of constructing a BRT system are approximately $20 +/- million dollars per mile. LRT is typically more expensive to implement as it requires the reconstruction of the corridor to handle the steel track, the installation of an electrical power system for the vehicles, the purchase of more expensive vehicles and the construction of an operation and maintenance yard along the corridor. There were also three areas identified specifically that may drive up the costs of constructing a LRT system in this corridor, including the potential need for grade separated tracks due to access restrictions or sharp turns near the East Falls Church Metrorail station, and also in the Seven Corners area. Additional engineering analysis would be required to identify the final cost estimate for the project.

BRT and LRT are obviously different technologies for providing transit service and have notable differences in implementation costs. The decision on a selected mode typically comes down to a set of factors that includes: expected ridership, with LRT able to process more riders due to larger vehicles; and preference, with communities having different perspectives on the two modes and how each may fit into the corridor character and best serve existing and future surrounding land uses.

Capital costs are obviously an important consideration for new transit service, and are a major component of the assessment of any project to determine overall project cost effectiveness for meeting the demands of the community.

3.4.2 Operating Costs

Operating costs for the project were developed for the various alternatives and based on corridor length, the amount of time estimated between bus arrivals (headway), and the required number of buses required to provide service on the corridor. Estimates for system operation including the following specific assumptions for the selected alternative, which are presented as an example of the type of calculations completed in that technical effort:

- End to End Travel Time – Approximately 52 minutes
- Average Speed – Approximately 16 miles per hour
- Frequency of Buses in Peak – Every 10 minutes

- Frequency of Buses in Off-Peak – Every 15 minutes
- Vehicles Required to Provide the Service (with required spares) – 15 vehicles

The development of any high capacity transit system also requires consideration of how other parallel or connecting services may change to help facilitate better connections or reflect the improvements realized from a Route 7 service. The service planning identified adjustments to the two WMATA 28 bus lines that run on Route 7 as well as other WMATA or local bus system connecting routes. The costs of those adjustments are also included in identified costs estimates.

As an example, the estimated cost of running the selected service – BRT from Tysons to Mark Center with the connection to the East Falls Church Metrorail station is approximately $9.5 million dollars annually. Maintaining the WMATA 28A service along Route 7 to facilitate shorter, more localized trips, would cost an estimated $5 million dollars annually, and adjusting other routes to improve overall system connectivity and service is estimated to cost another $3.5 million for a total service cost of around $18 million dollars to implement the *Envision Route 7* service.

3.5 Funding Implementation of the *Envision Route 7* Service

An important question always on major capital transit projects like *Envision Route 7* is how the implementation of a transit service costing hundreds of millions of dollars to construct can be accomplished. And, how the service costs will be covered for operating and maintaining the service once it is in place. The desire to pursue and assemble the required funds for construction, and the capability of funding operation of the service, are key considerations to be discussed. Therefore, an assessment was performed during this preliminary planning phase to fully define what the implementation parameters may be for these costs to give the public and stakeholders an idea on how it may occur.

There are a number of sources that have been identified as options for constructing the guideway and purchasing the equipment required to run the service. These options include federal, state, local and private sources of the capital required to pay for construction and/or operation of the system. Table ES-2 below identifies those sources that could be utilized to fund some portion of the costs of the system.

The available funds can be put into a number of categories:

- Federal and state government transportation funding – funds to pay for transportation projects or operating expenses through existing programs. These funds include major programs like the federal New Starts program, and Virginia's SMART SCALE program. Each program must specifically identified uses for the funds.
- Regional funding measures – often specific to the area immediately surrounding a new alignment to help pay for the system. This can be in the form of local tax measures, such as tax increment financing, often termed "value capture" as it is an effort to capture some of the property value benefits derived from installing a high capacity system.
- Other – project specific revenues such as fare revenues, funding provided directly by developers (through proffer negotiations) or impact fees, or through revenue generated by advertising along the transitway, or on the vehicles themselves.

Table ES-2 *Potential Sources of Funding for Capital and Operating Costs for the Envision Route 7 Project*

State	Regional	Federal	Value Capture	Other
Operating Assistance Capital Assistance SMART SCALE Revenues	NVTC Gas Tax Revenue NVTC Transform66 NVTA HB 2313 Regional Revenues NVTA '30 Percent" Local Revenues Locally Generated Revenues	New Starts/Small Starts (5309) Urbanized Federal Formula Funds (5307) Bus and Bus Facilities (5339) Congestion Mitigation Air Quality (CMAQ) Surface Transportation Program (STP) TIGER	Tax Increment Financing Special Assessment Districts Joint Development Air Rights	Developer Contributions Developer Impact Fees Fare Revenue Advertising Naming Rights

Many transit funding efforts are some combination of the sources outlined above and effort to fund major transit project have become more innovative. The Silver Line metro extension was funded in part by property owners in the Tysons area and the Purple Line in Maryland is scheduled to be completed through a public-private partnership agreement whereby a private entity provides capital required to build and operate the system. Agencies are becoming more creative in finding ways to pay for desired systems.

Given the status of this project, the study team developed a recommended funding strategy to pay for the *Envision Route 7* service that is oriented toward more traditional funding sources, recognizing that later efforts may alter that in the future should the project advance to that stage. The effort on this project included an assessment of each funding program to determine which funds would be most appropriate to use for this project. The recommended funding to consider for constructing the system include:

- The New Starts / Small Starts Capital Investment Grant (CIG) program – a federal grant program that can help fund up to 50 percent of the costs of the system (for New Starts projects) or $100 million dollars in costs (for Small Starts projects) and is therefore a highly desirable source of funding. This funding source is very competitive and has some significant requirements – but the benefits of this level of funding make it one of significant interest and it is therefore recommended for the *Envision Route 7* program.
- SMART SCALE Funds – a state funding source with over $1 billion dollars in funding available over the next five years. This source of funds, while also highly competitive ($7 billion in requests in its first year), represents another source of significant funds to help pay for the *Envision Route 7* system.
- HB 2313 Regional Revenues – a tax-funded program implemented to help pay for transportation projects in the northern Virginia region. This fund is estimated to be funded at approximately $200 million annually, and is administered by NVTA. This program is also highly competitive, with the expectation that over $700 million dollars in requests will be made this fiscal year.
- Value Capture – this initiative will need to be explored by Fairfax County, Falls Church, and the City of Alexandria as a way to fund development of the corridor and help generate the additional funds that may be required that are not a part of existing funding programs.

Funding annual operation costs for the system, approximately $18 million as outlined above, will require special consideration. Current operating budgets for transit have no capacity to handle additional costs associated with the *Envision Route 7* system. Funding operations may require increases in Commercial and Industrial (C&I) tax rates, or a commitment of funds from general operating budgets in the jurisdictions along the corridor. Value capture mechanisms could be used to fund operations, but would reduce the availability of these funds to pay for capital costs.

Funding the *Envision Route 7* system will require additional and extended dialogue on regional and local transportation priorities and the consideration of how the benefits provided by the system fit within the broader transportation dialogue. There are options available, as outlined above, but they all will require a level of commitment from the funding administration based on the final project in order to secure. Should the project advance the commitment of funds should be identified early, to ensure that this critical factor is secure prior to additional commitment of planning or design funds.

3.5.1 Federal Program Competitiveness

A key criteria for assessing project viability is the ability of the project to obtain federal New Starts / Small Starts CIG funds to construct the system. Transit planning for projects such as these often advances well down the road, and require significant resources to complete the work, before finding out whether the project may even qualify or be competitive for federal funding. NVTC had an interest in determining that question early, so the technical team performed an assessment of the various project alternatives given data generated during the two project phases.

In order to receive discretionary CIG program funding from FTA, eligible projects must be evaluated and rated by FTA according to specific statutory project justification and local financial commitment criteria. The FAST Act's project justification criteria include the following criteria: Mobility Improvements:

- Cost Effectiveness;
- Environmental Benefits;
- Economic Development;
- Land Use; and
- Congestion Relief.

Each criterion is "scored" on a five-point scale, rated from Low to High. Summary project justification and local financial commitment ratings are prepared and combined to arrive at an overall project rating. To qualify for CIG funding, projects must achieve an overall project rating of at least Medium (point three on the five-point scale), as well as receive at least Medium summary ratings for both project justification and local financial commitment.

Table ES-3 presents preliminary project justification criteria ratings for each of the Route 7 Build alternatives, concluding with their summary project justification ratings. Ratings were derived consistent with FTA's *Final Capital Investment Grant Program Policy Guidance* and *Reporting Instructions for the Section 5309 Capital Investment Program* and corresponding reporting templates, all dated August 2015. In the absence of a financial plan for a preferred alternative, it is premature to undertake an evaluation and rating of the local financial commitment

criteria. However, once a preferred alternative is selected and a financial plan for the project is developed, it is recommended that NVTC subject it to an evaluation against the FAST Act's financial criteria.

It must also be stressed that these preliminary ratings reflect a "snapshot in time." As a locally preferred alternative is selected and advanced into engineering and design, cost and ridership estimates will be refined which may affect its rating. Moreover, **it is presumed that transit supportive land use and economic development plans within the corridor will become more fully realized, and that a sustainable revenue source to match CIG funding to construct the project and to eventually support its operation will be secured. These local actions can only improve a Route 7 transit investment project's ratings.**

Table ES-3 *Alternatives New Starts/Small Starts Ratings*

	Alt 2 Small Starts BRT	Alt 4 Small Starts BRT	Alt 5 New Starts BRT	Alt 6 New Starts At Grade LRT	Alt 6 New Starts Elevated LRT
Mobility Improvements	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Cost Effectiveness	High (5)	Medium-High (4)	High (5)	Medium (3)	Medium (3)
Congestion Relief	Medium (3)	Medium (3)	Medium-High (4)	Medium-High (4)	Medium-High (4)
Environmental Benefits	High (5)	Medium-High (4)	High (5)	Medium-High (4)	Medium-High (4)
Land Use	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Economic Development	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Sum and Average Score	22/6 = 3.67	20/6 = 3.33	23/6 = 3.83	20/6 = 3.33	20/6 = 3.33
Project Justification Rating	Medium-High	Medium	Medium-High	Medium	Medium

4.0 The Selected Alternative

A selected alternative was identified to be carried forward based on a number of factors, including:

- Public input gathered from various outreach efforts;
- Coordination with planning staff in study jurisdictions on ongoing efforts and any extraordinary implementation challenges;
- Project technical assessment of ridership; and
- Competitiveness for federal, regional or state funds.

The identification of the final selected alternative was completed through conducting a series of screening steps as outlined in the graphic below.

***Figure ES-7** Alternatives Screening Steps*

The final selected alternative is one that best reflects the needs of the corridor and is most viable across all of the assessment criteria. That is:

- BRT – Connecting Tysons (Springhill Metrorail Station) to the Mark Center Transit Station along Route 7 while also connecting to East Falls Church Metrorail Station

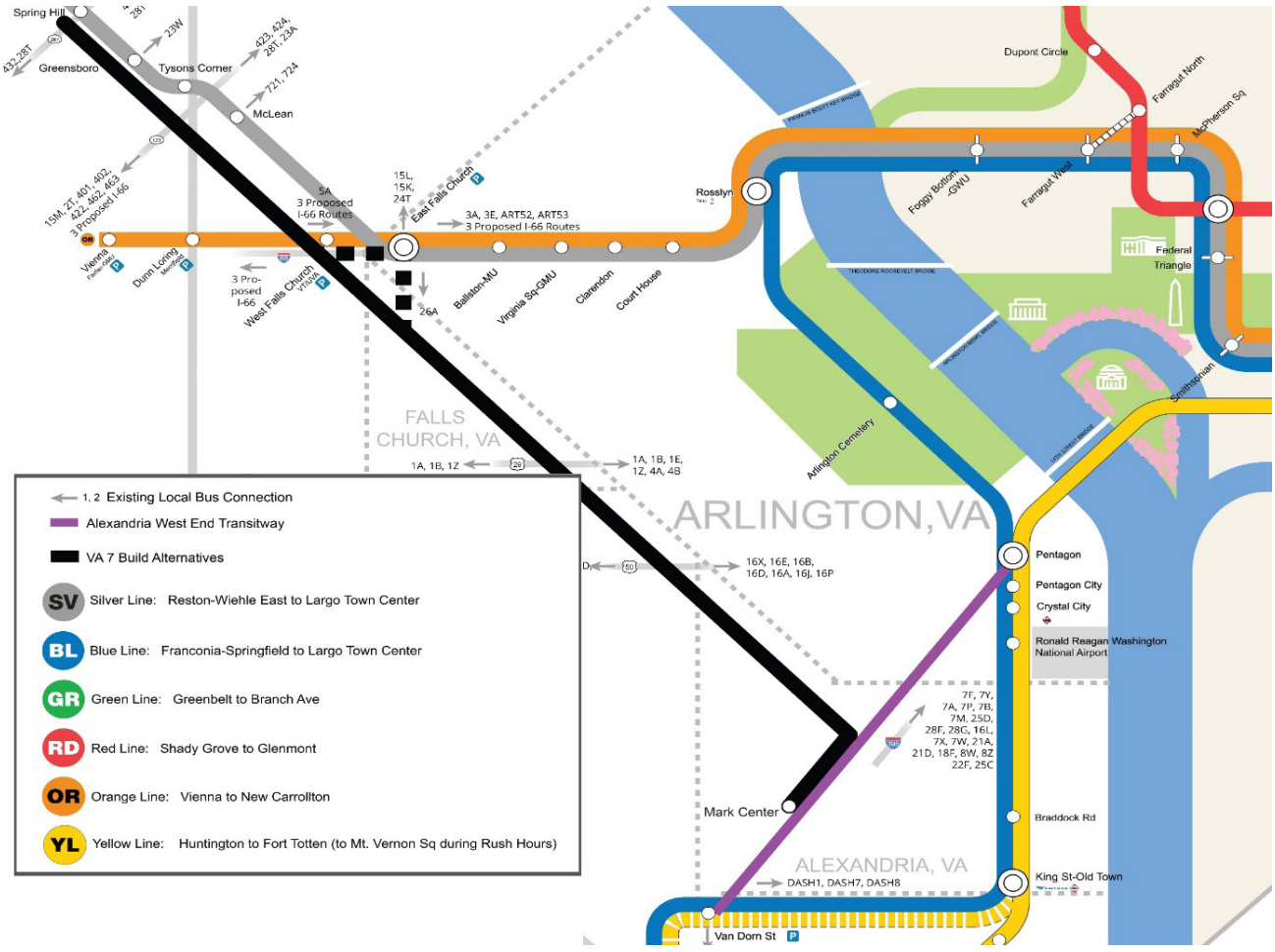
This alternative was chosen over the others for the following reasons:

- The service meets the needs outlined in public comments collected through the extensive outreach program conducted for this project. Specifically, it provides for much improved transit service along the corridor while also providing transit access to and among the various neighborhood and commercial centers.
- The alternative accomplishes the general goal outlined in original project guidance for a transit alternative that links Tysons and the City of Alexandria.

- The transit alignment is a part of existing transportation master plans for Fairfax County and the City of Alexandria and transit connectivity in the City of Falls Church has been a stated goal. Presence in jurisdictional master plans is an important condition in many identified funding programs.
- The alignment connects many of the neighborhoods that have been growing over the past few decades, with those with plans in place to continue to evolve into more densely populated mixed use centers. These neighborhoods include Southern Towers / Mark Center, Skyline, Baileys Crossroads, Seven Corners, Falls Church and Tysons.
- The service supports development occurring at Tysons by providing an additional transit mode into an area being transformed by a new master plan which is creating an urban center along Route 7.
- The alternative measures highly against federal capital funding program criteria, meaning that it is a competitive project in terms of cost-effectiveness, traveler benefits and accessibility. The competitiveness of the project will be critical if it advances into federal funding programs.
- Connecting to East Falls Church indicates a more desirable travel option for transit system users than remaining on Route 7, with a projected ridership increase of almost 40% by making the connection. Ridership is the primary indicator of project effectiveness and competitiveness.
- BRT is more cost competitive than LRT, providing comparable benefits to riders for lower costs. Cost competitiveness is an important federal funding criteria and is expected to be a primary criteria for state and regional funds as well.

Figure ES-8 below shows conceptually how the selected alternative helps also create another link in a northern Virginia regional BRT network, which provides access to many of the important activity centers and communities throughout the region. By making direct connections to the Metrorail Silver Line at Tysons, the Metrorail Silver/Orange Lines at East Falls Church and the West End Transitway along Beauregard and at the Mark Center, the service creates a multi-modal network providing for many more options for transit riders in the region.

Figure ES-8 *The Selected Alternative and an Integrated Regional Transit System*



ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Chapter 1:
Study Overview and Travel Demand

1.0 Introduction

The Northern Virginia Transportation Commission is leading this study to determine the viability of providing high capacity transit along the Route 7 Corridor. This study – termed *Envision Route 7* – includes a number of technical analyses to develop data that can be used to make the three primary decisions associated with this project – alignment, termini and mode. The conclusion of this study identifies a recommended alignment for the project; the start and end point; and a recommended mode.

Understanding traveler demand for new transit service is a critical element of determining system viability. Demand forecasting efforts can define overall system demand, and also how different elements of the system compare against one another (i.e.- one connection versus another, etc). This chapter of the report provides a project overview and outlines the methods employed to estimate future system ridership and presents those results to project decision- makers.

The following pages includes information about the corridor, a description of the alternatives tested and some background on the transit model applied. The final pages present the results of the technical analysis and findings.

1.1 Project Overview

The project was initiated and scoped to develop data by which important decisions could be made on the final recommendation for the corridor. Other project tasks include the development of a future operations plan, the development of an order of magnitude cost estimate, and a review of funding options that could provide information to NVTC on how the corridor could look, and what it would take to pay for and operate the final identified service.

- The demand forecasting portion of the project work was conducted to provide information on a few key data points, including:
- How many riders would be expected to use the system?
- What would be the effect on ridership of connecting to / not connecting to the East Falls Church Metrorail station?
- How many more riders would be expected to ride an LRT system, as opposed to a BRT system?
- What alignment terminus in Alexandria would be the most viable in terms of demand, with a particular comparison between ending the service at the King Street Metrorail Station, or at the Mark Center transit station?

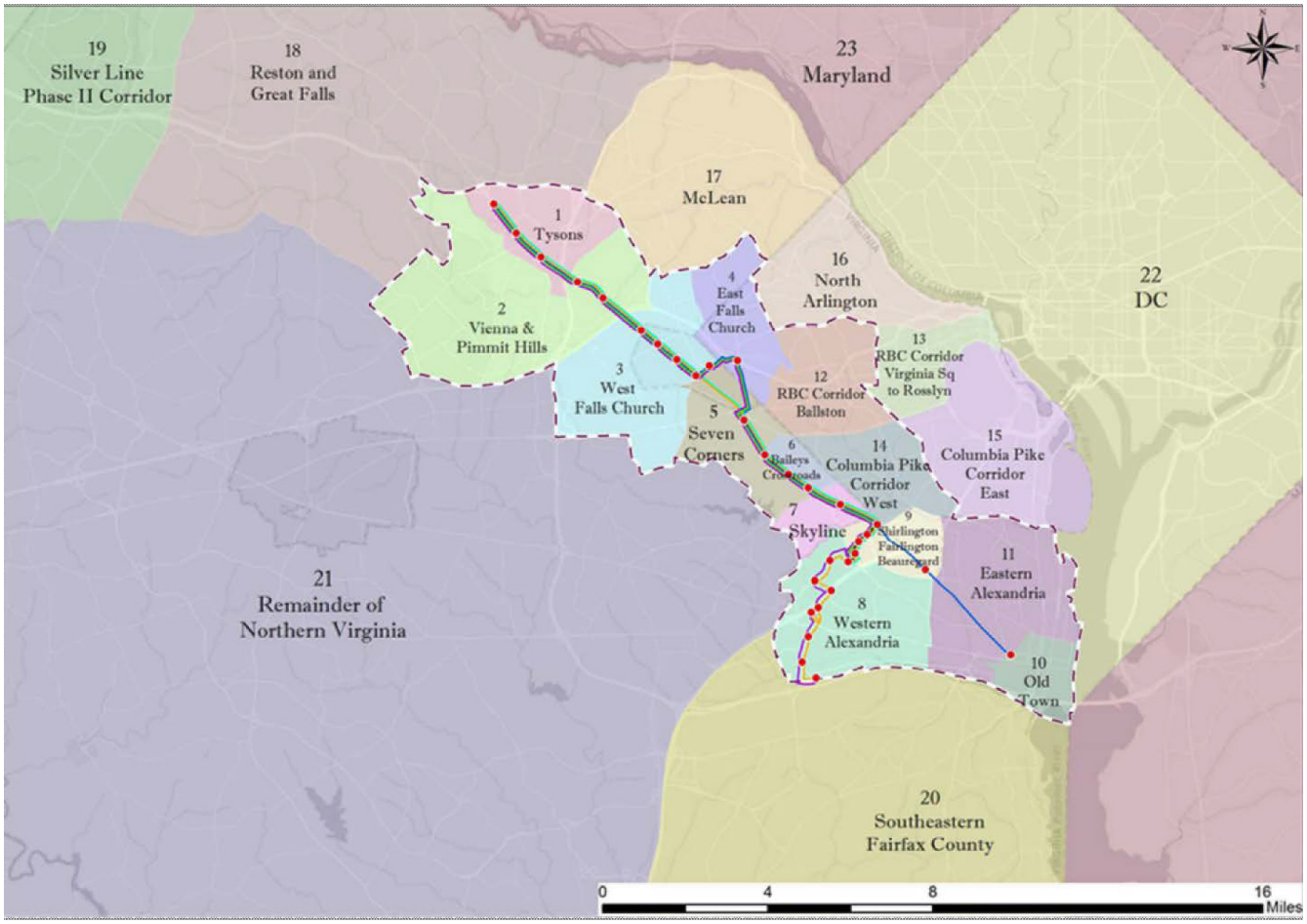
The alternatives tested using the demand forecasting model were developed to address these specific question. A fuller description of the alternatives is contained in the following pages.

1.2 Corridor Setting

The Route 7 corridor is an important arterial roadway linking many northern Virginia communities, from the highly dense and developing center at Tysons Corner, through the neighborhoods of eastern Fairfax County, through the town of Falls Church, then connecting Seven Corners, Bailey's Crossroads, and Skyline before entering the City of Alexandria. In Alexandria, the alignment options connect down King Street to the King Street Metrorail Station, or down Beauregard to the Southern Towers / Mark Center area – with an option of continuing on to make the connection to the Van Dorn Metrorail Station. The corridor is one with a diversity of land uses, from urbanized, to suburban/strip center, to downtown, to mixed use, to commercial center to neighborhood. It is a corridor that has grown organically over the extended period it has been in its location, with the roadway being adjusted as various developments come on line.

The trips in the corridor then would be expected to be a combination of trip types, from home to work trips, to trips to shop or visit community resources, to those accessing education centers or places of worship. The diversity of land uses means the trips would be of varied length and with a range of start and end points.

Figure 1-1 *District Definition*



2.0 Summary of Alternatives

As part of this study, ridership forecasts were developed for a total of seven alternatives, which included four build alternatives, and Existing Conditions, No Build and Transportation System Management (TSM) alternatives., Originally a larger set of alternatives was developed to assess the corridor which explains why the alternative numbering below is not consecutive, however that set was reduced to focus on some key project questions. The purpose of the travel demand forecast effort was to evaluate the impacts of various scenarios, including differences between modes (BRT versus LRT); the impact of a connection at East Falls Church; and, an extension to King Street as compared to a terminus at Mark Center. For that purpose, the following Build Alternatives were evaluated:

- Build Alternative 2 BRT Connecting Tysons and Mark Center via East Falls Church Metro
- Build Alternative 4: BRT from Tysons to Mark Center w/o East Falls Church Metro
- Build Alternative 5: BRT from Tysons to King Street Metro via East Falls Church Metro
- Build Alternative 6: LRT from Tysons to Mark Center via East Falls Church Metro

The Existing Year forecasts were based on 2015 conditions, while Future Year forecast were based on 2040 conditions. The TSM and Build alternatives are described in more detail in the *Service Operations Plan* prepared as part of this project. The following sections provide a brief description of the alternatives for which forecasts were developed. A detailed description of the forecasting methodology is provided in the subsequent section of this chapter.

The alternatives evaluated as part of this chapter are illustrated on Figure 1-2 through Figure 1-5.

2.1.1 Existing Conditions

This represents the Existing Year, 2015 conditions.

2.1.2 No Build Alternative

This represents the 2040 No Build conditions and consists of Existing plus committed projects in the region. The proposed improvements associated with the Route 7 Transit are not considered in this alternative.

2.1.3 TSM Alternative

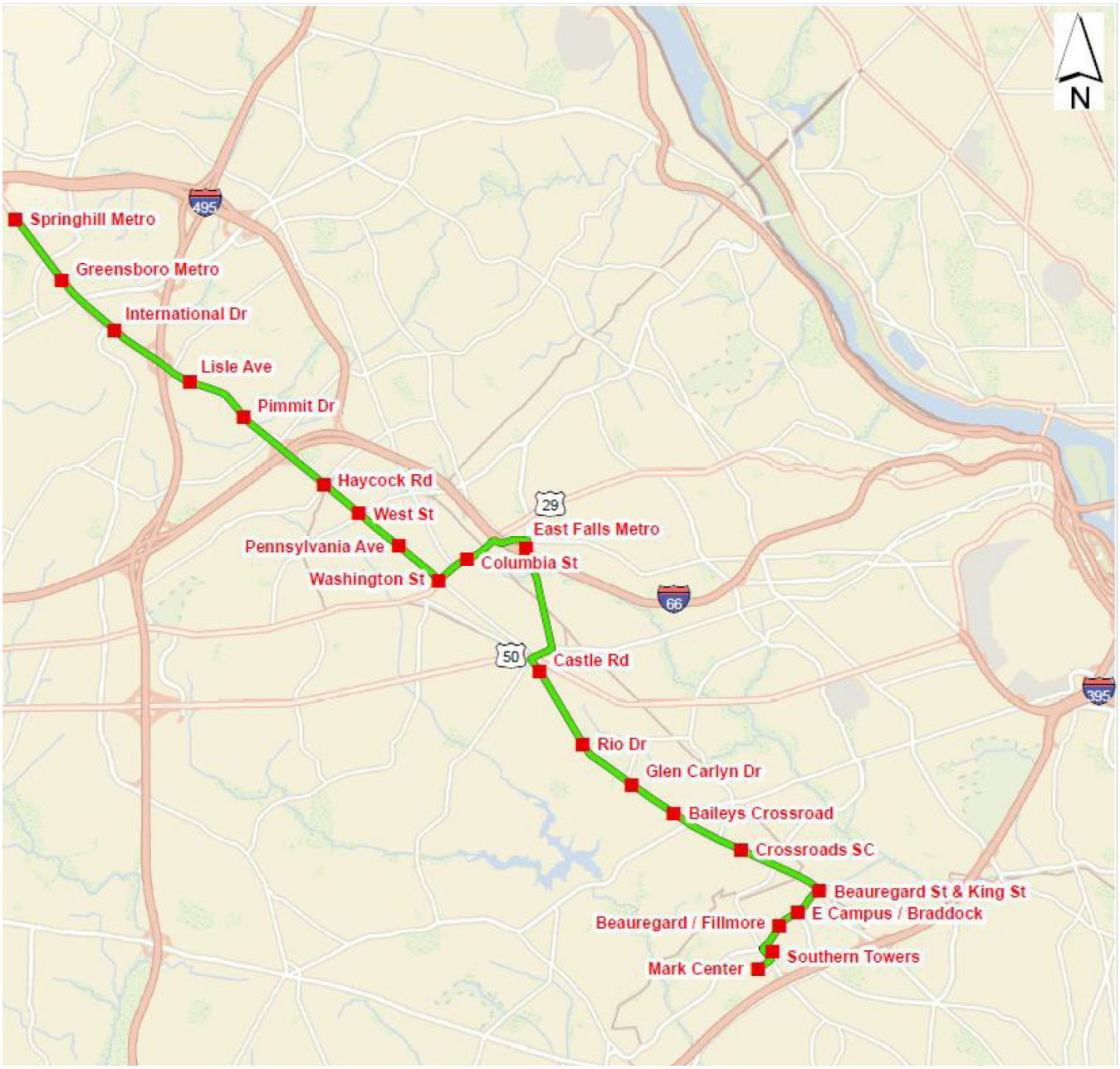
The TSM alternative represents the low-cost alternative for enhancing mobility along the Route 7 corridor. The TSM alternative would enhance existing bus transit service along Route 7 by improving the Metrobus Route 28A from all-day, 30-minute headways to all-day 10/15-minute peak/off-peak headways. The TSM alternative would provide direct transit service between the primary destinations along Route 7 and increase access to the Metrorail system along Route 7 between Tysons and the King Street Metrorail Station.

2.1.4 Build Alternative 2: BRT from Tysons to Mark Center via East Falls Church Metro

Build Alternative 2 is a Bus Rapid Transit (BRT) service, running at-grade from the Spring Hill Metrorail Station in Tysons to the Mark Center in the City of Alexandria. This alternative has a total of 21 stations and includes a direct connection with the existing East Falls Church Metrorail Station. The estimated end to end transit travel time is 51.9 minutes, with an average speed of 16.8 mph. The weekday peak and off-peak frequency for this phase of screening is assumed to be 10 minutes peak and 15 minutes off-peak.

Figure 1-2 shows route alignment and station locations for this alternative. Most of the segments are proposed to be exclusive-guideway using a combination of separate transitway, median transitway, side-of-road transitway and Business Access and Transit (BAT) lanes. The segments from Beauregard & King Street through Mark Center are proposed to be operating in mixed traffic.

Figure 1-2 *Build Alternative 2 - BRT from Tysons to Mark Center via East Falls Church Metro*

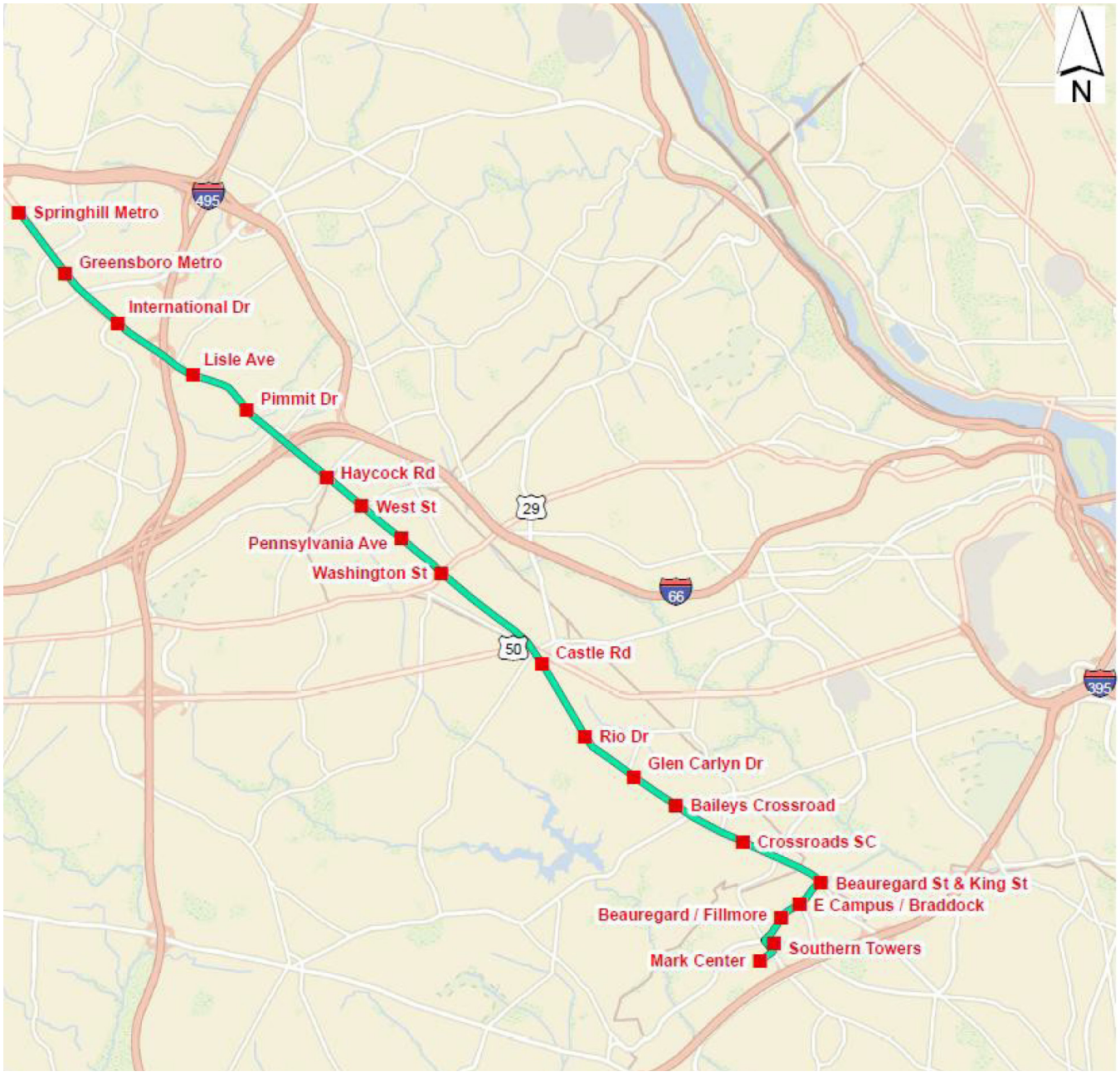


2.1.5 Build Alternative 4: BRT from Tysons to Mark Center w/o East Falls Church Metro

Build Alternative 4 is a Bus Rapid Transit (BRT) service, running at-grade from the Spring Hill Metrorail Station in Tysons Corner to Mark Center in Alexandria. This alternative has a total of 19 stations and would not serve the existing East Falls Church Metrorail Station. The estimated end to end transit travel time is 48.2 minutes, with an average speed of 16.5 mph. The weekday peak and off-peak frequency for this phase of screening is assumed to be 10 minutes peak and 15 minutes off-peak.

Figure 1-3 shows route alignment and station locations for this alternative. Most of the segments are proposed to be exclusive-guideway using a combination of separate transitway, median transitway, side-of-road transitway and Business Access and Transit (BAT) lanes. The segments from Beauregard & King Street through Mark Center are proposed to be operating in mixed traffic.

Figure 1-3 *Build Alternative 4 - BRT from Tysons to Mark Center w/o East Falls Church Metro*

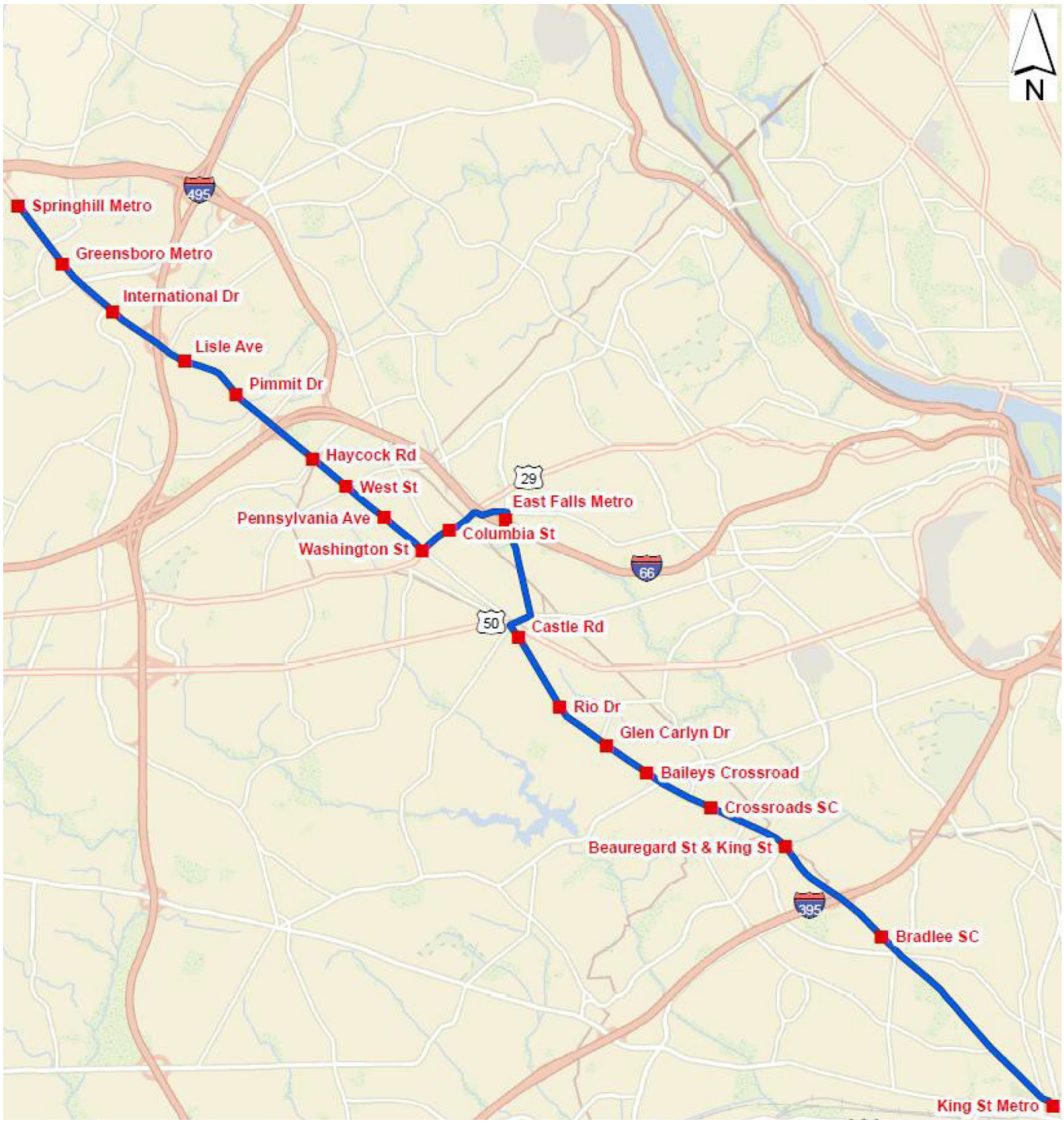


2.1.6 Build Alternative 5: BRT from Tysons to King Street Metro via East Falls Church Metro

Build Alternative 5 is a Bus Rapid Transit (BRT) service running at-grade from the Spring Hill Metrorail Station in Tysons Corner to the King Street Metrorail Station in Alexandria. Build Alternative 5 has a total of 19 stations and includes a direct connection with the existing East Falls Church Metrorail station. The estimated end to end transit travel time is 64.0 minutes, with an average speed of 16.9 mph. The weekday peak and off-peak frequency for this phase of screening is recommended to be 10 minutes peak and 15 minutes off-peak.

Figure 1-4 shows route alignment and station locations for this alternative. Most of the segments are proposed to be exclusive-guideway using a combination of separate transitway, median transitway, side-of-road transitway and Business Access and Transit (BAT) lanes. Only the segment from Bradlee Shopping Center to King Street Metro is proposed to be operating in mixed traffic.

Figure 1-4 *Build Alternative 5 - BRT from Tysons to King St Metro via East Falls Church Metro*

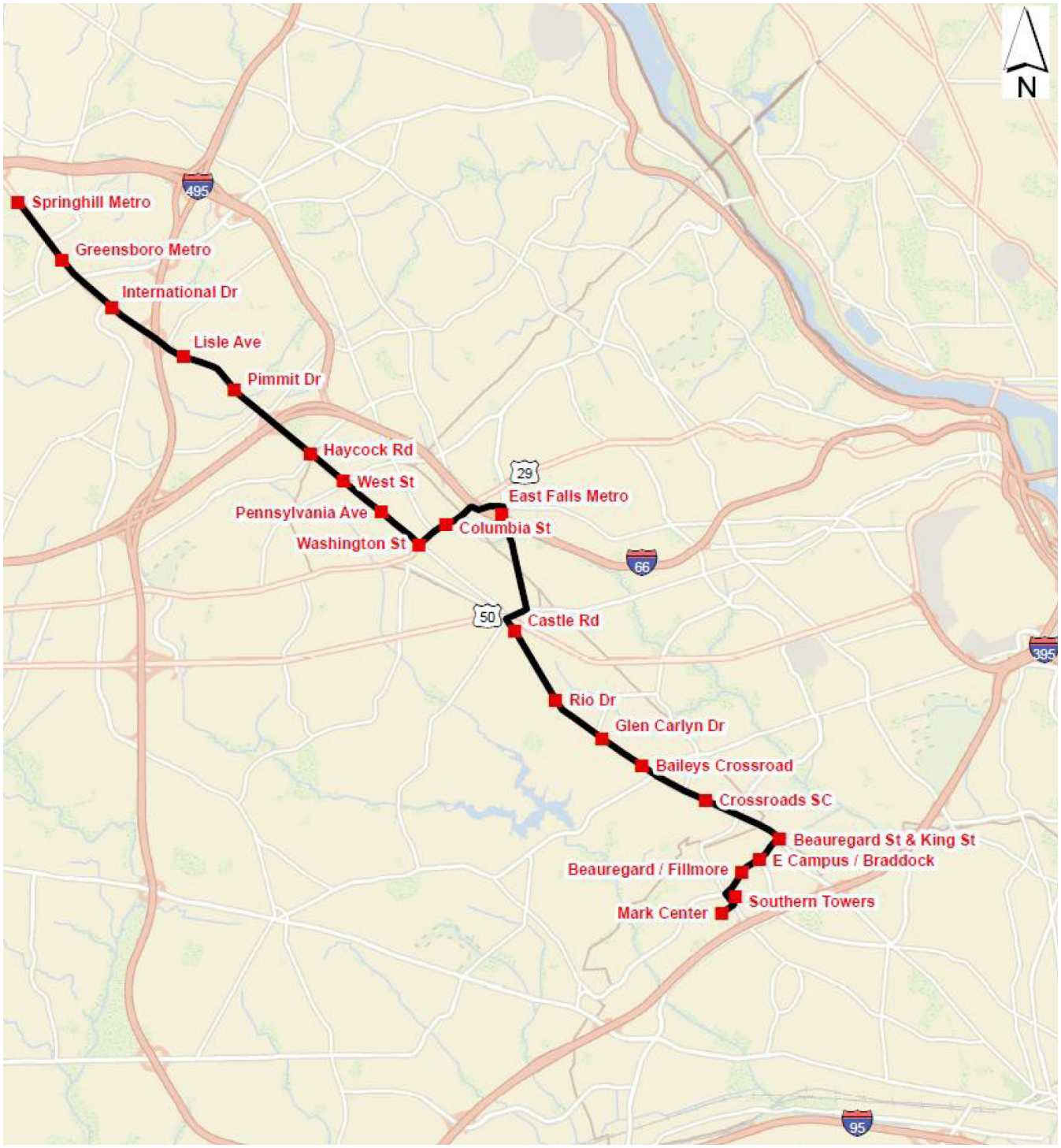


2.1.7 Build Alternative 6: LRT from Tysons to Mark Center via East Falls Church Metro

Build Alternative 6 is a Light Rail (LRT) line, running at-grade and on fixed guideway from the Spring Hill Metrorail Station in Tysons on the Silver Line to Mark Center in Alexandria. Alternative 6 has a total of 21 stations and includes a direct connection with the East Falls Church Station. The estimated end to end transit travel time is 42.4 minutes, with an average speed of 20.6 mph. The weekday peak and off-peak frequency for this phase of screening is assumed to be 10 minutes peak and 15 minutes off-peak.

Figure 1-5 shows route alignment and station locations for this alternative. This alternative is similar to Build alternative 2 with respect to alignment and station locations except that the LRT will be on exclusive guideway with faster travel time but same frequency.

Figure 1-5 *Build Alternative 6 - LRT from Tysons to Mark Center via East Falls Church Metro*



3.0 Forecasting Methodology

The project team has implemented a modeling approach that both meets FTA transit ridership modeling requirements and represents current land use and transportation plans. In effect, we are applying a hybrid approach that makes use of the data inputs of two separate versions of the regional MWCOG travel demand model. The following sections provide detailed information on the methodology used to develop the forecasts for this project.

3.1 Model

The transit ridership demand modeling approach for Route 7 was developed to meet the following objectives and specific needs of this study:

1. Development of ridership forecasts for the proposed Route 7 premium transit service that followed a process to potentially meet FTA requirements and guidelines for New Starts/Small Starts project evaluations if the project progresses to that stage. A future step in this project's evolution will likely be entry into FTA's Project Development Process following completion of this Phase II study and in order for it to be considered by FTA during that phase, the ridership forecasts need to be based on a travel demand model that has been reviewed and approved by FTA for this purpose. Applying a demand forecasting model now which has already been reviewed and applied on other projects was recommended.
2. The ridership demand forecasting model needed to reflective at the time the currently-approved MWCOG Round 8.3 cooperative land use forecasts.
3. The ridership demand forecasting model needed to reflective the currently planned and programmed highway and transit projects within the Route 7 corridor, to reflect relative accurate background conditions on which to base assumptions.

The base model platform used to develop the ridership forecasts for new Route 7 premium transit service was Version 2.2 of the MWCOG/TPB model with a modified and enhanced mode choice component developed, validated and approved by FTA for use on the Purple Line (LRT), Corridor Cities Transitway(BRT) and Crystal City Streetcar projects. This model is known as the MDAAII model. The land use forecasts and highway and transit networks used correspond to current MWCOG Round 8.3 land use forecasts and current CLRP projects within the Route 7 corridor, with several important modifications as described in the following sections. Year 2015 was used as the base year for the analysis.

The 2014 Constrained Long Range Transportation Plan (CLRP), which was formally approved in October 2014, was used to develop the planned transit and highway networks within and affecting the Route 7 Corridor to reflect the proposed networks in the year 2040. Given that the timing of this current study fell prior to the next formal Constrained Long Range Plan (CLRP) update, modifications to the model networks included:

1. The Crystal City and Columbia Pike Streetcar projects was removed.
2. I-66 outside the Beltway highway and transit improvements were included.

3.2 Land Use Update

The base land-use data for this study was obtained from the MWCOG 2040 Round 8.3 land use forecasts. To better represent projected development in the corridor, the land use projections were updated for three traffic analysis zones (TAZ's) in the Seven Corners area to be reflective of the Fairfax County Comprehensive Plan Amendment that were approved by the Fairfax County Board of Supervisors in the summer of 2016. This amendment represented a significant departure from the land use forecasts for these three zones in the Round 8.3 dataset. Prior to formal submittal to FTA, this will need to updated based on the approved land-use included in the Long Range Plan and the official travel demand model for the region.

3.2.1 Conversion from 3,722-TAZ to 2,191-TAZ System

The Maryland Alternatives Analysis (MDAA) II model utilizes 2,191-TAZ system based on MWCOG model version 2.2, released in March 2008. In October 2014, MWCOG released model version 2.3.57 which is based on 3,722-TAZ system. The new zone system covers the same geographic area but with smaller average zone sizes and has land use data from Round 8.3 Cooperative Forecast released in April 2014.

For Route 7 Alternatives Analysis Phase II project (this project), land use data from Round 8.3 was used for the two scenario years, 2015 and 2040. Since the MDAA II model is based on 2191-TAZ system and Round 8.3 land was only available in 3,722-TAZ system, a conversion from 3,722-TAZ to 2,191-TAZ system was required.

Upon the consultant team's request, MWCOG provided Round 8.3 land use data in 2,191-TAZ system for all non- BMC (Baltimore Metropolitan Council) jurisdictions on Feb 4, 2015. MWCOG also provided control totals and employment adjustment factors by jurisdictions for Round 8.3 data.

For the BMC model area comprising of Anne Arundel, Carroll and Howard counties, the consultant team utilized a similar methodology to map Round 8.3 land use data from 3,722-TAZ to 2,191-TAZ system. Each TAZ from the 3,722-system was mapped to one TAZ from the 2,191-system in GIS using many-to-one relationship. For most part, TAZ boundaries on both systems matched. For locations where there was an overlap, care was taken to map TAZs such that the zone centroid location remained unchanged and hence traffic loading on to centroid connector remained a good representation and consistent with the highway network. Employment adjustment factors were applied in accordance with data provided and model documentation.

As a check, control totals by jurisdictions were calculated and compared to control totals from:

a. MWCOG provided on Feb 4, 2015

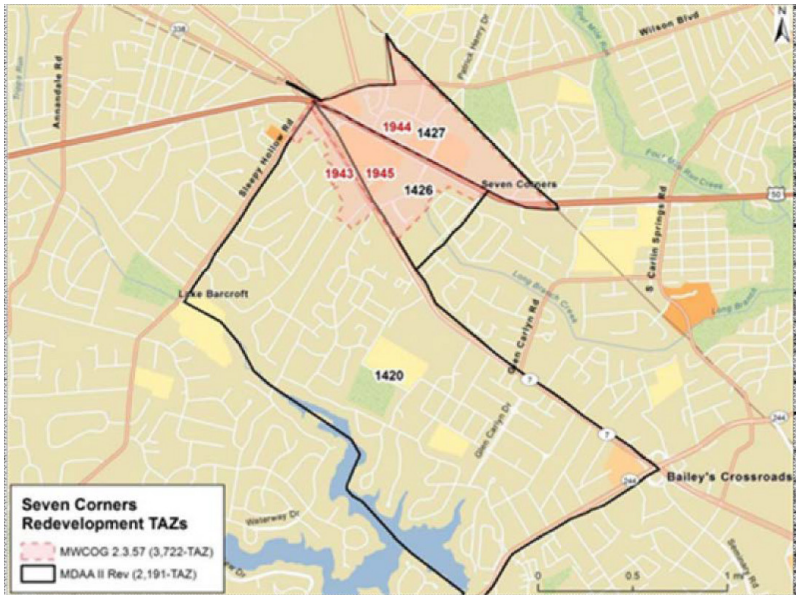
b. Version 2.3.57 model documentation

Control totals for 2015 and 2040 developed for this project matched the Round 8.3 control totals provided by MWCOG on Feb 4, 2015. Note that due to Takoma Park annexation, control total in two jurisdictions, and hence in overall model region, differ slightly from the 3,722-TAZ control totals in the official model documentation. The consultant team followed up with MWCOG and concluded that the difference is very small and does not affect the analysis for this project.

3.2.2 Seven Corners Comp Plan Update

Seven Corners Comp plan update includes high density redevelopment in three TAZs in Seven Corners shown in Figure 1-6. Fairfax County provided change in land use data between existing and proposed comp plan. Based on factors used by Fairfax County and MWCOG, these land use changes were converted to socio-economic (SE) data used in the model. Table 1-1 shows the SE data used in base model for 2040 as per Round 8.3 land use and updated SE data used in the model as a result of Seven Corners Comp plan update.

***Figure 1-6** TAZs Updated for Seven Corners Redevelopment*



COG TAZ 1943	
Change in Uses Existing Uses vs Proposed Comp Plan	
Multi-Family Residential Units	275
Townhomes	65
Retail Sqft	-75,843
Office Sqft	-55,026

COG TAZ 1944	
Change in Uses Existing Uses vs Proposed Comp Plan	
Multi-Family Residential Units	1,953
Retail Sqft	143,516
Public Facility Sqft	159,126

COG TAZ 1945	
Change in Uses Existing Uses vs Proposed Comp Plan	
Multi-Family Residential Units	2,727
Retail Sqft	-6,999
Office Sqft	560,600
Hotel Sqft	164,850

Table 1-1 *Updated SE Data for Seven Corners TAZs*

In Base Model (Corresponding to MWCOG 2.3.57 model, Round 8.3 Land Use) [A]

	HHS40	POP40	GQS40	TPOP40	TEMP40	IND40	RET40	OFF40	OTH40
1420	4456	13799	0	13799	266	0	1194	0489	83
1426	945	2300	42	2342	1409	0	1186	166	57
1427	1207	2659	0	2659	1153	0	953	177	23

Change due to Seven Corners Redevelopment [B]

	HHS40	POP40	GQS40	TPOP40	TEMP40	IND40	RET40	OFF40	OTH40
1420	178	489		489	-269	0	-159	-109	-1
1426	1399	3880		3880	1010	0	-75	1019	66
1427	1045	2875		2875	126	0	85	-26	67
Net Change	**2622**	**7244**	**0**	**7244**	**867**	**0**	**-149**	**884**	**132**

For use in 2040 model, after Redevelopment [A + B]

	HHS40	POP40	GQD40	TPOP40	TEMP40	IND40	RET40	OFF40	OTH40
140	4634	14288	0	14288	2497	0	1035	1380	82
1426	2344	6180	42	6222	2419	0	1111	1185	123
1427	2252	5534	0	5534	1279	0	1038	151	90

Compared to 2040 base year data from Round 8.3, the proposed comp plan update results in net increase of 2,622 households, 7,244 total population and 867 total employment for the three TAZs.

3.3 Network Update

The base highway and transit networks used for the study correspond to the approved 2014 CLRP projects within the Route 7 corridor, with several important modifications as described in the following sections.

3.3.1 Highway Network Update

Highway network for 2015 and 2040 were reviewed and updated within the Route 7 study area. The highway networks were compared to corresponding networks in latest MWCOG model (version 2.3.57) available at the time. Number of lanes and speed class were updated to match the latest model. For the purpose of this analysis which focuses on transit improvements, High Occupancy Toll (HOT) lanes were not included in the highway network.

3.3.2 Transit Network Update

For Existing Year, 2015, newly opened Silver Line Phase I was included in the transit network. Prior to developing the forecasts, the corridor transit network was reviewed and updated to 2015 conditions in the corridor.

For Future Year 2040, the transit network in the corridor was reviewed and updated based on latest MWCOG model available at the time (version 2.3.57). Also included were proposed transit improvements related to I-66 Outside the Corridor and West End Transit. I-66 Inside the Beltway transit improvements were not included as they were still being finalized and the operating plan recommendations in the draft report for the project were not detailed enough to be represented in the transit network. Table 1-2 summarizes the changes to the highway and transit networks that were performed as part of this study.

Table 1-2 *Transit Update for 2040 No Build*

Routes deleted	
Columbia Pike Streetcar	
Crystal City Streetcar	
Routes added	**Project**
1. West End Transit	West End Transit
2. Haymarket to Tysons	Transform I-66 (Outside)
3. Gainesville to Tysons (via Monument)	Transform I-66 (Outside)
4. Gainesville to Tysons (via Manassas P&R, Monument)	Transform I-66 (Outside)
5. Gainesville to Downtown DC (via Monument, East Falls Church)	Transform I-66 (Outside)
6. Gainesville to East Falls Church (Manassas P&R), Monument)	Transform I-66 (Outside)
7. Manassas to Tysons	Transform I-66 (Outside)
8. Manassas to Downtown DC (via East Falls Church)	Transform I-66 (Outside)
Routes Updated	
28A - Update peak frequency to 10 minutes and off-peak frequency to 15 minutes.	

For the TSM and Build alternatives, several bus routes were updated based on the *Route 7 Service Operations Plan* developed as part of this project.

Since there are no LRT and BRT modes in the existing network, a calibration constant cannot be developed in the travel demand model. Consistent with FTA's guidelines, un-included attributes are then developed (within a set range of values provided by FTA) to account for these modes. For this project, the un-included attributes for LRT and BRT modes are identical except for the differences noted below:

- LRT is higher in hierarchy than BRT, meaning that an LRT trip with BRT transfer is accounted as an LRT trip but not in the BRT trip.
- In case of choice between LRT and BRT mode, all other aspects being identical, the model will always assign trip to LRT since it is higher in hierarchy.
- Speed and travel time assumptions calculated as part of the operational plan.

This is consistent with the methodology used for other projects in the region, including the Purple Line and the City Corridor Transit. In addition, average speeds for each alternative were developed as part of the operating plan prepared for this project and account for the provision of transit priority elements at intersections (transit signal priority, queue jumps) that would be provided as part of the implementation of the transit improvements along the Route 7 Corridor.

4.0 Existing and Future Conditions

4.1 Existing Year (2015) Validation

Development of the MDAAII model 2015 scenario was based on the updates described in the previous sections. In order to build confidence that the base model accurately replicates travel patterns within the corridor, model results were compared to observed data in order to validate the model for 2014 and 2015 conditions. Year 2014 and 2015 data were the most recent full year of data available from the various transit operators in the area (WAMATA, ART, DASH, and others). The ridership comparison was performed both at the corridor and regional levels. A regional level, estimates within 10 to 15 percent are usually found acceptable. At the route and/or corridor-level, a much higher tolerance is acceptable, taking into account that transit ridership is calibrated at the regional level and not at the route level.

Table 1-3 summarizes the estimated and observed ridership. The routes within the corridor show model ridership 11 to 15 percent higher than observed at the aggregate level. Differences in ridership by route are higher than 10% but that is deemed acceptable since models are not calibrated at the route level. At the regional level, WMATA bus ridership is 10% higher than observed and Metrorail is 9% higher than model when compared to observed. Note that the observed values were for 2014 before the Silver Line was fully operational.

Table 1-3 Validation of Daily Boardings for Metrobus Routes in Corridor

Route Code	Route Name	Mode	Model 2015	Observed 2014	Observed 2015
WM03T	3T Pimmit Hills - Falls Church	1	210	724	683
WM23	23A,B,T: McLean - Crystal City	1	7,085	3,936	3,530
WM25B	25B Landmark - Ballston Line	1	2,110	1,308	1,270
WM28A	28A Leesburg Pike	1	3,200	4,966	5,166
WM28X	28X Leesburg Pike Limited	1	1,080	1,297	945
		Total	**13,685**	**12,231**	**11,594**
Metrobus	WMATA	Total	534,100	480,000	
Metrorail	WMATA	Total	828,620	750,000	

Note: Observed Metrobus Passenger Boardings were impacted by Silver Line Metro construction and opening

4.2 Population and Employment Growth

There are approximately 402,700 residents in 175,800 households in the corridor, and 316,200 jobs.

The corridor includes a moderate transit dependent population with 11 percent of the households not owning a car, many by choice, particularly near the Metro stations.

By 2040, close to nine percent of the region's population growth is expected to occur in the Route 7 Corridor or an increase of approximately 158,000 residents. The number of households in the corridor shows a 42 percent increase compared to 28 percent in the region. By 2040, the number of households will increase by close to 73,500 in the corridor compared to a 138,800 increase in employment. Within the Route 7 Corridor, the Tysons Corner area shows the largest increase in population, households, and employment.

Between 2015 and 2040, population and number of households in the region are expected to grow by 25 and 28 percent respectively or 1,744,500 inhabitants and 733,100 households. Employment is expected to grow by 34 percent, or 1,394,400 new jobs for the entire region. Population, household, and employment growth in the Route 7 Corridor area are more aggressive than the growth expected by the region overall. While the population and number of households in the region are expected to grow by 25 and 28 percent between 2015 and 2040, the Route 7 Corridor will see 39 and 42 percent growth respectively. Employment in the Route 7 Corridor will experience a 44 percent growth, compared to 34 percent in the region.

For ease of analysis, the region was divided into districts as illustrated on Figure 1-1.

Table 1-4 and Table 1-5 summarize the demographic conditions in 2015 and 2040 by district for the region.

Table 1-4 *Household and Population Growth*

District		Households			Total Population		
Num	**Name**	**2015**	**2040**	**Change**	**2015**	**2040**	**Change**
1	Tysons	8,934	38,358	329%	18,028	75,211	317%
2	Vienna & Pimmit Hills	16,277	18,006	11%	46,756	51,941	11%
3	West Falls Church	14,274	18,207	28%	38,200	45,841	20%
4	East Falls Church	6,884	7,530	9%	18,061	19,571	8%
5	Seven Corners	8,769	13,142	50%	23,083	35,540	54%
6	Baileys Crossroads	2,468	2,600	5%	6,412	6,774	6%
7	Skyline	6,858	8,593	25%	15,844	19,811	25%
8	Western Alexandria	28,025	36,190	29%	59,549	76,303	28%
9	Shirlington/Fairlington/Beauregard	14,754	17,593	19%	25,749	31,544	23%
10	Old Town	8,937	11,947	34%	16,491	22,748	38%
11	Eastern Alexandria outside of Old Town	27,042	35,612	32%	57,990	75,561	30%
12	RBC Corridor - Ballston	18,180	19,426	7%	39,514	42,319	7%
13	RBC Corridor - Virginia Square to Rosslyn	25,272	29,171	15%	47,416	55,453	17%
14	Columbia Pike Corridor West	14,357	22,026	53%	37,069	57,562	55%
15	Columbia Pike Corridor East	26,597	35,912	35%	49,322	69,361	41%
16	North Arlington	9,883	10,028	1%	25,052	25,373	1%
17	McLean	10,445	11,825	13%	28,793	32,386	12%
18	Reston & Great Falls	31,695	38,404	21%	82,736	95,623	16%
19	Silver Line Phase II Corridor	170,381	230,753	35%	482,638	630,002	31%
20	Southeastern Fairfax County	161,757	236,832	46%	451,482	641,363	42%
21	Remainder of Northern Virginia	429,004	551,958	29%	1,280,699	1,616,701	26%
22	DC	287,112	370,758	29%	660,527	883,568	34%
23	Maryland	1,314,135	1,610,317	23%	3,545,757	4,191,153	18%
Region Total		**2,642,040**	**3,375,188**	**28%**	**7,057,168**	**8,801,709**	**25%**
Corridor Total		**175,759**	**249,230**	**42%**	**402,746**	**560,726**	**39%**

Table 1-5 Employment Growth

District		Total Employment		
Num	Name	2015	2040	Change
1	Tysons	89,308	151,460	70%
2	Vienna & Pimmit Hills	21,106	22,589	7%
3	West Falls Church	16,469	23,041	40%
4	East Falls Church	1,953	1,996	2%
5	Seven Corners	13,166	15,976	21%
6	Baileys Crossroads	2,779	2,848	2%
7	Skyline	13,144	17,892	36%
8	Western Alexandria	33,505	51,387	53%
9	Shirlington/Fairlington/Beauregard	10,686	12,115	13%
10	Old Town	35,965	41,937	17%
11	Eastern Alexandria outside of Old Town	34,427	66,494	93%
12	RBC Corridor - Ballston	33,453	35,672	7%
13	RBC Corridor - Virginia Square to Rosslyn	86,314	112,540	30%
14	Columbia Pike Corridor West	10,246	11,554	13%
15	Columbia Pike Corridor East	106,332	137,869	30%
16	North Arlington	5,402	5,453	1%
17	McLean	24,548	25,249	3%
18	Reston & Great Falls	40,847	45,801	12%
19	Silver Line Phase II Corridor	267,348	422,086	58%
20	Southeastern Fairfax County	225,171	335,382	49%
21	Remainder of Northern Virginia	512,592	726,392	42%
22	DC	814,953	1,001,807	23%
23	Maryland	1,726,834	2,253,367	30%
Region Total		**4,126,548**	**5,520,907**	**34%**
Corridor Total		**316,207**	**454,961**	**44%**

5.0 Forecast Results

Travel forecasts provide a wide range of information used for analysis of the proposed alternatives. These estimates include measures such as mode shares, mode of access, user benefits, station boardings, vehicle-hours and vehicle-miles, and average daily volumes are reported in other reports such as the Environmental Impact Statement. This section includes information on 2040 conditions on person and transit trips with and without the project, ridership levels, and benefits of the TSM Alternative and the Build Alternatives.

There are special market rail trips (circulation trips) that are generated when a rail system becomes available to the transit user because of the rail's visibility, reliability, and ease of use. A non-home-based-direct demand model was developed in 1989 for estimating these special circulation trips for the Washington Metro Area Transit Authority (WMATA). This model estimates the number of non-home-based-trip ends at each rail station. The model was updated and re-estimated using 2005 WMATA Rail Survey data. The forecast runs summarized in this section include the trips from the special rail market.

5.1 Future Trip Characteristics in the Corridor

Within the Route 7 Corridor, no significant changes to the transit service are planned over the next three decades. Similarly, the highway network will remain relatively unchanged.

In contrast, increases in population and in employment are projected to occur by the year 2040. Therefore, while the demand for transportation service will increase due to demographic growth, the transportation system will not keep up with the expected needs. Using the same districting format as shown in Figure 1-1, the 2015 and 2040 trips were aggregated by district. The summaries are provided in Table 1-6 and Table 1-7.

Table 1-6 *2015 Model Trips Characteristics*

Total Person Trips	Total	% of Region	Transit Person Trips	Total	% of Region	Transit %
Within Corridor	866,103	4%	Within Corridor	25,365	2%	3%
Start Inside Corridor & End Outside	812,954	3%	Start Inside Corridor & End Outside	96,698	7%	15%
End Inside Corridor & Start Outside	1,051,551	4%	End Inside Corridor & Start Outside	66,837	5%	9%
Outside Corridor	22,803,837	89%	Outside Corridor	1,149,861	86%	5%
Regional Total	25,534,445	100%	Regional Total	1,338,761	100%	6%

Table 1-7 *2040 No Build Model Trip Characteristics*

Total Person Trips	Total	% of Region	Transit Person Trips	Total	% of Region	Transit %
Within Corridor	1,246,849	4%	Within Corridor	46,118	3%	4%
Start Inside Corridor & End Outside	972,930	3%	Start Inside Corridor & End Outside	143,826	8%	15%
End Inside Corridor & Start Outside	1,136,981	4%	End Inside Corridor & Start Outside	105,478	6%	9%
Outside Corridor	27,980,407	89%	Outside Corridor	1,516,364	84%	5%
Regional Total	31,337,167	100%	Regional Total	1,811,786	100%	6%

Table 1-8 displays the trip growth between 2015 and 2040 in the model. Total trips show a growth consistent with expected change in demographics while transit trips show a relatively higher growth.

Table 1-8 *Trip Growth between 2015 and 2040*

Total Person Trips	Change from 2015 to 2040	% Change	Transit Person Trips	Change from 2015 to 2040	% Change
Within Corridor	380,746	44%	Within Corridor	20,753	82%
Start Inside Corridor & End Outside	159,976	20%	Start Inside Corridor & End Outside	47,128	49%
End Inside Corridor & Start Outside	85,430	8	End Inside Corridor & Start Outside	38,641	58%
Outside Corridor	5,176,570	23%	Outside Corridor	366,503	32%
Regional Total	5,802,722	23%	Regional Total	473,025	35%

Transit usage in the markets served by the corridor is expected to increase by approximately 106,500 trips per day between 2015 (188,900) and 2040 (295,400). In 2040, of the total Route 7 Corridor market share of 295,400 transit trips, approximately 46,200 (16 percent) trips are produced and attracted within the corridor, while the remaining 249,300 (84 percent) trips have one end inside and the other end outside the corridor. Between 2015 and 2040, the transit trips identified in the travel markets for the Route 7 Line will increase by 106,500 (56 percent). The greatest growth between 2015 and 2040 is experienced by the transit trips that remain entirely within the corridor. This market grows by 82 percent from 25,360 in 2015 to 46,120 in 2040. The other two markets increase by 49 percent and 58 percent.

5.2 Daily Transit Boardings

Tables 1-9 through 1-11 summarize the projected average daily ridership for each of the alternatives evaluated. Due to the relatively small change in the transit network between the No-Build and TSM alternatives, daily transit boardings in the region would remain relatively flat, with only less than one half percent difference with the TSM Alternative. The largest increase in the number of boardings is seen with the implementation of the Alternative 6, resulting in an increase of 36,055 trips or 1.35 percent increase over the No-Build Alternative, regionwide.

Table 1-9 Daily Transit Boardings by Mode

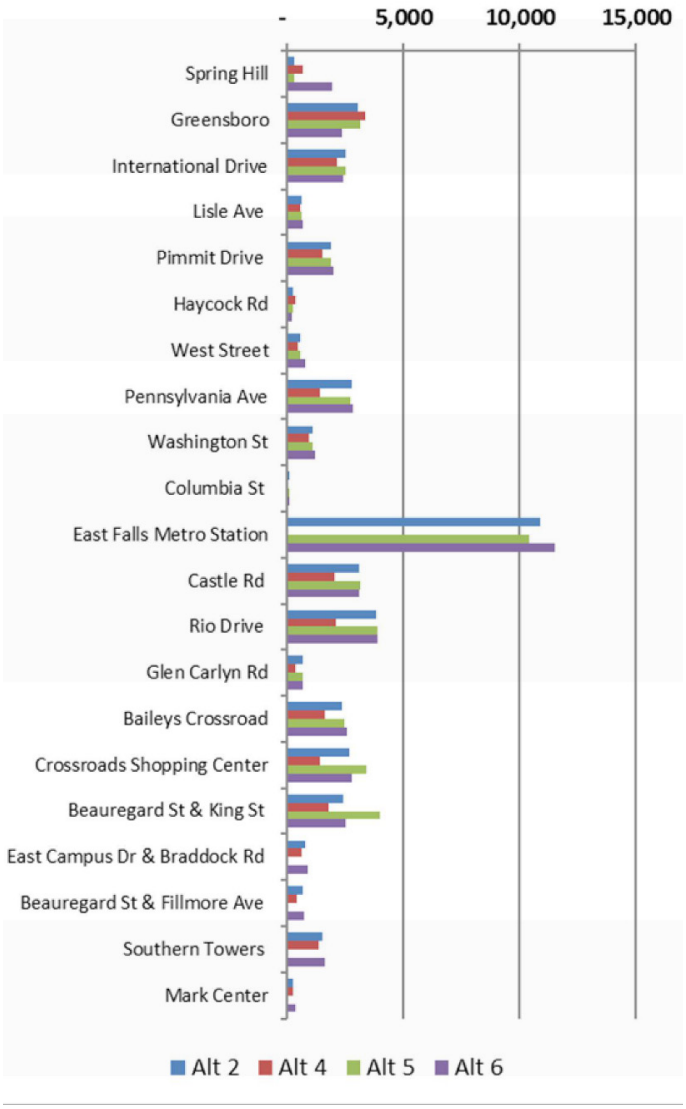
Mode Num	Mode Description	No Build	TSM	Alt 2	Alt 4	Alt 5	Alt 6
1	Local Bus	627,409	629,703	616,217	621,336	615,900	616,134
2	Express Bus	56,098	56,030	54,729	55,944	54,779	56,719
3	Metrorail	1,640,009	1,639,612	1,642,034	1,635,354	1,641,706	1,642,103
4	Commuter Rail	40,125	40,148	40,100	40,097	40,263	40,106
5	LRT	84,643	84,643	84,655	84,644	84,655	129,433
6	Other Local Bus	181,179	180,590	181,311	183,783	179,670	181,100
7	Other Express Bus	13,713	13,735	13,374	13,382	13,271	13,461
8	Other Local Bus	12,867	12,867	12,867	12,867	12,867	12,867
9	Other Express Bus	29,808	29,804	29,971	29,870	29,934	29,982
10	BRT	-	-	41,970	23,122	45,365	-
	Total	**2,685,851**	**2,687,132**	**2,717,228**	**2,700,399**	**2,718,410**	**2,721,905**

Table 1-10 Daily Boardings for Route 7 Lines

2040 Daily Boardings	No Build	TSM	Alt 2	Alt 4	Alt 5	Alt 6
Route 7	-	-	41,970	23,122	45,365	44,803
28X	1,177	813	-	-	-	-
28A	7,162	10,572	1,696	1,904	1,294	1,656
Total in Route 7 corridor	**8,339**	**11,385**	**43,666**	**25,026**	**46,659**	**46,459**
Change from No Build	0	+3,046	+35,327	+16,687	+38,320	+38,120
West End Transit	16,669	16,521	15,598	17,800	15,283	14,587

Table 1-11 *Build Alternative Daily Boardings by Station*

Name	Alt 2	Alt 4	Alt 5	Alt 6
Spring Hill	283	639	281	1,923
Greensboro	3,046	3,353	3,119	2,347
International Drive	2,477	2,136	2,525	2,385
Lisle Ave	594	538	594	636
Pimmit Drive	1,855	1,522	1,870	1,959
Haycock Rd	238	320	240	174
West Street	554	451	558	779
Pennsylvania Ave	2,741	1,403	2,728	2,843
Washington St	1,077	927	1,073	1,212
Columbia St	66	-	68	93
East Falls Metro Station	10,891	-	10,414	11,496
Castle Rd	3,087	2,033	3,128	3,080
Rio Drive	3,838	2,098	3,886	3,888
Glen Carlyn Rd	671	341	671	681
Baileys Crossroad	2,341	1,600	2,434	2,568
Crossroads Shopping Center	2,656	1,423	3,412	2,741
Beauregard St & King St	2,401	1,744	3,979	2,507
East Campus Dr & Braddock Rd	746	593	-	861
Beauregard St & Fillmore Ave	682	421	-	716
Southern Towers	1,483	1,345	-	1,589
Mark Center	261	248	-	337
Bradlee Shopping Center	-	-	1,133	-
King St Metro Station	-	-	3,261	-
Total Boardings	**41,970**	**23,120**	**45,370**	**44,800**



5.3 Travel Time Impacts

Transit travel times were used to evaluate the impact of the proposed selected alternatives between key origin and destination locations within the corridor. The TSM Alternative and Alternatives 2 and 6 were compared to the No-Build Alternative as summarized on Table 1-12. With the implementation of an LRT (Alternative 6), more than 40 minutes of travel time savings are estimated between Tysons and Columbia Pike East areas when compared to the No-Build Alternative. The highest travel time savings is also between these two areas when a BRT (Alternatve 2) is implemented, with an estimated reduction by more than 28 minutes. Travel time savings of 20 and 24 minutes are estimated between Tysons and Old Town areas with the implementation of a BRT (Alternative 2) and LRT (Alternative 6) respectively.

Table 1-12 *Travel Time and Path Traces for Selected OD Pairs*

Origin Location	Destination Location	Alternative	Transit Path	IVT (min)	Wait Time (min)	Walk Access Time (min)	OVT (min)	No of Transfers	Saved IVT + 2 OVT (min)
Tysons	Old Town	NB	Bus	110.41	7.50	8.20	15.70	0	141.81
		TSM	Bus	113.74	4.29	8.20	12.49	0	138.72
		LRT6	LRT	52.23	20.00	12.60	32.60	1	117.73
		BRT2	BRT	56.09	20.00	12.60	32.60	1	121.29
Tysons	Columbia Pike East	NB	Bus	64.29	18.33	8.20	26.53	1	117.35
		TSM	Bus	64.29	18.33	8.20	26.53	1	117.35
		LRT6	LRT	40.79	7.10	10.80	17.90	1	76.59
		BRT2	BRT	49.95	7.66	11.80	19.46	1	88.87
Skyline	Reston	NB	Bus	44.56	8.04	15.20	23.24	1	91.04
		TSM	Bus	52.74	8.75	6.40	15.15	1	83.04
		LRT6	LRT	33.87	8.75	18.40	27.15	1	88.17
		BRT2	BRT	36.82	8.75	18.40	27.15	1	91.12
Springfield	Tysons	NB	Bus	17.92	2.22	12.80	15.02	0	47.96
		TSM	Bus	17.92	2.22	12.80	15.02	0	47.96
		LRT6	LRT	17.86	2.22	12.80	15.02	0	47.96
		BRT2	BRT	17.86	2.22	12.80	15.02	0	47.96

5.4 User Benefits

"User benefits" is a parameter that attempts to capture the overall benefits of each of the alternatives in terms of equivalent travel time. The user benefits for the TSM, BRT (Build Alternative 2), and LRT (Build Alternative 6) Alternatives were evaluated and summarized in Table 1-13. The benefits of the TSM Alternatives were evaluated against the No-Build Alternative, while the BRT and LRT Alternatives were evaluated against the TSM Alternative. The analysis was performed for the year 2040.

Table 1-13 *Daily Hours of User Benefit*

	TSM vs No Build		Alt 2 BRT vs TSM		Alt 6 LRT vs TSM	
Trips	Total Hours	Percent	Total Hours	Percent	Total Hours	Percent
Within Corridor	455	76%	5,738	44%	6,079	44%
Start Inside Corridor & End Outside	63	11%	3,362	26%	3,595	26%
End Inside Corridor & Start Outside	78	13%	3,216	25%	3,453	25%
Outside Corridor	1	0%	630	5%	741	5%
Regional Total	**597**	**100%**	**12,946**	**100%**	**13,868**	**100%**

Compared to the TSM Alternative, Alternative 6 brings close to 1,000 more hours of user benefits, with the largest benefits (44 percent) experienced by travelers whose trips start and end within the corridor. While only 11 percent of the benefits in the TSM Alternative are experienced by trips that start inside the Corridor with destination outside the corridor, this market segment's benefits increase to 26 percent with Alternative 2 and Alternative 6.

5.5 Regionwide VMT and VHT

Vehicle Miles of Travel (VMT) and Vehicle Hours of Travel (VHT) are measures used to evaluate impact of proposed improvement on travel characteristics in the region. Both parameters provide an assessment of the ability of an alternative to address congestion issues. As seen

on Table 1-14, Alternatives 2 and 6 are the most effective in reducing VVMTs in the region, while Alternatives 5 and 6 are the most effective at reducing VHTs.

Table 1-14 *Regionwide Transit Trips, VMT and VHT*

2040	Daily Transit Person Trips			VMT			VHT		
	Regional Total	Change from No Build	Percent Change	Regional Total	Change from No Build	Percent Change	Regional Total	Change from No Build	Percent Change
No Build	1,811,786	-	-	195,222,061	-	-	12,609,278	-	-
TSM	1,812,644	858	0.05%	195,238,412	16,351	0.01%	12,607,088	-2,190	-0.02%
Build Alt 2 (BRT)	1,830,666	18,880	1.04%	195,137,534	-84,527	-0.04%	12,573,249	-36,029	-0.29%
Build Alt 4 (BRT)	1,823,136	11,350	0.63%	195,213,872	-8,189	0.00%	12,589,463	-19,815	-0.16%
Build Alt 5 (BRT)	1,832,095	20,309	1.12%	195,155,132	-66,929	-0.03%	12,568,450	-40,828	-0.32%
Build Alt 6 (LRT)	1,831,860	20,074	1.11%	195,138,781	-83,280	-0.04%	12,569,596	-39,682	-0.31%

5.6 Transit Trips by Travel Market

Table 1-15 compares daily unlinked transit trips for all the alternatives evaluated based on trip origin and destination TAZ. The percentage increase in transit trips as compared to No Build is provided along-side as well. All the Build alternatives show a similar increase in transit trips within the corridor ranging from 21 percent for Alt 4 to 30 percent for Alt 5. Note that Alt 4, which does not provide a connection at East Falls Church Metro, has fewer trips as compared to the other three Build alternatives for trips starting/ending inside corridor & ending/starting outside corridor.

Table 1-15 *Daily Transit Person Trips (Unlinked) by Travel Market*

2040 Trips (Unlinked)	No Build	TSM		Alt 2		Alt 4		Alt 5		Alt 6	
Within Corridor	46,118	46,827	+1.54%	58,931	+27.78%	55,685	+20.74%	60,055	+30.22%	58,393	+26.62%
Start Inside Corridor & End Outside	143,826	143,865	+0.03%	146,517	+1.87%	144,517	+0.48%	146,408	+1.80%	148,012	+2.91%
End Inside Corridor & Start Outside	105,478	105,551	+0.07%	107,246	+1.68%	105,989	+0.48%	107,627	+2.04%	108,289	+2.67%
All Other	1,516,364	1,516,401	+0.00%	1,517,972	+0.11%	1,516,945	+0.04%	1,518,005	+0.11%	1,517,166	+0.05%
Regional Total	1,811,786	1,812,644	+0.05%	1,830,666	+1.04%	1,823,136	+0.63%	1,832,095	+1.12%	1,831,860	+1.11%

5.7 Transfers at East Falls Church Metro Station

East Falls Church Metro Station accounts for about a 25 percent of the total boardings and alightings in the corridor. A detailed analysis shows that most of these (>80%) are transfer trips to and from Metrorail. Build Alt 4, which does not connect to East Falls Church Metro, shows a sharp decline in boardings compared to the Build alternatives which connect to East Falls Church Metro.

A detailed analysis was performed for the transfer trips at East Falls Church Metro Station. More than two-thirds of the transfer trips at EFC serve the demand between southern part of Route 7 corridor and inside the beltline including DC. There are very few trips, less than five percent that transfer at the East Falls Church Metro Station and continue to or from Tysons.

6.0 Summary

The analysis of population and employment data as well as the travel demand forecasts for the 2015 existing conditions and 2040 future conditions with and without proposed transit improvements within the Route 7 Corridor show the following:

- Corridor has high density land use and traffic congestion today and provides opportunity to promote transit oriented development
- Proposed growth along the corridor is very high - especially Tysons and Seven Corners. To accommodate this high growth, improvements to both highway and transit needed.
- Travel demand forecasts show significant increase in average daily boardings and strong demand for enhanced transit in the corridor
- Travel demand forecasts show high number of transfers from East Falls Church (EFC) Metro Station. Highest demand is from southern part of the corridor (Alexandria) to the region's core (DC) through EFC.
- Strong demand for trips within the corridor - north (Tysons) and south (Alexandria).
- With Silver Line Phase 1 in operation, limited demand from north (Tysons) to other Metrorail destinations.

ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Chapter 2: Service Operations Plan

1.0 Introduction

The service operations plan for the *Route 7 Corridor Transit Study* outlines how transit service along the route would function, service headways and also vehicle requirements for the various alternatives under analysis. This chapter includes the definition of alternatives for the six build alternatives and TSM alternative being considered in Phase II of the *Route 7 Corridor Transit Study*. Each alternative description includes a summary of the transit mode, routing, expected travel time, service characteristics and fleet requirements. This chapter also includes the local connecting bus service plan developed for each of the build alternatives.

2.0 Analysis Methodology

For the various build alternatives, travel time estimates and hence round trip travel times were derived using assumptions for the following:

1. Location of exclusive transitway vs. mixed traffic operation
2. Maximize allowable BRT and LRT operating speeds
3. Number and spacing of stations
4. BRT and LRT acceleration and deceleration characteristics
5. Dwell times at stations
6. Delays caused by cross street traffic at major and minor intersections
7. Travel time savings, where transit would interact with general traffic, associated with provision of Business Access and Transit, or BAT lanes (where buses would share a curb lane with right turn traffic), and intersection transit signal priority (TSP).

Table 2-1 shows the assumptions made for each of these characteristics for the build alternatives.

Table 2-1 *Assumptions Used in Build Alternative Travel Time Estimates*

Travel Time Factor	Assumption for Build Alternatives
Maximum transit running speed	Speed limit for exclusive guideway sections
Number and spacing of stations	Varied by alternative
BRT and LRT acceleration and deceleration characteristics	Established power curves for the two modes, given the spacing of stations (varied by alternative)
Dwell times at stations	30 seconds for each station for BRT alternatives. 40 seconds for each station for LRT alternative
Delays from cross street traffic	When stopped, avg. of 84 seconds for major intersections and 48 seconds for minor intersections
Travel time savings with transit priority treatments	10% savings with TSP, 28% savings with BAT lanes

3.0 TSM Alternative

The TSM alternative represents the low-cost alternative for enhancing mobility along the Route 7 corridor. The TSM alternative would enhance existing bus transit service along Route 7 by improving the 28A Metrobus route from all-day, 30-minute headways to all-day 10 to 15-minute headways. The 28X Metrobus route would continue to operate as it does today. In addition, to reduce travel time and improve schedule adherence, transit priority elements at intersections (transit signal priority, queue jumps) would be provided for both the 28A and 28X services to take advantage of priority treatments. The TSM alternative would provide direct transit service between the primary destinations along Route 7 and increase access to the Metrorail system along Route 7 between Tysons and the King Street Metrorail Station. For stops along the 28X service, enhanced passenger amenities (shelters, real-time passenger information, etc.) would also be provided.

The 28A service would operate at 10-minute peak and 15-minute off-peak headways on weekdays and on 15-minute headways on weekends. The span of service for the northern route would mirror that of the existing 28A route service span: 5 AM to 1 AM on weekdays and 6 AM to midnight on weekends. The span of service for the southern route would be from 5 AM to midnight on weekdays and from 6 AM to 11 PM on weekends.

Table 2-2 shows the TSM service characteristics, including travel times and estimated number of vehicles to provide the expanded 28A service.

***Table 2-2** TSM Alternative Service Characteristic*

	Peak Frequency	Off-peak Frequency	Daily service hours	One-way travel time	Cycle time	Peak Vehicles	Total Fleet
TSM Alternative – 28A	10 minutes	15 minutes	20 hours - weekdays 18 hours - weekends	84 minutes	194 minutes	20	24

4.0 Build Alternatives

Six build alternatives, as shown in Figure 2-1, have been evaluated for the Route 7 corridor:

1. BRT from Tysons to Van Dorn Metro via East Falls Church (EFC) Metro
2. BRT from Tysons to Mark Center via EFC Metro
3. BRT from Tysons to Van Dorn Metro w/o EFC Metro
4. BRT from Tysons to Mark Center w/o EFC Metro
5. BRT from Tysons to King Street Metro via EFC Metro
6. LRT from Tysons to Mark Center via EFC Metro

Each alternative is described with respect to route, end to end travel time, service characteristics, mainline fleet requirements, turnaround locations, operations and maintenance facility, and local/feeder bus strategy.

Figure 2-2 shows the assumed station locations for the Route 7 corridor from the Springhill Metrorail Station in the northwest end of the corridor to the King Street Metrorail Station in the southeast end. These station locations were identified through coordination with Fairfax County, City of Falls Church and City of Alexandria staff. There are a total of 19 stations serving major activity centers and residential areas.

The opportunities for enhanced transit implementation within the existing street right-of-way along Route 7 are summarized in Table 2-3 and illustrated in Figures 2-3 and 2-4. The table identifies typical sections for both BRT and LRT operations in the Route 7 corridor. In the Fairfax County section, exclusive lanes in the median are assumed where possible, recognizing that in most locations roadway reconstruction will be needed. Roadway improvements for LRT or BRT along Route 7 through the City of Falls Church are not assumed, and thus LRT or BRT service was assumed to be able to operate in BAT lanes.

Figure 2-4 also shows the planned configuration for the new West End Transitway in which Route 7 LRT service to Mark Center and Route 7 BRT service to Mark Center or the Van Dorn Metrorail Station would operate in the different build alternatives. The figure shows assumed stop locations and segments where dedicated transit lanes would be implemented along the West End Transitway, per current City of Alexandria plans. For those segments in Alexandria that are shown as mixed traffic operations (e.g., King Street and Beauregard to Mark Center), that assumption holds true for the BRT alternatives; however, the LRT alternative assumes an exclusive guideway through these segments.

Figure 2-1 *Route 7 Corridor Transit Study Phase 2 Build Alternatives*

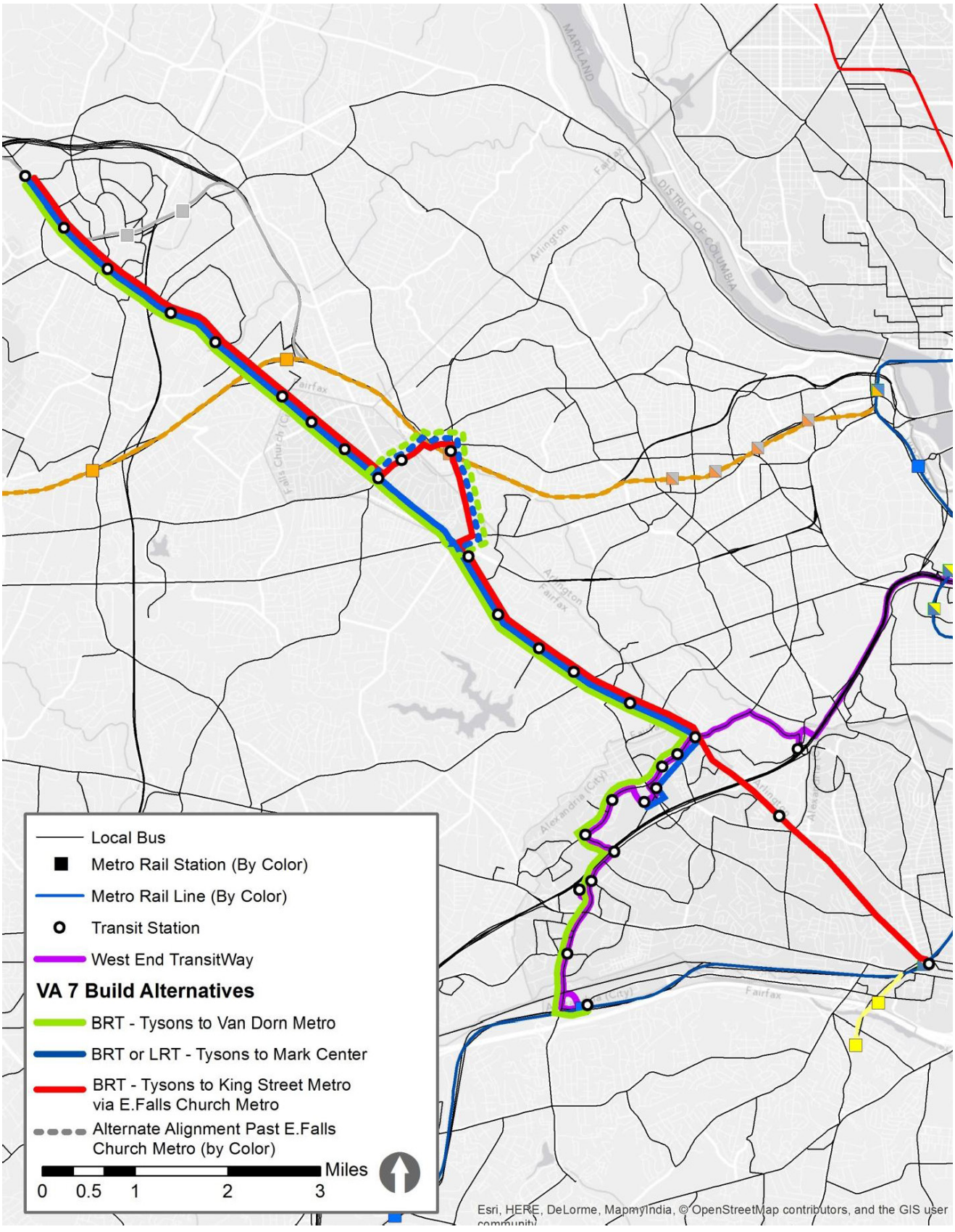


Figure 2-2 *Assumed Station Locations – Route 7 Corridor*

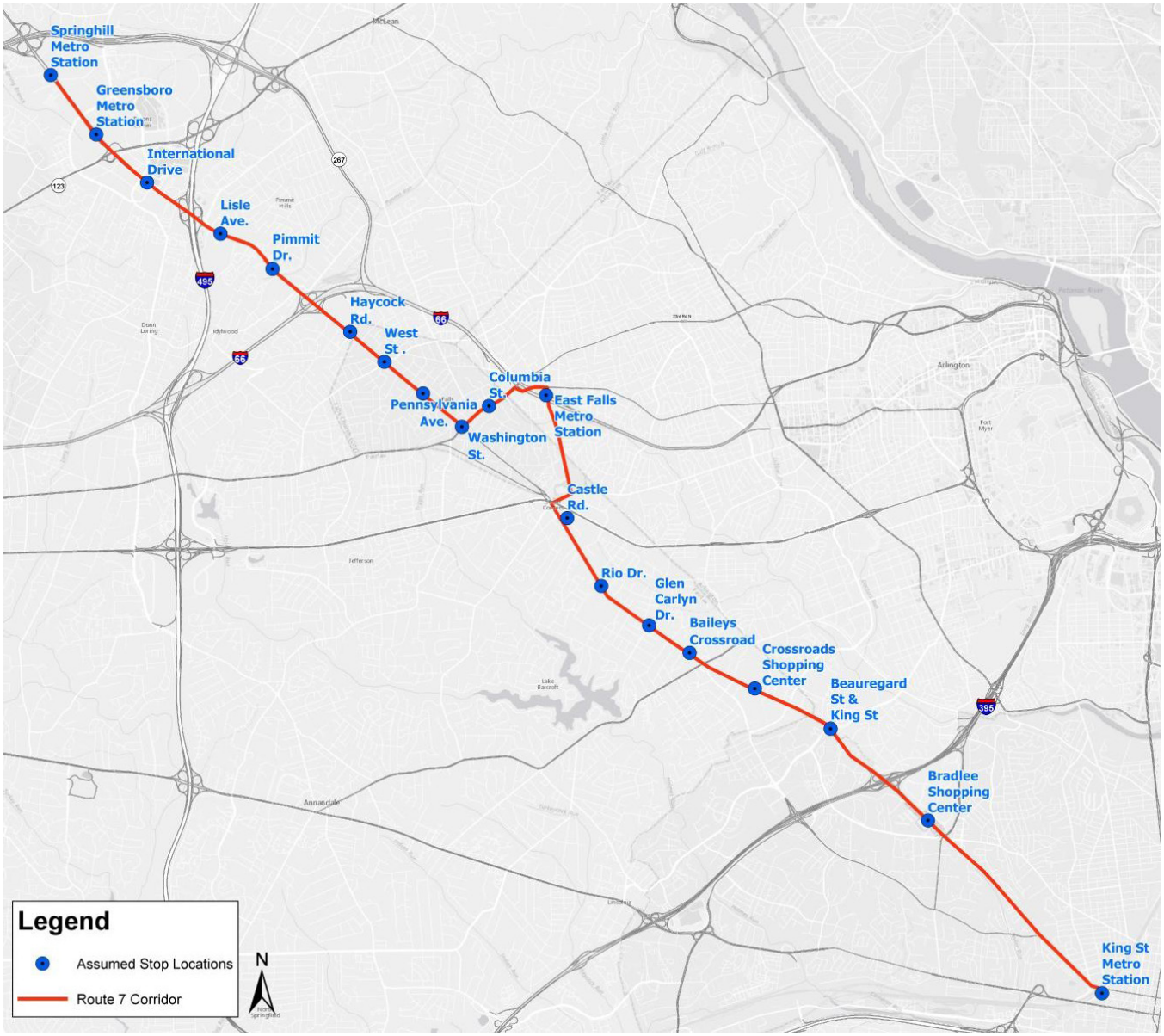


***Table 2-3** Enhanced Transit Opportunities within Route 7 Right-of-Way*

ROUTE 7 - PREMIUM TRANSIT OPPORTUNITIES WITHIN CROSS SECTION									
Route 123 to Beltway	M	TL	TL	TL BRT LRT	M BRT LRT	TL BRT LRT	TL	TL	M
Beltway to Ramada Rd.	TL	TL	TL BRT LRT	M BRT LRT	TL BRT LRT	TL	TL		
Ramada Rd. to Gordon Rd.	TL BRT LRT	TL BRT LRT	M BRT LRT	TL BRT LRT	TL BRT LRT				
Gordon Rd. to West Street.	TL BRT LRT	TL	TWLTL BRT LRT	TL	TL BRT LRT				
West Street. to US 50	TL BRT	TL	TL	TL BRT					
US 50 to Patrick Henry Dr.	M BRT LRT	TL BRT LRT	TL	TL	TL	TL	TL BRT LRT		
Patrick Henry Dr. to Crossroads Circle	M BRT LRT	TL BRT LRT	TL	TWLTL	TL	TL BRT LRT			
Crossroads Circle to Dawes Ave.	TL BRT LRT	TL	TL BRT LRT	M BRT LRT	TL BRT LRT	TL	TL BRT LRT		
Dawes Ave. to Hampton Dr.	TL BRT	TL	TL	TL BRT					
Hampton Dr. to Menakin Rd.	TL BRT	TL	TL BRT	M BRT	TL BRT	TL	TL BRT		
Menakin Rd. to Quaker Ln.	M BRT	TL BRT	TL BRT	M BRT	TL BRT	TL BRT			
Quaker Ln. to Janey's Ln.	TL BRT	TL	TL	TL BRT					
Janey's Ln. to Callahan Dr.	TL BRT	TL BRT							
Callahan Dr. through Metrorail Underpass	TL BRT	TWLTL	TL BRT						
CONNECTION OPTIONS TO EAST FALLS CHURCH									
Washington Street. (US 29)	TL BRT	TL	TL LRT	TL BRT LRT					
Fairfax Dr. (East of US 29)	S BRT LRT								
Roosevelt Blvd.	TL BRT	TL BRT LRT	M BRT LRT	TL BRT LRT	TL BRT				
Wilson Rd.	TL BRT	TL	TWLTL BRT LRT	TL	TL BRT				

LEGEND

TL - Through Lane	BRT/LRT BRT or LRT in Outside Through Lane (Stations Behind Curb); BAT Lane if Local Access Interface
TWLTL - Two-Way Left Turn Lane	BRT/LRT BRT or LRT in Inside Through Lane (Stations In Median)
M - Raised Median	BRT/LRT BRT or LRT with Stations in Median (Some Roadway Widening and Local Access Restrictions Required)
BRT - Bus Rapid Transit	BRT/LRT BRT or LRT with Stations in Frontage Road Median (Some Roadway Widening Required)
LRT - Light Rail Transit	BRT/LRT BRT or LRT in Separate Roadway
S - Separate Roadway	
	Potential Premium Transit Configuration for Ridership and Cost Estimation Purposes

Figure 2-4 *Route 7 Running Way Assumptions – Tysons to Seven Corners*

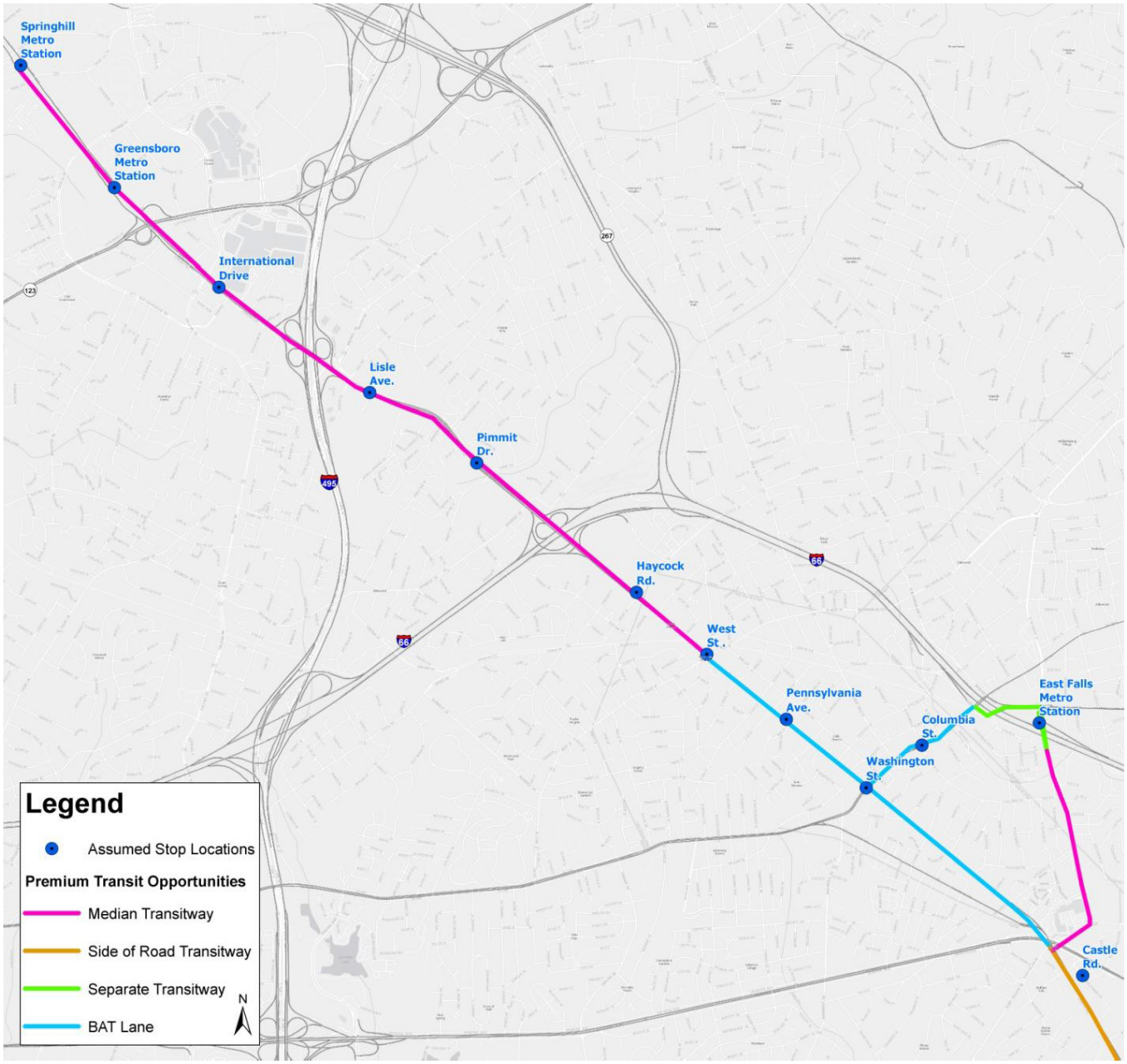
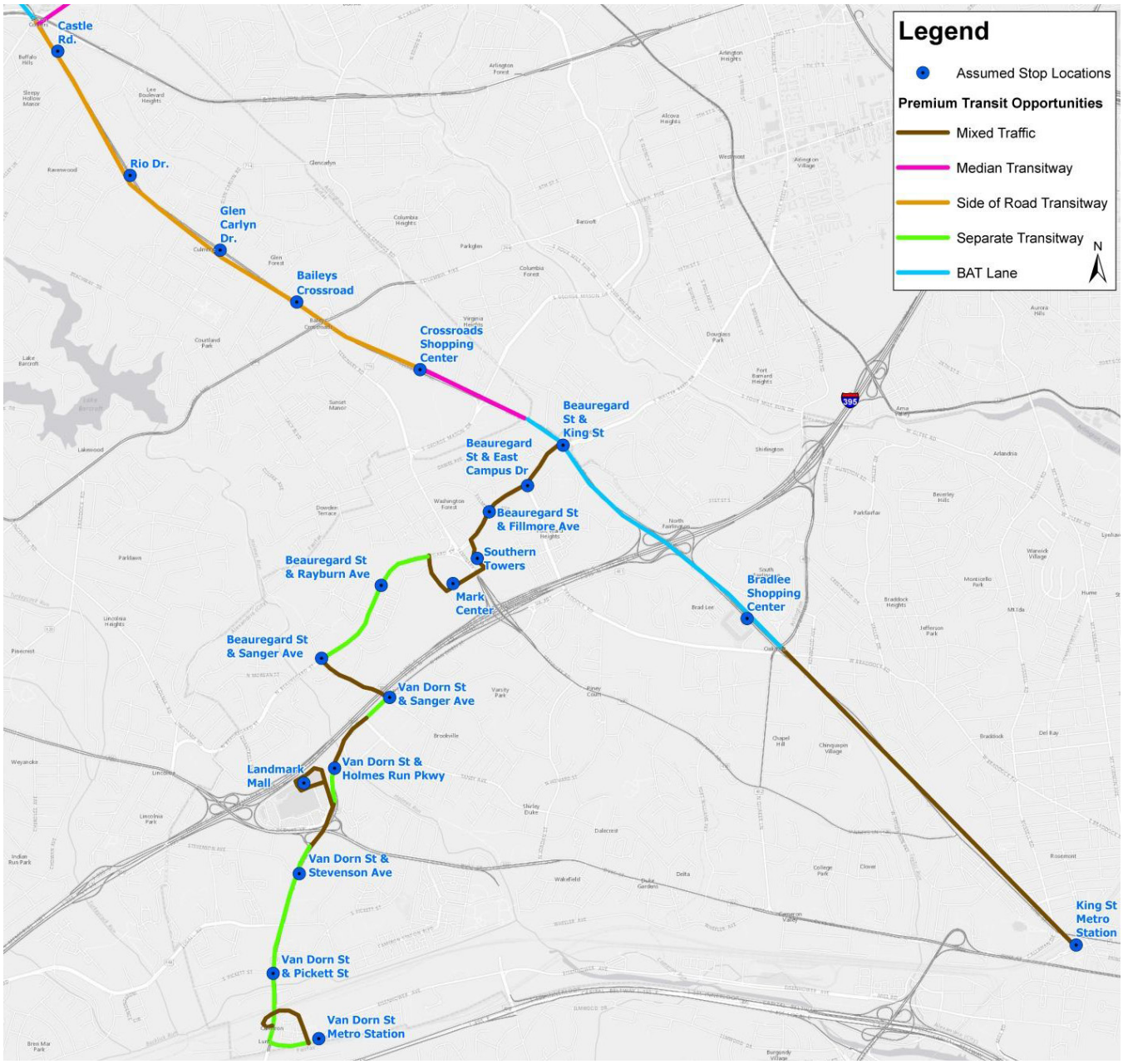


Figure 2-5 *Route 7 Running Way Assumptions – Seven Corners to King Street Metrorail Station and Van Dorn Metrorail Station*



4.1 Build Alternative 1: BRT from Tysons to Van Dorn Metro via East Falls Church Metro

Build Alternative 1 is a Bus Rapid Transit (BRT) alternative from the Spring Hill Metrorail Station in Tysons to the Van Dorn Metrorail Station in Alexandria. This alternative includes a direct connection with the East Falls Church Metrorail Station.

Route

The route for Alternative 1 would originate in the north at the Spring Hill Metrorail Station and follow Route 7/Leesburg Pike south toward North Washington Street. At North Washington Street, the route would turn eastward and follow the roadway toward Fairfax Drive where it would turn south along Fairfax Drive and follow the roadway over I-66 and the Orange Line Metrorail Right- of-Way to join Washington Boulevard. From Washington Boulevard, the route would turn south onto North Sycamore Street where it would directly connect with the East Falls Church Metrorail Station. The route would continue along North Sycamore Street before turning west onto Wilson Boulevard. The route would follow the roadway for less than one mile before re-joining the Route 7/Leesburg Pike Corridor in Seven Corners, turning south to follow the roadway.

The route would continue to follow the Route 7 corridor, continuing onto King Street. As it approaches North Beauregard Street, the route would turn south and operate in the West End Transitway Corridor using Beauregard Street, Sanger Avenue, and Van Dorn Street.

End to End Transit Travel Time

The estimated end to end weekday peak transit travel time for Build Alternative 1 is 67.3 minutes, with an average speed of 16.6 mph. The individual travel times between stations are shown in Table 2-4.

Service Characteristics

The weekday service characteristics for Build Alternative 1 are shown in Table 2-5. The weekday peak and off-peak frequency for this phase of screening is recommended to be 10 minutes peak and 15 minutes off-peak. A total of 22 weekday service hours are recommended, which would allow the service to meet passengers using the last Metrorail trains at the Van Dorn or Spring Hill Stations.

Mainline Fleet Requirement

An estimated weekday peak cycle time of 155 minutes is estimated for Build Alternative 1. This estimate assumes a 67.3 minute one-way travel time plus a 15% recovery/layover time for the line (or 20 minutes for one cycle). As a result, a requirement of 16 peak vehicles would be required in order to maintain a 10-minute frequency on the line. The total fleet is estimated at 20 vehicles assuming a 20% spare ratio.

Table 2-4 Build Alternative 1 Weekday Peak Travel Time: BRT Tysons to Van Dorn Metro via East Falls Church Metro

From	To	Station-to-Station Time (min.)	Distance (mi.)
Spring Hill (Silver Line)	Greensboro (Silver Line)	2.2	0.7
Greensboro (Silver Line)	International Drive	2.5	0.8
International Drive	Lisle Ave	2.9	1.1
Lisle Ave	Pimmit Dr	2.2	0.8
Pimmit Dr	Haycock Rd	3.2	1.2
Haycock Rd	West Street	1.7	0.5
West Street	Pennsylvania Ave	2.5	0.6
Pennsylvania Ave	Washington Street	2.3	0.6
Washington Street	Columbia Street	1.8	0.4
Columbia Street	East Falls Metro Station (Orange Line)	3.1	0.9
East Falls Metro Station (Orange Line)	Castle Rd	3.9	1.7
Castle Rd	Rio Dr	3.0	0.9
Rio Dr	Glen Carlyn Rd	2.2	0.8
Glen Carlyn Rd	Baileys Crossroad	2.0	0.7
Baileys Crossroad	Crossroads Shopping Center	2.3	0.9
Crossroads Shopping Center	Beauregard Street & King Street	3.6	1.0
Beauregard Street & King Street	East Campus Dr & Braddock Rd	1.7	0.3
East Campus Dr & Braddock Rd	Beauregard Street & Fillmore Ave	1.3	0.2
Beauregard Street & Fillmore Ave	Southern Towers	1.5	0.3
Southern Towers	Mark Center	3.0	0.2
Mark Center	Beauregard Street & Rayburn Ave	1.2	0.2
Beauregard Street & Rayburn Ave	Beauregard Street & Sanger Ave	1.1	0.2
Beauregard Street & Sanger Ave	N Van Dorn Street & Sanger	5.0	0.4
N Van Dorn Street & Sanger	Van Dorn & Holmes Run	1.6	0.4
Van Dorn & Holmes Run	Landmark Mall	1.7	0.2
Landmark Mall	Van Dorn Street & Stevenson Ave	2.7	0.9
Van Dorn Street & Stevenson Ave	Van Dorn Street & Pickett Street	2.6	0.9
Van Dorn Street & Pickett Street	Van Dorn Metro (Blue Line)	2.5	0.8
TOTAL UNDER NORMAL CONDITIONS		**67.3**	**18.6**
OPERATING SPEED (mph)		**16.6 mph**	

Table 2-5 Build Alternative 1 Weekday Service Characteristics

	Peak Frequency	Off-peak Frequency	Daily service hours	One-way travel time	Cycle time	Peak Vehicles	Total Fleet
Build Alternative 1: BRT from Tysons to Van Dorn via East Falls Church	10 minutes	15 minutes	22 hours	67.3 minutes	155 minutes	16	20

Turnaround Locations

Turnaround locations for BRT vehicles will be necessary at both the northern and southern ends of the Build Alternative 1 route. At the northern end, BRT vehicles are recommended to use an on-street turnaround alignment consisting of Tyco Road and Spring Hill Road in order to return to Route 7 for the southbound trip. Figure 2-5 shows this potential turnaround loop. A bus bay or off-street layover location for the BRT vehicles would need to be secured at this end of the route.

At the southern end, BRT vehicles would use the turnaround loop in front of the Van Dorn Metrorail Station. Figure 2-6 shows this potential turnaround loop. Autoturn bus templates will be used to determine whether the selected vehicle can make the movements diagrammed.

Figure 2-5 *Proposed Spring Hill Turnaround for Build Alternative 1*

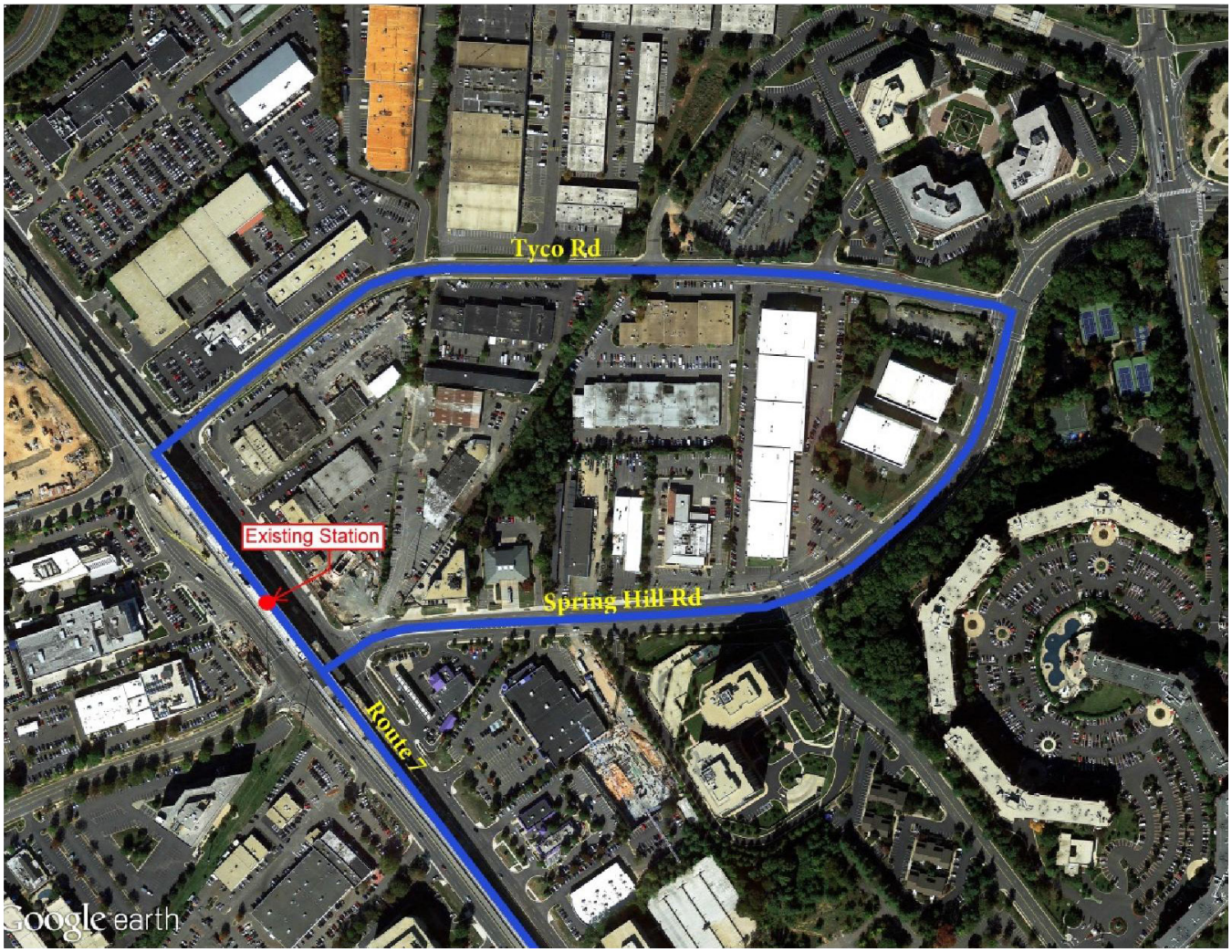
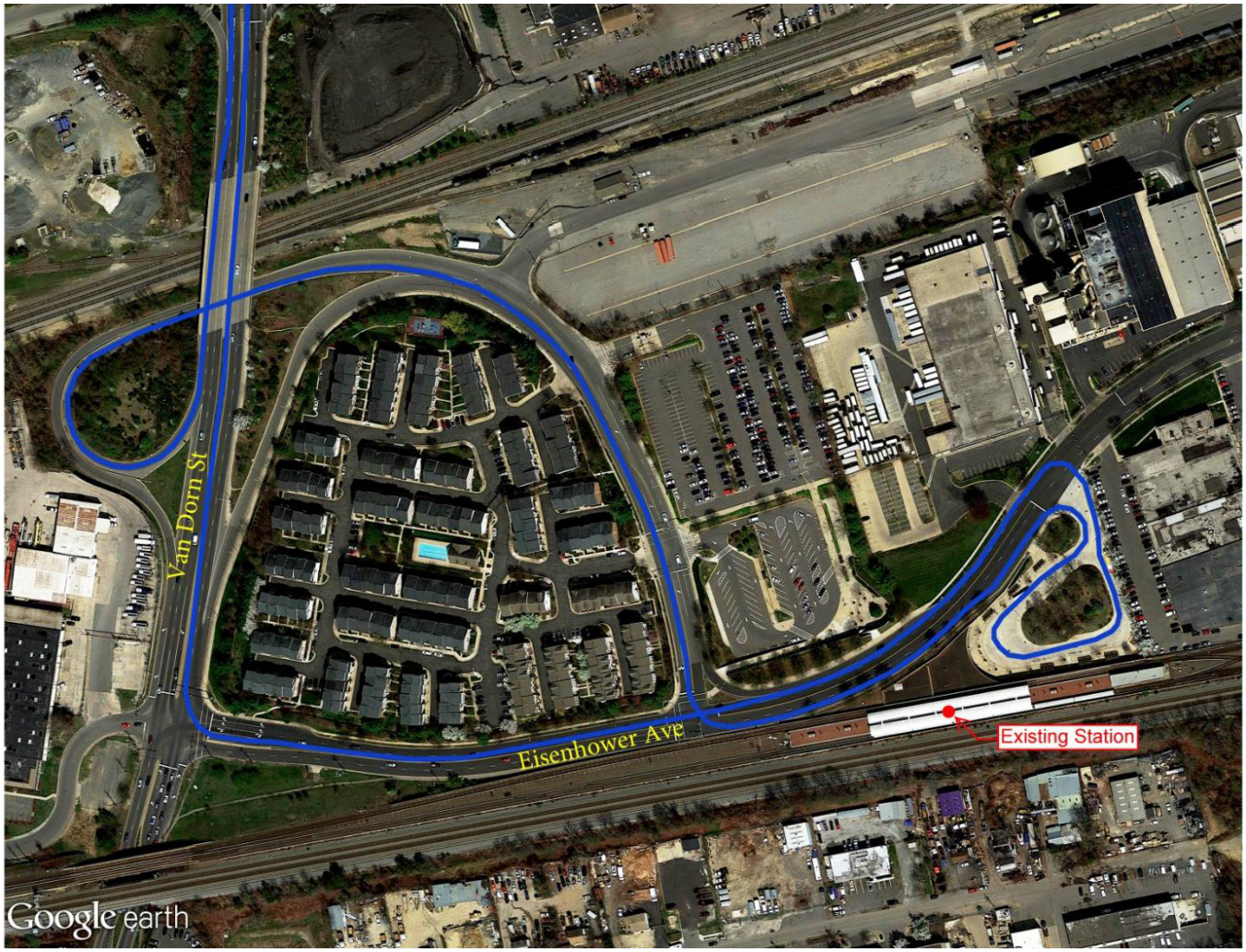


Figure 2-6 Proposed Van Dorn Turnaround for Build Alternative 1



Operations and Maintenance Facility

Operations and maintenance (O&M) facility provisions for Build Alternative 1 will require room for at least 20 BRT vehicles. For such a small number of vehicles, a new facility typically would not be constructed. There are also few locations along Route 7 that are large enough and appropriately zoned to accommodate such a facility. It is possible that the Alternative 1 BRT vehicles could be co-located with another bus garage in Northern Virginia, depending upon the proposed operator of the service, the location of other facilities, the ability to accommodate the selected BRT vehicle, whether the facility has sufficient capacity to accept the 20 additional vehicles, and an operating agreement that allows for this co-use of the facility.

4.2 Build Alternative 2: BRT from Tysons to Mark Center via East Falls Church Metro

Build Alternative 2 is a Bus Rapid Transit (BRT) alternative from the Spring Hill Metrorail Station in Tysons to the Mark Center in Alexandria. This alternative includes a direct connection with the East Falls Church Metrorail Station.

Route

The route for Build Alternative 2 would originate in the north at the Spring Hill Metrorail Station and follow Route 7/Leesburg Pike, south toward North Washington Street. At North Washington Street, the route would turn eastward and follow the roadway toward Fairfax Drive where it turns south along Fairfax Drive and follow the roadway over I-66 and the Orange Line Metrorail right-of-way to join Washington Boulevard. From Washington Boulevard, the route would turn south onto North Sycamore Street where it would directly connect with the East Falls Church Metrorail Station. The route would continue along North Sycamore Street before turning west onto Wilson Boulevard. The

route would follow the roadway for less than one mile before re-joining the Route 7/Leesburg Pike Corridor in Seven Corners, turning south to follow the roadway.

The route would continue to follow the Route 7 corridor, continuing onto King Street. At Beauregard Street, the route would turn south and follow the West End Transitway along Beauregard Street to Mark Center.

End to End Transit Travel Time

The estimated end to end weekday peak transit travel time is 51.9 minutes, with an average speed of 16.8 mph. The individual travel times between stations are shown in Table 2-6.

Service Characteristics

The weekday service characteristics for Build Alternative 2 are shown in Table 2-7. The weekday peak and off-peak frequency for this phase of screening is recommended to be 10 minutes peak and 15 minutes off-peak. A total of 22 weekday service hours are recommended, which would allow the service to meet passengers using the last Metrorail train at the Spring Hill Station.

Mainline Fleet Requirement

An estimated weekday peak cycle time of 113 minutes is estimated for Build Alternative 2. This estimate assumes a 51.9 minute one-way travel time plus a 15% recovery/layover time for the line (or 16 minutes for one cycle). As a result, a requirement of 12 peak vehicles is required in order to maintain a 10 minute frequency on the line. The total fleet is estimated at 15 vehicles assuming a 20% spare ratio.

Turnaround Locations

Turnaround locations for BRT vehicles will be necessary at both the northern and southern ends of the Build Alternative 3 route. At the northern end, the turnaround would be at the Spring Hill Metro Station as illustrated in Figure 2-5. A bus bay or off-street layover location for the BRT vehicles would need to be secured at this end of the route.

At the southern end, the turnaround would be at Mark Center as illustrated in Figure 2-6.

Figure 2-7 *Proposed Mark Center Turnaround for Build Alternative 2*

Table 2-6 Build Alternative 2 Weekday Peak Travel Times: BRT Tysons to Mark Center via East Falls Church Metro

From	To	Station-to-Station Time (min.)	Distance (mi.)
Spring Hill (Silver Line)	Greensboro (Silver Line)	2.2	0.7
Greensboro (Silver Line)	International Drive	2.5	0.8
International Drive	Lisle Ave	2.9	1.1
Lisle Ave	Pimmit Dr	2.2	0.8
Pimmit Dr	Haycock Rd	3.2	1.2
Haycock Rd	West Street	1.7	0.5
West Street	Pennsylvania Ave	2.5	0.6
Pennsylvania Ave	Washington Street	2.3	0.6
Washington Street	Columbia Street	1.8	0.4
Columbia Street	East Falls Metro Station	3.1	0.9
East Falls Metro Station	Castle Rd	3.9	1.7
Castle Rd	Rio Dr	3.0	0.9
Rio Dr	Glen Carlyn Rd	2.2	0.8
Glen Carlyn Rd	Baileys Crossroad	2.0	0.7
Baileys Crossroad	Crossroads Shopping Center	2.3	0.9
Crossroads Shopping Center	Beauregard Street & King Street	3.6	1.0
Beauregard Street & King Street	East Campus Dr & Braddock Rd	1.7	0.3
East Campus Dr & Braddock Rd	Beauregard Street & Fillmore Ave	1.3	0.2
Beauregard Street & Fillmore Ave	Southern Towers	1.5	0.3
Southern Towers	Mark Center	3.0	0.2
TOTAL UNDER NORMAL CONDITIONS		**48.9**	**14.6**
OPERATING SPEED (mph)		**17.9 mph**	

Table 2-7 Build Alternative 2 Weekday Service Characteristics

	Peak Frequency	Off-peak Frequency	Daily service hours	One-way travel time	Cycle time	Peak Vehicles	Total Fleet
Build Alternative 2: BRT from Tysons to Mark Center via East Falls Church	10 minutes	15 minutes	22 hours	48.9 minutes	113 minutes	12	15

Operations and Maintenance Facility

Operations and maintenance (O&M) facility provisions for Build Alternative 2 will require room for at least 15 BRT vehicles. For such a small number of vehicles, a new facility typically would not be constructed. There are also few locations along Route 7 that are large enough and appropriately zoned to accommodate such a facility. It is possible that Alternative 2 BRT vehicles could be co-located with another bus garage in Northern Virginia, depending upon the proposed operator of the service, the location of other facilities, the ability to accommodate the selected BRT vehicle, whether the facility has sufficient capacity to accept the 15 additional vehicles, and an operating agreement that allows for this co-use of the facility.

4.3 Build Alternative 3: BRT from Tysons to Van Dorn Metro w/o East Falls Church Metro

Build Alternative 3 is a Bus Rapid Transit (BRT) alternative from the Spring Hill Metrorail Station in Tysons Corner to the Van Dorn Metrorail Station in Alexandria, without serving the East Falls Church Metrorail Station.

Route

The route would originate in the north at the Spring Hill Metrorail Station and follow Route 7/Leesburg Pike, continuing onto King Street toward North Beauregard Street.

At North Beauregard Street, the route would turn onto the West End Transitway and continue to the Van Dorn Metrorail Station using Beauregard Street, Sanger Avenue, Van Dorn Street, and Eisenhower Avenue.

End to End Transit Travel Time

The estimated end to end weekday peak transit travel time is 67.4 minutes, with an average speed of 15.4 mph. The individual travel times between stations are shown in Table 2-8.

Service Characteristics

The weekday service characteristics for Build Alternative 3 are shown in Table 2-9. The weekday peak and off-peak frequency for this phase of screening is recommended to be 10 minutes peak and 15 minutes off-peak. A total of 22 weekday service hours are recommended, which would allow the service to meet passengers from the last Metrorail trains at the Van Dorn or Spring Hill Stations.

Mainline Fleet Requirement

An estimated weekday peak cycle time of 156 minutes is estimated for Build Alternative 3. This estimate assumes a 67.4 minute one-way travel time plus a 15% recovery/layover time for the line (or 20 minutes for one cycle). As a result, a requirement of 16 peak vehicles is required to maintain a 10 minute frequency on the line. The total fleet is estimated at 20 vehicles assuming a 20% spare ratio.

Turnaround Locations

Turnaround locations for BRT vehicles will be necessary at both the northern and southern ends of the Build Alternative 3 route. At the northern end, the turnaround would be at the Spring Hill Metro station as illustrated in Figure 2-5. A bus bay or off-street layover location for the BRT vehicles would need to be secured at this end of the route.

At the southern end, the turnaround would be at the Van Dorn Metro station as illustrated in Figure 2-6.

Table 2-8 Build Alternative 3 Weekday Peak Travel Times: BRT Tysons to Van Dorn Metro w/o East Falls Church Metro

From	To	Station-to-Station Time (min.)	Distance (mi.)
Spring Hill (Silver Line)	Greensboro (Silver Line)	2.2	0.7
Greensboro (Silver Line)	International Drive	2.5	0.8
International Drive	Lisle Ave	2.9	1.1
Lisle Ave	Pimmit Dr	2.2	0.8
Pimmit Dr	Haycock Rd	3.2	1.2
Haycock Rd	West Street	1.7	0.5
West Street	Pennsylvania Ave	2.5	0.6
Pennsylvania Ave	Washington Street	2.3	0.6
Washington Street	Castle Rd	8.9	1.7
Castle Rd	Rio Dr	3.0	0.9
Rio Dr	Glen Carlyn Rd	2.2	0.8
Glen Carlyn Rd	Baileys Crossroad	2.0	0.7
Baileys Crossroad	Crossroads Shopping Center	2.3	0.9
Crossroads Shopping Center	Beauregard Street & King Street	3.6	1.0
Beauregard Street & King Street	East Campus Dr & Braddock Rd	1.7	0.3
East Campus Dr & Braddock Rd	Beauregard Street & Fillmore Ave	1.3	0.2
Beauregard Street & Fillmore Ave	Southern Towers	1.5	0.3
Southern Towers	Mark Center	3.0	0.2
Mark Center	Beauregard Street & Rayburn Ave	1.2	0.2
Beauregard Street & Rayburn Ave	Beauregard Street & Sanger Ave	1.1	0.2
Beauregard Street & Sanger Ave	N Van Dorn Street & Sanger	5.0	0.4
N Van Dorn Street & Sanger	Van Dorn & Holmes Run	1.6	0.4
Van Dorn & Holmes Run	Landmark Mall	1.7	0.2
Landmark Mall	Van Dorn Street & Stevenson Ave	2.7	0.9
Van Dorn Street & Stevenson Ave	Van Dorn Street & Pickett Street	2.6	0.9
Van Dorn Street & Pickett Street	Van Dorn Metro	2.5	0.8
TOTAL UNDER NORMAL CONDITIONS		**67.4**	**17.3**
OPERATING SPEED (mph)		**15.4 mph**	

Table 2-9 Build Alternative 3 Weekday Service Characteristics

	Peak Frequency	Off-peak Frequency	Daily service hours	One-way travel time	Cycle time	Peak Vehicles	Total Fleet
Build Alternative 3: BRT from Tysons to Van Dorn w/o East Falls Church Metro	10 minutes	15 minutes	22 hours	67.4 minutes	156 minutes	16	20

Operations and Maintenance Facility

Operations and maintenance (O&M) facility provisions for Build Alternative 3 will require room for at least 20 BRT vehicles. For such a small number of vehicles, a new facility typically would not be constructed There are also few locations along Route 7 that are large enough and appropriately zoned to accommodate such a facility. It is possible that the Alternative 3 BRT vehicles could be co-located with another bus garage in Northern Virginia, depending upon the proposed operator of the service, the location of other facilities, the ability to accommodate the selected BRT vehicle, whether the facility has sufficient capacity to accept the 20 additional vehicles, and an operating agreement that allows for this co-use of the facility.

4.4 Build Alternative 4: BRT from Tysons to Mark Center w/o East Falls Church Metro

Build Alternative 4 is a Bus Rapid Transit (BRT) alternative from the Spring Hill Metrorail Station in Tysons Corner to Mark Center in Alexandria. This alternative would not serve the East Falls Church Metrorail Station.

Route

The route for Build Alternative 4 would originate in the north at the Spring Hill Metrorail Station and follow Route 7/Leesburg Pike, south toward North Washington Street. At North Washington Street, the route would turn eastward and follow the roadway toward Fairfax Drive where it would turn south along Fairfax Drive and follows the roadway over I-66 and the Orange Line Metrorail right-of-way to join Washington Boulevard. From Washington Boulevard, the route would follow the Route 7/Leesburg Pike Corridor, turning south to follow the roadway.

The route would continue to follow the Route 7 corridor, continuing onto King Street. At Beauregard Street, the route would turn south and follow the West End Transitway and Beauregard Street to Mark Center.

End to End Transit Travel Time

The estimated end to end weekday peak transit travel time is 48.2 minutes, with an average speed of 16.5 mph. The individual travel times between stations are shown in Table 2-10.

Service Characteristics

The weekday service characteristics for Build Alternative 4 are shown in Table 2-11. The weekday peak and off-peak frequency for this phase of screening is recommended to be 10 minutes peak and 15 minutes off-peak. A total of 22 weekday service hours are recommended, which would allow the service to meet passengers using the last Metrorail train at the Spring Hill station.

Table 2-10 Build Alternative 4 Weekday Peak Travel Times: BRT Tysons to Mark Center w/o East Falls Church Metro

From	To	Station-to-Station Time (min.)	Distance (mi.)
Spring Hill (Silver Line)	Greensboro (Silver Line)	2.2	0.7
Greensboro (Silver Line)	International Drive	2.5	0.8
International Drive	Lisle Ave	2.9	1.1
Lisle Ave	Pimmit Dr	2.2	0.8
Pimmit Dr	Haycock Rd	3.2	1.2
Haycock Rd	West Street	1.7	0.5
West Street	Pennsylvania Ave	2.5	0.6
Pennsylvania Ave	Washington Street	2.3	0.6
Washington Street	Castle Rd	8.9	1.7
Castle Rd	Rio Dr	3.0	0.9
Rio Dr	Glen Carlyn Rd	2.2	0.8
Glen Carlyn Rd	Baileys Crossroad	2.0	0.7
Baileys Crossroad	Crossroads Shopping Center	2.3	0.9
Crossroads Shopping Center	Beauregard Street & King Street	3.6	1.0
Beauregard Street & King Street	East Campus Dr & Braddock Rd	1.7	0.3
East Campus Dr & Braddock Rd	Beauregard Street & Fillmore Ave	1.3	0.2
Beauregard Street & Fillmore Ave	Southern Towers	1.5	0.3
Southern Towers	Mark Center	3.0	0.2
TOTAL UNDER NORMAL CONDITIONS		**49.0**	**13.3**
OPERATING SPEED (mph)		**16.3 mph**	

Mainline Fleet Requirement

An estimated cycle time of 113 minutes is estimated for Build Alternative 4. This estimate assumes a 49.0 minute one-way travel time plus a 15% recovery/layover time for the line (or 14 minutes for one cycle). As a result, a requirement of 12 peak vehicles is required in order to maintain a 10 minute frequency on the line. The total fleet is estimated at 15 vehicles assuming a 20% spare ratio.

Table 2-11 Build Alternative 4 Weekday Service Characteristics

	Peak Frequency	Off-peak Frequency	Daily service hours	One-way travel time	Cycle time	Peak Vehicles	Total Fleet
Build Alternative 4: BRT from Tysons to Mark Center	10 minutes	15 minutes	22 hours	49.0 minutes	113 minutes	12	15

Turnaround Locations

Turnaround locations for BRT vehicles will be necessary at both the northern and southern ends of the Build Alternative 3 route. At the northern end, the turnaround would be at the Spring Hill Metro station as illustrated in Figure 2-5. A bus bay or off-street layover location for the BRT vehicles would need to be secured at this end of the route.

At the southern end, the turnaround would be at Mark Center as illustrated in Figure 2-7.

Operations and Maintenance Facility

Operations and maintenance (O&M) facility provisions for Build Alternative 4 will require room for at least 15 BRT vehicles. For such a small number of vehicles, a new facility typically would not be constructed There are also few locations along Route 7 that are large enough and appropriately zoned to accommodate such a facility. It is possible that instead, the Alternative 4 BRT vehicles could be co-located with another bus garage in Northern Virginia, depending upon the proposed operator of the service, the location of other facilities, the ability to accommodate the selected BRT vehicle, whether the facility has sufficient capacity to accept the 15 additional vehicles, and an operating agreement that allows for this co-use of the facility.

4.5 Build Alternative 5: BRT from Tysons to King Street Metro via East Falls Church Metro

Build Alternative 5 is a Bus Rapid Transit (BRT) alternative from the Spring Hill Metrorail Station in Tysons Corner to the King Street Metrorail Station in Alexandria. Build Alternative 5 includes a direct connection with the East Falls Church Metrorail Station.

Route

The route for Alternative 5 originates in the north at the Spring Hill Metrorail Station on the Silver Line and follows Route 7/Leesburg Pike, south toward North Washington Street. At North Washington Street, the route turns eastward and follows the roadway toward Fairfax Drive where it turns south along Fairfax Drive and follows the roadway over I-66 and the Orange Line Metrorail Right-of-Way to join Washington Boulevard. From Washington Boulevard, the route turns south onto North Sycamore Street where it will directly connect with the East Falls Church Metrorail Station. The route continues along North Sycamore Street before turning west onto Wilson Boulevard. The route follows the roadway for less than one mile before re-joining the Route 7/Leesburg Pike Corridor in Seven Corners, turning south to follow the roadway, continuing onto King Street to its terminus at the King Street Metrorail Station in Alexandria.

End to End Transit Travel Time

The estimated end to end weekday peak transit travel time is 64.0 minutes, with an average speed of 16.9 mph. The individual travel times between stations are shown in Table 2-12.

Table 2-12 Build Alternative 5 Weekday Peak Travel Times: BRT Tysons to King Street Metro via East Falls Church Metro

From	To	Station-to-Station Time (min.)	Distance (mi.)
Spring Hill (Silver Line)	Greensboro (Silver Line)	2.2	0.7
Greensboro (Silver Line)	International Drive	2.5	0.8
International Drive	Lisle Ave	2.9	1.1
Lisle Ave	Pimmit Dr	2.2	0.8
Pimmit Dr	Haycock Rd	3.2	1.2
Haycock Rd	West Street	1.7	0.5
West Street	Pennsylvania Ave	2.5	0.6
Pennsylvania Ave	Washington Street	2.3	0.6
Washington Street	Columbia Street	1.8	0.4
Columbia Street	East Falls Metro Station	3.1	0.9
East Falls Metro Station	Castle Rd	3.9	1.7
Castle Rd	Rio Dr	3.0	0.9
Rio Dr	Glen Carlyn Rd	2.2	0.8
Glen Carlyn Rd	Baileys Crossroad	2.0	0.7
Baileys Crossroad	Crossroads Shopping Center	2.3	0.9
Crossroads Shopping Center	Beauregard Street & King Street	3.6	1.0
Beauregard Street & King Street	Bradlee Shopping Center	5.3	1.6
Bradlee Shopping Center	King Street Metro Station	17.3	2.9
TOTAL UNDER NORMAL CONDITIONS		**64.0**	**18.1**
OPERATING SPEED (mph)		**16.9 mph**	

Service Characteristics

The weekday service characteristics for Build Alternative 5 are shown in Table 2-13. The weekday peak and off-peak frequency for this phase of screening (pending analysis of ridership volumes) is recommended to be 10 minutes peak and 15 minutes off-peak. A total of 22 weekday service hours are recommended, which would allow the service to meet passengers from the last Metrorail trains at the King Street, East Falls Church, or Spring Hill Stations.

Table 2-13 Build Alternative 5 Service Characteristics

	Peak Frequency	Off-peak Frequency	Daily service hours	One-way travel time	Cycle time	Peak Vehicles	Total Fleet
Build Alternative 5: BRT from Tysons to King Street via East Falls Church	10 minutes	15 minutes	22 hours	64.0 minutes	148 minutes	15	18

Mainline Fleet Requirement

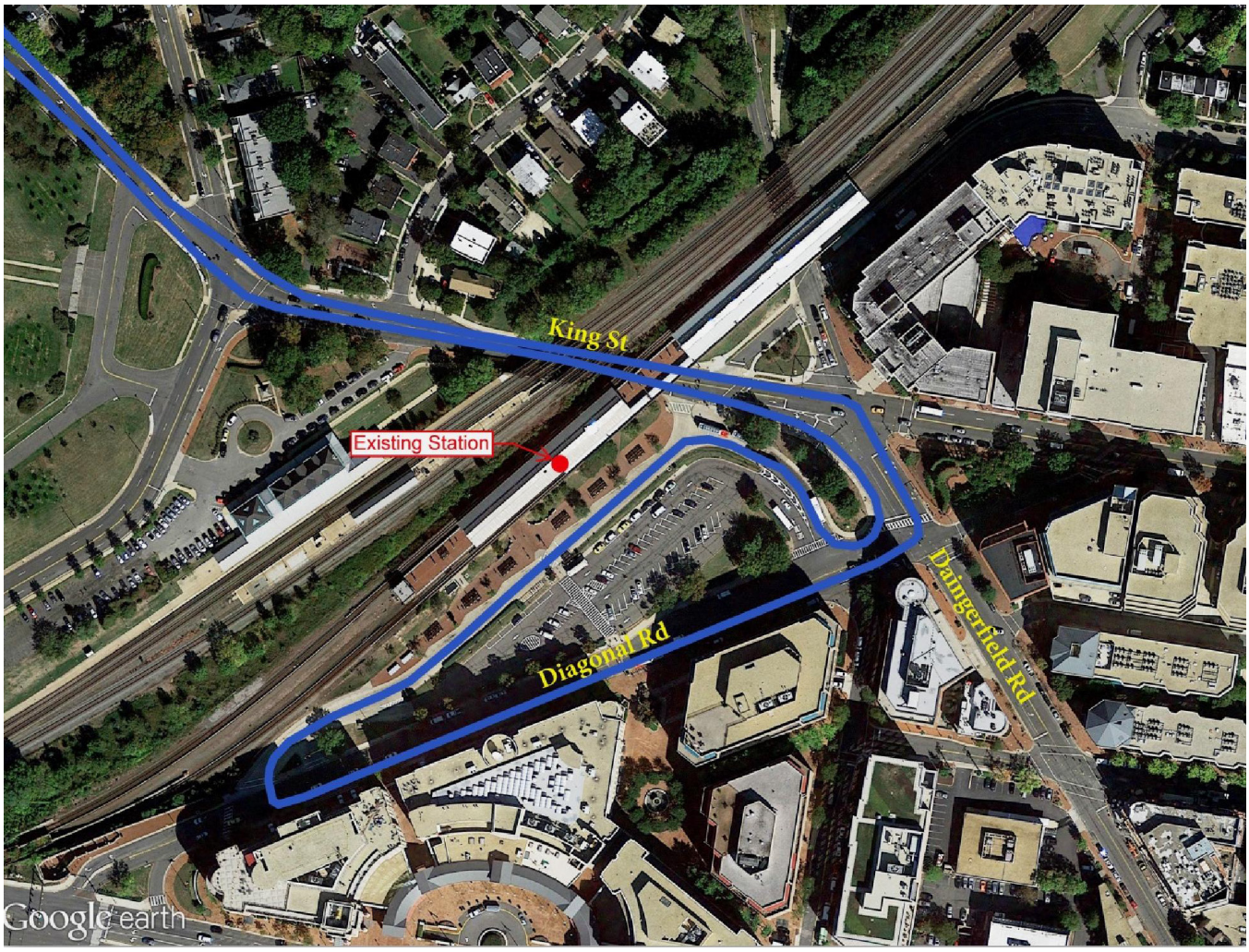
An estimated weekday peak cycle time of 148 minutes is estimated for Build Alternative 5. This estimate assumes a 64.0 minute one-way travel time plus a 15% recovery/layover time for the line (or 19 minutes for one cycle). As a result, a requirement of 15 peak vehicles is required to maintain a 10 minute frequency on the line. A total fleet of 18 vehicles is estimated assuming a 20% spare ratio.

Turnaround Locations

Turnaround locations for BRT vehicles will be necessary at both the northern and southern ends of the Build Alternative 6 route. A bus bay or off-street layover location for the BRT vehicles would need to be secured at this end of the route.

At the southern end, BRT vehicles will be able to use the turnaround loop in front of the King Street-Old Town Metrorail Station. Figure 2-8 shows this turnaround loop. Auto turn bus templates will be used to determine whether the selected vehicle can make the movements diagrammed.

Figure 2-8 *Proposed King Street Turnaround for Build Alternative 5*



Operations and Maintenance Facility

Operations and maintenance (O&M) facility provisions for Build Alternative 5 will require room for at least 18 BRT vehicles. For such a small number of vehicles, a new facility typically would not be constructed. There are also few locations along Route 7 that are large enough and appropriately zoned to accommodate such a facility. It is possible that the Alternative 5 BRT vehicles could be co-located with another bus garage in Northern Virginia, given the proposed operator of the service, the location of other facilities, the ability to accommodate the selected BRT vehicle, whether the facility has sufficient capacity to accept the 18 additional vehicles, and an operating agreement that allows for this co-use of the facility.

4.6 Build Alternative 6: LRT from Tysons to Mark Center via East Falls Church Metro

Build Alternative 6 is a light rail alternative from the Spring Hill Metrorail Station in Tysons on the Silver Line to Mark Center in Alexandria. Alternative 6 includes a direct connection with the East Falls Church Station.

Route

The route for Build Alternative 6 would originate in the north at the Spring Hill Metrorail Station and follow Route 7/Leesburg Pike, south toward North Washington Street. At North Washington Street, the route would turn eastward and follow the roadway toward I-66, where it would turn south along a new alignment on the north side of I-66 to access the East Falls Church Metrorail Station. The route would then

turn south onto North Sycamore Street where it would directly connect with the East Falls Church Metrorail Station. The route would continue along North Sycamore Street before turning west onto Wilson Boulevard. The route would follow the roadway for less than one mile before re-joining the Route 7/Leesburg Pike Corridor in Seven Corners, turning south to follow the roadway.

The route would continue to follow the Route 7 corridor, continuing onto King Street. At Beauregard Street, the route would turn south and follow Beauregard Street utilizing the West End Transitway to Mark Center.

End to End Transit Travel Time

The estimated weekday peak end to end transit travel time is 42.4 minutes, with an average speed of 20.6 mph. The individual travel times between stations are shown in Table 2-14.

Table 2-14 *Build Alternative 6 Weekday Travel Times: LRT - Tysons to Mark Center via East Falls Church Metro*

From	To	Station-to-Station Time (min.)	Distance (mi.)
Spring Hill (Silver Line)	Greensboro (Silver Line)	2.0	0.7
Greensboro (Silver Line)	International Drive	2.3	0.8
International Drive	Lisle Ave	2.7	1.1
Lisle Ave	Pimmit Dr	2.0	0.8
Pimmit Dr	Haycock Rd	2.9	1.2
Haycock Rd	West Street	1.5	0.5
West Street	Pennsylvania Ave	1.7	0.6
Pennsylvania Ave	Washington Street	2.1	0.6
Washington Street	Columbia Street	1.4	0.4
Columbia Street	East Falls Metro Station	2.8	0.9
East Falls Metro Station	Castle Rd	3.7	1.7
Castle Rd	Rio Dr	2.8	0.9
Rio Dr	Glen Carlyn Rd	2.0	0.8
Glen Carlyn Rd	Baileys Crossroad	1.8	0.7
Baileys Crossroad	Crossroads Shopping Center	2.1	0.9
Crossroads Shopping Center	Beauregard Street & King Street	3.3	1.0
Beauregard Street & King Street	East Campus Dr & Braddock Rd	1.2	0.3
East Campus Dr & Braddock Rd	Beauregard Street & Fillmore Ave	1.4	0.2
Beauregard Street & Fillmore Ave	Southern Towers	1.2	0.3
Southern Towers	Mark Center	1.4	0.2
TOTAL UNDER NORMAL CONDITIONS		**42.6**	**14.6**
OPERATING SPEED (mph)		**20.6 mph**	

Service Characteristics

The weekday service characteristics for Alternative 6 are shown in Table 2-15. The weekday peak and off-peak frequency for this phase of screening is recommended to be 10 minutes peak and 15 minutes off-peak. A total of 22 weekday service hours are recommended, which would allow the light rail service to meet passengers using the last Metrorail trains at the East Falls Church or Spring Hill stations.

Table 2-15 Build Alternative 6 Weekday Service Characteristics

	Peak Frequency	Off-peak Frequency	Daily service hours	One-way travel time	Cycle time	Peak Trains	Total Fleet Size
Build Alternative 6: LRT from Tysons to Van Dorn via East Falls Church	10 minutes	15 minutes	22 hours	42.6 minutes	98 minutes	10	12

Mainline Fleet Requirement

An estimated weekday peak cycle time of 98 minutes is estimated for Build Alternative 6. This estimate assumes a 42.6 minute one-way travel time plus a 15% recovery/layover time for the line (or 13 minutes for one cycle). As a result, a requirement of 10 peak trains is required to maintain a 10 minute frequency on the line. A total fleet of 12 vehicles is also estimated. The total fleet size was calculated based on an assumed 20% spare ratio and one light rail vehicle per train. If either of these assumptions changes in the future, then the total fleet size would need to be recalculated.

Turnaround Locations

This light rail alternative would most likely not require a turnaround loop. If two-way light rail vehicles are selected, then the driver of each train would switch ends at the terminal in order to operate the train in the opposite direction. If the light rail vehicle selected has only a single cab, then this assumption would need to be revisited.

Operations and Maintenance Facility

The operations and maintenance (O&M) facility for Build Alternative 6, with storage and repair facilities room for at least 12 light rail vehicles, is expected to be 82,800 square feet. There are few locations along Route 7 that are large enough and appropriately zoned to accommodate such a facility. It is possible that instead of developing a new O&M facility, the Alternative 6 O&M facility could be co-located with another light rail service (or even shared with a bus garage) in Northern Virginia, depending on the location of the other facility, the type of LRT vehicle selected, and an operating agreement that allows for this co-use of the facility.

5.0 Local Bus Service Modifications

5.1 Introduction

This section summarizes recommendations for modifications to local bus service within the sphere of influence of the Route 7 corridor transit alternatives. The recommended modifications have been developed to support the enhanced Route 7 transit service alternatives. Recommendations are made for each of the six build alternatives under consideration. The six alternatives under consideration are as follows:

1. BRT from Tysons to Van Dorn Metro via East Falls Church (EFC) Metro
2. BRT from Tysons to Mark Center via EFC Metro
3. BRT from Tysons to Van Dorn Metro w/o EFC Metro
4. BRT from Tysons to Mark Center w/o EFC Metro
5. BRT from Tysons to King Street Metro via EFC Metro
6. LRT from Tysons to Mark Center via EFC Metro

The objectives in developing local bus service modifications for the different build alternatives include:

- Improve connections between existing bus service and proposed BRT/LRT stations to improve system connectivity
- Reduce duplication of service along the Route 7 corridor between local bus service and proposed BRT/LRT service
- Shift resources from eliminated, reduced, or truncated routes to other similar routes in order to improve coverage, frequency, or span and improve access to the corridor
- Minimize negative impact to existing transit-users whenever possible
- Maintain or improve current levels of transit service for neighborhoods in the study area

5.2 Methodology

In order to develop recommendations for adjustments to local bus service, a holistic and comprehensive evaluation of 112 local bus routes from four 4 different transit agencies that transect or interact with the Route 7 corridor was undertaken. The first step in this process was a thorough review and cataloguing of the existing conditions data collected in Phase I of this study. All local bus data (headways, span) was then updated in a comprehensive database that includes all of the routes interacting with the corridor from all jurisdictions.

To identify the local bus routes that could be impacted by the Route 7 transitway, GIS was utilized to identify all bus routes which intersect or operate within a half mile of each of the Build Alternatives. Each route was then evaluated based on its current alignment, frequency, and span to develop a plan that identifies how they can be coordinated to provide a family of services that meet the needs of all transit users in the corridor. Recommendations under consideration included route adjustments to increase system connectivity and serve proposed BRT/LRT stations, increases in service (headway, span), truncating or eliminating routes, and reductions in service to reduce redundancy.

Recent ridership data at both the route-level and stop-level was analyzed in the evaluation of all recommendations. Previous plans and studies which have made recommendations for routes in the study area that would likely have an impact on the Route 7 transitway were also evaluated. The overarching goal of the recommendations that modify existing transit services is to leverage connectivity and maximize benefit across systems.

Once these recommendations have been finalized with the TAC the consultant team will evaluate the expected level of activity at each BRT/LRT station and make recommendations regarding the size of the facility and amenities offered at each.

5.3 Previous Relevant Studies

There were three previous studies whose recommendations we adopted in this study in order to ensure consistency across reports.

- City of Alexandria Transitway Corridor Feasibility Study, October 2012
- East Falls Church Metrorail Station Bus Facility Study, February 2015
- City of Alexandria Analysis and Environmental Assessment (AA/EA) for the West End Transitway, ongoing
  - The City has previously identified the DASH 1, 3, 7, Metrobus 7C, 7M, and ART 87X as routes that will need to be adjusted or eliminated once the West End Transitway is operational. However, the details regarding these adjustments have not yet been finalized and are not incorporated into this report at this time.

The East Falls Church Metrorail Station Bus Facility Study includes several short-term local bus route recommendations for both WMATA and ART service that are described below.

Metrobus Service Enhancements

Over the next several years improvements to WMATA Metrobus service at East Falls Church are recommended to accommodate the increase in transit demand, as shown in Table 2-16. The majority of the added service will be express bus service connecting East Falls Church to Downtown Washington, DC during peak periods.

Table 2-16 *Metrobus Proposed Service Enhancements*

Route	Description	Scheduled Implementation
2Y	Add a new route with a proposed weekday limited stop route with 30 minute headways. The bus would stop at East Falls Church, Ballston, and McPherson Square.	2015
3Y	Extend existing route which currently serves Lee Highway to Farragut Square during peak periods.	2015
3Y	Add a skip stop route to East Falls Church during peak hours.	2018
15M	Route will be discontinued, per WMATA and Fairfax County DOT	2015/2016

ART Service Enhancements

There are also additional improvements proposed for the ART bus service to the East Falls Church facility, as shown in Table 2-17. Most of the changes add or increase Saturday ART service on existing routes. In 2017, ART will add a new route, Route 44, connecting East Falls Church to parts of Arlington not served by Metrorail.

***Table 2-17** ART Proposed Service Enhancements*

Route	Description	Scheduled Implementation
Route 52	Add Saturday service 6:30 AM to 7:00 PM with 60 minute frequency.	2016
Route 53	Add Saturday service 6:30 AM to 7:00 PM with 60 minute frequency.	2016
Route 53	Split the route into two separate routes with coordinated arrivals at the Madison Center.	2018
Route 44	Add a new weekday route with 30-minute peak frequencies. It will connect East Falls Church to Shirlington and Dominion Hills.	2017

These proposed changes are relatively minor, and although they will improve local bus service to the East Falls Church Metrorail Station, are not expected to impact the Route 7 alternatives.

5.4 Current Level of Service

112 local bus routes from four different transit agencies transect or interact with the Route 7 corridor.

- 79 WMATA Metrobus routes (including alternative alignments of the same general route)
- 19 Fairfax County Connector
- 10 Alexandria Transit DASH
- 4 Arlington Transit

WMATA is the primary provider of bus transit in and around the Route 7 corridor. As a result, most of the proposed changes in this report impact WMATA routes, rather than Fairfax County, Arlington County, and Alexandria transit routes. The majority of Fairfax County Connector buses included in this report serve either the northern or southern portions of the corridor, but do not travel the entirety of the corridor. The northern routes provide bus access to Tysons while the southern routes serve the Van Dorn Street corridor or access Washington, D.C. via Interstate 395. As such, impacts to the Fairfax County Connector system are minimal.

5.5 Local Service Plans for Build Alternatives

Build Alternative 1: BRT from Tysons to Van Dorn Metro via East Falls Church Metro

Table 2-18 summarizes the local bus recommendations for Alternative 1.

***Table 2-18** Build Alternative 1 Local Bus Service Recommendations*

Route	Agency	Recommendation
1A	WMATA	• **Alignment: No change** is recommended for the alignment • **Level of service:** Once the Route 7 Transitway is operational, demand for access to the corridor will likely increase. As a result, WMATA should consider decreasing headways in off- peak hours from 30 minutes to 20 minutes.
1B	WMATA	• **Alignment: No change** is recommended for the alignment • **Level of service:** Once the Route 7 Transitway is operational, demand for access to the corridor will likely increase. As a result, WMATA should consider decreasing headways in off- peak hours from 30 minutes to 20 minutes.
2T	WMATA	• **Alignment: Minor adjustment.** The current 2T route runs along Chain Bridge Road, across Route 7, and terminates at the Tysons Corner Metrorail Station. WMATA should consider altering the route slightly to connect with the Greensboro Metrorail Station, before continuing on to Tysons. This will provide a direct connection between the 2T and the Route 7 Transitway, while still maintaining access to the Silver Line. (See Figure 9 for reference) • **Level of service:** No change.

***Table 2-18** Build Alternative 1 Local Bus Service Recommendations (cont'd.)*

Route	Agency	Recommendation
3A	WMATA	• **Alignment: No change** is recommended for the alignment. • **Level of service:** Current service is primarily between the East Falls Church and the Rosslyn Metrorail Stations with limited extended service to Annandale during peak hours between 20-60 minutes for a total of only 4 trips. Service during off-peak hours is 60 minutes. • In December 2015/January 2016, the portion of the 3A route between East Falls Church and Rosslyn was converted to a new route operated by Arlington Transit, the ART 55. • The 3A will remain in service, but will only run between East Falls Church and Annandale. • It is recommended that the frequency of the 3A be increased to every 15 minutes during peak periods and 30 minutes during non-peak periods in order to improve access to the Route 7 Transitway.
7C	WMATA	• **Alignment: Eliminate route.** • Per the City of Alexandria's West End Transitway study, the 7C would be replaced by new transitway service along Beauregard Street and I-395. (See Figure 10 for reference)
7F	WMATA	• **Alignment: Eliminate route.** • **Level of service:** Dedicate additional resources to the 7A in order to maintain current level of service. Riders will still have direct access to the Pentagon and Pentagon Metrorail Station via the remaining 7 line buses. Riders in the southern portion of the route will also continue to be served by DASH Routes 1 and 2. (See Figures 11 and 12 for reference)
7M	WMATA	• **Alignment: Eliminate route.** • Per the City of Alexandria's West End Transitway study, the 7M shuttle between the Mark Center and the Pentagon would be eliminated.
28A	WMATA	• **Alignment: No change** is recommended for the alignment. • **Level of service:** Although there is significant overlap between the 28A and the proposed Route 7 Transitway, the 28A provides the high level of local access some users require with a much higher stop density when compared to BRT. The transitway will attract some of the 28A's ridership, but there will likely still be a demand for the 28A's type of service. As a result, WMATA should consider maintaining the 28A, but reduce its frequency from every 20 minutes to 30 minutes. *(See Figure 14 for reference)*
28X	WMATA	• **Alignment: Eliminate route.** • The 28X is a peak-period only express service between Tysons Corner and the Mark Center. The Route 7 Transitway would duplicate the 28X's service, thus rendering it unnecessary. As a result, the 28X should be eliminated.[1]
109	FCC	• **Alignment: No change** is recommended for the alignment. • **Level of service:** The current route operates between the Van Dorn Street and Huntington Metrorail Stations every 30 minutes during peak hours, 60 minutes during off-peak hours, and 60 minutes on Saturdays. Once the Route 7 Transitway is operational, demand for access to the corridor will likely increase. The frequency of service should be increased from 60 minutes to 30 minutes during off-peak hours.
321/322	FCC	• **Alignment: No change** is recommended for the alignment. • **Level of service:** The current route operates between the Van Dorn Street and Franconia- Springfield Metrorail Stations every 30 minutes during peak hours, 60 minutes during off-peak hours, and 60 minutes on weekends. Once the Route 7 Transitway is operational, demand for access to the corridor will likely increase. The frequency of service should be increased from 60 minutes to 30 minutes during off-peak hours.
45	ART	• **Alignment: Minor adjustment.** • The ART 45 currently runs between Rosslyn Metrorail Station and the Arlington County Department of Human Services via Columbia Pike, but stops just short of the Route 7 corridor. Extending the route a short distance would provide a direct connection to the transitway and improve access to Route 7 for ART 45 users. *(See Figure 14 for reference)*

[1] Note that the Washington Headquarters Services is in discussion with WMATA regarding defunding a portion of the 28X's trips. Of the 43 trips that run Monday-Friday during peak hours (eastbound and westbound), 21 will potentially be defunded.

Figure 2-9 *Route 2T*

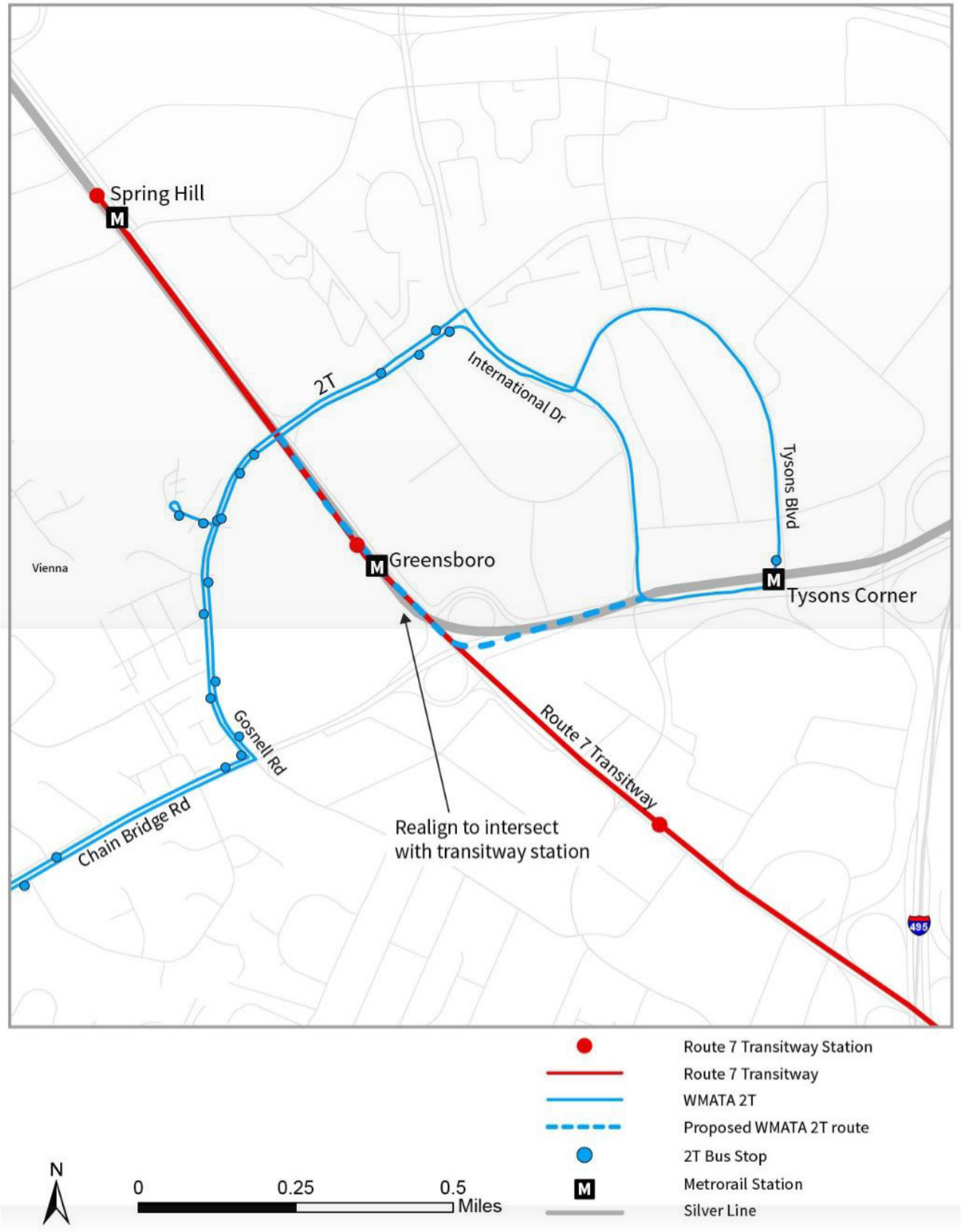


Figure 2-10 *Route 7C Ridership by Stop*

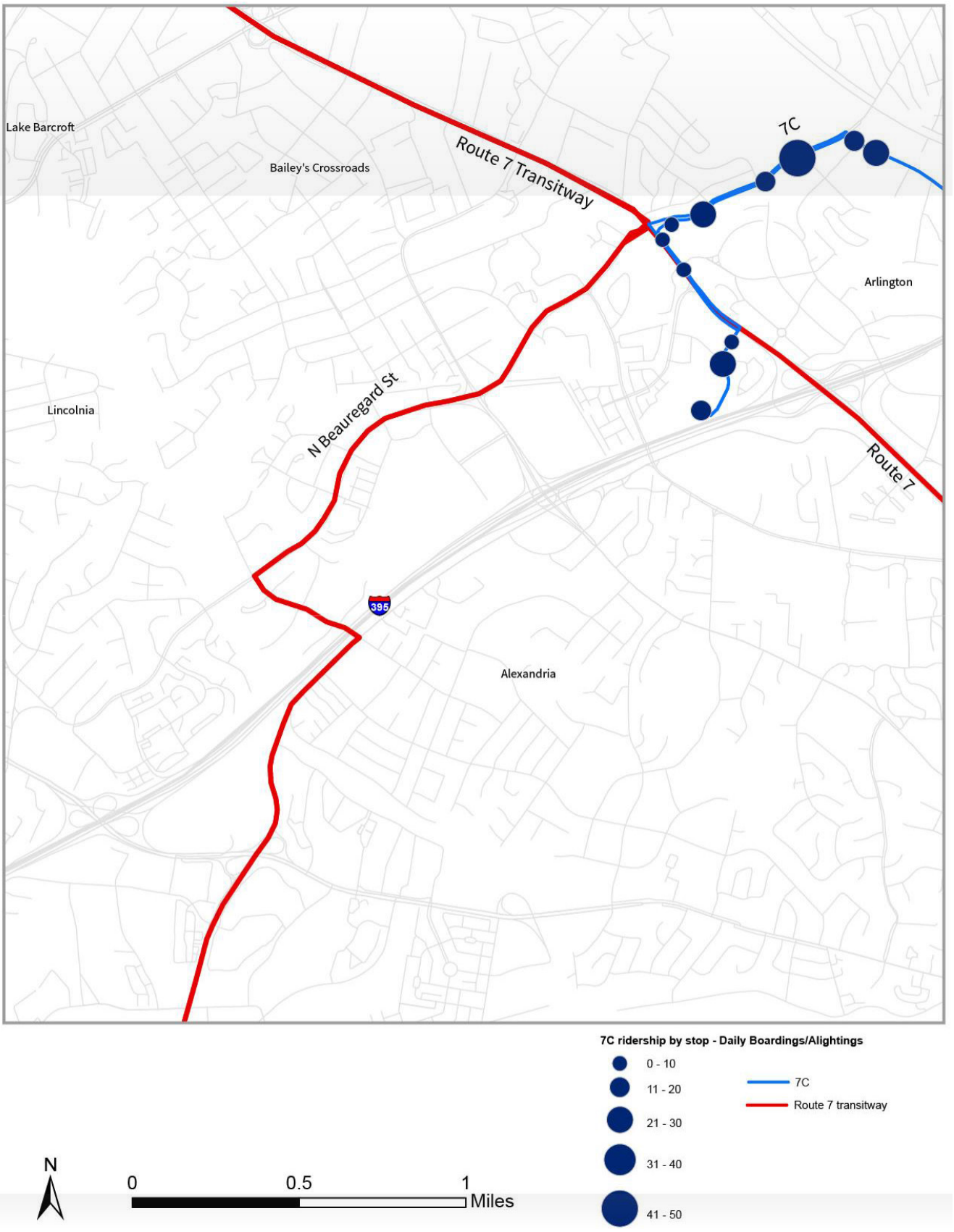


Figure 2-11 *Route 7F*

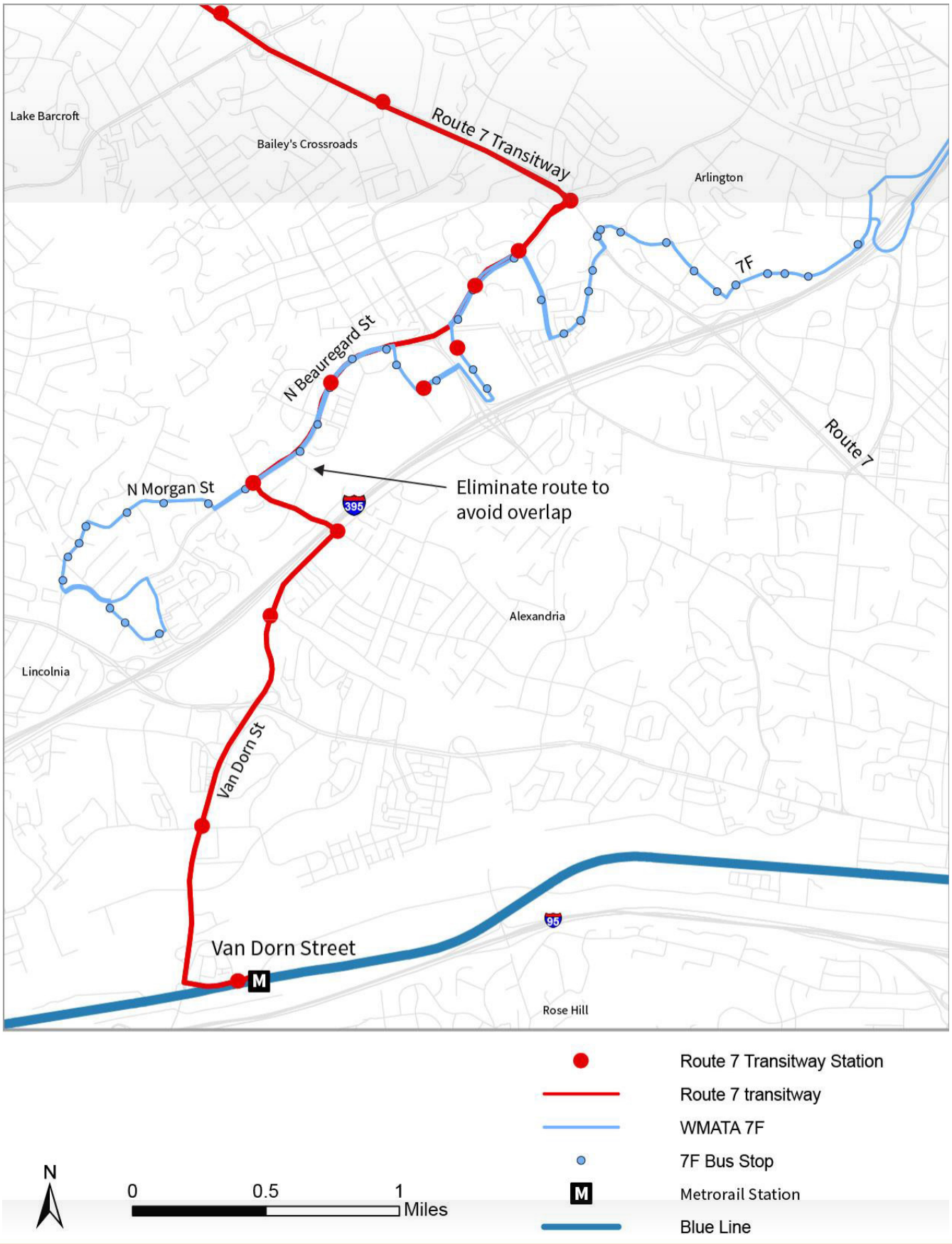


Figure 2-12 *Route 7F Ridership by Stop*

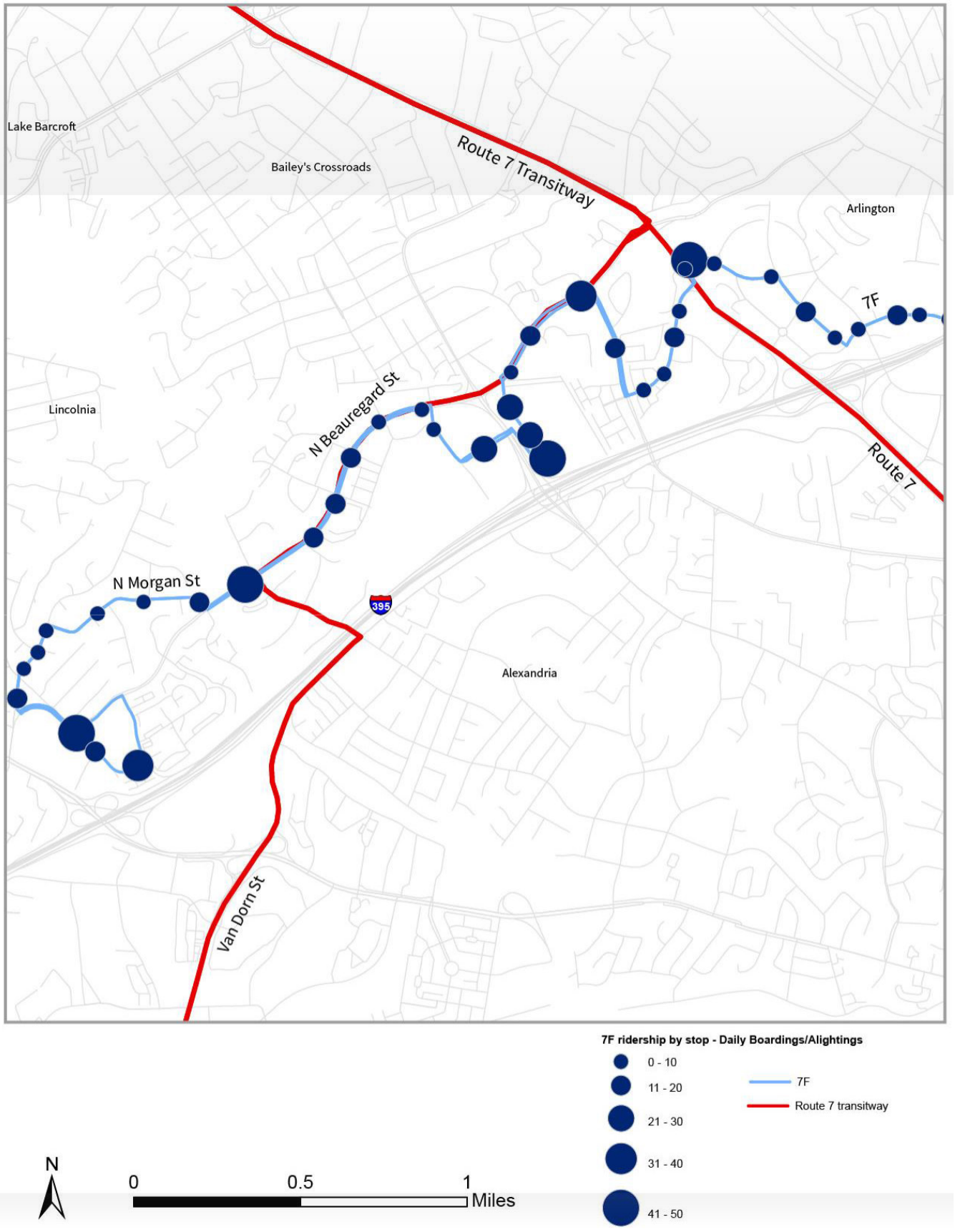


Figure 2-13 *Route 28X Ridership by Stop*

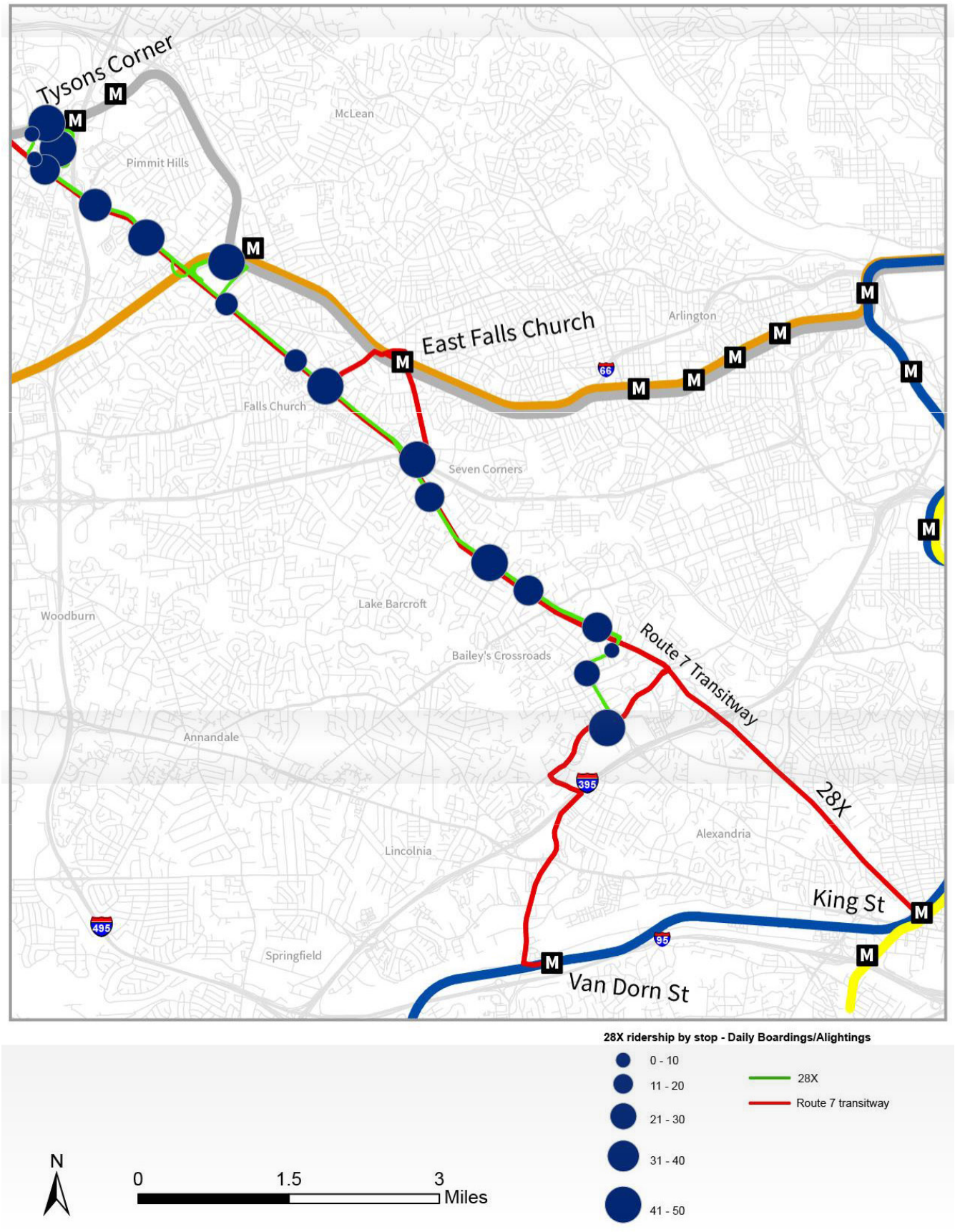
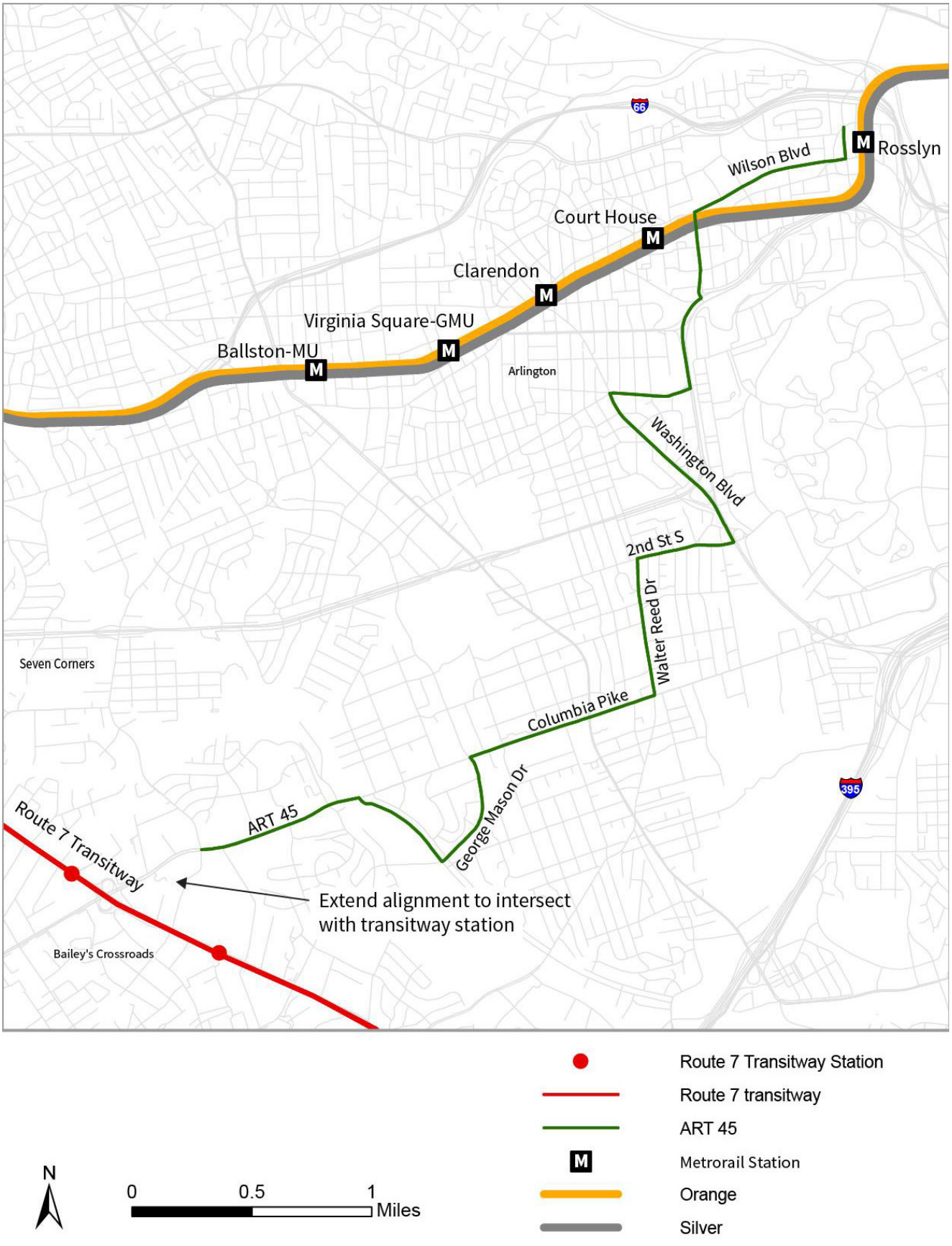


Figure 2-14 *Route ART 45*



Build Alternative 2: BRT Tysons to Mark Center via East Falls Church Metro

The local bus service recommendations for Build Alternative 2 are identical to Build Alternative 1, please refer to Table 2-18.

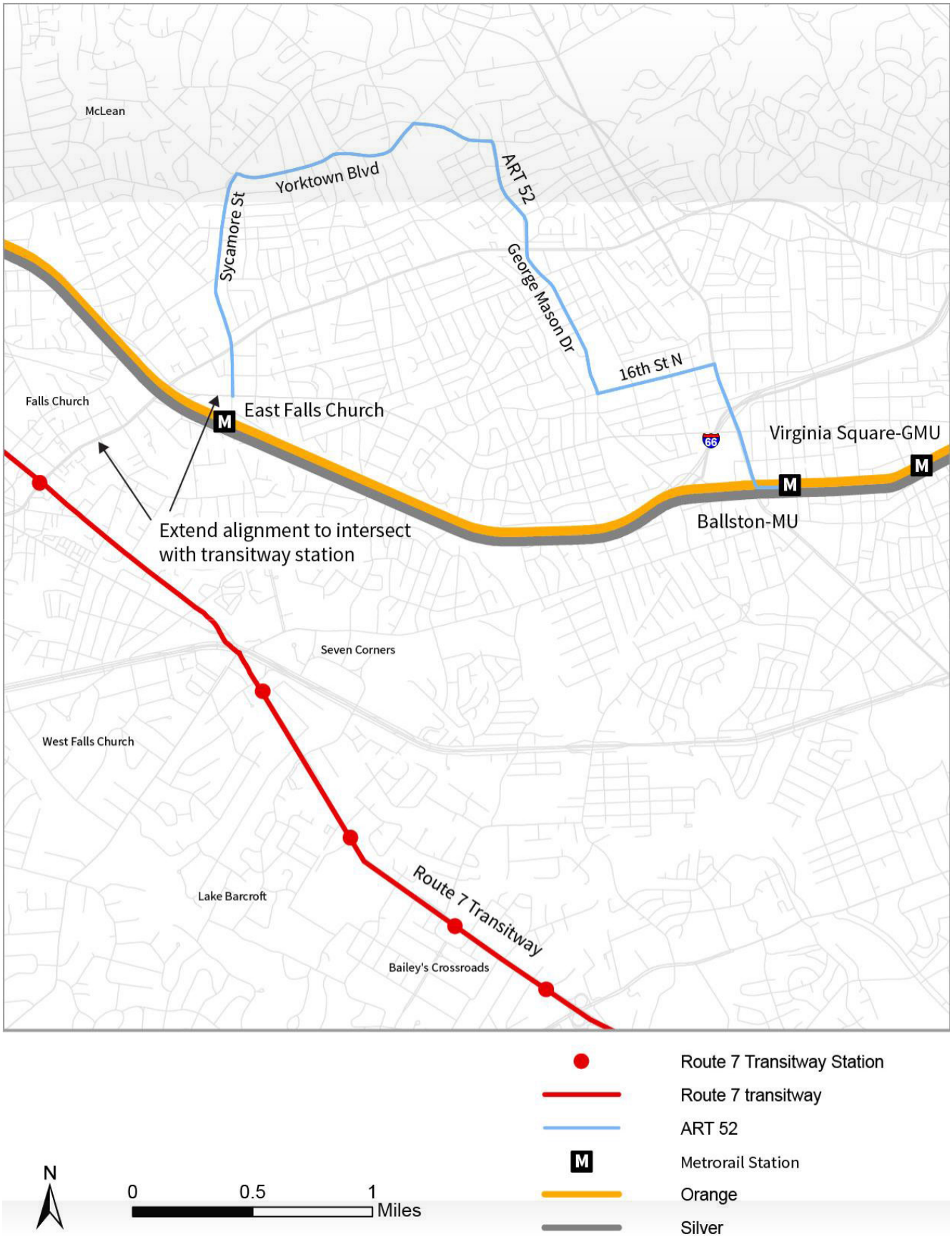
Build Alternative 3: BRT from Tysons to Van Dorn Metro w/o East Falls Church Metro

The recommendations for Build Alternative 3 are nearly identical to Build Alternatives 1 and 2 (please refer to Table 2-18). However, in addition to the recommendations shown in Table 2-18, there is one additional recommendation, shown below in Table 2-19.

Table 19 *Build Alternative 3 Local Bus Service Recommendations in Addition to Table 18*

Route	Agency	Recommendation
52	ART	• **Alignment: Minor adjustment.** • The ART 52 is a feeder route serving the Ballston and East Falls Church Metrorail Stations. Arlington County should consider extending the ART 52 to connect with the Route 7 Transitway. *(See Figure 15 for reference)*

Figure 2-15 *Route ART 52*



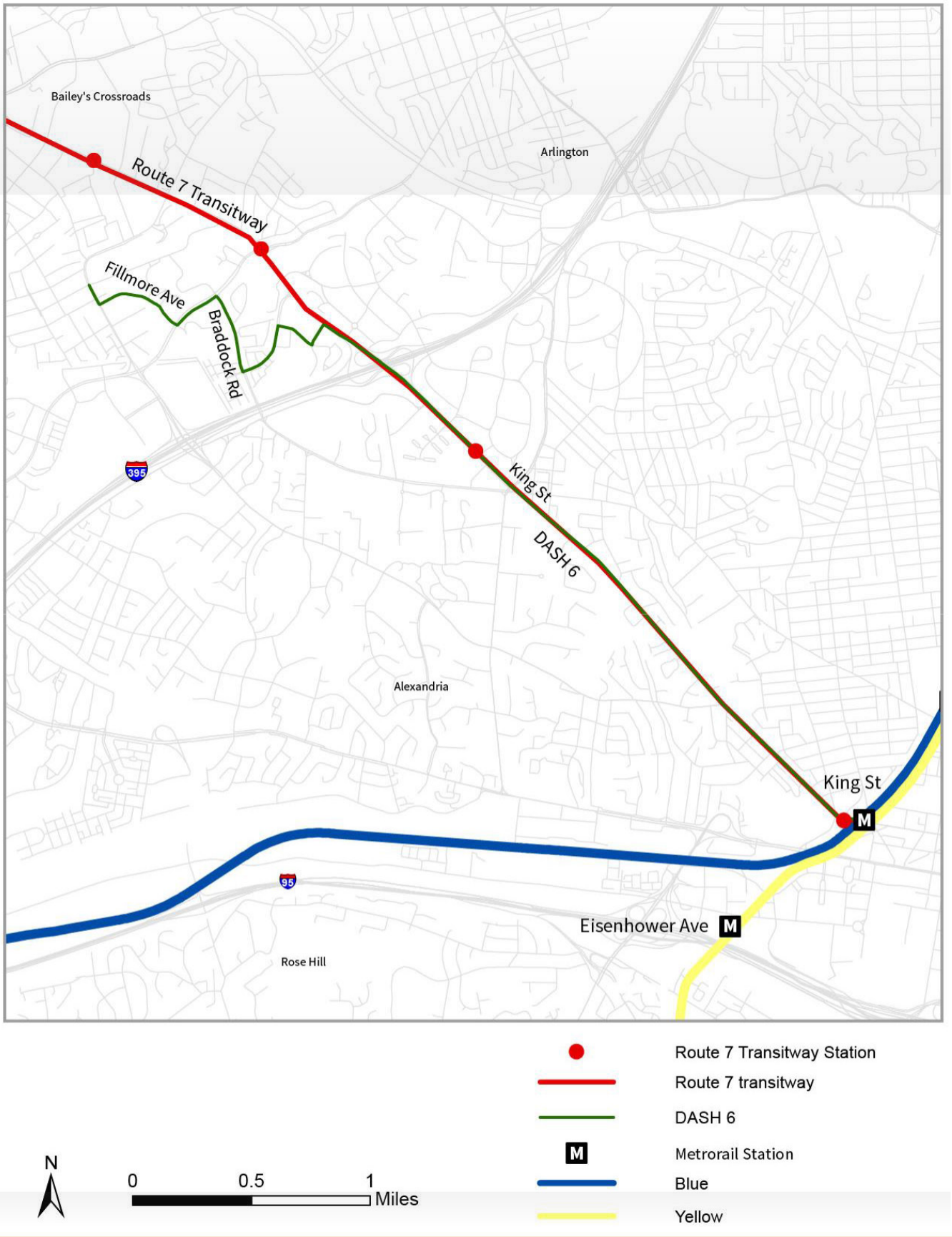
Build Alternative 4: BRT from Tysons to Mark Center w/o East Falls Church Metro

The local bus service recommendations for Build Alternative 4 are identical to Build Alternatives 1 and 2 (please refer to Table 2-18).

Build Alternative 5: BRT from Tysons to King Street Metro via East Falls Church Metro

The local bus service recommendations for Build Alternative 5 are identical to Build Alternatives 1, 2, and 4 (refer to Table 18). The DASH AT-6 has a significant amount of overlap with the Build Alternative 5 alignment. DASH has indicated, however, that this route is an important connection between the King Street Metrorail Station and the Alexandria campus of the Northern Virginia Community College (NVCC). Given the high number of students using the AT-6 to access NVCC, eliminating the AT-6, despite the significant overlap with Alt 5, is not recommended at this time. The City may wish to reexamine the potential to eliminate the AT-6 after BRT service opens, as the nearest planned stop will be less than one-half-mile from the center of campus.

Figure 2-16 *DASH Route AT 6*



Build Alternative 6: LRT Transit from Tysons to Mark Center via East Falls Church Metro

The local bus service recommendations for Build Alternative 6 are identical to Build Alternatives 1, 2, and 4 (please refer to Table 18).

6.0 2040 Bus Route Diagrams

Figure 2-17 *No Build and TSM Alternative*

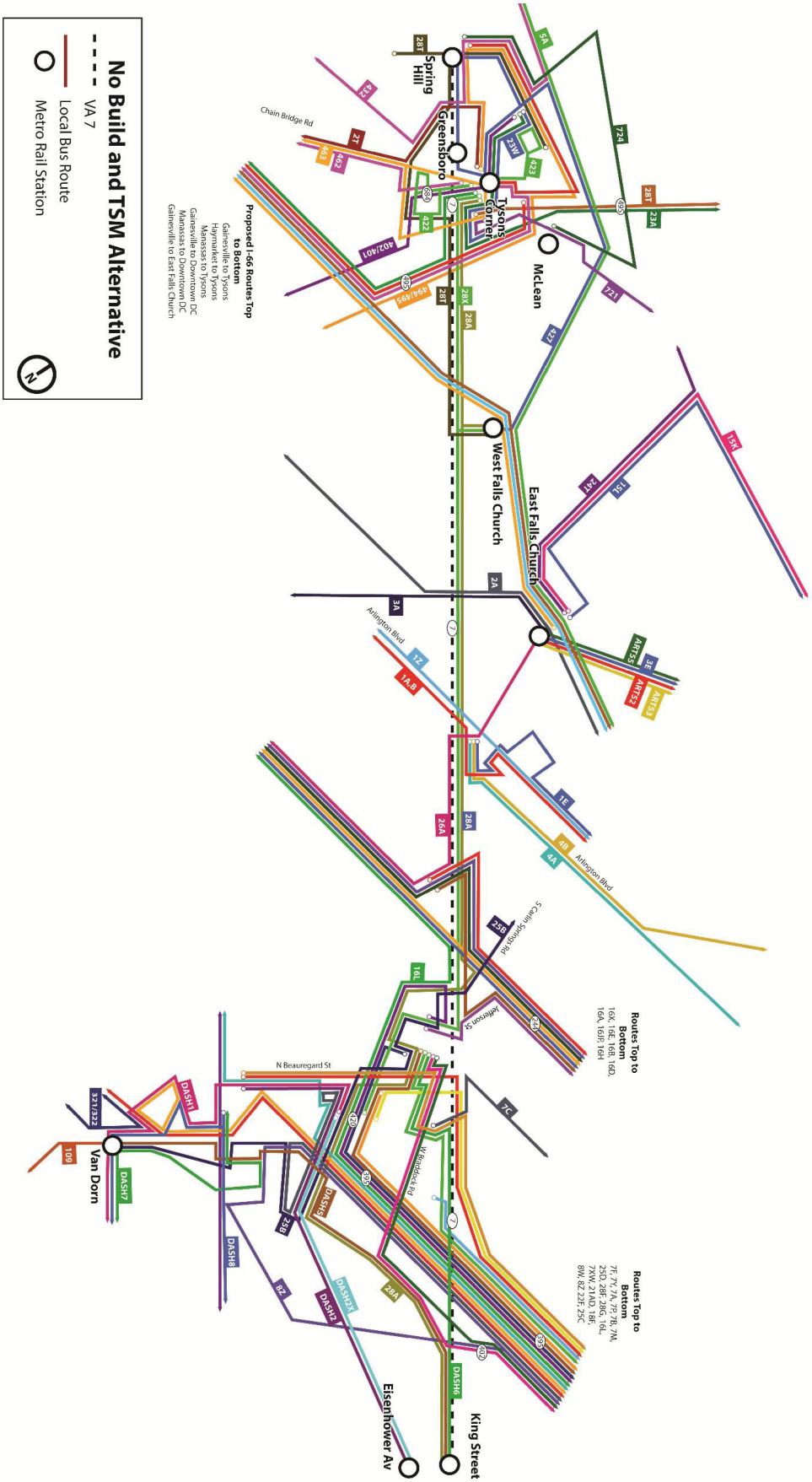


Figure 2-18 *Build Alternative 1*

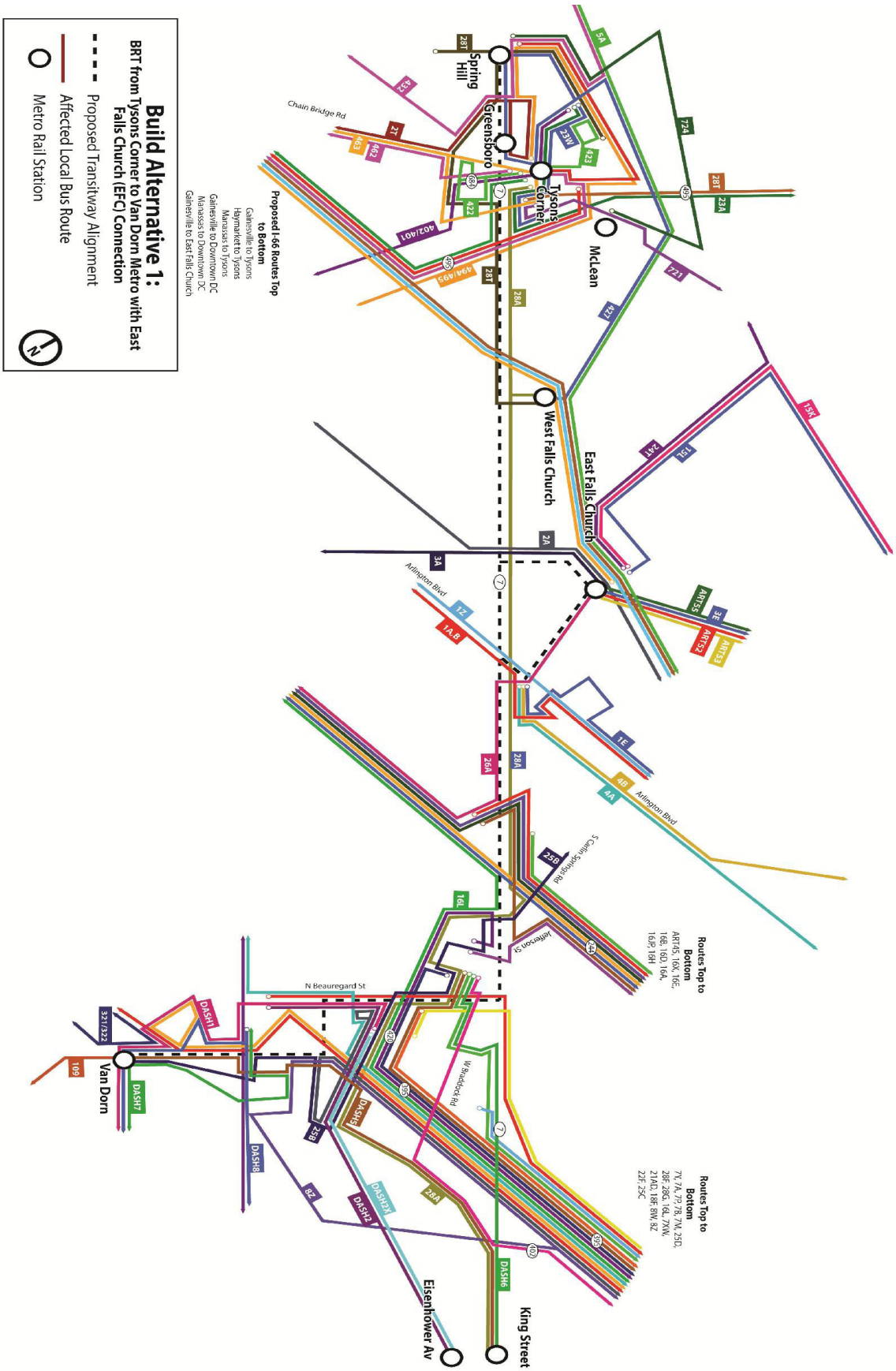


Figure 2-19 *Build Alternative 2/6*

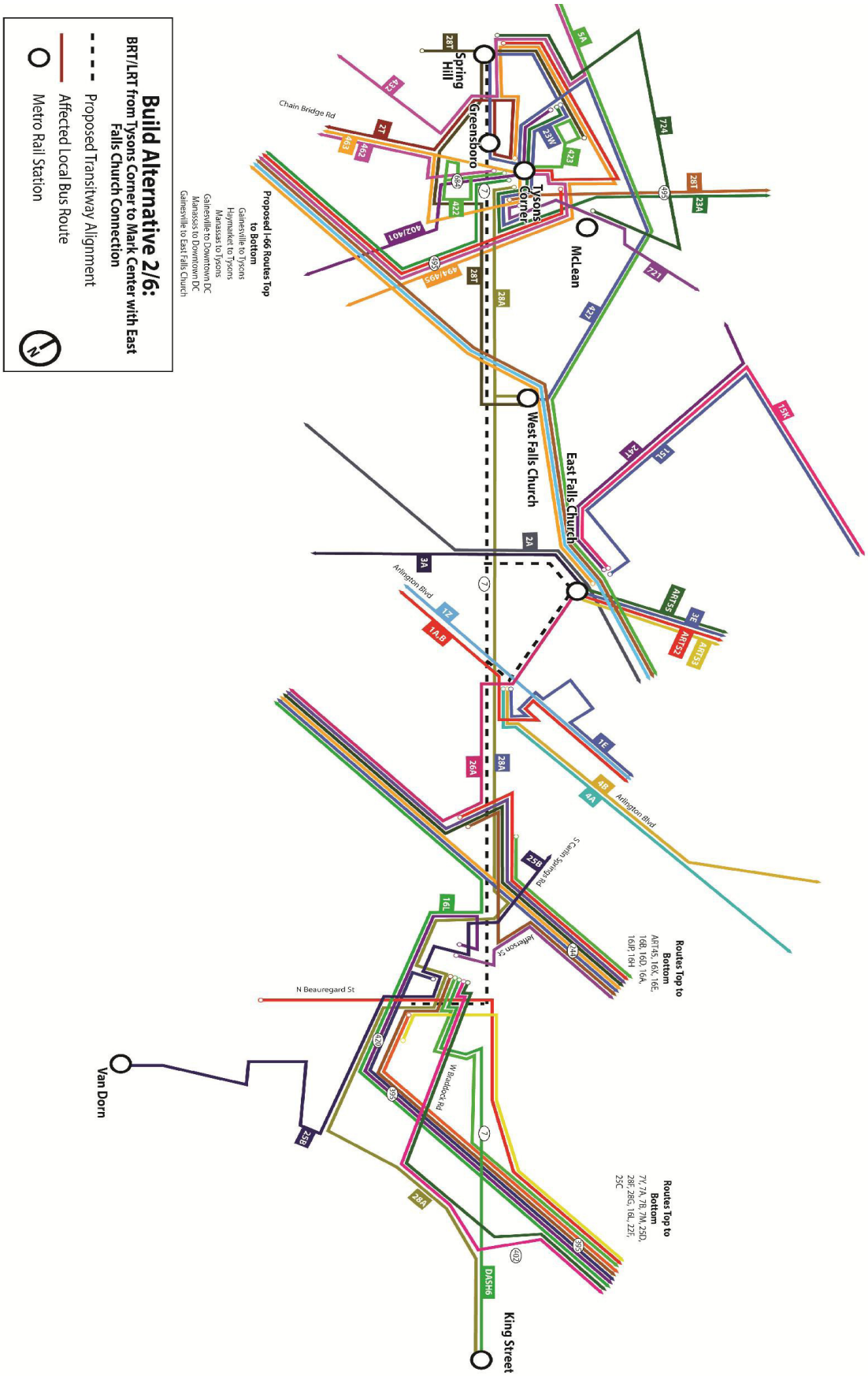


Figure 2-20 *Build Alternative 3*

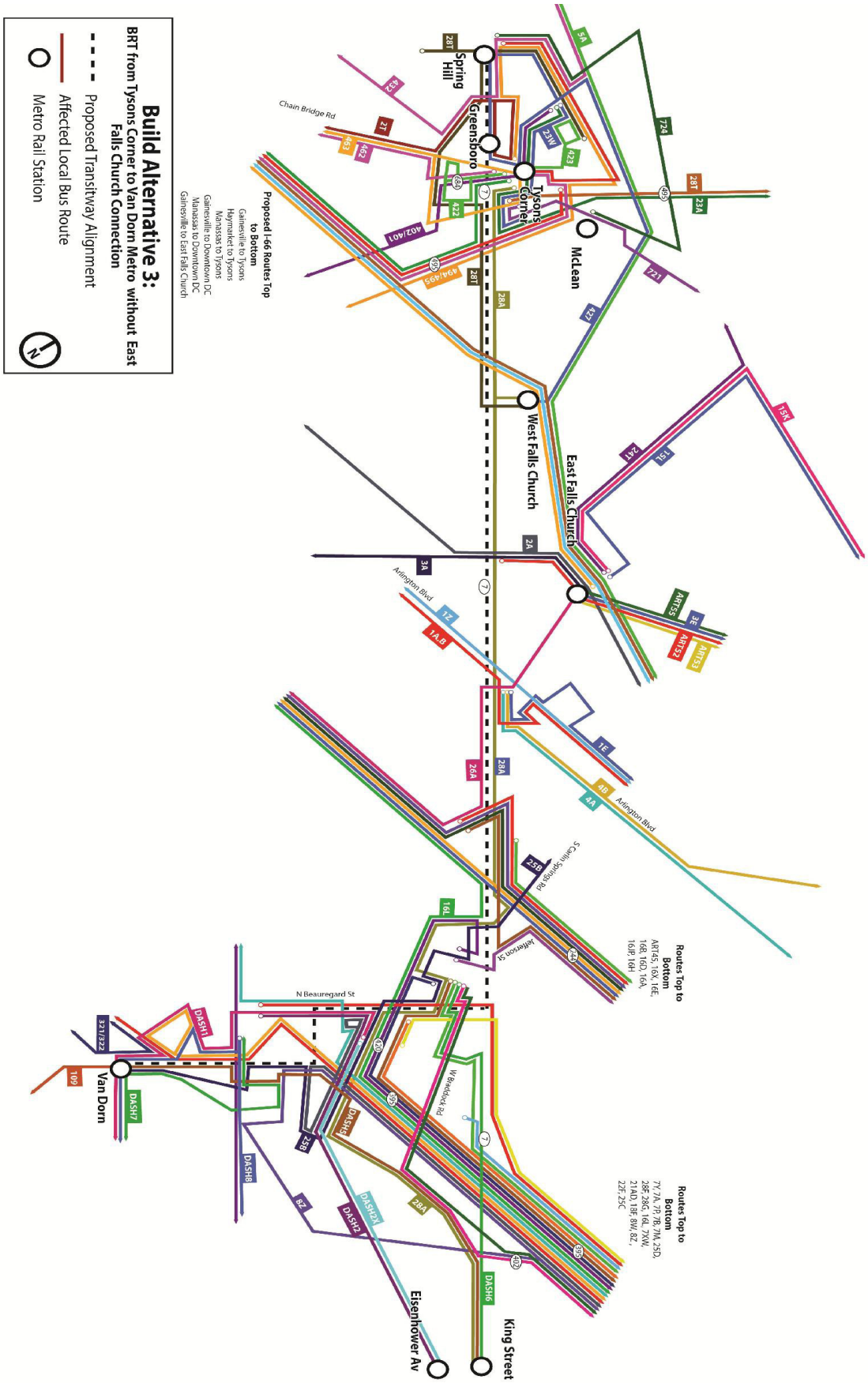


Figure 2-21 *Build Alternative 4*

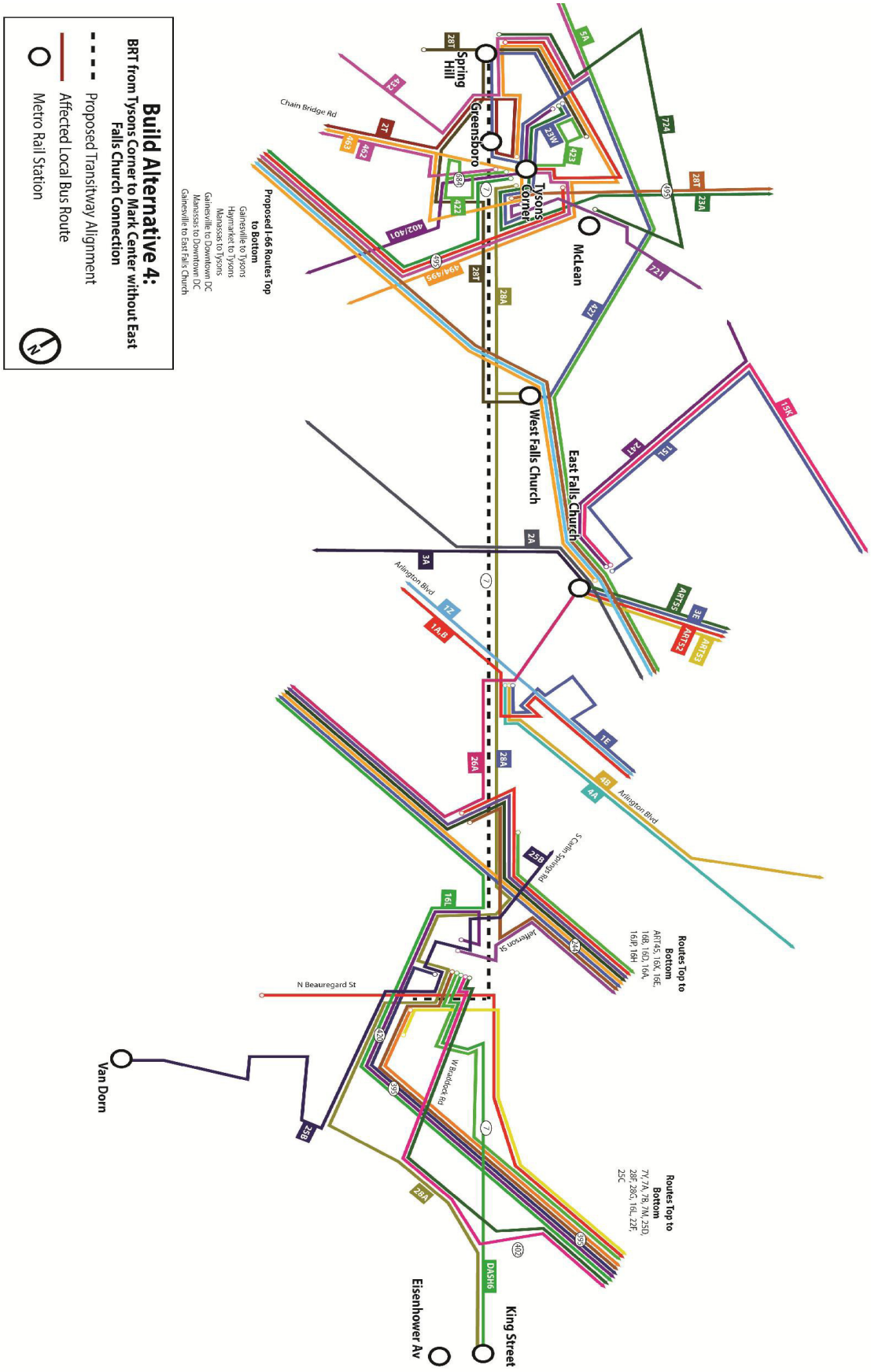
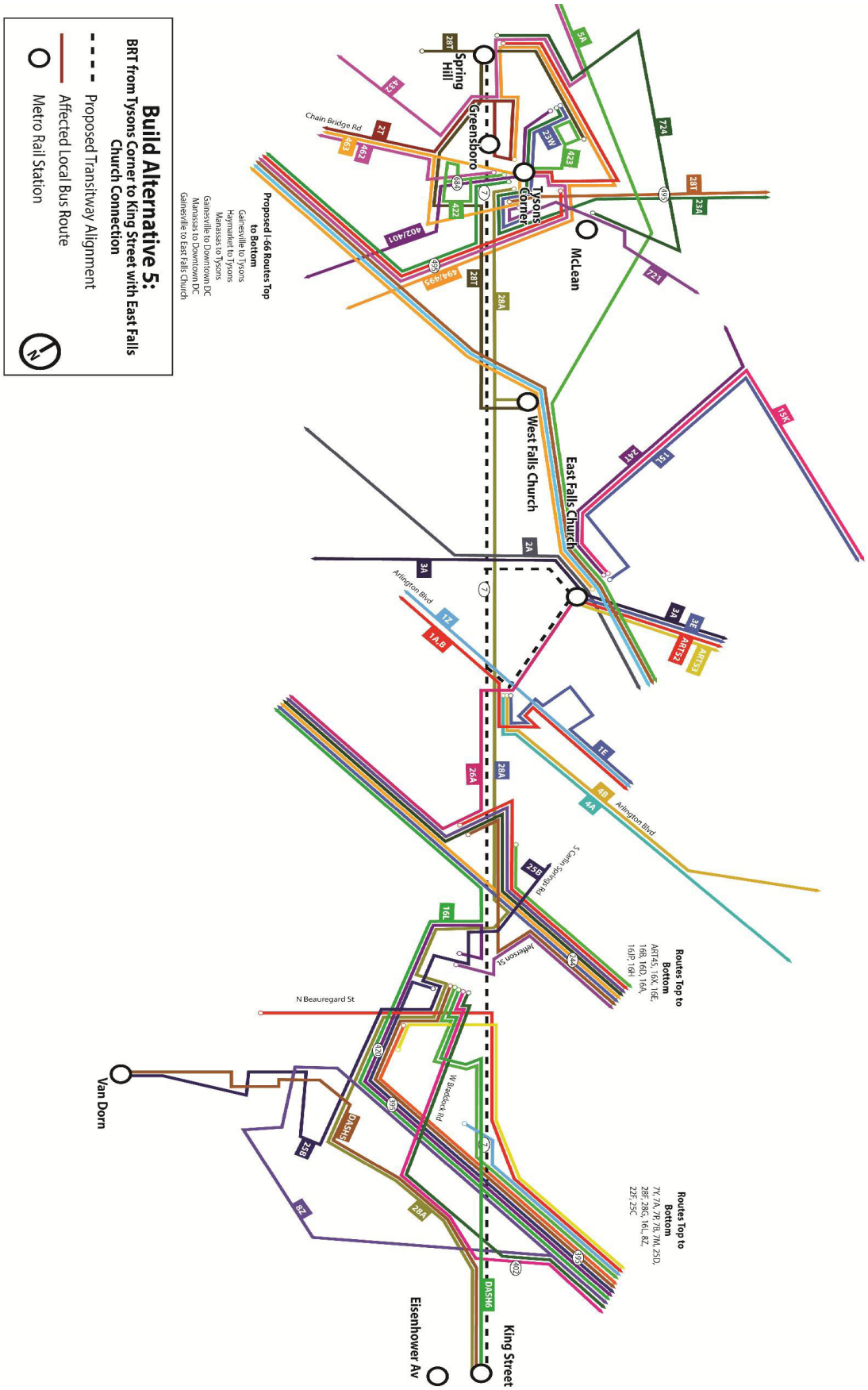


Figure 2-22 *Build Alternative 5*



ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Chapter 3: Capital and Operating Cost Estimates

1.0 Introduction

This chapter presents the capital and operating and maintenance (O&M) cost estimates for the TSM and build alternatives discussed in the previous chapter. The methodologies, costing assumptions and cost summaries are provided in this chapter. Appendices A and B contain more detailed supporting data on the derivation of those values contained in this report. Capital cost estimates are provided for each alternative in terms of low and high estimates that are based on ranges of assumed contingency costs as outlined in the following pages. O&M costs are based on the assumptions built into the service plans developed the previous chapter of this report. It should be noted that the capital cost estimates are at a planning-level since neither conceptual nor preliminary design activities are being performed as part of this Phase 2 effort - activities which would allow for the development of a more detailed assessment of those costs.

The TSM alternative, which does not entail major capital assumptions, represents the low-cost alternative for enhancing mobility along the Route 7 corridor. The TSM alternative would enhance existing bus transit service along Route 7 by improving the 28A Metrobus route from all-day, 30-minute headways to all-day 10 to 15-minute headways. The 28X Metrobus route would continue to operate as it does today. In addition, to reduce travel time and improve schedule adherence, transit priority elements at intersections (transit signal priority, queue jumps) would be provided for both the 28A and 28X services to take advantage of priority treatments.. The TSM alternative would provide direct transit service between the primary destinations along Route 7 and increase access to the Metrorail system along Route 7 between Tysons and the King Street Metrorail station. For stops along the 28X service, enhanced passenger amenities (shelters, real-time passenger information, etc.) would also be provided.

A total of six build alternatives, as shown in Figure 1, are being evaluated in terms of capital and O&M costs for the Route 7 corridor:

1. BRT from Tysons to Van Dorn Metro via East Falls Church (EFC) Metro
2. BRT from Tysons to Mark Center via EFC Metro
3. BRT from Tysons to Van Dorn Metro w/o EFC Metro
4. BRT from Tysons to Mark Center w/o EFC Metro
5. BRT from Tysons to King Street Metro via EFC Metro
6. LRT from Tysons to Mark Center via EFC Metro

Capital costs for Alternative 6 were developed to reflect two conceptual conditions – one which assumes at grade LRT operation along the length of the corridor and another which assumes required grade separation near the East Falls Church Metro Station and also at the Seven Corners intersection. Both of these locations were identified as engineering challenges for implementing a LRT system. The following sections present the results of the cost estimating effort for this project.

2.0 Capital Costs

2.1 Estimating Methodology

The following methodology was used to prepare capital cost estimates for the six build alternatives and was developed in general accordance with FTA guidelines for estimating capital costs. Part of the FTA guidelines call for cost estimates to be prepared and reported using the latest revision of the FTA's Standard Cost Categories (SCC). In the estimates, cost components for the various alternatives were developed and summarized into the SCC. These cost categories form the basis for the format and structure that is used for the capital cost detail and summary sheets that are developed for the project as well.

General Approach

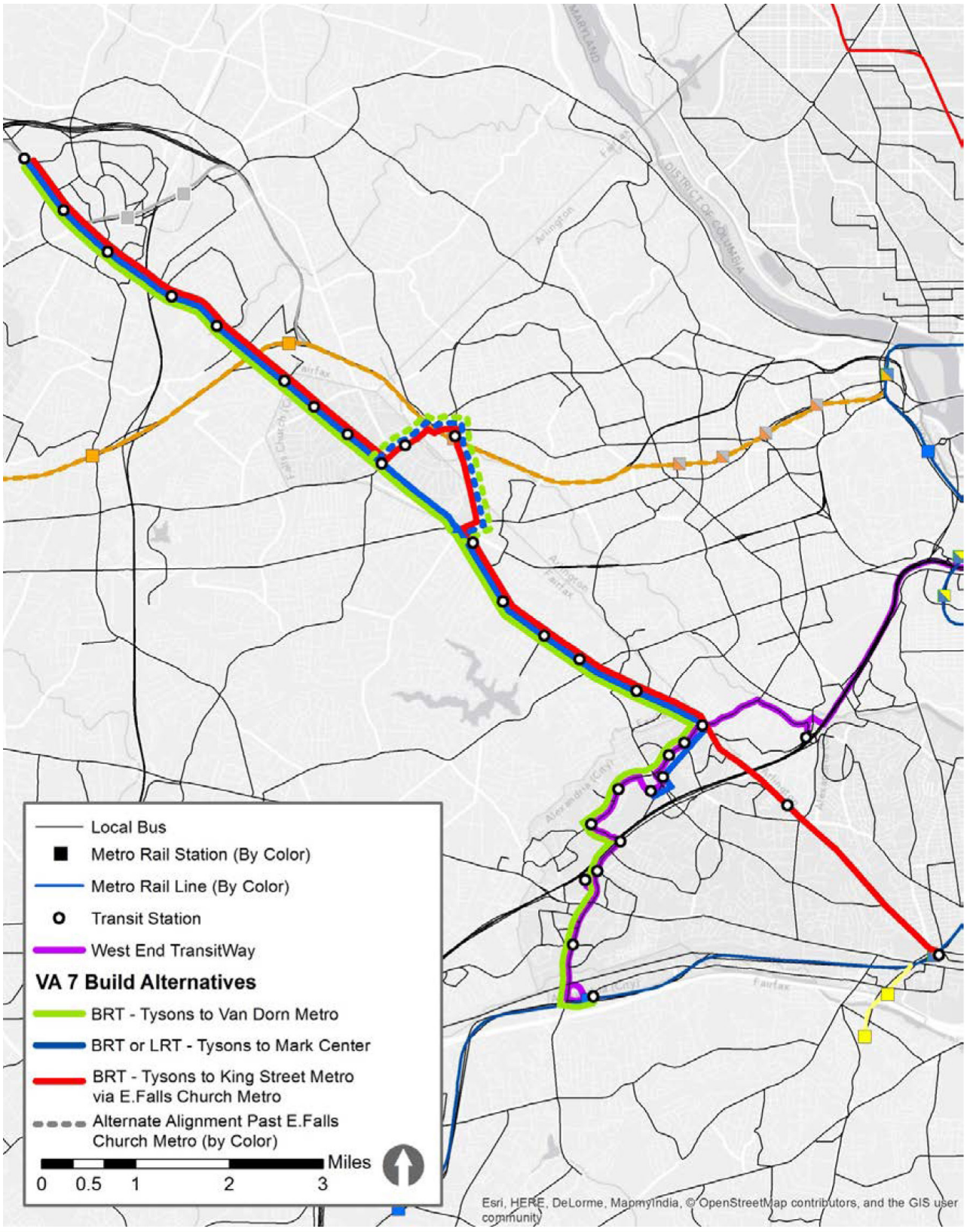
Each of the alternatives that were developed for the project has a schematic drawing indicating the general alignment and station locations. Next assumptions were made as to quantities for each of the major construction cost components. These planning documents form the basis for the identification of the various infrastructure elements that were used to prepare the capital cost estimates. Prototypical facility costs are developed for elements that can be defined by a typical cross-section and applied over a given length of alignment or based on a conceptual scope of work developed as appropriate for a specific typical facility. The typical facility composite unit cost is developed by combining the costs for all of the individual construction elements applicable to a given typical section or facility and creating a representative composite unit cost.

Allocated Contingency

Contingency is typically included in an estimate as an allowance for the level of engineering design completed or to address imperfections in estimating methods that are associated with a project's development stage. Contingency, in the statistical sense, is the estimated percentage by which a calculated value may differ from its true or final value. A contingency add-on is used to account for those items of work (and

their corresponding costs) which may not be readily apparent or cannot be quantified at the current level of design, such as unknown project scope items, or a potential project change resulting from public/political issues or environmental or technical requirements. For the purposes of these estimates, contingency will be assigned into two major categories – allocated and unallocated.

Figure 3-1 *Route 7 Corridor Transit Study Phase 2 Build Alternatives*



Allocated contingency is assigned based on the level of design information available for individual items of work, as well as the relative difficulty in establishing unit prices for these items. The allocated contingency allowance, in the range of 8 percent to 55 percent, is assigned according to the FTA construction or procurement cost categories. The percentage selected for each cost category is based on professional judgment and experience related to the cost variability typically seen for items of work within a particular cost category.

Low and high capital cost totals were developed for each of the six build alternatives. This range of capital costs was calculated based on different allocated contingency factors for cost categories 10 through 70, as summarized in Table 3-1 below. Professional services were calculated using fixed factors for each sub-element.

Unallocated contingency is similar in nature to allocated contingency in that it is primarily applied as an allowance for unknowns and uncertainties due to the level of project development completed. The major difference is that allocated contingencies are intended to address uncertainties in the estimated construction, right-of-way, and vehicle costs that typically occur based on the level of engineering and design completion, while unallocated contingency is typically much broader in nature and often address potential changes in the project scope or schedule. Unallocated contingency is calculated as a percentage of the total of SCC cost categories 10 to 50. An unallocated contingency factor of 10% was applied for this project.

Professional Services

This cost category includes allowances for final design, project management for design and construction and construction administration and management. These allowances are computed by applying a percentage to the total construction cost estimated (excluding right-of-way and vehicle costs). Right-of-way and vehicle costs typically are calculated to include the management and administration costs associated with these activities and are therefore excluded from the calculation of professional services.

Table 3-1 *Allocated Contingency Factor Ranges*

Category No.	Description	Contingency Range	
		Low	High
10	GUIDEWAY & TRACK ELEMENTS	18%	28%
20	STATIONS, STOPS, TERMINALS, INTERMODAL	18%	28%
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS.	18%	28%
40	SITEWORK & SPECIAL CONDITIONS	28%	38%
50	SYSTEMS	12%	22%
60	ROW, LAND, EXISTING IMPROVEMENTS	45%	55%
70	VEHICLES	8%	15%
80	PROFESSIONAL SERVICES	Calculated as fixed percentage of construction subtotal	
	Preliminary Engineering	4.0%	
	Final Design	10.0%	
	Project Management	5.0%	
	Construction Admin. & Management	8.0%	
	Insurance	3.0%	
	Legal; Permits; Fees	0.5%	
	Surveys; Testing; Investigation; Inspection	2.0%	
	Agency Force Account Work	1.0%	

Cost Data

Cost data was developed using several sources and has been adjusted to be comparable to those seen in the Northern Virginia region. The first task in developing the cost data is to prepare a list of typical construction elements that are based on a normal scope of work for a given transit technology. Composite unit costs for these major work elements is then estimated using various cost references and historical cost data. All unit costs include contractor's direct construction cost plus all taxes, general expense, overhead and profit. The unit costs do not include items such as engineering, construction management, owner's administrative costs and allowances for contingencies. These costs are included as percentage add-ons to the cost estimate under various locations.

Sources of Cost Data

Composite unit costs used in the estimates were derived from several resources including historical cost data from a number of similar transit projects around the US. All cost resources are adjusted to reflect current local Northern Virginia region rates and conditions. Adjustments for differences in geographic locations use a factor calculated from the current city cost index for any source location and the Northern Virginia region using city cost indexes published by RS Means. Adjustments for differences between the published date of any historical cost data and the current base year of the cost estimates uses an escalation factor calculated using the Producer Price Index (PPI) of Highway and Street Construction published by the US Bureau of Labor Statistics (BLS).

2.2 Capital Cost Estimates

Table 3-2 presents a summary of the low and high capital cost estimates for each of the six build alternatives. Note that the LRT alternative has two sets of capital cost estimates – one for a completely at-grade alignment and one for a partially elevated alignment. Detailed breakdowns of each capital cost estimate for alternatives are provided in Appendix A.

***Table 3-2** Capital Cost Summary*

Alt.	Description		Capital Cost Estimate (2015 Dollars in Millions)	
			Low	High
1	BRT Tysons to Van Dorn Metro with EFC Metro Connection	Total	$284.32	$307.78
		Per Mile	$18.56	$20.10
2	BRT Tysons to Mark Center with EFC Metro Connection	Total	$246.90	$267.30
		Per Mile	$19.62	$21.24
3	BRT Tysons to Van Dorn Metro without EFC Metro Connection	Total	$248.91	$269.40
		Per Mile	$18.85	$20.41
4	BRT Tysons to Mark Center without EFC Metro Connection	Total	$211.49	$228.92
		Per Mile	$20.20	$21.86
5	BRT Tysons to King Street Metro with EFC Metro Connection	Total	$274.66	$297.31
		Per Mile	$18.69	$20.23
6-AG	LRT Tysons to Mark Center with EFC Metro Connection at grade	Total	$874.34	$946.08
		Per Mile	$69.55	$75.25
6-ELV	LRT Tysons to Mark Center with EFC Metro Connection with elevated sections	Total	$921.90	$997.44
		Per Mile	$73.33	$79.34

The capital cost estimates shown in Table 3-2 are for the new Route 7 service itself. In addition to the capital costs of the new BRT or LRT service, recommended changes to local connecting service plans will result in changes to local bus capital costs once the Route 7 service becomes operational. For example, in some instances, a recommendation of increased connecting service frequency required an additional bus to provide this new service. In other instances, the elimination of a route resulted in excess vehicles which could be used on another route. The net variance between the existing and proposed peak vehicle requirements under the build alternatives was then multiplied by an assumed cost of $486,653 for the purchase of a new 40' bus[1]. Under each Route 7 build alternative, the number of excess buses was more than the number of required new buses, resulting in a net decrease in capital costs. This decrease, which would be subtracted from the capital cost estimates in Table 3-2, was estimated to be $4,866,530 under Alternatives 1, 2, 4, 5 & 6, and $4,379,877 under Alternative 3.

An important consideration to capital cost is the effect of time on project cost estimates, and the increasing costs associated with inflation and other economic factors. The project construction date (if carried forward) remains and unknown, for the purposes of this report costs for 2015, 2020 and 2025 have been identified below in Table 3-3.

[1] Per the American Public Transportation Association 2013 Vehicle Database

Table 3-3 Capital Cost Estimate to Various Future Years (Assuming 3% annual escalation)

Alt.	Description	Capital Cost Estimate (2015 $ in Millions)		Capital Cost Estimate (2020 $ in Millions)		Capital Cost Estimate (2025 $ in Millions)	
		Low	High	Low	High	Low	High
1	BRT Tysons to Van Dorn Metro with EFC Metro Connection	$284.32	$307.78	$329.60	$356.80	$382.10	$413.63
2	BRT Tysons to Mark Center with EFC Metro Connection	$246.90	$267.30	$286.22	$309.87	$331.81	$359.23
3	BRT Tysons to Van Dorn Metro without EFC Metro Connection	$248.91	$269.40	$288.55	$312.31	$334.51	$362.05
4	BRT Tysons to Mark Center without EFC Metro Connection	$211.49	$228.92	$245.17	$265.38	$284.22	$307.65
5	BRT Tysons to King Street Metro with EFC Metro Connection	$274.66	$297.31	$318.41	$344.66	$369.12	$399.56
6-AG	LRT Tysons to Mark Center with EFC Metro Connection at grade	$874.34	$946.08	$1013.60	$1096.77	$1175.04	$1271.45
6-ELV	LRT Tysons to Mark Center with EFC Metro Connection with elevated sections	$921.90	$997.44	$1068.73	$1156.31	$1238.96	$1340.48

3.0 Operating and Maintenance Costs

3.1 Estimating Methodology

The operating costs for the TSM, BRT and LRT build alternatives were derived through a seven-step process:

1. Identify travel times associated with existing local bus service along corridor.
2. Estimate BRT and LRT acceleration and deceleration characteristics, and assumption for station dwell times and intersection delay.
3. Identify appropriate adjustments to base travel time to reflect the above-mentioned mode characteristics and specific assumed running-way configuration along different roadway segments and transit priority treatments (Business Access and Transit (BAT) lanes, and signal priority).
4. Adjust running times for 2040 conditions to reflect increase in congested speed on roadway segments where BRT and LRT would operate in mixed traffic.
5. Identify appropriate unit cost per revenue hour for BRT and LRT based on local agency experience for bus and LRT developed in another urban area.
6. Calculate revenue hours of service based on the assumed operations plan for each alternative, and subsequent O&M costs on annual basis.
7. Calculate operating costs for both new and eliminated local connecting services based on existing operating cost per hour data.

Each of these steps is further explained as follows:

Identify Base Travel Times for Existing Bus Service - The schedule for the existing 28A service in the Route 7 corridor was reviewed to identify existing bus travel time between the assumed BRT and LRT stations along the corridor

Establish BRT and LRT Operating Characteristics - Where BRT and LRT would be operating in exclusive guideway, with no interference with general traffic, the acceleration and deceleration time between stations was estimated based on available horsepower curves. A 30-second dwell time at a BRT station and a 40-second dwell time at a LRT station were assumed. A different average delay at a minor (42 seconds) vs. major (84 seconds) cross street signalized intersection was also assumed.

Make Adjustments in Base Travel Time – Using the base travel times for existing service in the corridor, and the adjustments identified for BRT and LRT operating characteristics and running-way configuration before – mentioned adjustments, a base travel time for the TSM and

build alternatives was developed, a round trip travel time in the corridor was established for each alternative. The travel time reflected a 15% layover assumption at both ends of the route.

Adjust for 2040 Conditions. - Congested roadway speeds for year 2040 from the MDAII model were identified and used to adjust the TSM and build alternative travel times to future conditions.

Identify Appropriate Unit Costs – Year 2013 National Transit Database unit costs were used to develop the BRT and LRT operations and maintenance (O&M) costs. For BRT, the WMATA bus O&M cost of $144.42 per vehicle revenue hour was used, which was the highest for the potential transit agencies which might operate a new Route 7 BRT (Fairfax County and Alexandria DASH being the others). The Hampton Roads LRT was used as a representative LRT system, with a cost of $412.78 per vehicle revenue hour.

Translating to Revenue Hours and Costs - The same level of service on weekends as on weekdays was assumed in the development of annual O&M costs.

Operating costs for changes to local connecting services - In order to determine the cost of service changes to the local bus network, it was necessary to calculate two factors:

- the additional operating cost of new service
- the operating cost savings resulting from eliminated service

Operating costs for both new and eliminated service were based on an assumed operating cost per hour, as provided by each of the four transit agencies which provide service along the Route 7 corridor: WMATA, Fairfax Connector, Arlington Transit, and DASH. These operating costs per hour figures are:

- WMATA $144.42
- Fairfax Connector $103.04
- Arlington Transit $78.31
- DASH $81.10

The amount of new and eliminated service was then calculated using each route's runtime, headway, and number of trips per day. Annual revenue hours were then calculated for both the existing and proposed scenarios. The variance between existing revenue hours and proposed revenue hours was multiplied by the operating cost per hour to determine the changes in operating costs associated with each build alternative.

3.2 Operating and Maintenance Cost Estimates

Table 3-4 presents a summary of the O&M cost estimates for the TSM and six build alternatives. The WMATA 28 route costs are broken out separately since they will parallel the new Route 7 service. Detailed breakdowns of the Route 7 O&M cost estimates are provided in Appendix B. The incremental costs for changes to connecting services do not include the WMATA Route 28 services.

Table 3-4 *Operating & Maintenance Cost Summary (2015 Dollars in Millions)*

Alternative	WMATA Route 28A	WMATA Route 28X	Route 7 Corridor Service	Incremental Costs for Changes to Connecting Services	Total O&M Costs
TSM	$14.63	$1.50	$0	$0	$16.13
1.BRT Tysons to Van Dorn Metro with East Falls Church Metro Connection	$4.76	$0	$13.12	$3.46	$21.34
2.BRT Tysons to Mark Center with East Falls Church Metro Connection	$4.76	$0	$9.56	$3.46	$17.78
3.BRT Tysons to Van Dorn Metro without East Falls Church Metro Connection	$4.76	$0	$13.20	$3.63	$21.59
4.BRT Tysons to Mark Center without East Falls Church Metro Connection	$4.76	$0	$9.56	$3.46	$17.78
5.BRT Tysons to King Street Metro with East Falls Church Metro Connection	$4.76	$0	$12.52	$3.46	$20.74
6.LRT Tysons to Mark Center with East Falls Church Metro Connection	$4.76	$0	$23.70	$3.46	$31.92

ENVISION ROUTE 7

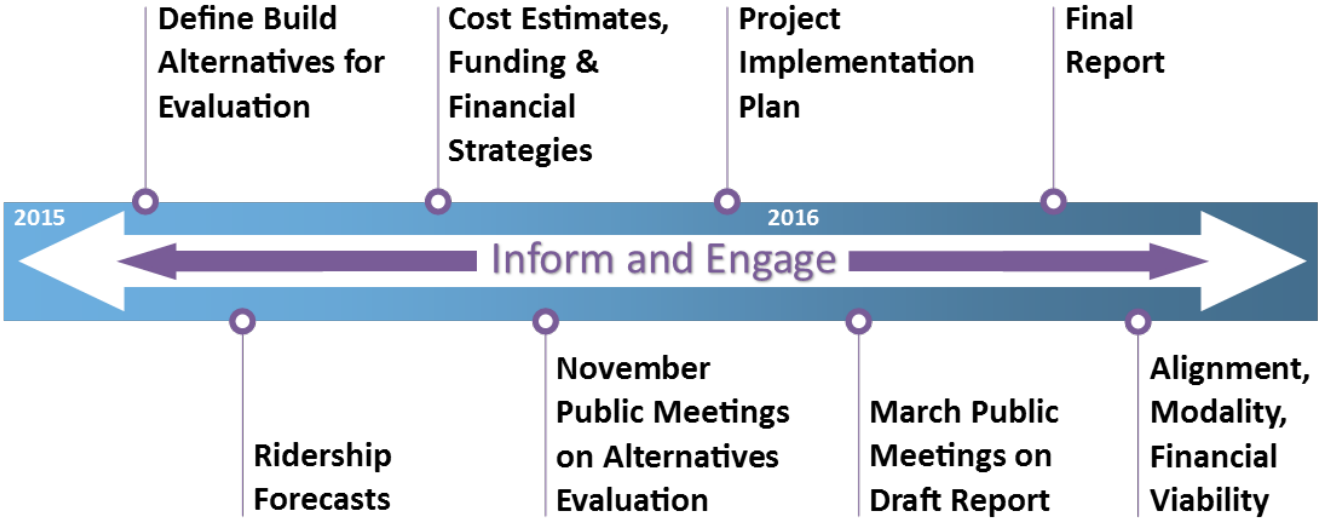
The Route 7 Corridor Transit Study
FINAL REPORT

Chapter 4: Public Outreach

1.0 Introduction

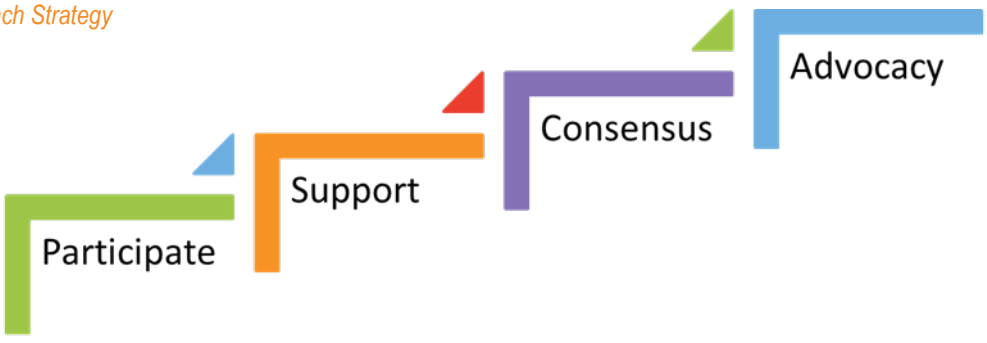
The Northern Virginia Transportation Commission (NVTC) recognizes that engaging all facets of the community is integral to the future of the Route 7 corridor. A successful engagement component has been underscored for this project to build on the community awareness of the Route 7 corridor established during the first phase of the study. NVTC, along with its partner agencies and member localities, committed to an inclusive approach to involving the community as this corridor analysis was conducted. This chapter provides an overview of the public outreach activities conducted in support of this project from the public project kick-off in April 2015 through the public meetings that occurred in November 2015 and June 2016. Information collected from all engagement techniques outlined in this chapter were used to establish the community's perceptions of the Route 7 Corridor and the study alternatives being considered.

Figure 4-1 *Study Timeline*



At the outset of the project, an outreach plan was developed by NVTC and the consultant team in conjunction with the project's Technical Advisory Committee (TAC). A multi-tiered outreach strategy was designed to allow elected and appointed officials, agency executives and senior staff, community-based organizations, and the general public to contribute to the decision making process as the study progresses. To engage each target audience and garner the support needed to carry study recommendations forward, outreach activities have been implemented that solicit input from stakeholders throughout the study duration while the project team conducted the technical analysis needed for key study milestones. The desired outcome of the outreach strategy is that participation will lead to support among stakeholders, which will help reach consensus on the future of the corridor. Ultimately, it is desired that successful outreach will help encourage program advocates among key stakeholders and interested parties along the Route 7 Corridor.

Figure 4-2 *Outreach Strategy*



2.0 Public Outreach Approach

The public outreach effort is designed to inform residents, businesses, and community group leaders alike about the study and analysis of transit alternatives for the Route 7 Corridor while engaging them in the process. To accomplish this, the project team developed an approach to establish and strengthen preliminary relationships with the public and community-based organizations along the project corridor, laying the foundation for ongoing community education, communication, and involvement throughout the study. Successful engagement of the public

and community stakeholders can help to identify influential individuals and groups and outline ways in which they may provide meaningful input into the process and outcomes of the Route 7 Corridor Transit Study. The following goals were identified for outreach to the public and community-based organizations. It is expected that outreach efforts will accomplish the following:

1. Educate and inform the public and community-based organizations about the purpose and progress of the study by providing balanced and objective information on the Route 7 Corridor and the progress of the study at key milestones.
2. Involve the public and community-based organizations in the study process by broadly disseminating project-related information and soliciting feedback that reflects concerns and interests of the general public and community and regional groups on the scope of the project and preliminary technical findings.
3. Establish new forums for information exchange and collaboration while also leveraging existing relationships with groups and organizations.
4. Identify ways to involve the business community along the corridor as the study progresses.
5. Develop community advocates by educating the public and community-based organizations on the benefits of improved transit in the Route 7 Corridor and its role in enhancing economic development in communities in Northern Virginia.

To accomplish these goals, several techniques have been employed to garner substantial, frequent, and sustained involvement from the community and general public throughout the duration of the project. Outreach techniques included development of a project website, sending broadcast emails to the project stakeholder list, the publication of a newsletter, the advertisement and use of a telephone comment line, social media sites, briefings to community organizations and groups, and a series of public meetings.

3.0 Results of Public Outreach Activities

3.1 Virtual Public Kick-Off

The public outreach efforts for the project were initiated on Monday, April 20, 2015, with a virtual public kick-off. This virtual kick-off was the jumping-off point for sharing project details with and soliciting comments and input from the public and the community. A virtual kick-off was used to announce the study in lieu of a public meeting in an effort to reach a more widespread audience and share project information. The techniques as described in Table 4-1 were used to mark the kick-off for the project.

Table 4-1 *Virtual Public Kick-off Techniques*

Technique	Description
Public Website	The project website www.EnvisionRoute7.com went live on April 20, 2015. The website was advertised on all publications, in a broadcast email, and via social media.
Broadcast Email	A broadcast email was sent to 383 individuals announcing the website and providing information on how to download the first issue of the newsletter.
Newsletter	The newsletter was published in English and Spanish and was posted to the website and distributed via email. Several hundred hard copies of the newsletter were distributed to twelve (12) community centers and libraries.
Bus Advertisements	Posters advertising the study, website, and telephone comment line were posted on buses serving the Route 7 Corridor.
Telephone Comment Line	The telephone comment line, 844-RT7-STUDY, was opened and has a menu for input in English and Spanish.
Social Media	Social media pages were created on Facebook, Twitter, and Instagram.
Press Release and Media Relations	NVTC shared a press release with local media outlets. The study was highlighted in a story on WTOP (103.5 FM).

3.2 Project Website

An established and effective web presence is a critical component of the communication and outreach program with stakeholders and others interested in the project. The project website, www.EnvisionRoute7.com, serves as the central communication tool for the Route 7 Corridor Transit Study. In our increasingly busy and media-savvy culture, where consumers and stakeholders expect timely information in an easily-digestible format, the project website provides convenience and economy for sharing important project information and updates.

The Envision Route 7 website is dynamic and informative and uses innovative and intuitive techniques to encourage public participation. The website uses web-based and map-based tools to both educate website visitors on technical project details and solicit feedback to identify community preferences.

The project website features a page that provides an overview of the study, a "Get Involved" page highlighting opportunities to engage in the study, information on transit mode options, a document and video library, frequently asked questions (FAQs), and a "Contact Us" page. The home page of the website also includes a "What's New" section as well as a community poll and a crowdsource map. Both the community poll and crowdsource map allow visitors of the website to provide input directly on the website. The homepage also includes links to the social media pages for the project. The website is periodically updated to ensure that recent and time-sensitive information is available to the public.

Information submitted on the website is captured and managed using the WSP-Parsons Brinkerhoff tool CommentSense®. CommentSense® is a proprietary, web-based software tool designed to facilitate the capture, storage, and management of stakeholder and customer data by demographics, submissions, and other individual categories. This partially-customized database application is being used to streamline the collection, tracking, and analysis of data input for this project through the Envision Route 7 website.

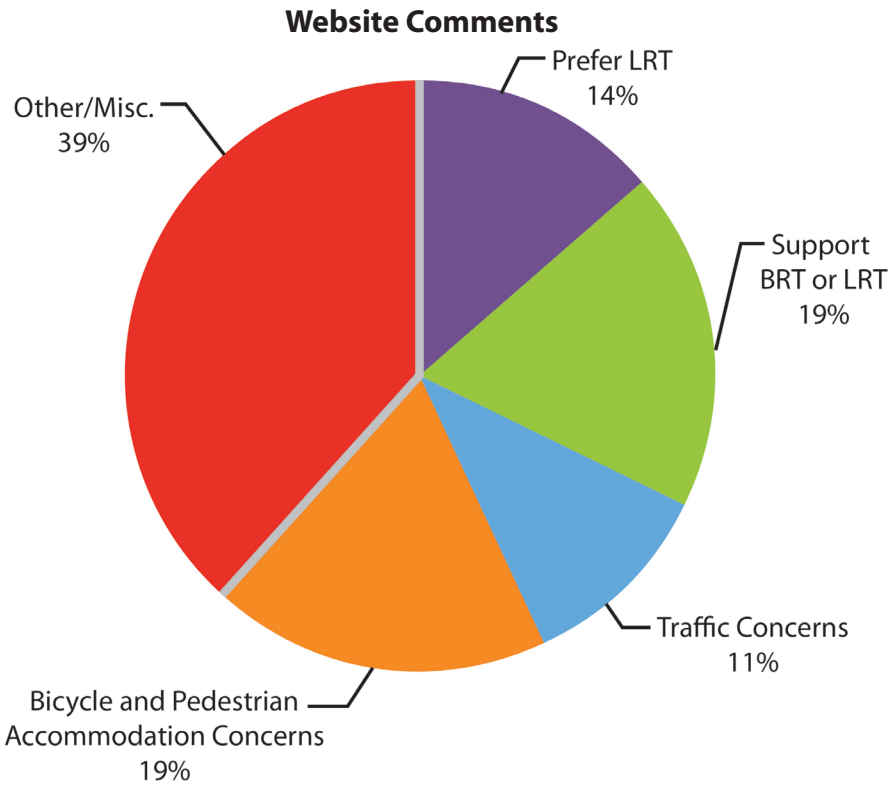
Table 4-2 Website Sign-ups

Month	Number of Sign-Ups Via Website
April 2015	31
May 2015	22
June 2015	13
July 2015	8
August 2015	5
September 2015	2
October 2015	15
November 2015	18
December 2015	2
March 2016	2
April 2016	8
May 2016	4
June 2016	9
July 2016	9

A total of 771 contacts have been captured in the CommentSense® database for this project. Of those included, 148 individuals signed up to receive project information through a form on the website. The others were either imported into the system from the stakeholder list developed by the project team or signed up to received project information by email at a public meeting or other project presentation.

The website form is an effective tool for soliciting open-ended comments from anyone who visits the project website. A total of thirty-five (35) written comments were received via the web form.. The comments vary by subject matter and topics range from mode preference and complaints about traffic along Route 7 to concerns about safety and bicycle and pedestrian accommodations. Figure 4-1 shows the comments received by category. Website comments received can be found in Appendix C.

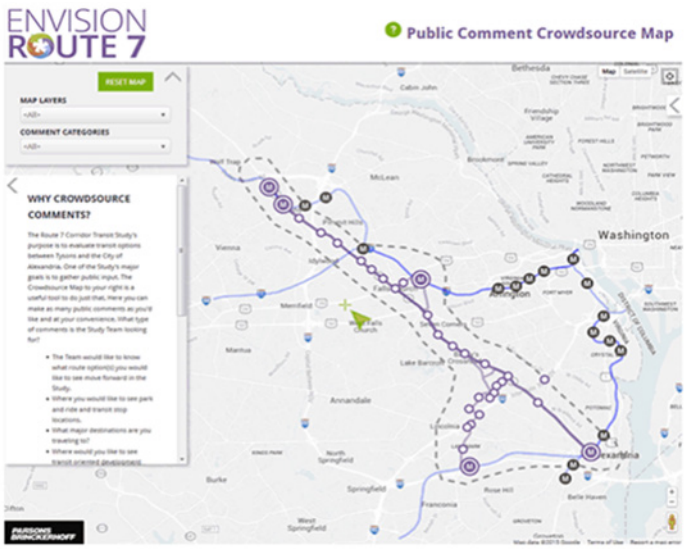
Figure 4-3 Categories of Website Comments



3.3 Crowdsource Map

An interactive map has been placed on the Envision Route 7 home page to capture input from the public in a geographic format. The crowdsource map is a useful tool for gathering public input that can be used to help evaluate transit options between Tysons and the City of Alexandria.

Figure 4-4 *Crowdsource Map*

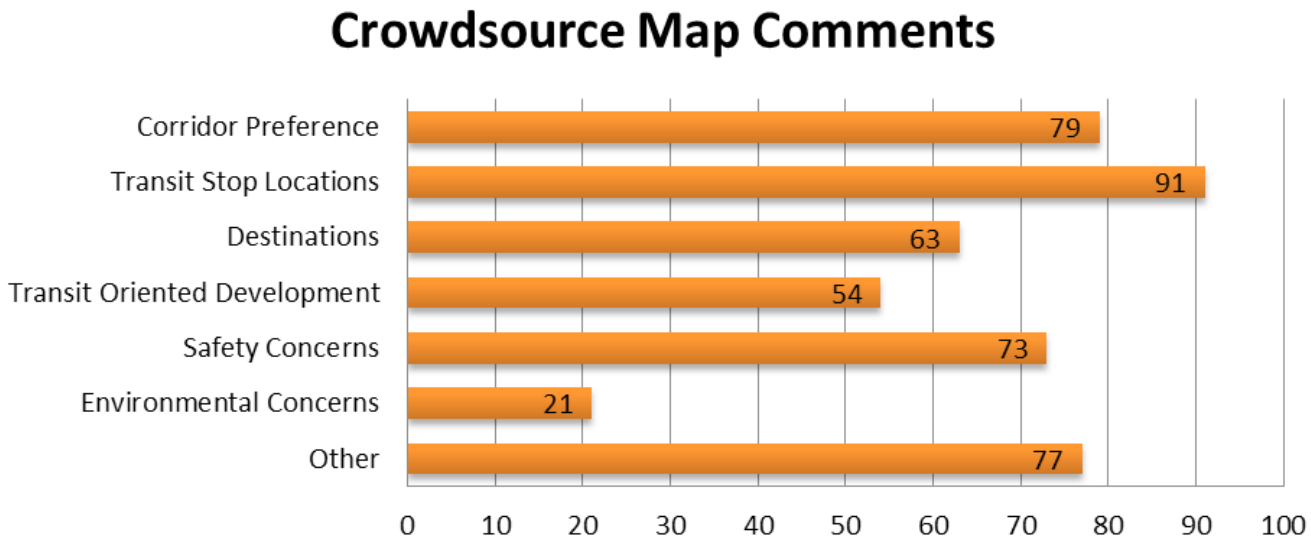


The crowdsource map has been the most frequently used source of input for the project. A total of 300 comments were received. The map captures comments related to corridor preference, transit stop locations, destinations, transit oriented development opportunities, safety concerns, environmental concerns, and "other" aspects of the corridor. Individuals were allowed to select more than one (1) category for each comment submitted. Most comments relate to transit stop locations and corridor preference.

Why Crowdsource?

Transportation data resources that can be used to better understand detailed location and time-based travel patterns and personal experience can be difficult to find. Crowdsourcing, or the process of obtaining information, insight, and knowledge from user-generated data provided through web and mobile applications, can help address these data gaps efficiently. In addition to increased data availability, crowdsourcing offers broad and diverse perspectives, local knowledge, data timeliness, and direct dialogue between planners and those affected by planning decisions.

Figure 4-5 *Comments from Crowdsource Map*



3.4 Online Polls

The website home page features a community poll that has been used to solicit input on topics that are related to the analysis being conducted for this study. While this type of online poll cannot be used to survey a representative sample of the overall population that uses the Route 7 Corridor, it can be used to gauge the interest of individuals who are interested in the corridor study and have visited the project website.

Two (2) online polls have been conducted. The first poll which asked, "Is improved transit service needed along the Route 7 Corridor?" had 184 respondents. Overwhelmingly, respondents strongly agreed that the corridor could benefit from improved transit service. The second poll asked, "What is the primary mode of transportation you use to traverse Route 7?" There were 347 respondents. It was not surprising to find that approximately 78% of respondents traveled the corridor by car or taxi. Approximately 12% of the respondents indicated that they use bus to traverse Route 7.

Figure 4-6 Online Community Poll

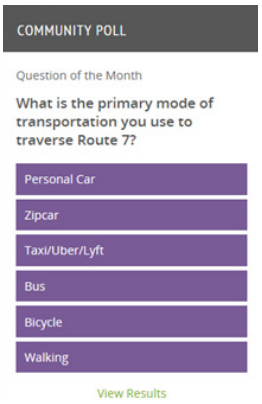
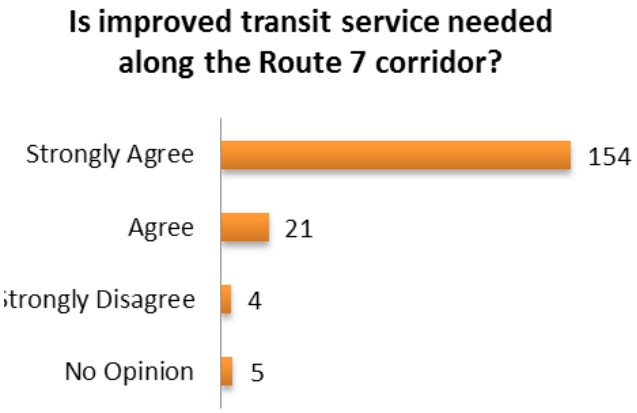


Figure 4-7 Results of Online Poll 1



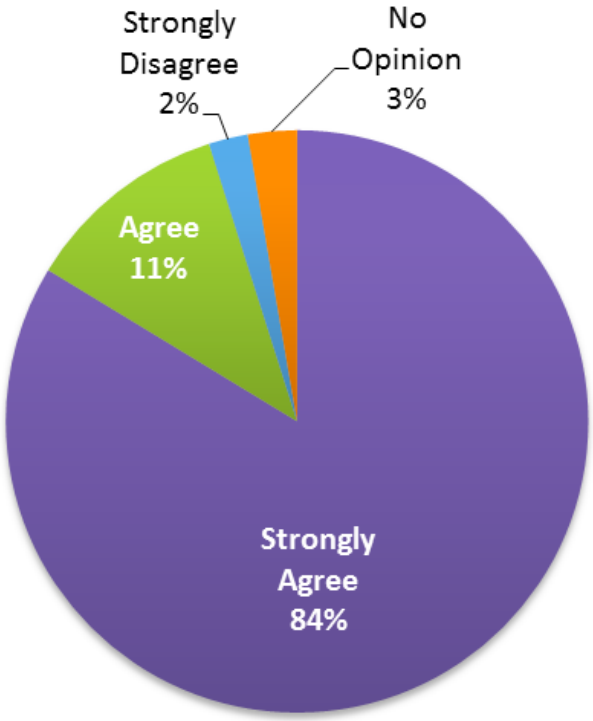
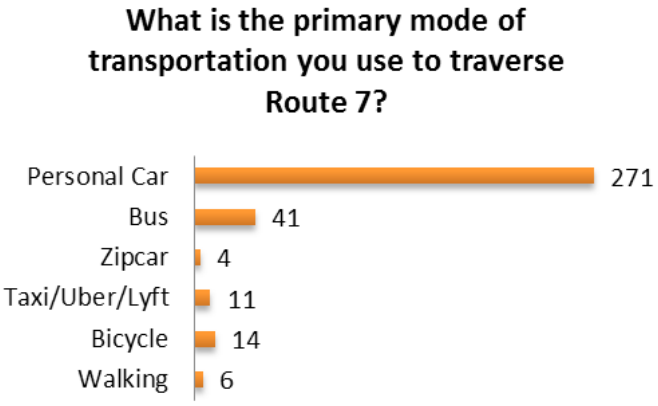
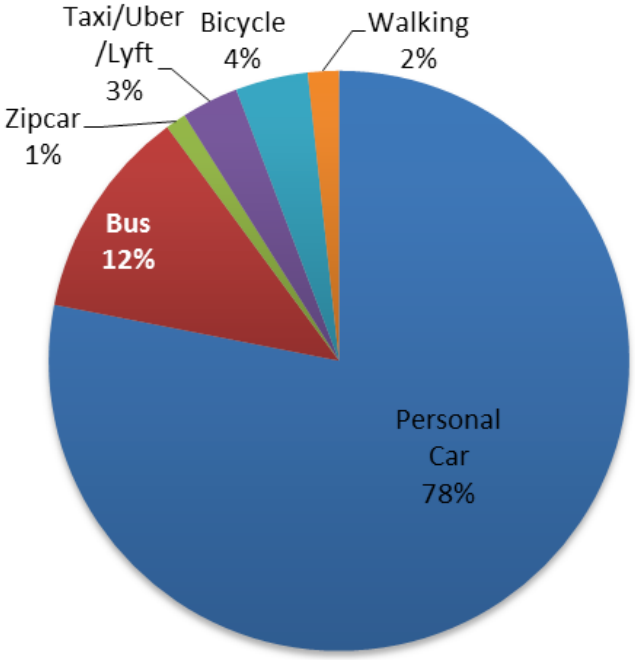


Figure 4-8 Results of Online Poll 2





3.5 Outreach to Community Organizations

Stakeholders can directly influence whether or not a project is accepted by the overall community. Stakeholder involvement is different from public outreach; it is approach that involves specific, targeted efforts toward diverse and segmented populations, each of which has different perspectives, opinions, real and perceived needs, concerns, and spheres of influence. NVTC has actively engaged community stakeholders such as the business community and community-based organizations along the corridor by providing group briefings and presentations and including them in the contact list for all project-related correspondence.

Sharing information with smaller groups allows NVTC to focus on disseminating specific information and obtaining input from the public in a more intimate and context-sensitive way. In a corridor where so many people have busy lives and may not have the ability to attend traditional public meetings, taking meetings to the public instead of expecting the public to come to meetings has been a successful outreach technique, especially in reaching traditionally under-served and under-represented members of the community.

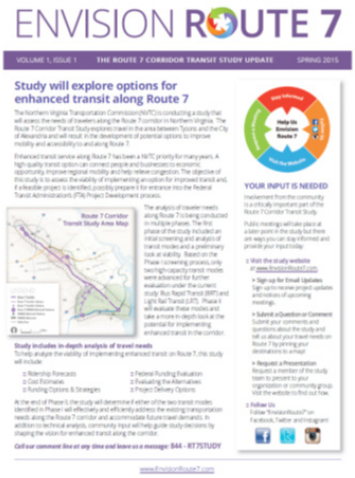
The NVTC staff and consultant team have provided project briefings to the following groups:

- Alexandria Transportation Commission
- Arlington Transportation Commission
- Bailey's Crossroads Rotary Club
- Bailey's Crossroads/ Seven Corners Revitalization Corp
- Coalition for Smarter Growth
- Fairfax County TAC
- Falls Church Chamber of Commerce
- Falls Church City Council & CAC on Transportation
- Falls Church League of Women Voters
- League of Women Voters of the Nat. Cap. Area Trans. Forum
- Mason District Land Use Council
- McLean Citizens Association
- Sierra Club

3.6 Newsletters

Newsletters can be an effective technique for sharing information with a broad audience. A project newsletter was produced and distributed on April 20, 2015, as a part of the virtual project kick-off. The newsletter was used to introduce the study to the public and provide an overview of the study as well as details on how to gain more information about the project through the website, phone line, email, and social media sites. The newsletter was disseminated electronically via a broadcast email. Also, English and Spanish versions of the newsletter were posted to the project website and the NVTC website. Copies of the newsletter were printed and distributed to libraries and community centers along the corridor in all three (3) affected localities. Below, a list of locations where the newsletter was distributed is provided. Hard copies of the newsletter were also made available in the lobby of NVTC's Arlington office and were taken for distribution to various community briefings and events. English and Spanish copies of the newsletter can be found in Appendix D.

Figure 4-9 Project Newsletter


ENVISION ROUTE 7

Study will explore options for enhanced transit along Route 7

YOUR INPUT IS NEEDED

Figure 4-10 Newsletter Distribution List

Alexandria	Falls Church	Fairfax County
• Chinquapin Recreation Center: 3210 King Street, Alexandria (Old Town) • William Ramsey Recreation Center: 5650 Sanger Avenue, Alexandria (West End) • Durant Center: 1605 Cameron Street, Alexandria (Old Town) • Ellen Coolidge Burke Library: 4701 Seminary Road, Alexandria (West End) • James M. Duncan Library: 2501 Commonwealth Avenue, Alexandria (Del Ray)	• Fall Church Community Center: 223 Little Falls Street, Falls Church • Mary Riley Styles Library: 120 N. Virginia Avenue, Falls Church	• Bailey's Crossroads Community Center: 5920 Summers Lane, Falls Church • James Lee Community Center: 2855 Annandale Road, Falls Church • Willston Multicultural Center: 6131 Willston Drive, Falls Church • George Mason Regional Library: 7001 Little River Turnpike, Annandale • Tysons-Pimmit Regional Library: 7584 Leesburg Pike, Falls Church

3.7 Telephone Comment Line

A secure telephone comment line was established as a way to receive and document public comments from individuals who may not have web access or prefer to provide verbal comments. The toll free number, 844-RT7-STUDY, was publicized on the website, in the project newsletter, on bus signs, in public meeting literature, and in presentations given to community groups. Calls are answered automatically by a voicemail service and callers are given the option to leave comments in English and Spanish. One (1) message has been received. The transcript for this call can be found in Appendix E.

3.8 Social Media

Social media is an important part of the public engagement program for the Route 7 Corridor Transit Study. An online and interactive presence for the project helps engage the public by providing consistent, informative, and pertinent content about the project and progress being made on the study. The NVTC staff established pages on Facebook and Twitter to share information about the study. These social media sites were launched as a part of the virtual project kick-off. The pages have been publicized on the website, in the newsletter, on bus signs, in public meeting literature, and in presentations given to community groups. Comments received on social media sites have been positive and supportive of the study efforts.

Table 4-3 Social Media Activity

Social Media Site	Amount of Activity
Facebook	
Number of Likes	108
Number of Posts	71
Twitter	
Number of Followers	66
Number of Tweets	65

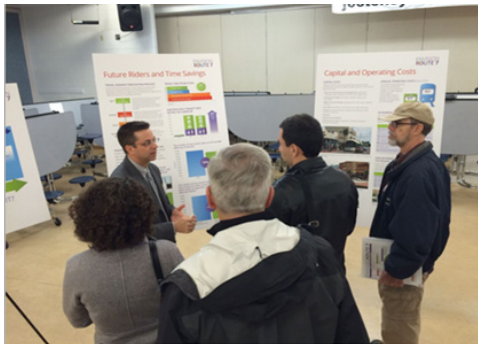
NVTC staff updates and monitors the social media sites regularly. The sites are used to announce updates to the project website including new community polls and updated documents and presentations. The Facebook and Twitter pages were used to publicize the public meetings. Posts were also made to the sites when the public meeting materials were posted to the website.

3.9 Public Meetings

Public meetings create an opportunity to give a human face to the technical work and reinforce NVTC's commitment to including the public in the process of studying the need for enhanced transit service along the Route 7 Corridor. Meetings were held to engage the local community and provide information about the study as well as to solicit input on identified alternatives and gain insight on public preferences from attendees. The first round of public meetings was held in November 2015 at three (3) selected locations along the corridor. In June of 2016, 3 additional meetings were held to share the results of the study. All meetings were held from 7 to 9 PM.

- The Alexandria meetings were held on November 4, 2015 at the Alexandria Health Department Building at 4480 King Street and June 6, 2016 at The Pavilion, The Apartments at the Mark Center.
- The Falls Church based meetings were held on November 10, 2015 and June 14, 2016 in the cafeteria of Mary Ellen Henderson Middle School at 7130 Leesburg Pike, Falls Church, Virginia.
- The Fairfax based meetings were held on November 18, 2015 and June 8, 2016 in the cafeteria of Glen Forest Elementary School at 5829 Glen Forest Drive, Falls Church, Virginia.

Figure 4-11 *Public Meeting November 2015, Falls Church*



The purpose of the first round of public meetings was to provide the public with an understanding of the project, generate interest in continued involvement in the process, and provide the results of the technical analysis conducted to assess future ridership, future traffic conditions, potential travel time savings, regional transit service connections, and the capital and operating costs of alternatives. The meetings also provided an opportunity for project staff to listen to and capture the concerns of attendees about transportation needs along the corridor. The second round of meetings were held to share the results of the study and provide information on next steps for advancing the study recommendations.

3.9.1 Broadcast Emails and Public Notices

Broadcast emails were sent to over 500 individuals included in the CommentSense© project database to share information about the public meetings. All individuals in the database were either identified during outreach activities for the first phase of the Route 7 Corridor Transit Study, were identified by the project team as key stakeholders, or have signed up for regular project updates via the project website. The meeting notice was also published in the NVTC e-newsletter.

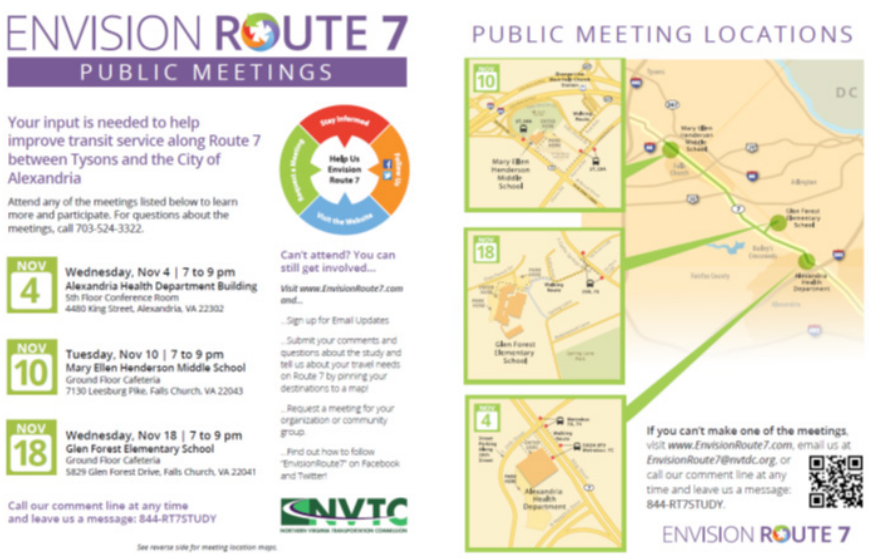
Table 4-4 *Broadcast Emails for Public Meetings*

	Date	# of Recipients	# Read
E-blast #1	October 21, 2015	451	182
E-blast #2	October 28, 2015	458	144
E-blast #3	November 2, 2015	464	171
E-blast #4	November 9, 2015	472	161
E-blast #5	November 17, 2015	503	172
E-blast #6	November 20, 2015	517	175
E-blast #7	May 31, 2016	531	206
E-blast #8	June 3, 2016	535	197
E-blast #9	June 6, 2016	536	166
E-blast #10	June 8, 2016	538	129
E-blast #11	June 8, 2016	538	149
E-blast #12	June 9, 2016	538	178
E-blast #13	June 13, 2016	539	156
E-blast #14	June 14, 2016	539	145

3.9.2 Flyer Distribution

A two-page flyer was used to advertise the meetings and was printed in both English and Spanish. The front of the flyer featured information about the three (3) meeting dates and locations while the back provided directional maps for each location as well as additional contact information. The flyers was posted to the project website, made available in the NVTC office, and distributed to local libraries and community centers. Additionally, approximately 350 flyers were distributed to families of students at Glen Forest Elementary School via students' back-packs for the November 2015 meetings.

Figure 4-12 *Public Meeting Flyer*



3.9.3 Attendance

Collectively, eighty-two (82) individuals registered their attendance at the three (3) public meetings that were held in November 2015. This number includes some representatives of local jurisdictions and NVTC partner agencies, but does not include staff from NVTC or the consultant team. A total of 53 individuals attended the series of meetings held in June 2016. This figure does not include jurisdictional staff, NVTC staff nor the consultant team.

3.9.4 Summary of Meetings:

November 2015 Meetings

All meetings were conducted in an open house format allowing attendees to come and go during the established time. The meetings had three (3) main areas: a video station, a display of technical boards and project information, and an area to share public comments. In lieu of a formal presentation, attendees were able to view a continuously looped project overview video that provided details about the corridor and the study. The following stations and exhibits were available for review by attendees:

- A station for viewing a video introducing the purpose of the study and providing an overview of the project.
- A map highlighting the role Route 7 has played as a historic thoroughfare in Northern Virginia.
- An overview map of the study area.
- A list of the key questions to be addressed by the study and information about the modes, alignment, and financial sources being explored as a part of the study.
- Information on future growth and traffic along the corridor.
- Details about the integrated transit network connected to the Route 7 Corridor.
- Information on future potential riders and time savings associated with enhanced transit service on the corridor.

Figure 4-13 *Public Meeting November 2015, Alexandria*

- A summary of estimated capital and operating costs for enhanced transit modes.
- A timeline outlining the steps in the current and future phases of the project.
- Information on public input efforts and a station for submitting written comments.

Project staff was available throughout the meeting to guide attendees through the technical displays and answer questions about the project. Attendees were also given a handout summarizing the information provided in the video and exhibits using a combination of infographics, technical, and general information. Images of the public meeting exhibits can be found in Appendix F.

3.9.5 Comments Received

The public meetings sought to get the public's input on three (3) key questions: *"What type of transit service would best serve people and businesses in the corridor?"; "Where should it go?"*; and *"How do we make it financially viable?"* Throughout the meeting, attendees were given the opportunity to provide comments in three (3) different formats:

1. Comments could be written on flip charts placed throughout the technical exhibits;
2. Comments could be posted to a map using post-it notes; and
3. Written comments could be provided using comment sheets that were provided.

Comments on Flips Charts

Meeting participants were asked to provide their reactions to the technical information presented by the project team. When space permitted, flipcharts were placed throughout meeting venues on which attendees were encouraged to write down their comments and reactions to the exhibited information. Flip chart comments were collected at the public meetings held on November 10, 2015, and on November 18, 2015. Over thirty (30) comments were received on flipcharts collectively at both meetings. The comments were reviewed and inductive data analysis was used to categorize comments based on emerging themes. The following categories/themes emerged from the comments received:

- Preference for BRT
- Preference for LRT
- Support for either BRT or LRT
- In favor of East Falls Church (EFC) alternative
- In favor of Mark Center alternative
- In favor of King Street alternative
- Support or concerns for bicycle and/or pedestrian amenities
- Related to economic development in the corridor
- Related to "other" topics

Because of the large amount of technical information provided at the meetings, the comments varied widely by category. While some comments clearly indicated a preference for one mode of public transit over another (bus rapid transit versus light rail transit), other comments spoke of preferred locations for transit service, specific amenities such as the need for parking and bicycle and pedestrian accommodations along the corridor. The chart below shows the categories in which comments were related. Many of the comments received were unique and could not be included in any of the categories. The full list of comments received on the flip charts is in Appendix H.

Figure 4-14 *Public Meeting November 2015, Fairfax*

Figure 4-15 *Public Meeting November 2015, Falls Church*

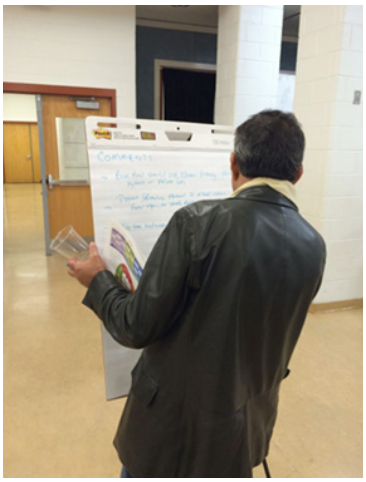
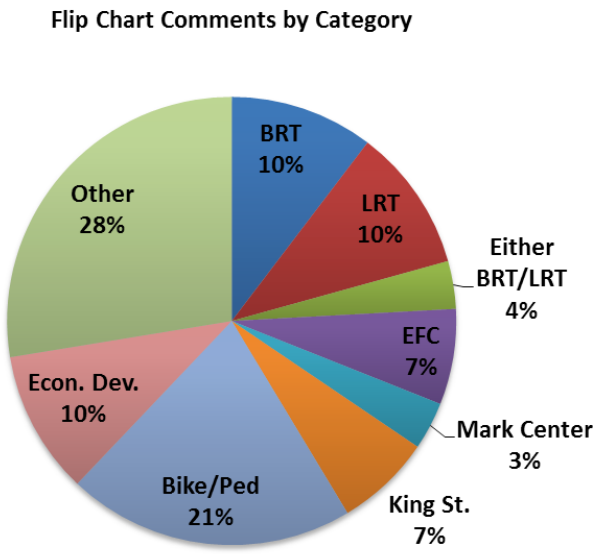


Figure 4-16 *Flip Chart Comments*



Maps Comments

The purpose of the mapping exercise was to develop a geographic representation of comments submitted at the public meetings. Similar to the online crowdsource map, individuals were provided post-it notes and asked to place comments on a map of the corridor. This visual activity allowed attendees to pin point geographic locations along the corridor and provide input associated with those locations. Ten (10) comments were placed on the map during the course of three (3) public meetings. The results are displayed in the figure below.

Figure 4-17 *Public Meeting Map Exercise, November 2015*

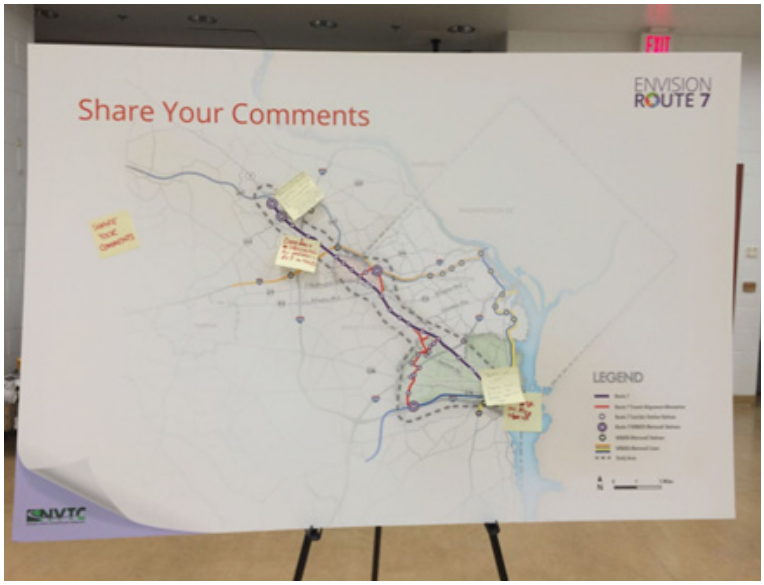
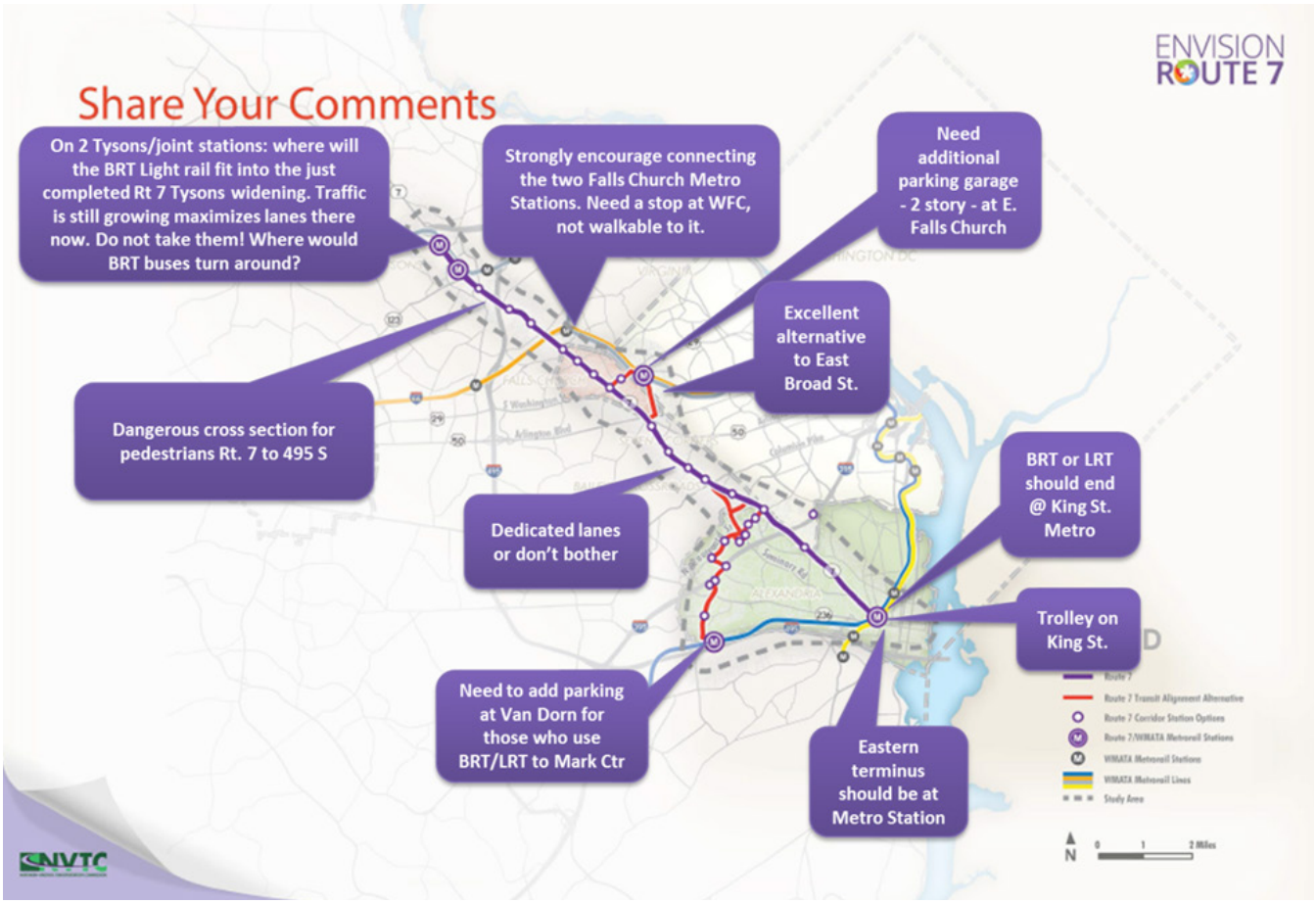


Figure 4-18 *Map Exercise Comments*



Comment Sheets

The traditional approach of soliciting open-ended written comments on a form was applied at all three (3) meetings. Some written comment forms were collected at the meetings. In general, comments received on the forms were supportive of enhanced transit on Route 7.

Summary of Public Meeting Comments

In general, public meeting attendees indicated support for enhanced transit service along the Route 7 Corridor. As previously mentioned, the three (3) public meetings held in November 2015, were conducted to seek the input on three (3) key questions: "What type of transit service would best serve people and businesses in the corridor?"; "Where should it go?"; and "How do we make it financially viable?"

The results of the public meetings provided information that is helpful to understand attendees' views related to the first two (2) questions. The collective comments received across the board (from the flip charts, mapping exercise, and comment forms) were reviewed and inductively analyzed to identify if there were emerging themes and, if so, how those themes related to key study questions.

The following categories/themes emerged from the comments received:

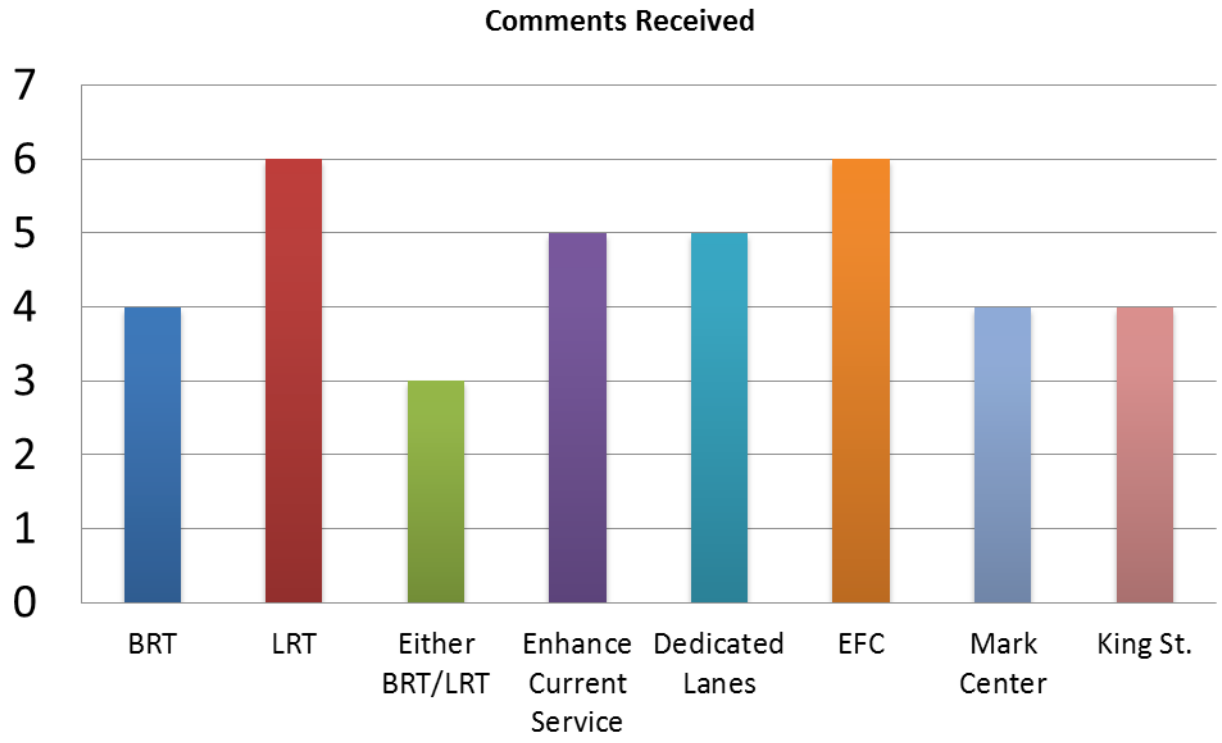
Figure 4-19 Public Meeting November 2015, Falls Church

Table 4-5 Analysis of Comments

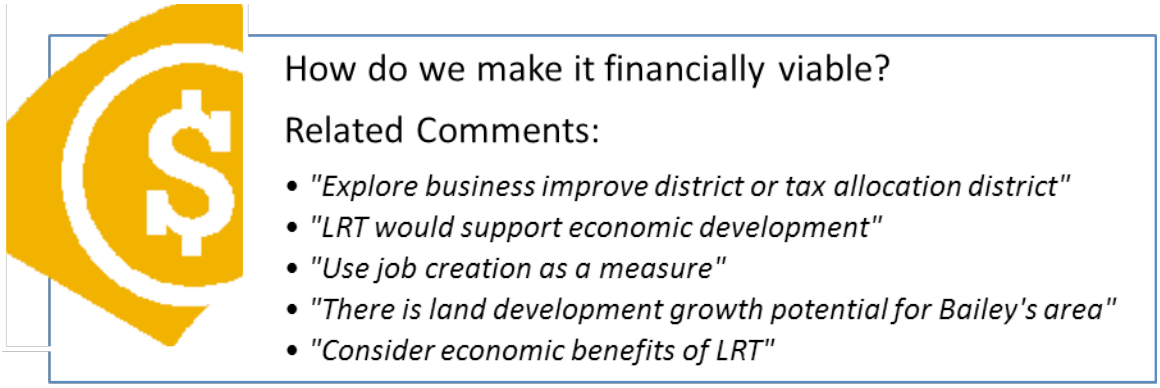
What type of transit service would best serve people and businesses in the corridor?	Where should it go?
• Support for BRT mode • Support for LRT mode • Support for either BRT or LRT • Support for enhance current transit service • Support for dedicated lanes	• In favor of East Falls Church (EFC) alternative • In favor of Mark Center alternative • In favor of service to King Street

The chart below shows how the public meeting input relates to the identified study questions. The number of comments received is too small to draw conclusions about specific modes or alternatives, but it is helpful to understand how the attendees comments help answer the questions of what type of service is needed on Route 7 and where it should go.

Figure 4-20 Analysis of Comments



There were some comments that relate to the third study question that was presented to the public: *"How do we make it financially viable?"* Comments received related to this questions are listed below:



June 2015 Meetings:

The meetings held in June of 2016 were intended to share the study findings which can be found in previous chapters of the report. All meetings used an open format and the study findings were shared on display boards. The board exhibits can be found in Appendix G of this report. Project staff spoke with meeting attendees and answered questions about the results of the study. The comments received, while generally supportive of BRT, raise location-specific concerns about the potential route and termini of BRT. There was one comment that was somewhat critical of the project.

4.0 Conclusions

As stated previously, public comment collected from all engagement techniques outlined in this chapter were used to establish the community's perceptions of the Route 7 Corridor and the study alternatives being considered.

ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Chapter 5: Alternatives Evaluation

1.0 Introduction

The purpose of the alternatives evaluation is to subject each of the Route 7 transit alternatives to a set of evaluation measures to help decision-makers select a preferred alternative to advance into further refinement and development. This section of the report begins with a discussion of the methodology utilized by the study team to evaluate the alternatives. The methodology is based upon a set of measures that are linked to the goals and objectives established for a transit improvement on Route 7, as documented in the *Route 7 Corridor Transit Study Phase I Report*. Having established a framework for the evaluation, this report applies the evaluation measures to each of the "Build" alternatives and, where appropriate, the "No-Build" and "Transportation System Management (TSM)" alternatives.

Notable among the measures used to evaluate the Build alternatives are those defined by the Federal Transit Administration (FTA) to consider candidate projects for funding under its Capital Investment Grant (CIG) program. As discussed below and in the *Route 7 Corridor Transit Study* Financial Analysis Report, the CIG program is the largest Federal discretionary revenue source available for implementing large capital transit projects, and is a potential source of funding for a transitway on Route 7. Incorporation of the CIG project justification criteria and measures into the evaluation of Route 7 alternatives provides decision-makers with invaluable insights into the competitiveness of each alternative for Federal discretionary funding.

This section of the report concludes with a summary of how each alternative performs against the evaluation measures. As these measures are not weighted, the summary will focus on a qualitative discussion of the trade-offs between alternatives, and a recommended preferred alternative.

2.0 Evaluation Methodology

This evaluation methodology has been crafted in response to input provided by the Northern Virginia Transportation Commission (NVTC) and Technical Advisory Committee (TAC) members for the Route 7 study area during Phase I of the *Route 7 Corridor Transit Study*. The intent of the methodology is to inform the selection of an appropriate transit mode, termini, and alignment that address the need for a transit investment in Route 7:

- to improve transit speeds and system reliability;
- to increase the competitiveness of transit for commuting and other trip-making purposes; and
- to support regional goals for development, redevelopment, and sustainability.

The methodology was developed to facilitate decision-making for each phase of the Route 7 study. The Phase I evaluation was completed in 2013 and resulted in the identification of the six build alternatives which are the subject of the Phase II analysis. While the goals and objectives for both the previous and current phases of the study remain the same, the evaluation measures which align with these goals and objectives have been refined to better distinguish the alternatives in terms of five specific perspectives which serve as an organizing principle for presentation of the evaluation of alternatives. These perspectives – which are taken from FTA's Procedures and Technical Methods for Transit Project Planning – are defined as the following:

- **Effectiveness** measures assess the extent to which the alternatives address the stated needs in the corridor. Suitable measures for evaluation are derived from adopted goals and objectives of the *Route 7 Corridor Transit Study*.
- **Impacts** measures assess the extent to which the alternatives support other local policy goals such as economic and community development and/or improving the environment, or result in issues that might hamper these goals or otherwise influence the selection of a preferred alternative.
- **Equity** measures assess the extent to which an alternative's impacts and benefits are distributed fairly across different population groups, particularly transportation disadvantaged communities.
- **Cost-effectiveness** measures assess the extent to which the costs of the alternatives, both capital and operating, are commensurate with their anticipated benefits.
- **Feasibility** measures assess the financial and technical feasibility of the alternatives. Financial feasibility measures assess the extent to which funding for the construction and operation of each alternative is considered to be readily available. Technical feasibility measures assess potential engineering challenges or restrictions that could limit the viability of an alternative.

Organizing the evaluation around these different perspectives helps to bring out the important trade-offs which must be considered in the selection of a preferred alternative. In particular, understanding the cost effectiveness and feasibility (both financial and technical) implications for each alternative provides an important "reality-check" on the actual deliverability of any of them. That is, while one alternative may prove to be the most effective in meeting the goals and objectives of a transit investment in the Route 7 corridor, it may prove infeasible or carry costs which far outweigh its benefits.

Table 5-1 below presents the evaluation measures used to evaluate the Route 7 alternatives according to project goals and objectives and for each of these five perspectives. Italicized measures are those that FTA uses to evaluate candidate projects for CIG program funding.

The foundation of the evaluation process is the abundant data on current and forecast corridor conditions and the costs, benefits, and impacts of the study alternatives generated throughout the *Route 7 Corridor Transit Study* which "feed" the measures. This data includes:

- Current and forecast population, employment, and land use data provided by the Metropolitan Washington Council of Governments.
- Transit ridership by purpose and income group, travel times, and changes to transit and automobile vehicle miles travelled (VMT) generated by the Maryland Alternatives Analysis II (MDAAIII) Model
- Existing bicycle and pedestrian facilities in the City of Alexandria and Arlington and Fairfax Counties.
- Land use development data gathered from existing small area plans and master plans found on City and County websites.
- Capital and operations and maintenance costs and vehicle carrying capacities for each alternative estimated by the Study team.

These data-driven measures are then reported for each alternative and either ranked (for non-CIG program measures, as presented in Section 2.0) or rated (according to FTA's CIG program criteria/measures, as described in Section 3.0), with the highest Alternative ranking or rating bolded for emphasis. Summary observations on the evaluation of alternatives are then presented in Section 4.0.

***Table 5-1** Study Goals, Objectives, and Evaluation Measures*

Goals	Objectives	Measures
Transportation Effectiveness		
Increase Mobility in the Corridor and Improve Access for Corridor Residents, Employees, and Visitors	Serve Areas with the Greatest Density of Residences and Jobs	Current Year Employment within 1/2 Mile of Stations
		2040 Employment within 1/2 Mile of Stations
		Current Year Employment Density within 1/2 Mile of Stations
		2040 Employment Density within 1/2 Mile of Stations
		Current Year Population Density within 1/2 Mile of Stations
		2040 Population Density within 1/2 Mile of Stations
Attract New Riders Through Development of an Integrated Regional Multimodal Transportation System	Minimize Distance Between Route 7 Corridor Stations/ Stops and Other Transit and Bike Routes	Number of Bus Route Connections
		Number of Rail Station Connections
		Number of Bike Lane/Path Connections
Increase Transit Use by Providing Transit Services that Meet the Needs of all Potential Users in the Corridor	Ability to Increase Number of Linked Trips on the Transit System	2040 Weekday Boardings
		2040 Weekday Boardings Per Mile
		2040 Weekday Boardings per Revenue Mile
Increase Mobility and Improve Access for All Modes in the Corridor	Increase Transit Mode Share for Work Trips	2040 Weekday Work Trips
		2040 Work Trip Transit Mode Share
	Reduce Traffic Congestion	2040 New Weekday Boardings
		Peak Hour Person Capacity
Provide a Range of Transit Options and Improve Transit Reliability in the Corridor	Reduce the Percentage of Transit Trips that Require a Transfer	2040 Number of Reduced Transfers
	Increase the Average Speed of Transit Vehicles in Revenue Service	2040 Average Transit Travel Speed

Table 5-1 Study Goals, Objectives, and Evaluation Measures (cont'd.)

Goals	Objectives	Measures
Economic and Environmental Impacts		
Leverage Public Investment in Transit to Accommodate Future Growth and Support Local Plans for Economic and Community Development	Provide Convenient and Accessible Transit Service to Areas with Economic Potential	Cumulative TIF and Assessment Revenues over 15 Years
		TIF and Assessment Revenue as a Percent of Total Capital Costs
	Provide Convenient and Accessible Transit Service to Existing and Planned Activity Centers	Number of Existing Activity Centers Served
		Number of Planned Activity Centers Served
Encourage Increased Use of Public Transit as a Key Element in Regional Efforts to Improve Air Quality and Reduce GHG Emissions	Reduce Air Pollutant and GHG Emissions	2040 Change in Auto VMT
		2040 Change in Transit VMT, by Transit Mode
		2040 Change in GHG Emissions
Reduce Impacts of Transportation Along the Corridor	Enhance the Environment	Dollar value of the anticipated direct and indirect benefits to human health, safety, energy, and the air quality environment scaled by the annualized capital and operating cost
Equity		
Increase Mobility in the Corridor and Improve Access for Corridor Residents	Serve Areas with Transit Dependent Populations	2040 Weekday Transit Dependent Boardings
		2040 Transit Dependent Boardings Per Mile
Cost Effectiveness		
	Select Transit Technologies and Corridors that Most Efficiently Serve Transportation Needs in a Cost Effective Manner	Average Annualized Cost per Boarding
		Average Annualized Cost per New Boarding
Feasibility		
	Technical Feasibility	Qualitative Summary
	Financial Feasibility	Preliminary Capital Investment Grant Rating
		Evaluation of Value Capture Opportunities

3.0 Evaluation of Alternatives

The *Route 7 Corridor Transit Study* was performed with the intent to conduct a pre-NEPA style planning analysis where significant questions regarding the viability of transit service were assessed. The study was a technical analysis of a conceptual alignment connecting Tysons and the City of Alexandria, along the Route 7 corridor with the termini, connections and alignment specifics being undefined – and being an expected outcome of the planning work.

At the outset of the Phase II portion of the study a few key points of guidance were identified by the project TAC. These points included:

- A King Street alignment beyond Quaker Lane would be extremely problematic given significant right of way constraints in that area, and that the only design possible through that area would be a mixed traffic operation, limiting the opportunities for an effective and reliable transit service in that area. However the connection to the Metro system may be more desirable from a system perspective, so a test of that alignment was still warranted.
- The City of Alexandria has invested in high capacity transit which connects Van Dorn Metro Station to Mark Center and beyond and therefore a regional transit system should connect to the intermodal station at Mark Center and not extend to, and be redundant

with, the West End Transitway. A service traveling along Route 7 could travel along the improved West End Transitway alignment to connect to the major employment center at Mark Center.

- Whether the connection to East Falls Church would be warranted for travelers, or an alignment which instead stayed on Route 7 to provide more of a main street transit service and connectivity would be more desirable.

As a result of this dialogue, and for the purposes of completing an assessment of the remaining viable alternatives, the set of alternatives originally carried forward from Phase I of the study, which are listed below, were assessed and reduced for the purposes of conducting the technical analysis for Phase II. The alternatives are listed below, showing those that were eliminated from consideration based on this feedback.

- ~~Alternative 1 BRT from Tysons to Van Dorn Metro via East Falls Church (EFC) Metro~~
- Alternative 2 BRT from Tysons to Mark Center via EFC Metro
- ~~Alternative 3 BRT from Tysons to Van Dorn Metro w/o EFC Metro~~
- Alternative 4 BRT from Tysons to Mark Center w/o EFC Metro
- Alternative 5 BRT from Tysons to King Street Metro via EFC Metro
- Alternative 6 LRT from Tysons to Mark Center via EFC Metro

Based upon the methodology presented in Section 1, the following presents an evaluation of Alternatives 2, 4, 5, and 6.

3.1 Effectiveness Measures

Measures related to effectiveness both establish the reasons for which major transit improvements are being considered, and identify ancillary concerns that may constrain options. Transportation concerns – congestion, mobility, etc. – are usually the primary basis for consideration of a major transit investment in a corridor. The following presents a series of measures which align with the *Route 7 Corridor Transit Study* goals and objectives for general mobility and accessibility.

3.1.1 Serves Areas with the Greatest Density of Residences and Jobs

The purpose of this set of measures is to identify the extent to which each of the alternatives serve existing and planned residences and jobs. As shown in Table 5-2, the higher the number of jobs and population - or the higher population density – served, the closer that alternative comes to meeting the project goal of increasing mobility and improving access for corridor residents, employees, and visitors. Higher values are also an indicator of the potential performance of the alternatives in terms of passenger utilization, and are strongly correlated with the ridership estimates presented in Sections 2.1.3 and 3.1.1.

Table 5-2 *Population and Employment Accessibility Measures*

	Alt 2	Alt 4	Alt 5	Alt 6
Current Year Employment within 1/2 Mile of Stations	111,696 (2)	110,326 (4)	**120,064 (1)**	111,696 (2)
2040 Employment within 1/2 Mile of Stations	160,022 (2)	158,345 (4)	**168,292 (1)**	160,022 (2)
Current Year Employment Density within 1/2 Mile of Stations	10,359 (3)	**11,057 (1)**	10,434 (2)	10,359 (3)
2040 Employment Density within 1/2 Mile of Stations	14,842 (2)	**15,870 (1)**	14,626 (4)	14,842 (2)
Current Year Population Density within 1/2 Mile of Stations	8,037 (2)	**8,082 (1)**	7,626 (4)	8,037 (2)
2040 Population Density within 1/2 Mile of Stations	14,126 (2)	**14,503 (1)**	13,216 (4)	14,126 (2)

Table 5-2 demonstrates that while Alternative 5 serves the greatest number of current and planned jobs located within the corridor (as defined as being within a ½ mile catchment area – a standard maximum walk distance - of each proposed station), it serves the lowest employment density of all alternatives. This is because Alternative 5 features the highest number of stations but the least dense – that is, transit supportive – development environment among alternatives. Alternative 4 demonstrates the opposite condition, serving the fewest jobs but the highest density development around its fewer stations.

3.1.2 Minimize Distance between Route 7 Corridor Stations/Stops and Other Transit and Bike Routes

Good connectivity to other non-vehicular modes of transportation is an important objective of the *Route 7 Corridor Transit Study*. Table 5-3 on the following page presents the number of "intersections" between existing or planned bus routes, existing bike lanes or paths, and Metrorail stations. More specifically, the number of bus connections were identified based on the number of individual bus routes which either directly intersected with an alternative, or which provided a stop directly adjacent to a proposed alternative's stop, easily allowing passengers to transfer between the bus and proposed Route 7 transit service. Each bus route was only counted once, even if it connected to several proposed stations.

The five potential Metrorail connections within the study area are:

- Spring Hill
- Greensboro
- East Fall Church
- Van Dorn
- King Street

The number of bike lanes and paths that directly intersect with one of the proposed Route 7 stations were derived from GIS data provided by Arlington, Fairfax, and Alexandria Counties. Only bike lanes categorized as marked bike lanes either on the street or on the adjacent sidewalks, or official bike trails adjacent to the route, were counted in this estimate. Each County has distinct criteria for classifying their bike lanes and paths, which could lead to a slight variation in the actual number of marked bike lanes along the Fairfax County portion of the routes.

***Table 5-3** Transit and Bike Connection Measures*

	Alt 2	Alt 4	Alt 5	Alt 6
Number of Bus Route Connections	35 (3)	37 (2)	**40 (1)**	35 (3)
Number of Rail Station Connections	3 (2)	2 (4)	**4 (1)**	3 (2)
Number of Bike Lane/Path Connections	5 (2)	5 (2)	**14 (1)**	5 (2)

As Table 5-3 shows, Alternative 5 provides the most transit connectivity, due primarily to its reach to the King Street Metrorail station and East Falls Church-serving alignment. Alternative 5 also provides the greatest connectivity to corridor bicycle facilities, due to the presence of Alexandria's strong bicycle lane network along the eastern end of the alignment. The other alternatives perform relatively similarly in terms of multimodal connectivity.

3.1.3 Ability to Increase Number of Linked Trips on the Transit System

Ridership on a proposed transit investment is perhaps the most fundamental benefits measure in any transit alternatives analysis. Even an indirect impact such as economic development is related to changes in ridership; that is, the likelihood that a transit project will have significant impacts on development patterns is largely determined by its ability to provide significant increases in accessibility and ridership. As a result, a project with little or no service and ridership impacts will likely have modest development impacts. Table 5-4 presents the 2040 ridership forecasts for each of the Build alternatives, as well as the TSM Alternative and No- Build condition.

***Table 5-4** Weekday Boardings*

	Alt 2	Alt 4	Alt 5	Alt 6	TSM	No-Build
2040 Weekday Boardings	41,990 (3)	23,140 (4)	**45,370 (1)**	44,820 (2)	11,390 (5)	8,340 (6)

Alternative 5 carries the highest ridership, followed closely by Alternative 6. Alternative 2 also demonstrates strong ridership. The absence of a connection to the East Falls Church station significantly limits ridership on Alternative 4, while the absence of exclusive guideway and the consequently slower travel speeds in the TSM Alternative condition inhibits its attractiveness to potential riders.

To normalize the differences in the reach of alternatives, Table 5-5 presents ridership per route mile (that is, the length of each alternative) and per revenue mile (which captures the level/frequency of service of each option). Both measures capture the efficiency of the Route 7 transit alternatives.

***Table 5-5** Transit Efficiency Measures*

	Alt 2	Alt 4	Alt 5	Alt 6
2040 Weekday Boardings per Route Mile	3,359 (2)	2,225 (4)	3,108 (3)	**3,557 (1)**
2040 Weekday Boardings per Revenue Mile	34 (2)	22 (4)	31 (3)	**36 (1)**

As Table 5-5 shows, the light rail alternative (Alternative 6) is forecast to carry the most riders against the two metrics, followed closely by Alternative 2. The performance of the alternatives in terms of cost will be analyzed further in Section 2.4

3.1.4 Increase Transit Mode Share for Work Trips

Work trips are by far public transportation's most significant travel market. Additionally, an alternatives' ability to serve work trips – which typically occur during peak weekday hours – and increase transit mode share for work trips is an important indicator of its contribution to peak period congestion relief. Table 5-6 presents the 2040 forecast work trips served by each alternative which do not involve a transfer to Metrorail, and the resulting mode share. It must be noted that many more work trips in the corridor occur than those reported. Excluded trips all involve a transfer to/from Metrorail, but the MDAAII model - developed for the Purple Line and Capitol Corridor Transit projects and used to generate travel forecasts for the *Route 7 Corridor Transit Study* - assigns "credit" for multimodal work trips to the "highest order" transit mode - which for the Washington metropolitan area is Metrorail.

***Table 5-6** Work Trips and Transit Mode Share*

	Alt 2	Alt 4	Alt 5	Alt 6
2040 Weekday Work Trips Trips	13,266 (3)	11,916 (4)	**14,685 (1)**	14,087 (2)
2040 Work Trip Transit Mode Share (%)	**30.0 (1)**	29.4 (4)	**30.0 (1)**	**30.0 (1)**

All of the alternatives improve transit mode share over the 28.7 percent share forecast for the No-Build condition. Alternative 5 is forecast to carry the greatest number of work trips in the corridor, and all but Alternative 4 contributes to the attainment of an approximately 30 percent regional work trip transit mode share.

3.1.5 Reduce Traffic Congestion

An important and simple evaluative measure of congestion relief is the number of new transit riders who are attracted by alternative investments. Table 5-7 presents the forecast new transit riders carried by each of the Build Alternatives. Table 5-7 also presents the hourly person capacity provided by each of the alternatives, based on the assumption that BRT vehicles possess a passenger capacity of 120 and that LRT vehicles have a 200 person carrying capacity.

***Table 5-7** New Weekday Boardings and Peak Hour Capacity*

	Alt 2	Alt 4	Alt 5	Alt 6
2040 New Weekday Boardings	18,880 (3)	11,350 (4)	**20,310 (1)**	20,074 (2)
Peak Hour Person Capacity	720 (2)	720 (2)	720 (2)	**1,200 (1)**

Correlating with all of the other previously presented ridership measures, Alternative 5 attracts the highest number of new riders to transit of all of the alternatives, while Alternative 4 draws the fewest. However, Alternative 5 – as well as the other BRT alternatives – do not provide the most overall transit capacity at currently assumed service frequencies, because buses are smaller than LRT vehicles. It is likely that BRT headways – that is, the amount of scheduled time between buses – will need to be reduced in order to fully meet passenger demand at these forecast ridership levels. This will be analyzed in the next phase of study should BRT emerge as the preferred alternative.

3.1.6 Reduce the Percentage of Transit Trips that Require a Transfer

While the option to connect to other forms of transportation is an important objective of the *Route 7 Corridor Transit Study*, so too is the convenience for riders to reach desired destinations without requiring a transfer. The implementation of a major new transit service in the Route 7 corridor is estimated to result in the following number of reduced transfers in comparison with the No-Build condition.

***Table 5-8** Reductions in Transfers*

	Alt 2	Alt 4	Alt 5	Alt 6	TSM
2040 Reduction in Transfers Compared to the No-Build	12,240 (2)	3,150 (4)	12,190 (3)	**15,930 (1)**	340 (5)

Given the high preponderance of transfers between Route 7 service and the Metrorail system in Northern Virginia, the reduction in the amount of transfers is modest, reflecting only improvements in intra-corridor service. Alternative 6 achieves the greatest reduction in transfers – followed by Alternatives 2 and 5 - while Alternative 4 realizes the fewest, consistent with its lower overall ridership.

3.1.7 Increase the Average Speed of Transit Vehicles in Revenue Service

Travel speed is an important factor – particularly for choice transit riders - in the attractiveness of a major transit investment. Table 5-9 presents the average speed of each alternative along the length of their alignments.

***Table 5-9** Average Travel Speed*

	Alt 2	Alt 4	Alt 5	Alt 6
2040 Average Transit Travel Speed (MPH)	17.9 (2)	16.5 (4)	16.9 (3)	**20.6 (1)**

Alternative 6 achieves the highest average speed, because it operates within an exclusive right-of-way, with no intersection conflicts. Alternative 4, on the other hand, features the longest non-exclusive alignment with multiple intersection conflicts, and therefore demonstrates the slowest speed among the Build alternatives.

3.2 Economic, Community, and Environmental Impacts

Transportation projects typically create several secondary impacts. The predominant secondary impacts used to evaluate transportation alternatives are economic, community, and environmental impacts, as presented below.

3.2.1 Provide Convenient and Accessible Transit Service to Areas with Economic Potential

In addition to facilitating improved mobility and access to jobs and other destinations, transit has the potential to promote economic development. As discussed in the *Route 7 Corridor Transit Study* Financial Analysis section of this report, it is possible to capture the new and increased value of existing land and properties generated as a result of a major transit capital investment, and to utilize a portion of this increase in value to help offset the costs of such improvements. This value is a measure of the economic development potential of improved transit service on Route 7.

Table 5-10 below presents a comparative assessment of the economic development potential of the four alternatives, including both the at-grade and elevated LRT options. As emphasized in the Financial Analysis section of this report, this analysis only illustrates the *comparative potential* of a tax increment finance (TIF) district as a value capture mechanism in the Route 7 corridor. For the cumulative revenue analysis presented below, the dollar values presented are less important than the rankings, which compares the relative potential for each alternative.

***Table 5-10** TIF Revenue Potential (in $million) and Share of Capital Cost*

	Alt 2	Alt 4	Alt 5	LRT Alt 6 At- Grade	LRT Alt 6 Elevated
Total cumulative TIF and Assessment Revenues over 15 years	$80.43 (4)	$78.50 (5)	$89.28 (3)	**$115.29 (1)**	**$115.29 (1)**
Revenue Percent of Total Capital Costs	30.2% (2)	**34.4% (1)**	30.2% (2)	11.6% (5)	12.2% (4)

Within the context described above, an LRT investment is estimated to achieve the highest level of economic development among the Route 7 alternatives, which is not surprising. However, given the assumptions for capital costs and TIF revenues used in the Financial Analysis, increased development value associated with the LRT alternatives would cover the lowest percentage of overall project costs, due to light rail's significantly higher cost than BRT. Alternative 4 performs the best in terms of "return on investment," followed very closely by the other BRT alternatives.

3.2.2 Provide Convenient and Accessible Transit Service to Existing and Planned Activity Centers

One of the goals of a Route 7 transit improvement is to leverage a public investment in transit to support local plans for economic and community development. One measure of this is the extent to which candidate transit alternatives serve existing and planned activity centers. Activity centers were identified within a half mile of proposed station locations. Activity centers considered in this analysis included shopping centers with more than four retailers and ample parking; Metrorail or bus transit centers; university campuses; office centers; and blocks with more than two mixed-use multi-family residential buildings. Planned activity centers have been identified through City and County websites and small area plans with approved development projects.

Table 5-11 *Existing and Planned Activity Centers*

	Alt 2	Alt 4	Alt 5	Alt 6
Activity Centers	18 (2)	15 (4)	**19 (1)**	18 (2)
Planned Activity Centers	**6 (1)**	5 (4)	**6 (1)**	**6 (1)**

Table 5-11 shows that Alternative 5 serves the most existing activity centers and that Alternatives 2, 5, and 6 serve the greatest number of planned centers.

3.2.3 Reduce Air Pollutant and GHG Emissions

The reduction of pollutants and emissions is another important objective of a transit investment in the Route 7 corridor. Such reductions are achieved largely by attracting commuters to transit who would otherwise travel by private vehicle. The greater the reduction in private "Vehicle Miles Travelled (VMT)," the greater the reduction in air pollutants and greenhouse gas (GHG) emissions. Table 5-12 presents the forecast change in VMT for automobiles and various transit modes resulting from implementation of each of the alternatives, while Table 5-13 shows the predicted change in GHG emissions based on each alternative. Figures in parenthesis are reductions.

Table 5-12 *Change in VMT*

	Alt 2	Alt 4	Alt 5	Alt 6	TSM
Change in Automobile VMT	**(84,527) (1)**	(8,189) (4)	(66,929) (3)	(83,280) (2)	16,351 (5)
Change in Local Bus VMT	(488)	(488)	(760)	(488)	1,020
Change in LRT VMT	-	-	-	2,446	-
Change in BRT VMT	2,446	2,228	3,032	-	-

Table 5-13 *Change in GHG Emissions*

	Alt 2	Alt 4	Alt 5	Alt 6
GHG Emission Reduction	**(10,029) (1)**	(968) (4)	(9,880) (3)	(9,882) (2)

Both tables show that Alternative 2 would have the most positive impact on air quality of the Build alternatives, while Alternative 4 generates less than 10 percent of Alternative 2's GHG emission reductions.

3.2.4 Enhance the Environment

Section 3.1.3 presents each of the Route 7 alternatives' performance in terms of the Environmental Benefits measure that FTA uses to evaluate candidate Capital Investment Grant projects. This measure is reported as the dollar value of the anticipated direct and indirect benefits to human health, safety, energy, and the air quality environment scaled by the annualized capital and operating cost of the project. These benefits are computed based on the change in VMT resulting from implementation of a proposed transit corridor investment, and their resulting environmental benefits, based on industry research. These benefits are then monetized and their weighted values are summed and compared to annualized project costs. FTA has developed a simple spreadsheet model to calculate these benefits.

Table 5-14 below presents this Environmental Benefits calculation for each Route 7 Build alternative, minus the comparison with annualized costs; the full calculation is presented in Section 3.1.3 of this report. The intent of reporting the benefits measure here is to demonstrate the overall estimated monetized environmental impacts of each of the alternatives.

Table 5-14 *Monetized Environmental Benefits*

	Alt 2	Alt 4	Alt 5	Alt 6
Dollar value of the anticipated direct and indirect benefits to human health, safety, energy, and the air quality environment	**$ 6,394,145 (1)**	$ 617,790 (4)	$ 6,304,559 (2)	$ 6,300,723 (3)

Table 5-14 demonstrates that Alternative 2 would generate the highest value of monetized health, safety, energy, and air quality benefits among the Route 7 Build alternatives.

3.3 Equity

Ensuring that a public transit investment provides enhanced mobility for low income corridor residents – or employees – is a critical objective of both the *Route 7 Corridor Transit Study* and the Federal Transit Administration in its allocation of discretionary Capital Investment Grant program funding. FTA's measures associated with low-income mobility are reported in Sections 3.1.1 and supplement the equity measures below.

3.3.1 Serve Areas with Transit Dependent Populations

For the purposes of this analysis, transit dependent riders are defined as one-half of the Year 2040 forecast passengers classified as Income Group 1 in the MDAAII mode choice model. The reason that one-half of this figure is used is that Income Group 1 combines the two lowest income quartiles that the model uses to capture the socioeconomic characteristics of residents in the Washington DC region; one-half of this figure approximates the lowest income quartile. Table 5-15 presents the number of such riders projected to utilize the Build Alternatives in 2040, as well as their number by mile of alignment.

Table 5-15 *Transit Dependent Mobility Measures*

	Alt 2	Alt 4	Alt 5	Alt 6
2040 Weekday Transit Dependent Boardings	7,556 (3)	6,650 (4)	**8,124 (1)**	8,065 (2)
2040 Transit Dependent Boardings Per Mile	604 (3)	639 (2)	556 (4)	**645 (1)**

Alternative 5 is forecast to carry the most transit dependent riders, which is not surprising given that it features the highest overall ridership and is the longest – and farthest reaching – of the Build alternatives. When normalized to a per-mile basis, however, it carries only the fourth most transit dependent riders. Alternative 6 carries the most transportation-disadvantaged riders per mile, and nearly as many overall as Alternative 5.

3.4 Cost Effectiveness

So far, the evaluation of Route 7 alternatives has focused on their absolute benefits and impacts, with some normalization to reflect their different reach (length). But the use of cost effectiveness measures help to identify the most efficient use of public resources to achieve desired goals and objectives; that is, to determine the greatest "bang for the buck." Cost effectiveness is also a critical component of FTA's decision to invest CIG funds in a corridor transit investment. Its cost effectiveness measure is presented in Section 3.1.2 and complements the measures reported below.

3.4.1 Select Transit Technologies and Corridors that Most Efficiently Serve Transportation Needs in a Cost Effective Manner

Table 5-16 presents the cost effectiveness of the Build alternatives – including the two LRT design options - in terms of total and new boardings in 2040. Costs include both annual operations and maintenance (O&M) costs and annualized capital costs estimated consistent with FTA guidance on the useful life of transit capital assets and discounted at a two percent rate.

Table 5-16 *Cost Effectiveness Measures*

	Alt 2	Alt 4	Alt 5	LRT Alt 6 At- Grade	LRT Alt 6 Elevated
Average Annualized Cost per Boarding (2040)	**$ 2.02 (1)**	$ 3.96 (3)	$ 2.20 (2)	$ 4.55 (4)	$4.72 (5)
Average Annualized Cost per New Boarding (2040)	**$ 4.49 (1)**	$ 8.07 (3)	$ 4.92 (2)	$10.15 (4)	$10.51 (5)

Table 5-16 shows that Alternative 2 is the most cost effective alternative – nearly twice as cost effective as Alternative 4 and just under three times more cost effective than the elevated LRT option in terms of total boardings.

3.5 Feasibility

3.5.1 Technical Feasibility

By its very nature, light rail transit – which involves the implementation of track and traction power substations which may result in significant utility displacement; construction of overhead catenary systems; and a lengthy procurement process for vehicles – is a much more complex transit mode to build and operate than BRT. Moreover, none of the project sponsors have ever implemented or operated LRT, whereas Fairfax and Arlington Counties and the City of Alexandria have procured buses and operated bus transit systems. While none of the jurisdictions operate BRT, they have each constructed complex bus passenger facilities and implemented other BRT-like enhancements such as real-time passenger information systems.

FTA evaluates the technical capacity and the past performance of project sponsor's ability to deliver transit corridor investments on time and on budget prior to deciding to award a CIG grant. Given the complexity of LRT and the Route 7 jurisdictions' lack of experience with its implementation and operation, the BRT alternatives are much more technically feasible than the LRT alternatives.

Among the BRT alternatives, however, the King Street section of Alternative 5 between I-395 and the King Street Metrorail Station presents signification implementation challenges, as right-of-way is constrained and community concerns are significant. Because of this, Alternatives 2 and 4 are the most technically feasible transit capital investment options in the Route 7 corridor.

3.5.2 Financial Feasibility

The transportation and other benefits (including cost effectiveness) of any transportation alternative is moot if it is not financially feasible. One of the conclusions of the financial analysis is that FTA Capital Investment Grant program funding is the most feasible foundational revenue source, able to deliver up to 50 percent of project capital costs, provided that the preferred alternative meets the CIG program's project justification and local financial commitment criteria.

Section 4 of this report presents detailed results of a preliminary evaluation and rating of the Route 7 Build alternatives' based on the CIG program's project justification criteria. The summary or "roll-up" project justification rating for the alternatives is presented below, along with the amount of non-CIG funding that would need to be secured to match a potential Capital Investment Grant. The range in funding for Alternatives 2 and 4 depends upon whether they proceed as a New Starts or Small Starts project, as described in Section 3.1.

Table 5-17 *Preliminary CIG Project Justification Rating and Resulting Funding Gap (in $millions)*

	Alt 2	Alt 4	Alt 5	LRT Alt 6 At- Grade	LRT Alt 6 Elevated
Preliminary Capital Investment Grant Project Justification Rating	**Medium-High (1)**	Medium (3)	**Medium-High (1)**	Medium (3)	Medium (3)
Amount of Non-CIG funding needed for construction	$133.14 - $166.28 (2)	**$113.95 - $127.90 (1)**	$147.64 (3)	$473.04 (4)	$498.72 (5)

Table 5-17 demonstrates that Alternatives 2 and 5 would achieve the highest CIG rating among the Route 7 alternatives. The table also shows that Alternative 4 would require the least amount of match needed to be generated by Route 7 stakeholders; in other words, Alternative 4 would place the lowest capital financial burden on project funding partners.

4.0 Capital Investment Grant Program Evaluation and Rating

In order to receive discretionary Capital Investment Grant (CIG) program funding from FTA, eligible projects must be evaluated and rated by FTA according to specific statutory project justification and local financial commitment criteria. The FAST Act's project justification criteria include the following:

- Mobility Improvements:
- Cost Effectiveness;
- Environmental Benefits;
- Economic Development;
- Land Use; and
- Congestion Relief.

The FAST Act also requires FTA to examine the following when evaluating and rating local financial commitment:

- The financial condition of the project sponsor;
- The commitment of capital and operating funding sources to the project; and
- The reasonability of the project's financial plan, including the availability of local resources to recapitalize, maintain, and operate the overall existing and proposed public transportation system without requiring a reduction in existing services.

Each criterion is "scored" on a five-point scale, rated from Low to High. Summary project justification and local financial commitment ratings are prepared and combined to arrive at an overall project rating. To qualify for CIG funding, projects must achieve an overall project rating of at least Medium (point three on the five-point scale), as well as receive at least Medium summary ratings for both project justification and local financial commitment.

The following presents preliminary project justification criteria ratings for each of the Route 7 Build alternatives, concluding with their summary project justification ratings. Ratings were derived consistent with FTA's *Final Capital Investment Grant Program Policy Guidance and Reporting Instructions for the Section 5309 Capital Investment Program* and corresponding reporting templates, all dated August 2015. In the absence of a financial plan for a preferred alternative, it is premature to undertake an evaluation and rating of the local financial commitment criteria. However, once a preferred alternative is selected and a financial plan for the project is developed, it is recommended that NVTC subject it to an evaluation against the FAST Act's financial criteria.

It must also be stressed that these preliminary ratings reflect a "snapshot in time." As a locally preferred alternative is selected and advanced into engineering and design, cost and ridership estimates will be refined which may affect its rating. Moreover, **it is presumed that transit supportive land use and economic development plans within the corridor will become more fully realized, and that a sustainable revenue source to match CIG funding to construct the project and to eventually support its operation will be secured. These local actions can only improve a Route 7 transit investment project's ratings.**

4.1 Project Justification

FTA weighs the six project justification criteria equally (16.67% each) in order to determine a summary project justification rating. A few notes on how FTA evaluates candidate CIG projects, and the assumptions used by the Route 7 study team to comply with FTA requirements, are disclosed as follows:

- FTA requires that estimates of ridership and changes in VMT which support several of the criteria be based on existing land use. At the discretion of project sponsors, FTA will accept the results of travel forecasts based upon horizon year land use as 50 percent of the input to the criteria, so long as existing land use serves as the other 50 percent input.

  Because only 2040 travel forecasts were developed for the *Route 7 Transit Corridor Study*, assumptions must be made for current year ridership estimates for each alternative. To be conservative, the Study team assumed that estimates of current year ridership and change in VMT would be 50 percent of the 2040 forecast values.

- FTA's measures for Cost Effectiveness and Environmental Benefits are different depending on whether the project qualifies as a "New Start" or "Small Start." New Starts are fixed guideway transit projects costing at least $300 million or requiring more than $100 million in CIG funding. By policy practice, FTA permits New Starts project sponsors to assume no more than 50 percent of capital costs may be covered with CIG funding. Small Starts projects cost less than $300 million *and* require less than $100 million in CIG funding. The differences between New Starts and Small Starts measures for Cost Effectiveness and Environmental Benefits is presented in Section 3.2.1 and 3.2.2.

It is assumed for the purposes of this evaluation that Alternatives 5 and 6 are New Starts; even though Alternative 5 is estimated to cost less than $300 million ($295.3 million) in current year dollars, the project cost should be expected to escalate above the Small Starts threshold by the time it is ready for construction. Alternatives 2 and 4 are evaluated as both New Starts and Small Starts. In the first case, CIG funding could be assumed to cover up to 50 percent of either alternatives' capital cost – but both would be evaluated against New Starts standards. In the second case, CIG funding would be capped at $100 million, but would have an easier path towards implementation. The differences in the development process between New Starts and Small Starts projects is explained in the *Route 7 Corridor Transit Study* Implementation Strategy Report.

4.1.1 Mobility Improvements

FTA defines the measure for the Mobility Improvements criterion as the estimated annual trips on the project in the current year. Acknowledging the important role that public transportation plays in providing mobility to populations without regular access to a private automobile, FTA allows transit dependent riders - as codified in the regional travel demand mode (see Section 2.I) – to be double-counted.

Table 5-18 presents an estimate of trips by non-transit dependents riders plus trips by transit dependent riders multiplied by two, and the resulting Mobility Improvements rating for each Route 7 alternative.

Table 5-18 *Mobility Improvements*

Alt 2 BRT	Alt 4 BRT	Alt 5 BRT	Alt 6 At- Grade LRT	Alt 6 Elevated LRT
11,110,691	7,083,759	12,536,472	10,050,885	10,050,885
Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)

Each evaluated alternative would receive a Medium rating for Mobility Improvements. Of the four, Alternative 5 has the highest ridership and carries the largest number of transit dependent riders.

4.1.2 Cost Effectiveness

The Cost Effectiveness measure for New Starts projects is the annual capital and operating and maintenance (O&M) cost per trip on the project. The Small Start Costs Effectiveness measure is the Federal share of annualized capital cost per trip; O&M costs are not factored into the Small Starts Cost Effectiveness calculation. Table 5-16 presents the Cost Effectiveness values and corresponding ratings for each of the Route 7 Build alternatives; for Alternatives 2 and 4, the Small Starts Cost Effectiveness value and rating precedes the New Starts rating.

Table 5-19 *Cost Effectiveness*

Alt 2 BRT	Alt 4 BRT	Alt 5 BRT	Alt 6 At- Grade LRT	Alt 6 Elevated LRT
$ 0.56 /$ 3.04	$ 1.02 / $ 5.41	**$ 3.31**	$ 6.84	$ 7.08
High (5) / High (5)	Medium- High (4) / Medium-High (4)	**High (5)**	Medium (3)	Medium (3)

Table 5-19 demonstrates that Alternatives 2 and 5 each receive FTA's highest ratings for Cost Effectiveness. It is particularly notable that Alternative 2 earns a High rating as a New Start, because it carries the full "burden" of project capital and operating costs. Alternative 2 and both LRT options achieve only a Medium rating for this measure, the former due to its limited benefits and the latter due to their high costs relative to ridership.

4.1.3 Environmental Benefits

FTA's measure for the Environmental Benefits criterion for New Starts projects is defined as the dollar value of the anticipated direct and indirect benefits to human health, safety, energy, and the air quality environment scaled by the annualized capital and operating costs of the project. The resulting ratio is multiplied by 100, and thus the measure is expressed as a percentage. The measure is the same for Small Starts except, as with Cost Effectiveness, only the Federal share of capital costs is included in the calculation.

Environmental Benefits are computed based on the change VMT resulting from implementation of the proposed project. The calculation is facilitated by an FTA-produced spreadsheet tool which includes values corresponding to the benefits noted above. Table 5-20 below presents the Environmental Benefits value and rating for each of the Route 7 alternatives.

Table 5-20 Environmental Benefits

Alt 2 BRT	Alt 4 BRT	Alt 5 BRT	Alt 6 At- Grade LRT	Alt 6 Elevated LRT
68.6 % / 12.6 %	6.6 % / 1.1%	**10.5 %**	5.2 %	5.0 %
High (5) / High (5)	Medium-High (4) / Medium (3)	**High (5)**	Medium-High (4)	Medium-High (4)

As the table shows, Alternative 2 achieves the highest rating for Environmental Benefits, as either or New Start or Small Start, owing to the VMT it is forecast to reduce as compared to its overall cost.

4.1.4 Economic Development

FTA's measure for Economic Development is the extent to which a proposed project is likely to enhance additional, transit- supportive development in the future based on a qualitative examination of existing local plans and policies to support economic development. More specifically, FTA evaluates the following five factors:

- Transit supportive plans and policies
- Tools to implement transit supportive policies
- The demonstrated performance of transit supportive policies
- Impact of the project on regional land use
- Plans and policies to promote affordable housing in the project corridor.

FTA's evaluation of Economic Development is an extremely rigorous exercise, involving a detailed review of land use development plans, policies, and other documentation, as well as an assessment of the performance of land use policies elsewhere in the region as a harbinger of success. Such an evaluation is well outside of the scope of the *Route 7 Corridor Transit Study*. In addition, it is too early in the Route 7 transit planning process to expect that significant transit-supportive policies would have been enacted; in fact, no alignment- or station area-specific plans currently exist. As such, the estimated rating below reflects the current state of transit supportive land use planning - which does not distinguish between alternatives- while acknowledging the tremendous development response to the presence of premium transit in Tysons Corner. Importantly, it should be expected that this rating will improve over time. Recommended planning next steps are presented in the *Route 7 Corridor Transit Study* Implementation Strategy Report.

Table 5-21 Economic Development

Alt 2 BRT	Alt 4 BRT	Alt 5 BRT	Alt 6 At- Grade LRT	Alt 6 Elevated LRT
Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)

4.1.5 Land Use

FTA has established five quantitative measures to determine a rating for existing Land Use:

- Employment within ½ mile of proposed stations
- Population density within ½ mile of proposed stations
- Average cost per day of downtown (central business district) parking
- Downtown parking spaces per employee
- Ratio of current affordable housing in the project corridor to region-wide affordable housing.

The affordable housing calculation is outside of the scope of this analysis, but the remaining measures for each alternative are presented in Table 5-22. Tysons Corner was used as the central business district for all alternatives when calculating the cost of parking per day and the number of parking spaces per employee, according to the Metropolitan Washington Council of Government's *Tysons Annual Report* (2014).

Table 5-22 *Land Use*

	Alt 2	Alt 4	Alt 5	Alt 6 At-Grade LRT	Alt 6 Elevated LRT
Current Year Employment within 1/2 Mile of Stations	111,696	110,326	120,064	111,696	111,696
Current Year Population Density within 1/2 Mile of Stations	8,038	8,082	7,626	8,037	8,037
Current Year Average Daily Parking Cost in Tysons Corner	$8.84	$8.84	$8.84	$8.84	$8.84
Current Year Tysons Corner Parking Spaces per Employee	1.1	1.1	1.1	1.1	1.1
Summary Rating	**Medium (3)**	**Medium (3)**	**Medium (3)**	**Medium (3)**	**Medium (3)**

As Table 5-22 shows, there is very little difference between the alternatives in terms of FTA's Land Use criteria, and each would earn a Medium rating.

4.1.6 Congestion Relief

FTA evaluates Congestion Relief based on the number of new weekday linked transit trips resulting from implementation of the project. Table 5-23 presents the factored (e.g. average of current and forecast year) number of weekday new riders and associated rating for each Build alternative.

Table 5-23 *Congestion Relief*

Alt 2 BRT	Alt 4 BRT	Alt 5 BRT	Alt 6 At- Grade LRT	Alt 6 Elevated LRT
14,160	8,513	15,233	15,056	15,056
Medium-High (4)	Medium (3)	**Medium-High (4)**	**Medium-High (4)**	**Medium-High (4)**

As Table 5-23 shows, all alternatives except for Alternative 4 reach the threshold (10,000 new daily trips) to qualify for a Medium- High rating.

4.1.7 Summary Project Justification Ratings

Each of the criteria above are weighted equally in determining an overall rating project rating above are combined into a summary project justification rating, as shown in Table 5-24 on the following page

Table 24 *New Starts (NS) and Small Starts (SS) Project Justification Ratings*

	Alt 2 Small Starts BRT (SS / NS)	Alt 4 Small Starts BRT (SS / NS)	Alt 5 New Starts BRT (NS)	Alt 6 New Starts At Grade LRT (NS)	Alt 6 New Starts Elevated LRT (NS)
Mobility Improvements	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Cost Effectiveness	High (5) / High (5)	Medium-High (4) / Medium-High (4)	High (5)	Medium (3)	Medium (3)
Environmental Benefits	High (5) / High (5)	Medium-High (4) / Medium (3)	High (5)	Medium-High (4)	Medium-High (4)
Economic Development	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Land Use	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Congestion Relief	Medium-High (4)	Medium (3)	Medium-High (4)	Medium-High (4)	Medium-High (4)
Sum and Average Score	(SS) 23/6 = 3.83 (NS) = 23/6 = 3.83	(SS) 20/6 = 3.33 (NS) 19/6 = 3.17	(NS) 23/6 = 3.83	(NS) 20/6 = 3.33	(NS) 20/6 = 3.33
Project Justification Rating	**Medium-High / Medium-High**	**Medium / Medium**	**Medium-High**	**Medium**	**Medium**

Table 5-24 demonstrates that – based on the present data and analysis - each of the Route 7 Alternatives achieves the minimum Medium rating necessary to qualify for consideration by FTA for Capital Investment Grant program funding. However, Alternatives 2 and 4 both earn Medium-High ratings, which is the second highest rating possible for CIG projects. Notably, Alternative 2 achieves a Medium-High rating as either a Small Start or a New Start. This provides Route 7 stakeholders with expanded options for advancing a major transit investment through the Federal transit project development process, as explained in the *Route 7 Corridor Transit Study* Implementation Strategy Report.

5.0 Summary of the Evaluation of Alternatives

5.1 Alternatives

5.1.1 Alternative 2

Alternative 2 is a 12.5 mile BRT system linking Tysons Corner with the Mark Center, providing a connection to the East Falls Church Metrorail station. At a capital cost of approximately $266 million ($2015), Alternative 2 is the second least expensive alternative evaluated in the Phase II study.

Alternative 2 features strong ridership, with 2040 forecasts showing just under 42,000 boardings. It performs well against all of the effectiveness measures, and is the highest ranked alternative in terms of cost effectiveness and environmental impacts. On the other hand, there is not a single evaluation measure for which Alternative 2 is ranked the lowest. Based on the current data, Alternative 2 would rate Medium-High against FTA's CIG program project justification criteria.

5.1.2 Alternative 4

Alternative 4 is a 10.4 mile BRT alignment similar to Alternative 2, but without the East Falls Church Metrorail connection. Alternative 4 is the least expensive Route 7 transit alternative, with an estimated capital cost of $227.9 million ($2015).

Alternative 4 is forecast to carry 23,100 boardings in 2040 – the lowest ridership of all alternatives and just more than one-half the ridership of Alternative 5. In general, Alternative 4 performs the weakest of the Route 7 alternatives in terms of effectiveness, impacts, and equity. This weakness demonstrates, in part, the importance of an East Falls Church Metrorail connection for a Route 7 transit investment's impact on mobility and air quality. Alternative 2 is estimated to rate Medium against FTA's CIG program project justification criteria.

5.1.3 Alternative 5

Alternative 5 is a 14.6 mile BRT alignment connecting Tysons Corner with the King Street Metrorail station in Alexandria. Alternative 5 also serves the East Falls Church Metrorail station. Alternative 5 is the most expensive BRT alignment at $295.3 million ($2015).

Alternative 5 is forecast to carry the most riders (45,400) and generally performs the best of all alternatives in terms of transportation effectiveness. It ranks just behind Alternative 2 for environmental impacts and cost effectiveness. Alternative 5 is estimated to rate Medium-High against FTA's CIG program project justification criteria.

However, technical feasibility problems for implementation, including limited rights of way along the section and also known community concerns make this alternative problematic.

5.1.4 Alternative 6

Alternative 6 is a 12.5 mile LRT alignment identical to Alternative 2 – but in a dedicated rail right-of-way. Alternative 6 was evaluated with two design options – one at-grade, and one elevated. The at-grade option is estimated to cost $946.1 million ($2015), while the elevated option is estimated at just under $1 billion ($997.4 million) – approximately 3 to 4 times more expensive than the BRT alternatives. Its annual operations and maintenance cost is approximately 75 percent higher than the BRT alternatives.

Alternative 6 is forecast to carry 44,800 riders in 2040. It performs well against all of the transportation effectiveness and environmental impact measures, and would rate Medium against FTA's New Starts criteria. However, given the complexity of its infrastructure and the (lack of) experience of Route 7 project stakeholders, it would be the most technically challenging of the Build alternatives to implement. In addition, even assuming that 50 percent of project funding would come from the CIG program, Route 7 stakeholders would have to generate nearly $500 million in match, at least $200 million of which must be state, local, or other non-Federal sources.

5.2 Recommended Alternative

Based on the preceding analysis and evaluation, the *Route 7 Corridor Transit Study* Team recommends that Alternative 2 be selected as the "recommended alternative" to advance into Federal environmental review, engineering, and design. **The Study Team finds that Alternative 2 best meets the following goals and objectives for a transit investment on Route 7.**

- **Increase Mobility in the Corridor and Improve Access for Corridor Residents, Employees, and Visitors.** Over 110,000 jobs are located within ½ mile of proposed stations along the Alternative 2 alignment; that figure is estimated to reach 160,000 jobs by 2040. Population density around proposed stations is 8,000 persons per acre, reaching over 14,000 persons by 2040, reflecting a planned residential densification in the corridor which promotes transit usage.
- **Attract New Riders through Development of an Integrated Regional Multimodal Transportation System.** Alternative 2 further features three connections to Metrorail along its alignment, as well as fair connectivity to local bus routes and bike lanes, at least in comparison to the other alternatives evaluated in the *Route 7 Corridor Transit Study*.
- **Increase Transit Use by Providing Transit Services that Meet the Needs of all Potential Users in the Corridor.** Alternative 2 is forecast to carry nearly 42,000 riders in 2040. This forecast results in 3,360 boardings per route mile and 34 boardings per revenue mile – the highest among all BRT options studied in the Route 7 corridor.
- **Provide a Range of Transit Options and Improve Transit Reliability in the Corridor.** In addition to expecting to attract nearly 19,000 new riders to transit by 2040, Alternative 2 would reduce by over 12,200 the number of transfers needed (as compared to the "No-Build" condition) to complete trips beginning or ending in the corridor – the most of any BRT alternative. Alternative 2's desirability to new transit riders is due to its frequency of service and relatively high average speed of approximately 18 miles per hour, the fastest of all BRT alternatives.
- **Leverage Public Investment in Transit to Accommodate Future Growth and Support Local Plans for Economic and Community Development.** Any investment in high quality, high capacity transit should be expected to promote economic development, particularly when local jurisdiction have enacted plans and policies to optimize development around transit passenger facilities. It is still early in the corridor planning process to expect the establishment of such plans. In addition, as the value capture analysis performed in the *Route 7 Transit Corridor Study* Financial Analysis Report suggests, it is difficult to measure the precise level of economic development attributable to rail and BRT projects. That said, Alternative 2 is consistent with Fairfax County plans to densify development along Route 7. If tapped to help finance a Route 7 transit investment, the Alternative 2 alignment can be expected to contribute to a portion of the project's capital costs – and perhaps a larger portion of costs than an LRT project might generate, given LRT's much higher cost.
- **Encourage Increased Use of Public Transit as a Key Element in Regional Efforts to Improve Air Quality and Reduce Greenhouse Gas Emissions.** Alternative 2 contributes to the highest reduction of private vehicle miles travelled of all Route 7 alternatives, therefor realizing the most GHG reductions and other air quality benefits.

Beyond the project goals and objectives, Alternative 2 also realizes three additional – and practical - outcomes. First, against every measure used in the *Route 7 Transit Corridor Study*, it is the most cost effective of the alternatives evaluated, thus providing stakeholders with the biggest "bang for the buck." Secondly, it performs well against FTA's Capital Investment Grant program project justification criteria, thus making it potentially eligible for up to $133 million in Federal discretionary funding – and reducing local financial requirements for it to a like amount (50 percent of total project capital costs). Third, it is among the most technically feasible alternatives evaluated, avoiding both the complexity of LRT implementation and operation and the difficulty of securing dedicated lanes on King Street, as required of Alternative 5.

ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Chapter 6: Financial Analysis

1.0 Introduction

This chapter documents and evaluates the potential revenue sources available to construct and operate a major capital transit investment in the Route 7 corridor. This Chapter recognizes that a discussion of funding and financing options early in project planning helps decision-makers understand the financial feasibility – and potential administrative burdens -- of advancing any of the alternatives being studied into the next phase, which ultimately should help support a decision on a preferred option.

Section 2 of this chapter begins with a summary of the planning level capital and operating costs estimated for each of the five BRT and two LRT alternatives being studied in the corridor. Section 3 presents an introduction to potential funding sources for transit available from state, regional, and federal agencies, and the processes by which they administer those sources. An exploration of alternative funding sources such as value capture options and other fees and revenues that might be secured to support the capital and operating needs of a Route 7 transit project is presented in Section 4. Table 6-1 below presents the revenue sources examined in this chapter.

Table 6-1 *Summary of Potential Revenue Sources*

State	Regional/Local	Federal	Value Capture	Other
Operating Assistance Capital Assistance Virginia SMART SCALE Revenues	NVTC Gas Tax Revenue NVTC Transform66 NVTA HB 2313 Regional Revenues NVTA "30 percent" Local Revenues Locally Generated Revenues	New Starts/Small Starts (FTA Section 5309) Urbanized Formula Program (5307) Bus and Bus Facilities Formula and Discretionary Program (5339) Congestion Mitigation Air Quality Surface Transportation Block Grant Program TIGER	Tax Increment Financing Special Assessment Districts Joint Development Air Rights	Developer Contributions Developer Impact Fees Fare Revenue Advertising Naming Rights

This Chapter concludes with an evaluation of each "eligible" funding option's feasibility to support a transit investment on Route 7, as well as a recommendation of the most promising sources for further investigation should a project advance into later planning and design phases.

It must be stressed that this analysis is merely an introduction to the opportunities for funding a major transit investment in Route 7 at this time. If a preferred alternative is selected and advanced into further development, it would be expected that project costs would be refined, which would adjust the capital and operating needs presented here. Likewise, ridership estimates may change and transit supportive land use planning activities will accelerate (as the reality of a new transit service becomes closer), which may then impact a project's competitiveness for federal discretionary funding. Finally, new funding programs and other opportunities may emerge in the years ahead. Consequently, this analysis should be considered a snap-shot of those options available at this time. Potential project stakeholders are encouraged to take the steps necessary to secure the revenues recommended here if an alternative is selected and advanced, but to closely monitor future opportunities – including the pursuit of new sources, as they become available.

2.0 Capital and Operating Costs

Table 6-2 and Table 6-3 below summarize the capital and O&M costs estimates for the seven proposed alternatives being evaluated for the Route 7 corridor. Capital costs are presented in FTA's standard cost categories in 2015 dollars; O&M costs are annual costs, also reported in 2015 dollars. Consequently, depending on a) the schedule for project development, design, and construction; b) the rate of inflation realized during this period; and c) refinements to the preferred alternative as it is subject to further design and formal environmental review, these costs should be expected to change. Nevertheless, the current cost estimates represent an adequate understanding of the differences between alternatives, particularly the dramatic difference in cost between the BRT and LRT alternatives.

Table 6-2 *Estimated Route 7 Alternative Capital Costs (Millions)*

	BRT Alt 1	BRT Alt 2	BRT Alt 3	BRT Alt 4	BRT Alt 5	LRT Alt 6 (At grade)	LRT Alt 6 (Elevated Sections)
10 Guideway & Track Elements	$77.63	$70.39	$65.03	$57.79	$81.16	$139.94	$162.11
20 Stations, Stops, Terminals	$33.79	$29.57	$30.98	$26.75	$26.75	$115.58	$115.58
30 Support Facilities	$7.60	$5.91	$7.60	$5.91	$6.76	$36.56	$36.56
40 Sitework & Special Conditions	$26.65	$23.86	$22.71	$19.92	$27.49	$149.96	$160.90
50 Systems	$41.63	$34.53	$36.10	$28.99	$39.20	$123.44	$123.44
60 ROW, Land , Existing Improvements	$18.60	$16.31	$15.93	$13.63	$18.17	$68.36	$72.21
70 Vehicles	$18.35	$14.27	$18.35	$14.27	$16.31	$66.24	$66.24
80 Professional Services	$62.75	$55.02	$54.41	$ 46.69	$60.75	$189.44	$200.53
Contingency	$18.73	$16.42	$16.24	$13.94	$18.14	$56.55	$59.86
Total Project Costs	**$305.74**	**$266.28**	**$267.36**	**$227.90**	**$295.27**	**$946.08**	**$997.44**
Cost Per Mile	**$20.10**	**$21.24**	**$20.41**	**$21.86**	**$20.23**	**$75.25**	**$79.34**

Table 6-3 *Estimated Route 7 Alternative Operating and Maintenance (O&M) Costs (Millions)*

	BRT Alt 1	BRT Alt 2	BRT Alt 3	BRT Alt 4	BRT Alt 5	LRT Alt 6 (At grade)	LRT Alt 6 (Elevated Sections)
O&M Costs	$16.58	$16.62	$16.65	$16.75	$15.98	$27.16	$27.16

3.0 Public Sector Funding Sources

The capital and operating costs of a transit system on Route 7 would qualify for funding under a number of state, regional, local, and federal programs. The following sections identifies agencies which administer candidate grant programs, outlines some information about the programs, and describes their potential applicability to a potential future Route 7 project.

Funding for transit from the Commonwealth of Virginia is administered by the following organizations:

- Commonwealth Transportation Board (CTB)

  The CTB is an 18 member board appointed by the governor responsible for establishing the administrative policies of the state's transportation systems. The CTB provides funding for highway, seaport, airport, and public transportation projects. It is responsible for administering a statewide transportation prioritization process for certain projects funded by the CTB - such as the SMART SCALE funds described below - and for developing a Six Year Improvement Program (SYIP) of transportation investments. The CTB is also responsible for administering and allocating the state's Transportation Trust Fund.

- Department of Rail and Public Transportation (DRPT)

  DRPT is a state agency which reports directly to the Virginia Secretary of Transportation and is governed by the CTB. DRPT focuses on rail, public transportation, and commuter services throughout the Commonwealth. DRPT administers the following transit programs.

  - DRPT Capital Assistance
  - DRPT Operating Assistance

- Virginia Department of Transportation (VDOT)

  VDOT is the state agency responsible for building, maintaining, and operating a majority of the state's roads, bridges, and tunnels. The Commissioner of VDOT reports directly to the Secretary of Transportation. The CTB acts as the board of directors overseeing VDOT's activities. VDOT administers the following state programs which may be used for transit purposes.

  - High Priority Project Program (HPPP)
  - Construction District Grant Program (CDGP)

3.1 DRPT Funding Sources

DRPT is responsible for administering its own grant programs as well as some federal funding sources available for local transit (as described in Section 2.4). The following describes DRPT's funding programs available for a potential transit fixed guideway project such as that identified for Route 7.

3.1.1 DRPT Capital Assistance Program

DRPT administers an annual Capital Assistance program for transit agencies throughout the Commonwealth. In FY 2016 DRPT programmed $54.7 million in current year funding along with $68.9 million in capital bond proceeds, resulting in a $123.5 million program. However, DRPT will no longer issue these bonds, resulting in the elimination of these revenues after 2019. The Capital Assistance program is expected to grow modestly, and is assumed to reach $99.8 million in 2021.

DRPT utilizes a three-tiered methodology for administering these funds. Funds are provided to cover a maximum percentage of total project costs based on the tier, as described below.

- Tier 1 (68 percent): The replacement/rehabilitation and acquisition of rolling stock.
- Tier 2 (34 percent): Infrastructure and facilities for transit purposes. Eligible activities include real estate acquisition, rehabilitation or renovation of existing infrastructure and facilities, and also new major capital projects.
- Tier 3 (17 percent): Other eligible transit related items, including the acquisition of support vehicles and shop equipment; project development (planning and engineering) expenses for capital projects, and more.

Match to the three tiers can be derived from a number of sources, including federal and regional programs, as described later in this Chapter. However, at least four percent of project funding must come from the local project sponsor in order to be eligible for DRPT Capital Assistance. Capital Assistance program applications are evaluated by DRPT based on eight criteria:

Project Justification, an explanation of the need/problem the project will address;

Planning, documentation that sufficient planning has been conducted to execute the project;

Project Scope, an approach to address the need/problem;

Project Readiness, the ability to initiate and advance the projected within the fiscal years the funds are applied for;

Technical Capability, identification of project management team and ability to execute the project;

Project Budget, the ability to execute the project scope within the project budget;

Project Schedule, the ability to execute the project scope within the schedule; and

Monitoring and Evaluation Plan, the applicant's approach to measuring performance and evaluation results of the request capital project.

DRPT has not assigned criteria weighting to the aforementioned evaluation measures. Once all eligible projects have been evaluated, DRPT makes its recommendations to the CTB for a project's inclusion in its funded six year implementation plan (SYIP). Northern Virginia was awarded over 90 percent of all Capital Assistance funds available throughout the state from 2015 to 2019, funding such projects as commuter rail vehicles for the Virginia Railway Express and buses for transit systems in Arlington, Fairfax, Loudon, and Prince William counties.

Demand for this funding source typically exceeds supply, and not all projects that request Capital Assistance receive an award; nor is DRPT always able to fund projects at the percentage share identified above for each tier. DRPT has stated that maintaining a maximum 68 percent funding share for Tier 1 projects in future years of funding is its intent, while funding as many Tier 1 type project applications as possible. According to DRPT staff, the consequence of this policy is that Tier 2 projects – which is the tier under which a Route 7 transit investment would be eligible – will likely see a decline in percentage match after FY 2018, with a match of 20 percent anticipated in FY 2019 and 15 percent from FY 2020 to FY 2023.

3.1.2 DRPT Transit Operating Assistance

This program supports up to 95 percent of eligible expenses of the costs of operating existing systems, the expansion of transit service, or the operation of new service. Due to ongoing funding constraints, however, program funds have traditionally matched only 15 - 25 percent of eligible system operating expenses.

Local and state governments, transportation district commissions, and public service corporations are eligible to apply for these funds. Local entities must provide DRPT with an implementation plan, such as the results of a transit feasibility study, before applying for operating assistance for new service. Grant funds are distributed through a formula calculation based on ridership and operating costs relative to all

other eligible transit operators in the state. Next, DRPT administers Maximum Eligibility and Maintenance of Effort tests which are based on the operators' previous years' operating expenses, fare box revenue, and percentage of state funding. The Maintenance of Effort test is only used when state funding for operating assistance has increased over the previous years. New transit systems which increase capacity may apply for operating assistance using a proposed two-year budget for the first two years of service.

The Transit Operating Assistance program provided $176.6 million to transit systems in FY 2016, $19.8 million of which was allocated to Arlington and Fairfax Counties and the City of Alexandria. In FY 2016 WMATA received nearly $100 million of DRPT program funding for the bus and rail service it provides in Northern Virginia.

3.2 Commonwealth Funding Sources

A total of $1 billion in transportation funding has been made available between FY 2017 – FY 2021 in the Commonwealth of Virginia under House Bill 1887. Although not yet authorized, it is expected that funding will continue to be made available after 2021. Funds will be administered through two separate grant programs which are equally funded at $500 million: the High Priority Project Program (HPPP) and the Construction District Grant Program (CDGP). Eligible applications for both programs will be rated through Virginia's SMART SCALE evaluation process which is intended to be the vehicle for the Commonwealth to fund larger transportation investments of all modes now and into the future, as described below. The first round of project submissions closed on September 30, 2015, with 321 project applications requesting a total of $6.95 billion in funding; projects proposed requested as little as a few hundred thousand to several hundred millions of dollars. Project ratings and rankings were released in mid-January 2016 and final funding decisions were be made in June 2016. A second round of applications submitted in September 2016 are currently under evaluation.

3.2.1 SMART SCALE

Originally known as the HB2 process, Virginia's SMART SCALE evaluation process was signed into law by Governor McAuliffe in 2014, SMART SCALE establishes a "quantifiable and transparent prioritization process for making funding decisions for capacity enhancing projects within the SYIP." The SMART SCALE process acts as an actual funding program and currently applies to the CDGP and HPPP program, which totals $1 billion in available funds over a five-year period.

Projects for either program must be submitted by a local entity such as a Metropolitan Planning Organization (MPO), Planning District Commission, public transit agency, county, city, or town that maintains their own transportation infrastructure. In addition to addressing a need specified in the *VTrans2040 Plan*, applications must demonstrate a clear project scope, a reasonable cost estimate, and a schedule that has been previously reviewed by VDOT (for highway projects) or DRPT (for transit projects) to confirm readiness to apply for funding.

After VDOT's Office of Intermodal Planning and Investment (OIPI) initially screens projects to ensure they meet eligibility requirements, a technical evaluation team comprised of staff from DRPT and VDOT evaluates each application based on the SMART SCALE criteria. SMART SCALE criteria weighting varies depending on region. Northern Virginia projects are subject to the following weighted criteria:

- Safety (5 percent),
- Congestion Mitigation (45 percent),
- Accessibility (15 percent),
- Environmental Quality (10 percent),
- Economic Development (5 percent), and
- Land Use (20 percent).

Transit projects must be at a level of planning and design sufficient to support the development and quantification of each of these measures. Once projects are scored and ranked, the CTB will then select projects to fund and include in the FY 2017 SYIP. In Year One of the program all funds for the following six years will be programmed. In FY 2018, the application process will reopen and new projects may be submitted to be programed for FY 2022 and FY 2023. From that point forward, new projects will be evaluated to be included in the revised six-year plan on a bi-annual basis.

Sponsors may request up to 100 percent of project costs through the SMART SCALE competitive process. Because this is the first year of the program's existence, it remains to be seen what percentage of projects funded will be transit versus roadway and what the average award amount will be. A potential new Route 7 transit system would be eligible to apply in FY 2018 for funding made available in FY 2022.

CDGP funds administered through SMART SCALE are attributable to each of the Commonwealth's Highway Construction Districts; approximately $135 million is available for Northern Virginia projects over five years. HPPP-funded projects compete statewide against the SMART SCALE criteria. After being evaluated and ranked, the Commonwealth Transportation Board (CTB) makes a final decision on which projects to fund.

3.3 Regional Funding

In addition to revenues administered by the Commonwealth, the Northern Virginia region benefits from transportation grant programs administered by the Northern Virginia Transportation Commission (NVTC) and Northern Virginia Transportation Authority (NVTA), agencies with missions as described below.

- Northern Virginia Transportation Commission (NVTC)

  NVTC is a transportation planning body which oversees and funds transportation projects for the region covering Arlington, Fairfax, and Loudon Counties, as well the cities of Alexandria, Fairfax, and Falls Church. NVTC coordinates with its members throughout the region to plan, coordinate, and secure funding for transit systems in Northern Virginia. NVTC is responsible for managing over $250 million in state transit assistance designated for its member jurisdictions. In 2015, NVTC also entered a 40 year agreement with the CTB to select multimodal improvement projects to receive funding from toll revenues collected by VDOT on the I-66 inside the Beltway. These funds are discussed below.

- Northern Virginia Transportation Authority (NVTA)

  NVTA is a political subdivision of the Commonwealth of Virginia, responsible for the long range transportation planning, prioritization, and funding for regional transportation projects in Northern Virginia, including all jurisdictions located along the Route 7 corridor. NVTA developed the long range regional transportation plan for Northern Virginia, currently *TransAction 2040*, which they update every five years. NVTA is responsible for administering the region's largest transportation funding source, HB 2313 (described below), to its member jurisdictions in VDOT's Planning District 8.

3.3.1 NVTC Gas Tax Revenue

NVTC is the direct recipient of a 2.1 percent motor vehicle wholesale fuel sales tax collected by the Commonwealth in Northern Virginia. This sales tax generated $48 million in funding FY 2014. By state law, these revenues are dedicated to the Washington Metropolitan Area Transit Authority (WMATA) to help fulfill the financial responsibilities of WMTA Compact members. For that reason, a new transit investment along Route 7 would not be eligible to receive these funds, and is therefore not considered in Section 4 of this Chapter.

3.3.2 NVTC Transform66: Inside the Beltway Toll Revenues

NVTC is responsible for selecting multimodal projects in Northern Virginia to receive funding revenues generated from the new tolls applied by VDOT to the use of I-66 inside the beltway through an annual competitive process.

Total net revenues for FY 2018 tolls (the first year with revenues) are estimated at $8-10 million. These funds may be used for both capital and operating costs of multimodal projects selected by NVTC which benefit toll-paying users living inside the beltway; demonstrate the ability to reduce congestion; move more people on the beltway; and will be implemented within five years of funding. Due to the location of Route 7, it would be difficult for a transit investment in the corridor to meet these criteria, and is therefore not considered in Section 4.

3.3.3 NVTA HB 2313

The Virginia Transportation Funding Bill HB 2313 was adopted in 2013, providing for regional taxes and fees to be used for highway and transit projects that increase capacity and reduce congestion. All of the taxes and fees collected by the Commonwealth under HB 2313 are administered by NVTA. Seventy percent of HB 2313 funding is available on a discretionary basis for regional transportation capital projects that have been included in NVTA's long range plan. The remaining 30 percent is allocated by formula to NVTA jurisdictions. In the FY 2015-2016 round of funding, approximately $346 million was made available for regional projects, with $187 million distributed to local jurisdictions. NVTA estimates that the FY 2017 program will make available $220 million for regional projects, and, based on previous experience, expects to receive approximately $750 million in funding requests, an indicator of the competitiveness of the program.

Regional Revenues

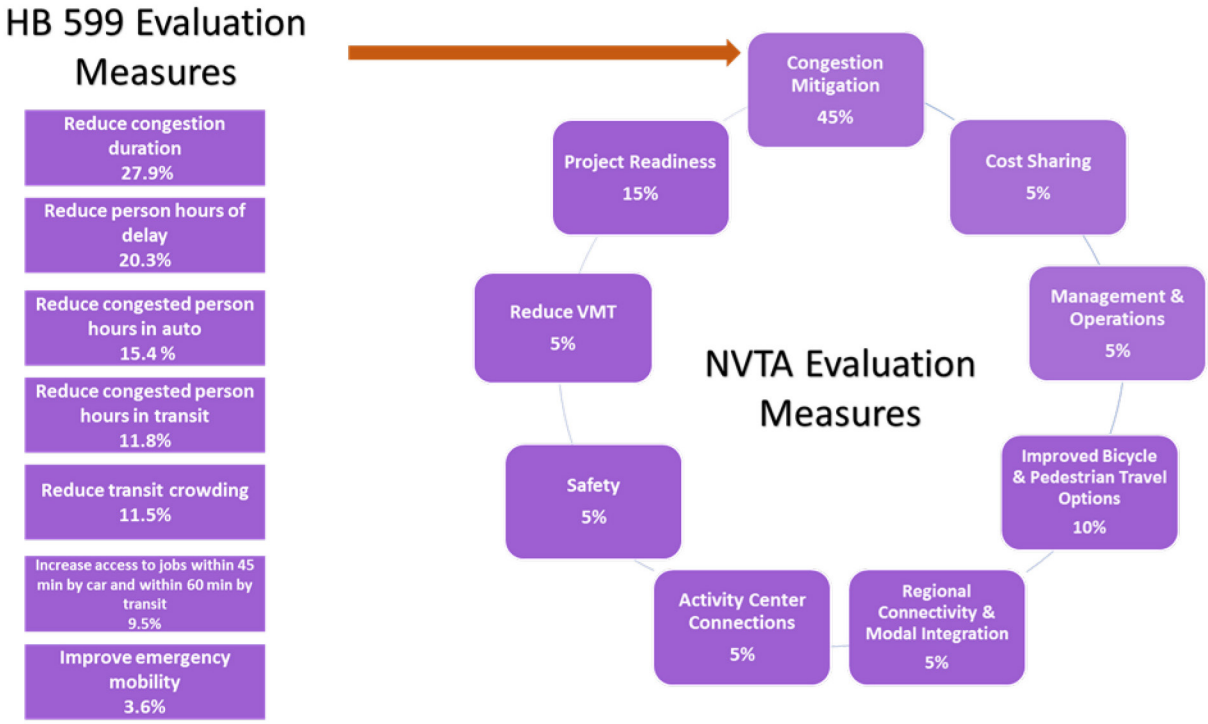
There are no funding set asides for transit versus roadway or other transportation projects within the 70 percent discretionary fund category. All projects are subject to two sets of evaluation criteria, including HB 599 and NVTA's own evaluation criteria.

House Bill 599 (HB 599) establishes an evaluation process specific to Northern Virginia which rates projects against each other based on seven performance measures related to reducing congestion and improving mobility, including: congestion duration, person hours of delay, person hours of congested travel in automobiles, person hours of congested travel in transit vehicles, transit crowding, accessibility to jobs, and emergency mobility. Beginning FY 2017, transit projects will be subject to the HB 599 evaluation process. The quantitative score that results from the HB 599 evaluation process is then used as an input for the NVTA congestion mitigation measure in its own evaluation process.

NVTA has also adopted new eligibility standards and evaluation criteria for project sponsors applying for regional funds in the FY 2017 round. First, NVTA has increased its criteria weighting for congestion reduction so as to align with the SMART SCALE criteria weighting for Northern Virginia. Second, NVTA evaluates projects based on its own nine quantitative criteria, which incorporates the total HB 599 score as NVTA's score for its congestion mitigation measure, as shown in Figure 6-1 below. Ultimately, this means that projects with the highest ratio of congestion reduction per unit costs tend to be ranked highest by NVTA. Third, candidate applicants must commit to begin to draw down funding by June 30, 2019. If a selected project does not meet this obligation, its sponsor is at risk of losing their funding.

The call for FY 2017 projects was closed on November 30, 2015. A Route 7 transit investment would be eligible to apply for HB 2313 regional funds in the FY 2018 (and subsequent) rounds, contingent upon its inclusion in the *TransAction* plan, which is currently being updated. If the proposed Route 7 investment is not included in the updated *TransAction* plan, then it will be ineligible for funding until the plan is updated again in five years.

***Figure 6-1** HB2313 Regional Revenue Evaluation Measures*



Between FY2014 and 2016, NVTA has funded activities that range from environmental studies to preliminary engineering to project construction, although they are not funding any planning activities at this time. Notable transit projects include $12 million for an additional Metrorail entrance at the Ballston station in Arlington and $69 million (over two years) for the Innovation Metrorail Station Silver Line Phase Two extension in Fairfax County.

Local Revenues

The remaining 30 percent of HB 2313 funding is distributed to NVTA members based on revenues collected in their jurisdiction. In order to receive their full portion of local funds, jurisdictions must either adopt the Commercial and Industrial (C&I) Property Tax for transportation at a rate of $0.125 per $100 of assessed value or deposit an equivalent amount from other local funds into a separate fund for transportation improvements. Localities will receive local revenues equivalent to the amount of C&I tax or equivalency funds they have set aside, if they chose not to adopt the C&I tax and set aside a lesser amount, they receive a smaller portion of local revenues. Arlington and Fairfax counties have adopted the C&I tax, while the cities of Falls Church and Alexandria utilize the equivalency method.

NVTA's "30 percent" funds may be used for locally-determined urban or secondary road construction, capital improvements to reduce traffic congestion, and public transportation purposes, including operating costs. Funds are distributed by formula. In FY 2015, $27 million funding went to the cities of Fairfax, Falls Church, and Alexandria and to Arlington and Fairfax Counties. Recent transit projects funded with these local formula revenues include $4.5 million for DASH Bus Fleet Replacement, $1.1 million in bus shelters and benches in Arlington County, and $3.2 million for Fairfax Connector service.

3.4. Local Funding

The Route 7 alignment alternatives currently travel through Fairfax and Arlington Counties, the City of Alexandria, and in four out of six proposed alternatives, the City of Falls Church. As mentioned previously, each jurisdiction has either adopted a C&I Property Tax to support transit or utilizes general revenues. It is assumed that such local funding streams cannot support a capital investment of the size being studied for Route 7, and is therefore not considered a viable source for assessment in Section 4 of this Chapter. However, these local revenues are evaluated for the applicability to support project operations.

3.4.1 Fairfax County Transit Funding

The C&I tax has been used as a transportation revenue sources since 2008 in Fairfax County, which reported to FTA's National Transit Database (NTD) an operating budget of over $72 million in 2013. The County Board of Supervisors approves allocations of these revenues for transit, most recently $650 million for a number of projects throughout the County. C&I tax revenues have been used as a primary funding source for the Fairfax Connector expanded bus service and fleet purchases, facility expansions, and associated maintenance, providing $225 million through FY 2020. It can also be used as debt service on Economic Development Authority (EDA) revenue bonds and TIFIA loans. These revenues can also be used as a supplemental source to transportation projects with funding gaps for both capital and operating costs. Thirteen percent of C&I tax allocations in FY 2013 -2016 were dedicated to Dulles Rail and Tysons Corner project; 43 percent was designated to other transit projects; and the remainder split between roadways, bike, pedestrian, and planning projects.

3.4.2 City of Alexandria Transit Funding

The City of Alexandria does not have a C&I tax, but instead reserves 2.2 cents of the base real estate tax in their general funds for transportation and transit project. Alexandria's FY 2017 budget assumes $9.4 million in reserved real estate revenues, $4.9 million set aside for operating costs such as DASH operations and service expansions, $1.4 million is reserved for WMATA operating funds, and $2.5 million is reserved for capital projects, such as the DASH fleet replacements. While the reserved real estate revenues grow over the ten-year life of the budget, the amount set aside for capital projects continually decreases. In FY 2017, Alexandria's total transportation and transit infrastructure budget totals $277 million, which includes $270 million for the Potomac Yard Metrorail Station. After the Potomac Yard project is funded, Alexandria's transportation and transit infrastructure budget decreases to under $20 million.

3.4.3 Arlington County Transit Funding

Arlington County has a Transportation Capital Fund which is funded from its Commercial and Industrial tax revenues. The County's FY 2016 budget projects the Transportation Capital fund receiving $24.7 million in C&I revenues and $11.3 million in NVTA local revenues for capital projects such a new Arlington Transit (ART) bus maintenance facility and fleet expansions, station improvements at the Ballston Metro stop, and the development of new transit passenger facilities on Columbia Pike. ART's operating budget – reported to the NTD at $11.3 million in 2013 - is funded through fare revenues, Arlington County's general fund, and local HB2313 revenues.

3.4.4 City of Falls Church

The City of Falls Church has chosen not to adopt the C& I Property Tax and does not have a designated local revenue source solely for transportation. Local funding contributions for transit and transportation projects come from their general revenues which are allocated to certain transportation projects through their department of public works.

3.5 Federal Funding

There are a number of transit funding opportunities provided by the federal government. The Federal Transit Administration (FTA) administers both formula and discretionary grant programs for transit projects requiring capital funds for construction activities. Also, the Federal Highway Administration (FHWA) administers, through VDOT and NVTC, capital funding programs which may be used for transit. Finally, transit corridor investments are an eligible purpose of the US Department of Transportation's (USDOT) "TIGER" multimodal discretionary grant program. The following provides an introduction to these potential federal programs.

3.5.1 Capital Investment Grant Program

The Fixing America's Surface Transportation (FAST) Act, signed into law by President Obama in December 2015, authorizes approximately $2.3 billion annually through 2020 for the Capital Investment Grant (CIG) program, FTA's largest discretionary resource for funding major transit capital investments. Three types of transit investments are eligible for funding through the Capital Investment Grant program:

New Starts – "fixed guideway" projects such as heavy rail transit (HRT), light rail transit (LRT), commuter rail, bus rapid transit (BRT) and streetcars costing more than $300 million ***or*** requiring more than $100 million in CIG funding. By law, the CIG share of a total project cost cannot exceed 60 percent, although in practice the CIG share rarely exceeds 50 percent of capital costs.

Small Starts – projects costing less than $300 million ***and*** requiring less than $100 million in CIG funding.

Core Capacity – capital investment projects of any cost that add capacity to existing rail or BRT systems.

Most of the Route 7 alternatives qualify as New Starts projects, although the lower cost alternatives could be eligible for Small Starts if the CIG share was limited to $100 million. This is an important consideration for the selection of a preferred alternative, as Small Starts projects are subject to fewer interim FTA approvals and an overall more streamlined project development process than more expensive New Starts investments.

In order to be considered for funding, proposed New Starts and Small Starts investments must also be evaluated and rated according to several "project justification" and "local financial commitment" criteria set forth in the FAST Act. The Act's project justification criteria for New Starts and Small Starts are:

- Cost Effectiveness;
- Mobility Improvements;
- Congestion Relief;
- Environmental Benefits;
- Land Use; and
- Economic Development.

The FAST Act's local financial commitment criteria include:

- Current Financial Condition (of the project sponsor);
- Commitment of Capital and Operating Funding; and
- Reliability and Reasonableness of the Project's Financial Plan (including the availability of local resources to recapitalize, maintain, and operate the overall existing and proposed public transportation system without requiring a reduction in existing services).

The *Route 7 Corridor Transit Study Alternatives Evaluation Chapter* (currently under development) provides additional information on the criteria and measures FTA uses to evaluate and rate candidate New Starts and Small Starts projects.

It is important to note that a project's rating is only one of several important technical factors that FTA considers when recommending to Congress how to allocate limited discretionary Capital Investment Grant funding. A candidate project's readiness for a capital grant for the year funding is sought and the technical capacity of project sponsors to effectively deliver proposed projects on time and within budget are other key components of FTA's decision-making process.

3.5.2 Section 5307 Urbanized Area Formula Program

Over $4.5 billion in federal formula funding is provided nationwide to urbanized areas for public transportation capital, planning, and preventative maintenance purposes. Funding is allocated according to population and also a combination of existing transit service factors including bus revenue vehicle miles, bus passenger miles, fixed-guideway revenue vehicle miles, and fixed guideway route miles. A minimum 20 percent local match is required to use these funds.

In Northern Virginia, DRPT is the designated recipient of Section 5307 funds, and all funds attributable to Arlington, Fairfax, and Loudoun counties are committed towards paying their annual contribution to WMATA for its service in the region. Therefore, unless WMATA is the owner and operator of a Route 7 transit investment, as it is with the Metroway BRT system, Section 5307 funds would not be available to the project.

3.5.3 Section 5339 Bus and Bus Facilities Program

The FAST Act authorizes over $3.7 billion through 2020 for capital investments in bus and bus facilities. While the majority of these funds are administered by formula (and, like Section 5307, used exclusively by WMATA in the Northern Virginia area), $268 million in FY 2016 – growing to $344 million by 2020 – is available nationally on a discretionary basis. No single grantee may receive more than 10 percent of the annual program. As Section 5339 is a funding program exclusively for bus transportation, it is only a potential funding option for the five BRT alternatives. The LRT alternatives are not eligible to receive these funds.

3.5.4 Section 5337 State of Good Repair Program

State of Good Repair funds are federal formula resources available to fixed guideway public transportation facilities in operation for at least seven years. Program resources may be used on existing guideway transit in need of asset replacement or modernization. In Northern Virginia, Section 5337 funds are used for the Virginia Railway Express (VRE) and MetroRail. This funding source would not be eligible for a new Route 7 transit investment, but would be eligible for necessary recapitalization investments if the project were to be implemented. It is not considered in Section 4.

3.5.5 Congestion Mitigation and Air Quality Improvement Program (CMAQ)

FHWA's CMAQ program funds are distributed to air quality maintenance or non-attainment areas (regions that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter) using a formula based on an area's population by county and the severity of its ozone and carbon monoxide problems within a non-attainment or maintenance area. Funds are available to transportation projects and programs for the purpose of reducing congestion and improving air quality. CMAQ funding can be used for the capital costs of transit projects and up to 5 years of the operating costs of new transit service.

The CTB receives approximately $60 million annually in CMAQ funds for the state of Virginia. Regionally, NVTA solicits and reviews its member jurisdictions' requests for CMAQ funding and sends their recommendations to CTB for inclusion in the SYIP. CMAQ funds in the region are currently programmed through FY 2021. A proposed Route 7 transit system would be eligible to apply for CMAQ funds to be used in FY 2022 and onward.

3.5.6 Surface Transportation Block Grant Program (STBGP)

FHWA's STBGP funds are distributed to states and MPOs using a formula based on lane-miles of federal-aid highways, total vehicle-miles traveled on federal highways, and estimated contributions to the Highway Account of the Highway Trust Fund attributable to commercial vehicles. Eligible projects include highway, transit, intercity bus, bicycle, and pedestrian projects.

NVTA solicits and reviews applications for STBGP funding administered by VDOT and DRPT. In the future, it is anticipated that STBGP funding requests will be evaluated using the HB 2 process and criteria presented earlier. Currently, STBGP funding through FY 2021 is already dedicated to projects statewide.

3.5.7 "TIGER" Program

The Transportation Investment Generating Economic Recovery (TIGER) program is a highly competitive USDOT grant program supporting the capital costs of road, rail, transit, and port projects that have a significant impact on the nation, a region, or a metropolitan area. Since 2009, TIGER grants have provided over $4.6 billion in funding to 381 transportation projects that are multi-modal, multi-jurisdictional, or otherwise challenging to fund through existing programs. Another $500 million will be available in 2016. During the 2015 round of TIGER grants, the 627 applications received by USDOT requested more than 20 times available funding, with only 39 projects receiving awards. For successful projects in urban areas, the TIGER program typically delivers $10 -$20 million in capital funding.

Compliance with TIGER's evaluation criteria, demonstrated commitment of local match, and broad local consensus—including support from both traditional and non-traditional partners —are key requirements to being competitively positioned for TIGER funding. USDOT also prefers projects that have performed considerable project development (e.g., completed federal environmental review).

4.0 Value Capture, Fees, and Other Revenues

This Section describes an array of funding strategies that might be used to capture the new and increased value of existing land and properties generated as a result of a major transit capital investment. A portion of this increase in value can then be recovered by local jurisdictions to help offset the costs of such improvements. In addition to describing these strategies, this Section also presents possible value capture scenarios along the Route 7 corridor for each alternative. It should be noted that these estimated values are based on limited information, including the review of existing small area plans and City and County websites, as well as professional observations of the conditions for development along the route. The values of new development were estimated using local construction cost estimates per square foot and the analysis did not account for existing tax increment finance (TIF) or assessment districts along the corridor. The utility of this analysis, therefore, is **only** to understand a) the degree to which value capture might contribute to the funding of a transit investment on Route 7 and b) the differences in value capture potential between alternatives. It should not be used as a basis for expecting a specific revenue return should value capture be used to support the financial plan of a future Route 7 transit investment.

4.1 Tax Increment Financing (TIF)

Tax Increment Financing (TIF) involves the creation of a special district to raise revenue for public improvements by capturing a portion of the additional assessed value generated by private-sector development. The tax base is frozen at predevelopment levels, and all or a portion of property tax revenues derived from increases in assessed values (the tax increment) are applied to a special fund created to retire bonds originally issued for development of the district. The initial TIF revenue yield is relatively low. However, revenue generally increases over time as redevelopment and escalation leads to increased property values. TIFs are often applied for periods of 20 to 30 years. While most TIFs capture the incremental increase in property values, some states allow the capture of other taxes as well.

It should be noted that while bonding against future TIF revenues may cover a portion of capital costs upfront, additional financing costs associated with issuing a bond will also need to be included in a project's total capital cost. Additionally, while TIFs are widely and successfully used across the country and in Virginia, there is a degree of risk associated with bonding against future revenues. These risks can be mitigated by conservatively estimating incremental revenues.

The first TIF District created by Fairfax County was the Mosaic-Merrifield Town Center project. The Town Center is also an example where the county created a Community Development Authority (discussed below) in conjunction with the TIF District. The TIF District bonds totaled $42 million and the CDA bonds generated $30 million to partially fund the public facilities on the site including road improvements, parks, and a portion of the parking garage.

In addition, the City of Alexandria is supporting the new Potomac Yard Metrorail Station through a $50 million loan from the Virginia Transportation Infrastructure Bank (VTB). The loan will be repaid from TIF and Community Development Authority revenues from the new private development at Potomac Yard.

Arlington County adopted the use of TIFs in 2009 and created a 33 percent assessment on growth in Crystal City, Pentagon City, and Potomac Yard. These revenues are dedicated to infrastructure such as transportation, utilities, and parks. The County's FY 2014 budget included $2.3 million for projects within the TIF district.

Virginia also allows a "TIF by Agreement" which allows the use of various taxes and/or fees including real estate taxes, personal property taxes, Business and Professional Occupancy Licenses tax, sales taxes (local portion), transient occupancy taxes, meal taxes, and special fees and charges.

4.1.1 Special Assessment Districts/Transportation Improvement Districts

Unlike a TIF, which captures the additional tax revenues generated from new development, a special assessment district is an area in which an additional property tax is applied to parcels of land that receive a special benefit from one or more public improvements funded by the special tax. The additional tax is applied to both existing and future properties. Commercial and residential properties are often taxed at different rates.

Commonly known as special assessment districts, Community Development Authorities (CDAs) in Virginia can be created by the governing bodies of cities, towns, and counties upon a petition of at least 51 percent of the landowners. The adoption of a CDA creates a separate and additional annual tax on real estate to support bonds to construct and/or operate and maintain specific infrastructure.

CDAs have been extensively used in Fairfax County, including the funding of improvements to Route 28 where the assessment is 18 cents per $100 of assessed value. Property owners adjacent to Phase I of the Sliver Line through Tysons Corner agreed to an assessment of 19 cents per $100 of assessed value that supported $400 million in bonds. Phase II of the same district, with a levy of 20 cents per $100 of assessed value, supports the development of the Silver Line to the Loudoun County line.

4.1.2 Joint Development

Joint Development is a partnership between a public entity and a private developer created to develop certain assets. According to FTA guidance, the development and the property must have a physical and a functional relationship. Joint Development can occur when an agency owns land that can be leased to the developer for a long period of time. This enables the developer to build on the land with a low risk of losing the capital investment. In exchange, rents are paid to the agency, creating a revenue stream that can be bonded against to support the development of a transit improvement. The revenue potential can vary depending on market conditions.

The Potomac Yards development is the best example of joint development in Alexandria, where the land development and new Metrorail station are being developed in conjunction.

4.1.3 Air Rights

Air Rights refer to the right to develop, occupy, and control the vertical space above a property. Air Rights can either be bought, leased, or transferred. This is most often seen in transit projects where the space above a transit station is developed by a private developer to build transit oriented developments.

The Virginia Office of Transportation Public-Private Partnerships (OTP3) and the Virginia DOT are gathering input from the public and ideas from the private sector for development of the airspace above Interstate 66 at the East Falls Church Metro Station. Since the Route 7 investment alternatives do not currently identify any structures owned by potential project sponsors, and the current right-of-way is already built, it is not likely air rights will be a viable funding option for the chosen alternative; therefore, this funding option is not included in Section 4 of this Chapter.

4.2 Value Capture Assessment of the Route 7 Alternatives

The following provides an analysis of the potential development values associated with each of the Route 7 alternatives. The development projections are based on City and County websites, small area plans, and observations made during a site visit to each potential station. At this early stage in the analysis, only publicly available information was used to project values. Geographic Information System (GIS) data for the property assessments were not available from the cities and counties, therefore the existing value of the properties within a half-mile radius of the alternatives has not been accounted for in this analysis. Contact with the local jurisdictions would be required before any projections beyond the preliminary ones provided in this Chapter are used in structuring a value capture strategy.

The alternatives for Route 7 include both BRT and LRT investments. While it has been demonstrated across the country that heavy rail and light rail corridor development significantly increases the value of properties along the route, in particular around new stations, less research has been conducted documenting land premiums that have occurred due to an investment in BRT; in fact, the existing literature suggests that return-on-investment and other economic analyses often attach a higher value capture premium to LRT than to bus and BRT. Developers often cite the sense of permanence attached to a city's investment in rail transit as an indicator of its commitment to promoting the economic development of the area it serves, and typically believe that nearby development will benefit from potential consumers preference for rail over bus transit.

On the other hand, the Institute for Transportation and Development Policy (ITDP) published a 2013 analysis of the development impacts of 21 North American corridors served by either light rail transit, streetcar, or BRT. The study found that it wasn't the mode that influenced development, but the institutional and market conditions in which a transit investment is made.

Given the lack of consensus on the modal impacts on economic development, the following analysis presents two scenarios when estimating revenue generated from the BRT and LRT alternatives. The first scenario assumes that BRT and LRT – which provide equitable transit service - will also capture value equally. The second scenario assumes that LRT is more desirable to property owners and developers, who are therefore willing to pay higher assessments. Again, the following is not intended to be used as a prediction of revenues which would be generated for a transit investment in the Route 7 corridor. Rather, it only serves to illustrate how a TIF might contribute to the funding and financing of new premium transit service on Route 7.

Scenario 1 "Mode Neutral" Value Capture Assumptions

Development Values: The alternatives account for development projections over a period of fifteen years based on City or County websites, small area plans and observations made during a site visit to each potential station. The potential values were calculated using local construction costs per square foot.

Assessment Revenues: An assessment rate of $0.05 per $100 of assessed values was assumed for generating preliminary revenue projections. The assumed assessment rate is low as the supporting roads and other public infrastructure already exists, unlike assessments that support entirely new investments in infrastructure. The actual assessment would also be against current assessed values. However,

for the purpose of this preliminary analysis, the current assessment data for the ½ mile station radius was not calculated, and the assessment revenues that would be generated by the existing values are not included.

TIF Revenues: Tax increment revenues are a sharing of the property taxes from the new development values along the corridor. The starting point in the evaluation is the current fiscal year property tax rates for the three taxing entities. Those tax rates, applied against new assessed values equal to market value, are:

- Alexandria: $1.043 per $100 of assessed value
- Falls Church: $1.305 per $100 of assessed value
- Fairfax County: $1.090 per $100 of assessed value
- Average Rate: $1.15 per $100 of assessed values

Based on experiences observed elsewhere, this analysis assumes that the taxing entities would agree to share 10 percent of the tax increment revenues to support development of a transit investment on Route 7. It is assumed that it would take 15 years for the total buildout of the development to be achieved in this analysis. Scenario 2 "LRT Premium" Value Capture Assumptions.

Development Values: Adjusting for the aforementioned land value premiums that may occur due to the modal preference for rail over bus, a 10 percent value premium (based on research and professional judgment) was applied to the projections made for the LRT alternatives. These higher values were used to calculate both assessment and TIF revenues.

Assessment Revenues: An assessment rate of $0.10 per $100 of assessed values was applied to the LRT alternatives. Assuming that a majority of the projected development along the LRT alternatives will be commercial (as shown in Table 6-4), and will be worth 10 percent more than the BRT alternative, it is assumed that property owners would be willing to accept a higher assessment rate due to the increased revenues their properties will be generating.

TIF Revenue: TIF revenues are calculated using the same existing tax rates as the BRT alternatives. The projected TIF revenues for the LRT alternatives are higher than the BRT alternatives due to the10 percent increase in land values.

This analysis did not research whether there are existing TIF or CDA districts for either the BRT or LRT alternatives. In order to account for existing revenue commitments, this analysis has conservatively estimated the share of TIF revenue a Route 7 transit investment might receive. As mentioned previously, if this funding option were to be explored, a detailed financial and political analysis of the properties within a proposed TIF district would need to be conducted. CDAs were created for Tysons to support the Silver Line. Whether the districts include every parcel within Tysons or only those developed when the district was formed has not been established. Similarly, if TIF districts were created by the taxing entities, the level of potential sharing of tax increment to support an LRT or BRT project would likely reduce the amount that might be committed to Route 7.

Development Value Projections

For purposes of the analysis, the Route 7 corridor was broken down into six segments, with the values of new development over a 15 year period calculated for each. These segments are defined as follows:

Segment 1 runs from Tysons southwest until North Washington Street exits Broad Street (Route 7 in Falls Church), where the alternative route to the East Falls Church Metro Station begins.

Segment 2 encompasses the development at the East Falls Church Metro Station. As the alternative routes identify the values via the station and without the station, this one element makes up Segment 2.

Segment 3 runs from North Washington Street in Falls Church to where North Beauregard Street exists King Street (Route 7 in Alexandria) to the Mark Center. This segment includes the major development programs at Seven Corners and Baileys Crossroads.

Segment 4 is comprised of the development at Mark Center which includes a combination of office, residential, retail and hotel development.

Segment 5 includes the development from Mark Center along North Beauregard and Duke Streets to Interstate 395.

Segment 6 follows Route 7 from North Beauregard Street to the King Street Turnaround at the Metro Station. The segment includes the Bradlee and Fairlington Shopping Centers. The segment ends at the King Street Metro Station.

The development projections are based on City or County websites, Small Area Plans (SAPs) and observations made during a site visit to each potential station. The projected development values across the segments are summed for each alternative and shown on Table 6-4. Note that because Alternatives 5 (BRT) and 6 (LRT), share the same alignment, they capture the same value under the "mode neutral" scenario.

Using the assessment rates and TIF shares assumptions described above, a preliminary value capture estimate for the alternatives are shown below in Table 6-5. The numbers represent the projected values in year fifteen, as well as the annual revenues in year fifteen.

Table 6-4 Potential Development Revenue over 15 Years by Alternative ($millions)

	BRT Alt 1	BRT Alt 2	BRT Alt 3	BRT Alt 4	BRT Alt 5 LRT Alt 6 (Mode Neutral)	LRT Alt 6 (LRT Premium)
Retail Hotel	$1,155	$941	$1,095	$881	$1,041	$1,145
Office	$2,275	$2,082	$2,275	$2,082	$2,292	$2,522
Multi-family Residential	$3,555	$3,051	$3,549	$3,046	$3,014	$3,316
Single Family Residential	$17	$17	$17	$17	$17	$19
Total development value over 15 Years	$7,003	$6,094	$6,937	$6,028	$6,366	$7,002

Using the assessment rates and TIF shares assumptions described above, a preliminary value capture estimate for the alternatives are shown below in Table 6-5. The numbers represent the projected values in year fifteen, as well as the annual revenues in year fifteen.

Table 6-5 Total Revenue Projections in Year 15 by Alterative ($millions)

	BRT Alt 1	BRT Alt 2	BRT Alt 3	BRT Alt 4	BRT Alt 5 LRT Alt 6 (Mode Neutral)	LRT Alt 6 (LRT at grade Premium)	LRT Alt 6 (LRT elevated Premium)
Assessed Values in Year 15	$7,002.87	$6,093.51	$6,937.21	$5,947.19	$6,365.51	$7,002.07	$7,002.07
Cumulative TIF Revenues over the 15 Year Buildout	$64.43	$56.06	$63.82	$54.71	$62.23	$61.67	$61.67
Cumulative Assessment Revenues over the 15 Year Buildout	$28.01	$24.37	$27.75	$23.79	$27.06	$53.62	$53.62
Total Cumulative Revenue in Year 15	$92.44	$80.43	$91.57	$78.50	$89.28	$115.29	$115.29
Share of Total Capital Costs	30.2%	30.2%	34.3%	34.4%	30.2%	11.6%	12.2%

The far right column of Table 6-5 presents projections which account for the ten percent premium and the additional $0.05 assessment applied to the LRT alternatives. Under these assumptions, when comparing Alternative 5 to Alternatives 6 and 7, the annual revenues from LRT Alternatives could generate up to $5.65 million more than BRT.

It must be re-emphasized that this analysis is only intended to illustrate the potential of a TIF as a value capture mechanism in the Route 7 corridor under two scenarios. To the extent that specific sites could be joint development projects, or where air rights would create values not anticipated in this analysis, the development projections would increase. Furthermore, this analysis does not assume any sharing of sales taxes, transient occupancy taxes or special fees or charges that could be part of a TIF by Agreement. It does, however, demonstrate that a TIF could be a complementary revenue source for a Route 7 transit investment, but should not be counted on as a foundation for a capital finance plan.

4.3 Other Fees and Revenues

This section describes various other project-specific sources of capital and O&M funding.

4.3.1 Developer Contributions

Developers often provide in-kind or monetary contributions to facilitate construction of infrastructure that would result in a positive impact on property values. Often these contributions are negotiated to reflect the benefit the developer derives from the project. If funding is negotiated, project sponsors often request the money during the early portion of any debt service period. This enables the project sponsor to better leverage other funding sources. In many instances, developers receive increased density allowances in return for their contributions. In the case of the Potomac Yard, developers within a ¼ mile of the proposed station agreed to contribute $10 per square foot of built development,

provided that the City of Alexandria would rezone the area from a maximum density of 6,000 square feet to a 7.5 million square foot mixed use development.

Developer contributions may be applied to fill the gaps in funding for both capital and operating costs of the project. Alternatively, developer contributions could serve as a backstop for TIF revenues. Any developer contributions for the project will likely serve as a supplement to other funding sources identified in this analysis.

4.3.2 Development Impact Fees

When a landowner requests a permit for a land use change (such as a building permit or certificate of occupancy) that places a burden on existing infrastructure, local government or another public agency may require that the landowner pay a fee as a condition of issuance. Development impact fees generally are applied for capital improvements and are not used for ongoing operations and maintenance costs. In addition, they are not typically applied to resolve existing infrastructure deficiencies.

4.3.3 Fare Revenues

Fare revenue is a sustainable funding source for operations once a transit project is in service. While annual fare revenue has yet to be estimated for the Route 7 alternatives, it is instructive to note that WMATA's MetroBus farebox recovery ratio is approximately 25 percent of its annual operating expenses, while Metrorail recovers approximately two-thirds of its operating costs. Nationally, light rail experiences a 30 percent recovery of operating expenses. Farebox revenue is generally used by transit providers to offset annual operating costs, but is sometimes bonded against to raise proceeds for capital programs.

4.3.4 Advertising/Sponsorships/Naming Rights

Advertising on vehicles, and at stations, facilities, and other property of the transit owner, can augment fare revenues as an ongoing operations funding source. Advertising revenues typically account for 2-4 percent of transit system operating budgets.

Sponsorships and "naming rights" have been an emerging financing tool for some US transit systems. The Cleveland Clinic and University Hospital (often fierce competitors) teamed up to purchase the naming rights for the Greater Cleveland RTA's BRT line on Euclid Avenue (upon which their major facilities are located). Formerly called the "Silver Line," the two hospitals committed $250,000 annually for 25 years to rename the route the "Health Line." San Francisco, Chicago, Cincinnati, and Dallas are also exploring opportunities to acquire sponsors for rail and bus lines.

It is important to note that there is a tremendous cost to changing station names and lines (both at the renamed facilities and on system maps). It is more efficient to initiate new systems with station or route sponsorships in place. As streetcar systems are beginning to come on line, many are trying to create sponsorship opportunities. The Tampa Tribune has a station named for it on Tampa's Tyco streetcar line, and stations and vehicles on Portland's and Seattle's streetcar systems have sponsors. It must be noted that such sponsorships are only modest revenue opportunities covering between 4 to 8 percent of operating costs in Portland and up to 10 percent of the costs to operate the Seattle system.

The M-1 Rail streetcar project currently under construction in Detroit is likely the most aggressive emerging system to take advantage of naming rights as a both an operating and capital revenue source. On the capital side of the ledger, institutions along Woodward Avenue like Wayne State University, the Detroit Medical Center, and Henry Ford Health Systems are contributing $3 million and will receive a basic station design upon which they can customize and enhance to promote their brand. Quicken Loans has pledged $10 million for the rights to name the 3.3 mile streetcar line for 10 years.

5.0 Evaluation of Funding Sources

Each of the revenue sources described in Sections 3 and 4 and not dismissed as being inappropriate or ineligible for a Route 7 transit investment has been evaluated according to its ability to fund project capital and operating expenses. The evaluation criteria is presented below. Following evaluation of each funding sources, this Section recommends several specific sources for further consideration in the development of a financial strategy for the Route 7 corridor.

5.1 Criteria

Eight criteria are used to evaluate candidate funding sources. Each criteria are rated either high ●, medium ◖, or low ○.

1. Revenue Potential: The estimated amount of revenue a funding source may yield for the Route 7 project is scored: high ●, medium ◖, or low ○.
2. Nexus with Beneficiaries: The extent to which each funding source relates to the beneficiaries of the Route 7 project is scored: directly related the beneficiaries of the project ●, some relation to the beneficiaries of the project ◖, or not directly related to the beneficiaries of the project ○.
3. Stability / Predictability: The annual predictability of a funding source is scored: generally stable and predictable ●, can be volatile but is generally predicable ◖, or relatively unpredictable and volatile ○.

5.2 Evaluation of Candidate Funding Sources

Table 6-6 on the following page presents an assessment of each of the applicable funding sources identified in Sections 3 and 4 against the criteria above.

Table 6-6 Route 7 Investment Funding Options

Funding Option	Capital	Operating	Revenue Potential	Nexus with Beneficiaries	Stability / Predictability
Federal Funding					
Capital Investment Grants	✓	X	●	○	◖
Section 5307 Urbanized Area Formula Funds	✓	X	○	◖	●
Section 5339 Bus and Bus Facilities Program Formula	✓	X	○	◖	●
Section 5339 Bus and Bus Facilities Program Discretionary	✓	X	○	○	◖
Section 5337 State of Good Repair Program	✓	X	○	◖	●
CMAQ	✓	✓	◖	◖	◖
STBGP	✓	X	○	◖	◖
TIGER	✓	X	○	○	○
State Funding					
DRPT Capital Assistance	✓	X	○	◖	○
DRPT Mass Transit Operating Assistance	X	✓	◖	◖	◖
SMART SCALE Revenues	✓	X	●	◖	◖
Regional and Local Funding					
NVTA HB2313 – Regional Revenues	✓	X	◖	●	●
NVTA HB2313 – Local Revenues	✓	✓	○	●	●
Locally Generated Revenues	✓	✓	○	●	●
Value Capture and Other Revenues					
TIF	✓	✓	◖	●	◖
Special Assessment Districts	✓	✓	◖	●	◖
Joint Development	✓	✓	◖	●	●
Developer Contributions	✓	✓	◖	●	○
Developer Impact Fees	✓	✓	◖	●	○
Fare Revenues	X	✓	◖	●	●
Sponsorships /Naming Rights	✓	✓	○	○	○
Advertising	X	✓	○	○	●

5.3 Recommended Funding Sources

Based on this assessment, the following observations can be made about available revenue sources' ability to support the capital costs of a major transit capital investment in the Route 7 corridor.

- Of existing revenue sources, **FTA's Capital Investment Grant (CIG) program and the Commonwealth of Virginia's SMART SCALE process would provide the most "foundational" funding for any Route 7 transit project**. That is to say, it is hard to imagine a financial plan that didn't include either one or both funding sources as its anchor.
- The CIG program is the largest single revenue source available to fund a major capital investment on Route 7. Based on its most recent set of executed grant agreements, the CIG program is contributing from between $445 million and $1.5 billion for New Starts projects ranging costing from $890 million to $5.1 billion. Assuming up to a 50 percent share of the costs of any of the Route 7 alternatives is reasonable.
- While the amount of CIG funding potentially available to any Route 7 alternative is large, the program's match requirements are significant. Assuming CIG funding would still require between $130 million and $500 million in non-CIG funds to complete the project, depending upon which alternative is selected.

- In addition, the program is intensely competitive. There are currently 70 major transit capital investments either under a CIG grant agreement or in the pipeline for funding. The total cost of these projects exceeds $63 billion, with a demand of nearly $18 billion in CIG funding.
- As described in Section 2.4.1 of this Chapter, in order to be considered for funding under the program, proposed New Starts and Small Starts investments must be evaluated and rated according to "project justification" and "local financial commitment" criteria set forth in the FAST Act. Each of the project justification criteria is rated equally and on a five-point scale, from Low (1) to High (5). To qualify for funding, projects must achieve an overall project justification rating of at least Medium as well as receive at least a Medium summary rating for local financial commitment.
- Each of the Route 7 alternatives were evaluated against the CIG program project justification criteria; detailed results of the evaluation are presented in the *Route 7 Corridor Transit Study* Alternatives Evaluation Chapter. As noted in that Chapter, each of the Route 7 Build alternatives meet the Medium rating threshold for project justification which would make them eligible for Capital Investment Grant program funds. Moreover, Alternatives 2 and 5 achieve Medium-High project justification ratings and should be considered the most competitive for CIG funding.
- SMART SCALE provides $1 billion over the next five years for transportation projects across the Commonwealth. Over 320 projects requesting almost $7 billion were submitted to the CTB for evaluation, with the largest request totaling $370 million. Although new, Commonwealth transportation officials believe that SMART SCALE revenues will be "the" source of funding for large capital projects which cannot be funded with state and federal formula programs. Funding for the two programs administered through the SMART SCALE process (the High Priority Projects Program and the Construction District Grants Program) is authorized for several years. It is further possible that other programs (for example, VDOT and DRPT's portion of the federal Surface Transportation Block Grant Program) may be included in the SMART SCALE revenue allocation process in the future.
- Like the CIG program, candidate projects compete for SMART SCALE revenues based on a strictly defined evaluation process. Unlike the CIG program, the SMART SCALE revenue allocation process is new, and it is not yet known how large transit projects will compete under its multimodal criteria. A review of the project rankings published by VDOT earlier this year shows several high ranking transit projects, but at a funding request level far below what would be needed to fund a major transit investment on Route 7.
- Also not yet known is how the CTB will program SMART SCALE funds for projects dependent upon other funding sources – such as Capital Investment Grant funds – when those revenues are not yet committed. The implications of the SMART SCALE project evaluation, selection, and programming process will be presented in the *Route 7 Corridor Transit Study* Implementation Strategy Chapter.
- NVTA's HB 2313 Regional Revenues and value capture revenues should be explored to help supplement CIG and SMART SCALE funding.
- NVTA has adopted new eligibility standards and evaluation criteria for projects applying for HB 2313 Regional Revenues. First, NVTA has increased its criteria weighting for congestion reduction so as to align with the SMART SCALE criteria weighting for Northern Virginia. Second, NVTA evaluates projects based on nine quantitative criteria, which incorporates the total HB 599 score as NVTA's score for its congestion mitigation measure. Ultimately, this means that projects with the highest ratio of congestion reduction per unit costs should be expected to be ranked highest by NVTA. Third, candidate applicants for the FY 2017 must commit to begin to draw down funding by June 30, 2019. If a selected project does not meet this obligation, its sponsor is at risk of losing their funding.
- Capturing the increased value of property positively impacted by a major transit capital investment could cover a share of project costs. However, much more analysis is required to accurately estimate the revenue potential of a tax increment finance or special assessment district.
- Other applicable federal programs, DRPT's Capital Assistance program, and local revenues, as they are currently constituted, should not be counted on to contribute anything more than a very marginal amount of funding for project construction.

Likewise, the following observations can be made about the disposition of existing revenues to accommodate the financial requirements of operating and maintaining a new BRT or LRT service on Route 7.

- The annual operating costs of the Route 7 transit alternatives range from approximately $16 - $27 million in 2015 dollars. This represents 22 – 37 percent of Fairfax County's $72 million 2013 annual operating budget (per FTA's National Transit Database) for its Connector bus service, and more than the entirety of Alexandria's and Arlington County's transit operating budgets ($15.2 million and $11.3 million, respectively). Consequently, **the use of local revenues – which are already stretched thin to provide current transit service – will be hard pressed to fund operation of a Route 7 project.**
- Except for FHWA's CMAQ program, federal funding may not be used for transit operations. While NVTA's 30 percent funding is a logical source of operating assistance for the project, its application to a Route 7 transit service may detract from operations elsewhere in the region.

- **Corridor municipalities may therefore need to consider raising their C&I taxes, setting aside a larger portion of general and/or other revenue sources for transit, or creating a new revenue source to fund operations of a Route 7 transit system.** The establishment of a special assessment district or the use of impact fees may also be considered, but would lessen the availability of such revenues for capital purposes.

Given these capital and operating funding observations, a strategy can be developed to advance a major transit investment in the Route 7 corridor.

ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Chapter 7: Implementation Strategy

1.0 Introduction

The *Route 7 Corridor Transit Study* is intended as a high-level, but reliable, analysis of the costs, benefits, and impacts of various options to improve transit service on Route 7 in order to determine the best alternative to move forward. Should the Northern Virginia Transportation Commission (NVTC) and its partners accept the *Route 7 Corridor Transit Study* Team's recommendation to advance the Alternative 2 bus rapid transit (BRT) investment for further development, they will be engaging in a lengthy and multi-disciplinary journey through federal, state, and local requirements and regulations; complex project management, design, procurement, and other technical work; extensive stakeholder engagement; and a rigorous and refined analysis of the costs and benefits of the new system, and how to pay for it. As its first steps, NVTC and its partners should prepare to take the following three actions:

1. Determine initial stakeholder roles and responsibilities for subsequent phases of project development.
2. Evaluate the project in compliance with the National Environmental Policy Act (NEPA) of 1969.
3. Secure funding for, and request project entry into, new Starts or Small Starts Project Development.

This *Route 7 Corridor Transit Study* Implementation Strategy chapter describes these three steps and presents observations, considerations, and recommendations for addressing each.

In addition, if the decision is made to pursue FTA Capital Investment Grant program funding for the project, as recommended in the *Route 7 Corridor Transit Study* Financial Analysis chapter, it is further strongly recommended that NVTC and its partners convene a meeting with Federal Transit Administration (FTA) staff (specifically, staff from FTA Region III and the Office of Natural and Human Environment) to introduce them to the proposed BRT project and discuss FTA expectations for the achievement of the four actions identified above. Additionally, it is recommended that Route 7 partner agencies meet with leadership at the Virginia Department of Rail and Public Transportation (DRPT) to discuss opportunities for funding – in terms of both the programs evaluated in the Financial Analysis chapter, and other emerging vehicles for funding a major transit capital investment in the corridor. Early and active engagement of these two partners in the development of a BRT investment on Route 7 is key to ensuring eligibility - and maximizing competitiveness - for state and federal discretionary funding.

2.0 Stakeholder Roles and Responsibilities

To date, NVTC has led the planning effort which has resulted in the identification of a recommended alternative for the Route 7 corridor. For the purposes of this *Route 7 Corridor Transit Study* Implementation Strategy chapter, NVTC is used to denote continued leadership of the implementation effort. But that need not be the case. Rather, NVTC and its partners need to determine which is the most appropriate agency to fulfill a number of key roles in the project's evolution.

Assuming that Federal funding will be used, in part, to fund the implementation of a Route 7 transit investment, the first decision that will need to be made is whether NVTC maintains its lead planning role, or if another partner – such as Fairfax County, Washington Metropolitan Transportation Authority (WMATA), or DRPT – serves as the sponsor of the federal NEPA evaluation discussed below.

Both WMATA and DRPT have experience managing NEPA review of complex transit projects, and in fact partnered on the Environmental Impact Statement (EIS) for the Silver Line MetroRail extension in Fairfax County. However, WMATA would not likely take on that role for Route 7 unless it was to operate the proposed BRT system (another question of responsibility which will need to be addressed; see below). Fairfax County has managed smaller NEPA evaluations for several of its Connector facilities. Given its location, the County is a logical sponsor; the most recent regional transitway project subject to federal environmental review – the Columbia Pike streetcar – was sponsored by Arlington County. Fairfax County is intending to sponsor the NEPA review of the Route 1 BRT project that DRPT lead the planning effort for.

There is no "right" answer to the question of NEPA sponsorship. Any of these partner organizations could lead the review. It may be that the entity that contributes the majority of funding for NEPA serves that role, or the one who has the most and/or experienced staff dedicated to managing it.

Other responsibilities will also need to be identified, although these are decisions which need not be made immediately. As noted, the question of which entity will operate the project once built will need to be answered. Management of project design and construction must be assumed by one of the project partners. And a grantee of Federal funds will need to be identified. Although the grant recipient of transit funding and the operator of service provided by federally funded assets are usually one and the same, there is no requirement that it be so. However, an FTA grantee is wholly responsible for complying with grant requirements and the successful execution of any activity funded with the grant. Any agreement between an FTA grantee and another entity responsible for executing or operating an FTA-funded project must ensure that all parties understand its obligations and responsibilities.

3.0 NEPA

The National Environmental Policy Act of 1969 requires federal agencies, in cooperation with state and local governments, to consider the potential environmental consequences of any federally funded infrastructure project. NEPA is the vehicle for identifying, evaluating, mitigating, and disclosing natural and human environmental impacts, and for engaging the public in the evaluation process. There are a number of social, cultural and natural resources that are typically analyzed in the NEPA evaluation process, including (but not limited to) the following:

- Transportation (Transit Ridership, Traffic, etc.)
- Land Use and Consistency of Project with Plans and Zoning
- Neighborhoods and Community Facilities
- Acquisitions and Displacements
- Environmental Justice
- Economics
- Visual and Aesthetic Resources
- Cultural and Historic Resources
- Air Quality
- Noise and Vibration
- Natural Environmental Resources
- Water Resources
- Floodplains
- Water Quality
- Soils and Geology
- Hazardous and Contaminated Materials
- Energy
- Utilities
- Safety and Security

There are three "classes of action" – that is, types of documented analysis - which satisfy NEPA law. Draft and Final Environmental Impact Statements (DEIS and FEIS) are prepared when a proposed project is likely to cause *significant* impacts to the environment. After completion and publication of the FEIS, a Record of Decision (ROD) is prepared that presents the basis for the federal finding made on the project, and commits the local sponsor and federal government agency (for transit projects this is typically FTA) to any necessary mitigation measures.

An Environmental Assessment (EA) is prepared when the impacts of a proposed project have not yet been identified – but are assumed to be insignificant. If no significant impacts are identified in the EA, a Finding of No Significant Impacts (FONSI) is prepared. Sometimes, however, an EA results in a determination that a project is likely to have a significant impact on the environment, in which case a DEIS and FEIS is required.

Categorical Exclusions (CE) are actions that do not individually or cumulatively have a significant environmental impact and are excluded from the requirement to prepare an EIS or an EA. CE actions do not induce significant impacts to planned growth or land use, do not require relocation of significant numbers of people and do not have significant impacts on any natural, cultural, recreational, historic, or other resources. As such, a documented CE is the least rigorous of the three classes of action.

In recent years, FTA has made a significant effort towards streamlining NEPA compliance for transit project sponsors, and broadening the applicability of Categorical Exclusions. Given that the proposed Route 7 BRT project appears to fall exclusively within existing transportation right-of-way and features other CEs identified in FTA guidance on their implementation (https://transit.dot.gov/regulations-and-guidance/environmental-programs/guidance-implementation-ftas-categorical-exclusions), it is likely that it would have little or no effect on the environment. A finding by FTA that the project constitutes a CE would thus significantly streamline any needed analysis. Initiating the discussion of what the appropriate NEPA class of action should be for the federal environmental review of a Route 7 BRT investment should be a topic of the introductory meeting with FTA that is recommended earlier in this chapter..

While it is a lesser effort than an EIS or EA, a great deal of documented analysis is still required to qualify for a CE. Consequently, assuming FTA funding is utilized for a Route 7 transit investment, NVTC and its partners will need to be prepared to document the following information

as part of the preparation of a CE (or any NEPA class of action); note that some of this information has already been collected and analyzed as part of the *Route 7 Corridor Transit Study*:

- **LAND USE:** Is the proposed project consistent with surrounding land use? If not, NVTC (or other project sponsor) should briefly describe the land uses within the project's study area and explain why not, or if it is consistent with future plans.
- **LAND ACQUISTIONS & RELOCATIONS:** Is there any need for land acquisition, or relocations? If so identify those needs. NVTC should document the amount of land acquisition in terms of acreage or square footage. Note that all land acquisition and/or relocation must comply with the Uniform Act of 1970. (https://www.fhwa.dot.gov/real_estate/uniform_act/)
- **ENVIRONMENTAL JUSTICE (EJ):** Determine the presence of minority and low-income (a.k.a. EJ) populations (business owners, landowners, and residents) within ¼ mile of the project area. If there are EJ populations present, it is recommended that NVTC contact FTA Region III for additional guidance.
- **NOISE AND VIBRATION:** Will the project result in a change in the level of noise and vibration in the area? Depending on the proposed project site and the surrounding land use, a noise and vibration assessment may be needed. Chapters 4 (see Table 4-1 on pg. 4-3, specifically) and 9 (see Table 9-2 on pg. 9-4, specifically) of FTA's Transit Noise and Vibration Impact Assessment Manual provides further guidance. (https://www.transit.dot.gov/regulations-and-guidance/environmental-programs/fta-noise-and-vibration-impact-assessment)
- **HAZARDOUS MATERIALS:** Are there hazardous materials in the project area (e.g., lead/asbestos in current facilities/building materials; aboveground or underground storage tanks)? As a first step, it is recommended that NVTC (or subsequent project sponsor) conduct a desktop survey, and/or review public (local, state, and federal) records and environmental databases. If hazardous materials are present, state how those materials would be treated and/or disposed. If the project involves land acquisition, a Phase I Environmental Site Assessment (ESA) for the land to be acquired will have to be completed.
- **WETLANDS/WATERS OF THE U.S.:** Will the project impact any wetlands or waters of the U.S. (including discharge of dredged or fill material into the resources) based upon review of the USFWS National Wetlands Inventory (NWI), NRCS soil map (for hydric soil), and/or by conducting a site visit? If so, it is recommended that NVTC contact FTA Region III for additional guidance.
- **CLEAN WATER ACT, SECTION 402 (STORMWATER PERMIT):** Is there stormwater and/or sediment runoff associated with the project, including runoff anticipated during construction, which would not be abated through use of Best Management Practices (BMPs) and involves more than one (1) acre of ground disturbance? If so, a stormwater permit is likely needed. If a stormwater permit is needed, then this need must be documented, and a permit pursued.
- **FLOODPLAINS/FLOODING:** Has the corridor flooded within the past 50 years? If so, NVTC should state when the flooding occurred. If the project is located within the 100-year floodplain, document the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) number and effective date to support the determination. If the FEMA FIRM is not available, contact the county flood control district or the local floodplain manager to determine if the project is located in a flood hazard area. If the project is located within a 100-year floodplain, NVTC must describe how the proposed project would not impact the base flood elevation and provide the local floodplain agency (with jurisdiction over the project area) an opportunity to review the project scope or design plans (if the project is located on the 100-year floodplain), and include their concurrence/support letter to the CE.
- **BIOLOGICAL RESOURCES/THREATENED AND ENDANGERED SPECIES:** NVTC must obtain a list of threatened and endangered species in the project area from the US Fish and Wildlife Service (USFWS) and attach to the documentation a current (within six (6) months) species list or map. NVTC should further describe any critical habitat or other ecologically-sensitive areas, and consult with the state natural resource agencies to identify any ecologically-sensitive areas (e.g., woodlands, prairies, scenic areas), state-listed species (i.e., species of concern), or protected native plants in the project area. If there are any listed species or their suitable habitat in the project area, determine if the project would impact either resource.
- **TRAFFIC AND PARKING:** Does the project result in increased traffic volumes? If so, NVTC should determine if existing/planned roadways and parking facilities have adequate capacity to handle the increased bus and other traffic and identify if travel patterns or access would be affected and if additional capacity or significant changes to travel patterns are required. If parking is being reduced or eliminated, NVTC should determine the number of parking spaces that would be affected and whether parking needs to be restored at an alternate location (onsite or offsite), and how this additional parking would be constructed to replace the loss of any parking spaces as a result of the project.
- **CULTURAL RESOURCES:** Does the project involve ground disturbance, construction of an above-ground structure, or modification of an existing structure? If so, NVTC must conduct database or archival research and/or contact Fairfax County's cultural resources staff to identify if any archeological and/or historical resources may be present within the project area. It is recommended that NVTC contact FTA Region III early in the project to determine the level of "Section 106" review (36 CFR Part 800) required.

- **SECTION 4(f) RESOURCES –Parklands and Historic Properties (23 CFR Part 774):** Section 4(f) protects publicly owned park and recreation areas that are open to the general public, publicly owned wildlife and waterfowl refuges, and public or privately owned historic sites. If Section 4(f) resources are present in the project area and/or the project involves a potential "use" of any Section 4(f) resources, FTA Region III should be contacted for additional guidance.
- **SECTION 6(f) RESOURCES:** Section 6(f) applies to outdoor recreational properties funded by the Land and Water Conservation Fund (LWCF). If the project impacts Section 6(f) resources (including playground equipment purchased with Section 6(f) funds, for example) or requires conversion of Section 6(f) resources, coordination and written concurrence/ approval from the land management agency and National Park Service would be required and stringent mitigation requirements met. Contact FTA Region III for further guidance if Section 6(f) impacts are anticipated.
- **CONSTRUCTION IMPACTS:** Are any temporary impacts, such as noise, air quality, sidewalk and road closures, traffic detour/access change, construction schedules (e.g., local ordinance may restrict late night work activity in residential neighborhoods), safety and security, expected to occur during construction of the project in residential or commercial areas? If so, NVTC should disclose those impacts, as well as describe mitigation measures to address the impacts, if applicable. If access to residential and commercial properties cannot be maintained, it is recommended that the FTA Region III office be contacted for additional guidance.
- **SECONDARY DEVELOPMENT:** If any secondary development is likely to result due to, or is dependent upon, the project, NVTC should describe the development.
- **UTILITIES:** Are utility impacts expected to occur (i.e., utility relocation, service disruption) due to construction of the proposed project? If so, NVTC should describe their impacts and mitigation measures, as applicable.
- **CONSISTENCY WITH LOCAL AND STATE PLANS:** Is the project included in the Metropolitan Washington Council of Government's financial constrained long range transportation plan? If the project is not in the Plan by the time the CE is submitted to FTA for review and approval, the estimated time for its inclusion in the TIP should be provided. FTA will not approve the CE until the Plan is adopted.

Performance of a CE can take anywhere between 6 and 18 months, depending on the availability of data and level of analysis needed to address these topics. An EA can take anywhere from 12 to 30 months. A significant driver in the schedule – and budget – for either a CE or EA is the extent of project design and travel forecasting efforts that are included in the environmental effort. It is possible, for example, to complete federal environmental review with "just enough" conceptual design to evaluate impacts. This may minimize the costs and reduce the schedule for NEPA. However, these costs must still be borne at some point in order to fully define a project scope, schedule, and budget for the project – all requirements of receiving FTA funding.

In fact, NEPA is just one of five primary purposes of "Project Development" – or "PD" - the first step of a process established by federal law to combine requirements of the National Environmental Policy Act with the other technical and financial work necessary to be eligible for funding under FTA's Capital Investment Grant (CIG) program. The purposes include:

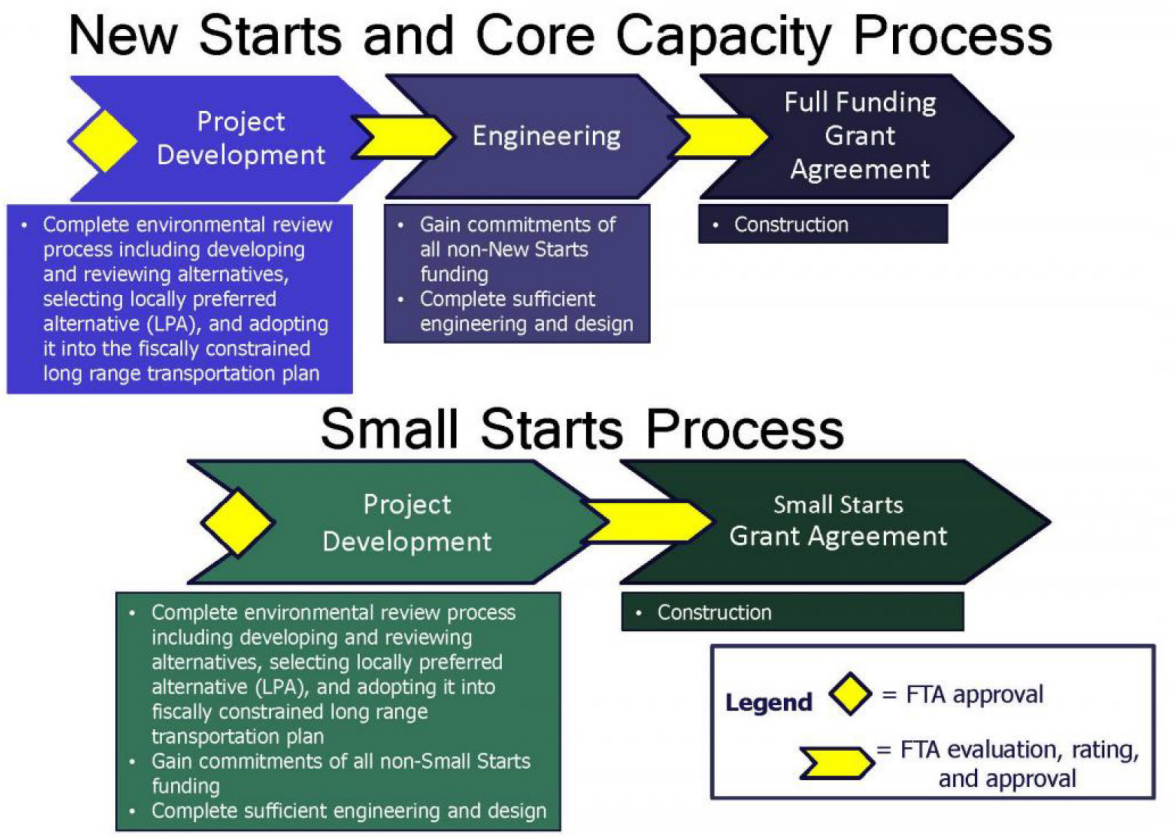
1. the completion of NEPA;
2. the refinement of a project scope and development of a reliable cost estimate;
3. the development of estimates of project benefits through the preparation of "CIG-grade" (that is, FTA-approved) travel forecasts;
4. the development of an FTA-compliant financial plan; and
5. the preparation of project management plans and sub-plans to advance the project beyond PD.

Project Development is discussed in Section 3 below.

4.0 Project Development

The Fixing America's Surface Transportation (FAST) Act continues a multi-step process first established by the Moving Ahead for Progress in the 21st Century (MAP-21) Act for the planning and development of candidate projects funded under FTA's Capital Investment Grant (CIG) program, as shown in Figure 7-1 on the following page.

Figure 7-1 *Capital Investment Program (CIG) Processes*



As noted in the *Route 7 Corridor Transit Study* Financial Analysis chapter, New Starts are "fixed guideway" projects such as heavy rail transit, light rail transit, commuter rail, and BRT, costing more than $300 million or requiring more than $100 million in CIG funding. Small Starts are projects costing less than $300 million and requiring less than $100 million in CIG funding. The differences between advancing a New Starts v a Small Starts project are explained later in this section. Core Capacity projects are capital investments of any cost that add capacity to existing rail or BRT systems; a new BRT investment on Route 7 is not an eligible Core Capacity project.

While the process for receiving a CIG grant is different depending on if a project is a New Starts project or a Small Starts project, the first step in the process for all candidate CIG projects is called Project Development (PD). FTA's requirements for entry into PD focus not on the merits of the project, but on the "readiness" of the project to advance, as measured by the level of previous planning work and the sponsor's understanding of the technical, procedural, and management activities necessary to complete NEPA, develop a project financial strategy, and develop the other information necessary for FTA to evaluate and rate the project against MAP-21's New Starts/Small Starts criteria, *within a defined schedule.*

The most significant benefit of entering PD is that its sponsor receives "pre-award authority," meaning that any local expenditure for NEPA, design, and other project development activities can be counted as match towards a future capital grant. FTA's PD approval also formally places the project in the "queue" for CIG funding, and could also be used locally as a "third party" endorsement of the project which demonstrates to stakeholders hat progress is being made, thus sustaining interest in and support of the project.

FTA's specific requirements for acceptance into Project Development are presented below, with the most significant of requirements underlined and discussed in greater detail afterwards.

- **The name of the study sponsor, any partners involved in the study, and the roles and responsibilities of each**
- Identification of a project manager and other key staff that will perform the Project Development work
- A brief description and clear map of the corridor being studied including its length and key activity centers
- The transportation problem in the corridor or a statement of purpose and need

- Identification of a proposed project if one is known and alternatives to that project if any are being considered
- Identification of a cost estimate for the project, if available
- **Identification of whether the project would be a New Starts, Small Starts, or Core Capacity project**
- A brief description of current levels of transit service in the corridor, including a listing of the existing transit routes in the corridor, their frequency, and existing ridership
- Copies of prior studies done in the corridor, if any
- **The anticipated cost of Project Development**
- **Identification of the funding available and committed to conduct the Project Development work**
- **Documentation demonstrating commitment of funds for the Project Development** work (e.g. Board resolutions, adopted budgets, approved Capital Improvement Programs, approved Transportation Improvement Programs, letters of commitment)

As FTA's PD requirements show, identifying partner roles and responsibilities – as suggested earlier in the *Route 7 Corridor Transit Study* – is a key requisite to entrance into PD. At a minimum, agency roles and responsibilities for carrying out NEPA and other PD activities must be established, with an acknowledgement that the responsibilities associated with subsequent activities (advance design, procurement, Federal grants management, construction management, operation, etc.) will be determined as part of the PD effort.

Another critical requirement is providing a cost estimate – and evidence that funding is committed - for carrying out Project Development. PD activities for which costs must be estimated include:

a. the completion of NEPA;

b. advancement of design to a point that project stakeholders believe that the project cost is firm enough to "lock in" the CIG funding request (typically somewhere between 30-60 percent level of design);

c. any improvements to the travel demand model used to support project ridership forecasts in a way which complies with FTA requirements for evaluating and rating candidate CIG projects. Conversely, project sponsors may forgo that investment and make use of FTA's Simplified Trips-on-Project Software (STOPS) model to generate ridership forecasts. While FTA also offers as an option the "warranting" of project ratings for New Starts and Small Starts projects being implemented in high-transit ridership corridors, existing transit ridership along Route 7 does not meet FTA's threshold. Guidance on the development of FTA-accepted travel forecasts and other inputs to the New Starts project justification criteria can be found at - http://www.fta.dot.gov/grants/15681.html and Reporting Instructions, attached as an appendix to this chapter.

d. The development of an FTA-compliant financial plan, as found at - (http://www.fta.dot.gov/grants/12866.html)

e. The develop project management plans which address post-PD development activities and provides FTA with evidence of a sponsor's technical capacity to advance the project.

According to capital cost estimates prepared for the *Route 7 Corridor Transit Study,* the cost to advance a 12.5 mile BRT alignment through PD is estimated at $6.6 million - $11.5 million, depending on the level of analysis needed to satisfy NEPA and the amount of design project sponsors feel comfortable with in order to lock in the requested CIG funding amount. This "lock-in" is critically important, because it signifies to FTA a level of confidence in the project cost estimate such that FTA can begin to consider it for a Capital Investment Grant Agreement, with the mutual understanding between FTA and potential grantee that any subsequent cost increase will NOT be borne by CIG funding.

4.1 New Starts Engineering

The process for advancing Small Starts and New Starts projects differ after PD approval. Upon completion of Project Development, along with securing at least one-half of non-CIG funding for the project, FTA may evaluate a Small Starts project for inclusion in the President's budget recommendation to Congress. If included in the budget – and if Congress appropriates funding for the President's request – the project sponsor begins to work with FTA on a "Small Starts Grant Agreement (SSGA)" which lays out the terms and conditions of a typically 1-3 year CIG payout schedule for executing the project. The SSGA may be executed once FTA re-evaluates the project cost estimate and the entirety of the non-CIG funding is committed and included in its financial plan.

New Starts projects, on the other hand, have an interim step between Project Development and receipt of a grant called (New Starts) Engineering. Unlike Small Starts projects, which have no constraints on the amount of time it takes to complete PD, **the FAST Act requires that candidate New Starts projects must complete PD (and therefore be ready to advance into Engineering) within two years of entrance**. New Starts project sponsors must also provide evidence that the proposed project costs are backed by a local financial commitment of at least 30 percent of non-CIG program funding in order to advance into Engineering. Finally, FTA expects that approval of a project

into Engineering is based upon at least a 30 percent level of design – or whatever level of design is required by the project sponsor to lock-in the amount of CIG funding for the project.

FTA specifies the kinds of project delivery documentation which accompanies this level of design, and which must be part of the request to enter into Engineering:

- Project Management Plan (PMP) and sub-plans -- should include processes and procedures to continuously manage the project during Engineering and a staffing plan that identifies key personnel and demonstrates the sponsor's management capacity and capability;
- Project definition – key elements are identified and reasonably defined;
- Cost Estimate – addresses key items within the project's work breakdown structure at an appropriate level. Includes both the basis for the estimate and required contingency based on the level of design and in accordance with FTA and industry best practices;
- Schedule – addresses key activities, milestones and elements within the project's work breakdown structure and incorporates proposed delivery methodology;
- Third Party Agreements and Right-of-Way – are identified with a plan and schedule for completion;
- Geotechnical – a preliminary geotechnical report has been completed and provided to FTA where applicable (for example this may not be needed when no geotechnical work is required - such as for most BRT projects);
- Project Delivery Method – the delivery method is identified (with related methodologies, activities, and milestones reflected throughout the other required products);
- Value Engineering (VE) Report – the report is substantially complete and a draft report shared with FTA where applicable (for example, a separate VE report may not be needed for some project delivery methods such as design-build, since bidders may be required to provide the VE options as part of their proposals.) Additional value engineering products may be developed during the Engineering phase.
- Safety – a preliminary safety hazard analysis and a preliminary threat and vulnerability analysis have been completed and the development of safety and security design criteria has been initiated;
- Accessibility – the sponsor demonstrates steps that will be taken to ensure compliance with DOT regulations and standards issued under the Americans with Disabilities Act (ADA), including a preliminary analysis of accessibility features such as accessible routes to, from, and within the station sites or boarding locations; detectable warnings; signage and communications; curb ramps; and other accessibility features required under the ADA; and
- Constructability Review Report– a draft report is submitted, where applicable (for example, for very simple projects, a constructability review early in the project development process might not yield great benefits). The report includes at a minimum the general construction approach, a discussion of site access, and other potential constraints. A more detailed Constructability Review is to be performed during the Engineering phase that may focus on the bid documents, among other aspects, that would affect procurement of the construction contracts.

New Starts projects are typically subject to a higher level of FTA oversight and reviews than Small Starts; in the past that has included the conduct by FTA of a formal risk assessment of New Starts projects' scope, schedule, and budget (risk assessments have also been performed for Small Starts projects, but are generally less rigorous). These risk assessment have sometimes resulted in FTA directing a sponsor to increase the budget of their projects. In addition, New Starts projects are subject to FTA's formal evaluation of their project justification and local financial commitment criteria (as described in Section 3 of the *Route 7 Corridor Transit Study* Evaluation of Alternatives chapter) when requesting entrance into Engineering. That means that New Starts are formally evaluated and rated twice by FTA prior to execution of a Full Funding Grant Agreement (FFGA).

4.2 New Starts v Small Starts

It should be noted that the development of project management plans, the analysis of project risk, and the securing of financial commitments are common sense "requirements" of implementing any major transit capital investment - CIG-funded or not. In other words, whereas New Starts projects must comply with more "requirements" than Small Starts projects, Small Starts projects will usually benefit from the rigor that these requirements entail.

The Route 7 preferred alternative, as currently defined, can qualify as either a New Start or a Small Start. There are pros and cons to each. The primary differences between the CIG process for New Starts and Small Starts are presented in Table 7-1, and summarized below:

Table 7-1 New Starts v Small Starts

Small Starts	New Starts
No 2 year deadline for completion of PD	Must complete PD within 2 years
Project evaluation only considers Small Starts share of project capital costs, and no operating costs	Project evaluation considers all annualized capital and operating costs
CIG funding limited to $100 million	CIG funding assumed as 50 percent of total project costs

Project Development Duration. The two year clock on Project Development for New Starts puts pressure on sponsors to accomplish a great deal of work within a short period of time. One way to relieve this pressure is to delay requesting entry into PD until most of NEPA has been completed, thus narrowing the scope of Project Development to the technical work necessary to prepare for an Engineering request. However, this also delays project sponsor receipt of pre-award authority.

Project Evaluation. FTA's measures for Cost Effectiveness and Environmental Benefits – which, as described in Section 3 of the *Route 7 Corridor Transit Study* constitutes one-third of the rating necessary to be eligible for CIG program funding - are different depending on whether the project qualifies as a New Start or Small Start. The Cost Effectiveness measure for New Starts projects is the annual capital and operating and maintenance (O&M) cost per trip on the project. The Small Start Costs Effectiveness measure is the federal share of annualized capital cost per trip; O&M costs are not factored into the Small Starts Cost Effectiveness calculation. Similarly, FTA's measure for the Environmental Benefits criterion for New Starts projects is defined as the dollar value of the anticipated direct and indirect benefits to human health, safety, energy, and the air quality environment scaled by the annualized capital and operating costs of the project. The measure is the same for Small Starts except that the federal share of capital costs is included in the calculation.

The result of these differences is that, typically, it is easier for Small Starts projects to achieve the necessary minimum rating to be eligible for CIG funding than for New Starts. That said, the recommended BRT investment for Route 7 performs equally well under either set of measures. This may change, or course, as the project's cost estimate and ridership forecast are refined as it advances into NEPA and further design.

Funding Limitation. The recommended Route 7 BRT alternative is estimated to cost $266.3 million in $2015. Once escalated to align with year of construction costs it can reasonably be expected to cost under $300 million, depending on design refinements to the scope accomplished during Project Development – making it eligibly to qualify as either a New Start or Small Start.

Assuming an un-escalated capital cost for the purpose of comparison, Table 7-2 provides a CIG/non-CIG funding breakdown for the Route 7 recommended alternative as either a Small Start or New Start:

Table 7-2 Small Starts v New Starts Funding Requirements

	Small Start ($ M)	New Start ($ M)
Capital Investment Grant Program (CIG)	100.00	133.14
Non - CIG	166.28	133.14

As Table 7-2 shows, the "cost" to local funding partners of advancing the project through the more streamlined Small Starts process is approximately $33.14 million in $2015 – a cost which will grow as the project's implementation schedule is clarified.

It may make sense for the Route 7 recommended alternative to enter Project Development – at least initially - as a Small Start. As the project advances through NEPA and design, NVTC and its partner agencies should explore funding availability under the Commonwealth of Virginia's SMART SCALE and NVTA's HB 2313 processes, as well as the potential for value capture opportunities in the corridor. It is further recommended that NVTC seek additional guidance on funding opportunities from DRPT. As the potential of these matching revenue sources become clearer, NVTC and its partners may decide that the project will need to qualify as a New Start, and bear the added requirements of doing so.

ENVISION ROUTE 7

The Route 7 Corridor Transit Study
FINAL REPORT

Appendices

Appendix A: Capital Cost Estimate Worksheets

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 1: BRT Tysons to Van Dorn Metro with East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
10	**GUIDEWAY & TRACK ELEMENTS**								
	Guideway								
	Single Guideway								
	At Grade - Mixed Flow Busway	RF		$340	$0	18%	28%	$0	$0
	At Grade - Dedicated Busway	RF		$880	$0	18%	28%	$0	$0
	At Grade - Busway/HOV	RF		$1,000	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$5,800	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$5,300	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$3,600	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$9,500	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$13,500	$0	28%	38%	$0	$0
	Subtotal - Single Guideway	RF[1]	0		$0				$0
	Double Guideway								
	At Grade - Mixed Flow Busway	RF	37,125	$400	$14,850,000	18%	28%	$17,523,000	$19,008,000
	At Grade - Dedicated Busway	RF	43,205	$1,060	$45,797,300	18%	28%	$54,040,814	$58,620,544
	At Grade - Busway/HOV	RF		$1,250	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$7,150	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$6,400	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$4,250	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$11,300	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$28,100	$0	28%	38%	$0	$0
	Subtotal - Double Guideway	RF	80,330		$60,647,300			$71,563,814	$77,628,544
	Subtotal Guideway	**RF[1]**	**80,330**		$60,647,300			**$71,563,814**	**$77,628,544**
	Total Category 10	**RF[1]**	**80,330**		$60,647,300			**$71,563,814**	**$77,628,544**
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**								
	Single Guideway Stations								
	At-Grade Platform	EA		$600,000	$0	18%	28%	$0	$0
	Elevated Platform	EA		$1,650,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$3,700,000	$0	18%	28%	$0	$0
	Subtotal - Single Stations	EA	0		$0			$0	$0
	Double Guideway Stations								
	At-Grade Platform	EA	24	$1,100,000	$26,400,000	18%	28%	$31,152,000	$33,792,000
	Elevated Platform	EA		$3,175,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$7,000,000	$0	18%	28%	$0	$0
	Subtotal - Double Stations	EA	24		$0			$31,152,000	$33,792,000
	Station Facilities								
	Parking Lots	STL		$4,600	$0	18%	28%	$0	$0
	Parking Garages	STL		$16,000	$0	18%	28%	$0	$0
	Pedestrain Overpasses	EA		$1,058,000	$0	18%	28%	$0	$0
	Subtotal - Station Facilities	LS	1		$0			$0	$0
	Total Category 20	**EA**	**24**		$0			**$31,152,000**	**$33,792,000**
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**								
	Yards & Shops								
	Maintenance Facility (per vehicle)	EA	18	$330,000	$5,940,000	18%	28%	$7,009,200	$7,603,200
	Central Radio System	LS		$2,650,000	$0	18%	28%	$0	$0
	Total Category 30	**LS**	**1**		**$5,940,000**			**$7,009,200**	**$7,603,200**

Alternative 1: BRT Tysons to Van Dorn Metro with East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
40	**SITEWORK & SPECIAL CONDITIONS**								
	Utility Relocation	LS	1	5.0%	$3,329,365	28%	38%	$4,261,587	$4,594,524
	Demolitions	LS	1	2.0%	$1,331,746	28%	38%	$1,704,635	$1,837,809
	Roadway Changes	LS	1	15.0%	$9,988,095	28%	38%	$12,784,762	$13,783,571
	Environmental	LS	1	4.0%	$2,663,492	28%	38%	$3,409,270	$3,675,619
	Landscaping	LS	1	3.0%	$1,997,619	28%	38%	$2,556,952	$2,756,714
	Total Category 40	**LS**	**1**		$19,310,317			**$24,717,206**	**$26,648,237**
50	**SYSTEMS**								
	Single Guideway								
	Traffic Signal System	RF		$290	$0	12%	22%	$0	$0
	Communications, Line	RF		$95	$0	12%	22%	$0	$0
	Subtotal - Single Systems	RF	0		$0			$0	$0
	Double Guideway								
	Traffic Signal System	RF	80,330	$380	$30,525,400	12%	22%	$34,188,448	$37,240,988
	Communications, Line	RF		$115	$0	12%	22%	$0	$0
	Subtotal - Double Systems	RF	80,330		$30,525,400			$34,188,448	$37,240,988
	Fare Collection (per station)	EA	24	$150,000	$3,600,000	12%	22%	$4,032,000	$4,392,000
	Total Category 50	**RF**	**80,330**		$34,125,400			**$38,220,448**	**$41,632,988**
	Construction Subtotal (Sum Categories 10 - 50)				$120,023,017			**$172,662,668**	**$187,304,969**
60	**ROW, LAND, EXISTING IMPROVEMENTS**								
	Right-of-Way (10% of Construction)	10.0%			$12,002,302	45%	55%	$17,403,337	$18,603,568
	Total Category 60	**LS**	**1**					**$17,403,337**	**$18,603,568**
70	**VEHICLES**								
	Revenue Vehicles - BRT	EA	20	$860,000	$17,200,000	8%	15%	$18,576,000	$19,780,000
	Revenue Vehicles - Connector Bus	EA		$470,000	$0	8%	15%	$0	$0
	Revenue Vehicles - Radio System	EA	20	$26,500	$530,000	8%	15%	$572,400	$609,500
	Total Category 70	**LS**	**1**		$17,730,000			**$19,148,400**	**$20,389,500**
80	**PROFESSIONAL SERVICES (Calculated on Construction Subtotal)**								
	Preliminary Engineering	4.0%						$6,906,507	$7,492,199
	Final Design	10.0%						$17,266,267	$18,730,497
	Project Management for Design and Co	5.0%						$8,633,133	$9,365,248
	Construction Administration & Managem	8.0%						$13,813,013	$14,984,398
	Insurance	3.0%						$5,179,880	$5,619,149
	Legal; Permits; Review Fees by other a	0.5%						$863,313	$936,525
	Surveys, Testing, Investigation, Inspect	2.0%						$3,453,253	$3,746,099
	Agency Force Account Work	1.0%						$1,726,627	$1,873,050
	Total Category 80	**LS**	**1**					**$57,841,994**	**$62,747,165**
90	**UNALLOCATED CONTINGENCY**								
	Project Reserve	10.0%						$17,266,267	$18,730,497
	Total Category 70	**LS**	**1**					**$17,266,267**	**$18,730,497**
	Total Project	Mile	15.2					**$284,322,666**	**$307,775,699**
			Cost (Million per Mile)					$18,688,207	$20,229,748

Note: 1. Length of overall alternative is based on length along one leg of one-way pairs.

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 2: BRT Tysons to Mark Center with East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
10	**GUIDEWAY & TRACK ELEMENTS**								
	Guideway								
	Single Guideway								
	At Grade - Mixed Flow Busway	RF		$340	$0	18%	28%	$0	$0
	At Grade - Dedicated Busway	RF		$880	$0	18%	28%	$0	$0
	At Grade - Busway/HOV	RF		$1,000	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$5,800	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$5,300	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$3,600	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$9,500	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$13,500	$0	28%	38%	$0	$0
	Subtotal - Single Guideway	RF[1]	0		$0				$0
	Double Guideway								
	At Grade - Mixed Flow Busway	RF	22,980	$400	$9,192,000	18%	28%	$10,846,560	$11,765,760
	At Grade - Dedicated Busway	RF	43,205	$1,060	$45,797,300	18%	28%	$54,040,814	$58,620,544
	At Grade - Busway/HOV	RF		$1,250	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$7,150	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$6,400	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$4,250	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$11,300	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$28,100	$0	28%	38%	$0	$0
	Subtotal - Double Guideway	RF	66,185		$54,989,300			$64,887,374	$70,386,304
	Subtotal Guideway	**RF[1]**	**66,185**		$54,989,300			**$64,887,374**	**$70,386,304**
	Total Category 10	**RF[1]**	**66,185**		$54,989,300			**$64,887,374**	**$70,386,304**
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**								
	Single Guideway Stations								
	At-Grade Platform	EA		$600,000	$0	18%	28%	$0	$0
	Elevated Platform	EA		$1,650,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$3,700,000	$0	18%	28%	$0	$0
	Subtotal - Single Stations	EA	0		$0			$0	$0
	Double Guideway Stations								
	At-Grade Platform	EA	21	$1,100,000	$23,100,000	18%	28%	$27,258,000	$29,568,000
	Elevated Platform	EA		$3,175,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$7,000,000	$0	18%	28%	$0	$0
	Subtotal - Double Stations	EA	21		$0			$27,258,000	$29,568,000
	Station Facilities								
	Parking Lots	STL		$4,600	$0	18%	28%	$0	$0
	Parking Garages	STL		$16,000	$0	18%	28%	$0	$0
	Pedestrain Overpasses	EA		$1,058,000	$0	18%	28%	$0	$0
	Subtotal - Station Facilities	LS	1		$0			$0	$0
	Total Category 20	**EA**	**21**		$0			**$27,258,000**	**$29,568,000**
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**								
	Yards & Shops								
	Maintenance Facility (per vehicle)	EA	14	$330,000	$4,620,000	18%	28%	$5,451,600	$5,913,600
	Central Radio System	LS		$2,650,000	$0	18%	28%	$0	$0
	Total Category 30	**LS**	**1**		**$4,620,000**			**$5,451,600**	**$5,913,600**

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 2: BRT Tysons to Mark Center with East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
40	**SITEWORK & SPECIAL CONDITIONS**								
	Utility Relocation	LS	1	5.0%	$2,980,465	28%	38%	$3,814,995	$4,113,042
	Demolitions	LS	1	2.0%	$1,192,186	28%	38%	$1,525,998	$1,645,217
	Roadway Changes	LS	1	15.0%	$8,941,395	28%	38%	$11,444,986	$12,339,125
	Environmental	LS	1	4.0%	$2,384,372	28%	38%	$3,051,996	$3,290,433
	Landscaping	LS	1	3.0%	$1,788,279	28%	38%	$2,288,997	$2,467,825
	Total Category 40	**LS**	**1**		$17,286,697			**$22,126,972**	**$23,855,642**
50	**SYSTEMS**								
	Single Guideway								
	Traffic Signal System	RF		$290	$0	12%	22%	$0	$0
	Communications, Line	RF		$95	$0	12%	22%	$0	$0
	Subtotal - Single Systems	RF	0		$0			$0	$0
	Double Guideway								
	Traffic Signal System	RF	66,185	$380	$25,150,300	12%	22%	$28,168,336	$30,683,366
	Communications, Line	RF		$115	$0	12%	22%	$0	$0
	Subtotal - Double Systems	RF	66,185		$25,150,300			$28,168,336	$30,683,366
	Fare Collection (per station)	EA	21	$150,000	$3,150,000	12%	22%	$3,528,000	$3,843,000
	Total Category 50	**RF**	**66,185**		$28,300,300			**$31,696,336**	**$34,526,366**
	Construction Subtotal (Sum Categories 10 - 50)				$105,196,297			**$151,420,282**	**$164,249,912**
60	**ROW, LAND, EXISTING IMPROVEMENTS**								
	Right-of-Way (10% of Construction)	10.0%			$10,519,630	45%	55%	$15,253,463	$16,305,426
	Total Category 60	**LS**	**1**					**$15,253,463**	**$16,305,426**
70	**VEHICLES**								
	Revenue Vehicles - BRT	EA	15	$860,000	$12,900,000	8%	15%	$13,932,000	$14,835,000
	Revenue Vehicles - Connector Bus	EA		$470,000	$0	8%	15%	$0	$0
	Revenue Vehicles - Radio System	EA	15	$26,500	$397,500	8%	15%	$429,300	$457,125
	Total Category 70	**LS**	**1**		$13,297,500			**$14,361,300**	**$15,292,125**
80	**PROFESSIONAL SERVICES (Calculated on Construction Subtotal)**								
	Preliminary Engineering	4.0%						$6,056,811	$6,569,996
	Final Design	10.0%						$15,142,028	$16,424,991
	Project Management for Design and Co	5.0%						$7,571,014	$8,212,496
	Construction Administration & Managem	8.0%						$12,113,623	$13,139,993
	Insurance	3.0%						$4,542,608	$4,927,497
	Legal; Permits; Review Fees by other a	0.5%						$757,101	$821,250
	Surveys, Testing, Investigation, Inspect	2.0%						$3,028,406	$3,284,998
	Agency Force Account Work	1.0%						$1,514,203	$1,642,499
	Total Category 80	**LS**	**1**					**$50,725,795**	**$55,023,720**
90	**UNALLOCATED CONTINGENCY**								
	Project Reserve	10.0%						$15,142,028	$16,424,991
	Total Category 70	**LS**	**1**					**$15,142,028**	**$16,424,991**
	Total Project	Mile	12.5					**$246,902,868**	**$267,296,175**
			Cost (Million per Mile)					$19,697,018	$21,323,922

Note: 1. Length of overall alternative is based on length along one leg of one-way pairs.

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 3: BRT Tysons to Van Dorn Metro without East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
10	**GUIDEWAY & TRACK ELEMENTS**								
	Guideway								
	Single Guideway								
	At Grade - Mixed Flow Busway	RF		$340	$0	18%	28%	$0	$0
	At Grade - Dedicated Busway	RF		$880	$0	18%	28%	$0	$0
	At Grade - Busway/HOV	RF		$1,000	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$5,800	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$5,300	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$3,600	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$9,500	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$13,500	$0	28%	38%	$0	$0
	Subtotal - Single Guideway	RF[1]	0		$0				$0
	Double Guideway								
	At Grade - Mixed Flow Busway	RF	34,125	$400	$13,650,000	18%	28%	$16,107,000	$17,472,000
	At Grade - Dedicated Busway	RF	35,055	$1,060	$37,158,300	18%	28%	$43,846,794	$47,562,624
	At Grade - Busway/HOV	RF		$1,250	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$7,150	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$6,400	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$4,250	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$11,300	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$28,100	$0	28%	38%	$0	$0
	Subtotal - Double Guideway	RF	69,180		$50,808,300			$59,953,794	$65,034,624
	Subtotal Guideway	**RF[1]**	**69,180**		$50,808,300			**$59,953,794**	**$65,034,624**
	Total Category 10	**RF[1]**	**69,180**		$50,808,300			**$59,953,794**	**$65,034,624**
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**								
	Single Guideway Stations								
	At-Grade Platform	EA		$600,000	$0	18%	28%	$0	$0
	Elevated Platform	EA		$1,650,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$3,700,000	$0	18%	28%	$0	$0
	Subtotal - Single Stations	EA	0		$0			$0	$0
	Double Guideway Stations								
	At-Grade Platform	EA	22	$1,100,000	$24,200,000	18%	28%	$28,556,000	$30,976,000
	Elevated Platform	EA		$3,175,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$7,000,000	$0	18%	28%	$0	$0
	Subtotal - Double Stations	EA	22		$0			$28,556,000	$30,976,000
	Station Facilities								
	Parking Lots	STL		$4,600	$0	18%	28%	$0	$0
	Parking Garages	STL		$16,000	$0	18%	28%	$0	$0
	Pedestrain Overpasses	EA		$1,058,000	$0	18%	28%	$0	$0
	Subtotal - Station Facilities	LS	1		$0			$0	$0
	Total Category 20	**EA**	**22**		$0			**$28,556,000**	**$30,976,000**
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**								
	Yards & Shops								
	Maintenance Facility (per vehicle)	EA	18	$330,000	$5,940,000	18%	28%	$7,009,200	$7,603,200
	Central Radio System	LS		$2,650,000	$0	18%	28%	$0	$0
	Total Category 30	**LS**	**1**		**$5,940,000**			**$7,009,200**	**$7,603,200**

Alternative 3: BRT Tysons to Van Dorn Metro without East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
40	**SITEWORK & SPECIAL CONDITIONS**								
	Utility Relocation	LS	1	5.0%	$2,837,415	28%	38%	$3,631,891	$3,915,633
	Demolitions	LS	1	2.0%	$1,134,966	28%	38%	$1,452,756	$1,566,253
	Roadway Changes	LS	1	15.0%	$8,512,245	28%	38%	$10,895,674	$11,746,898
	Environmental	LS	1	4.0%	$2,269,932	28%	38%	$2,905,513	$3,132,506
	Landscaping	LS	1	3.0%	$1,702,449	28%	38%	$2,179,135	$2,349,380
	Total Category 40	**LS**	**1**		$16,457,007			**$21,064,969**	**$22,710,670**
50	**SYSTEMS**								
	Single Guideway								
	Traffic Signal System	RF		$290	$0	12%	22%	$0	$0
	Communications, Line	RF		$95	$0	12%	22%	$0	$0
	Subtotal - Single Systems	RF	0		$0			$0	$0
	Double Guideway								
	Traffic Signal System	RF	69,180	$380	$26,288,400	12%	22%	$29,443,008	$32,071,848
	Communications, Line	RF		$115	$0	12%	22%	$0	$0
	Subtotal - Double Systems	RF	69,180		$26,288,400			$29,443,008	$32,071,848
	Fare Collection (per station)	EA	22	$150,000	$3,300,000	12%	22%	$3,696,000	$4,026,000
	Total Category 50	**RF**	**69,180**		$29,588,400			**$33,139,008**	**$36,097,848**
	Construction Subtotal (Sum Categories 10 - 50)				$102,793,707			**$149,722,971**	**$162,422,342**
60	**ROW, LAND, EXISTING IMPROVEMENTS**								
	Right-of-Way (10% of Construction)	10.0%			$10,279,371	45%	55%	$14,905,088	$15,933,025
	Total Category 60	**LS**	**1**					**$14,905,088**	**$15,933,025**
70	**VEHICLES**								
	Revenue Vehicles - BRT	EA	20	$860,000	$17,200,000	8%	15%	$18,576,000	$19,780,000
	Revenue Vehicles - Connector Bus	EA		$470,000	$0	8%	15%	$0	$0
	Revenue Vehicles - Radio System	EA	20	$26,500	$530,000	8%	15%	$572,400	$609,500
	Total Category 70	**LS**	**1**		$17,730,000			**$19,148,400**	**$20,389,500**
80	**PROFESSIONAL SERVICES (Calculated on Construction Subtotal)**								
	Preliminary Engineering	4.0%						$5,988,919	$6,496,894
	Final Design	10.0%						$14,972,297	$16,242,234
	Project Management for Design and Co	5.0%						$7,486,149	$8,121,117
	Construction Administration & Managem	8.0%						$11,977,838	$12,993,787
	Insurance	3.0%						$4,491,689	$4,872,670
	Legal; Permits; Review Fees by other a	0.5%						$748,615	$812,112
	Surveys, Testing, Investigation, Inspect	2.0%						$2,994,459	$3,248,447
	Agency Force Account Work	1.0%						$1,497,230	$1,624,223
	Total Category 80	**LS**	**1**					**$50,157,195**	**$54,411,484**
90	**UNALLOCATED CONTINGENCY**								
	Project Reserve	10.0%						$14,972,297	$16,242,234
	Total Category 70	**LS**	**1**					**$14,972,297**	**$16,242,234**
	Total Project	Mile	13.1					**$248,905,951**	**$269,398,585**
		Cost (Million per Mile)						$18,997,158	$20,561,210

Note: 1. Length of overall alternative is based on length along one leg of one-way pairs.

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 4: BRT Tysons to Mark Center without East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range		Total Amount	
						Low	High	Low	High
10	**GUIDEWAY & TRACK ELEMENTS**								
	Guideway								
	Single Guideway								
	At Grade - Mixed Flow Busway	RF		$340	$0	18%	28%	$0	$0
	At Grade - Dedicated Busway	RF		$880	$0	18%	28%	$0	$0
	At Grade - Busway/HOV	RF		$1,000	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$5,800	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$5,300	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$3,600	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$9,500	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$13,500	$0	28%	38%	$0	$0
	Subtotal - Single Guideway	RF[1]	0		$0				$0
	Double Guideway								
	At Grade - Mixed Flow Busway	RF	19,980	$400	$7,992,000	18%	28%	$9,430,560	$10,229,760
	At Grade - Dedicated Busway	RF	35,055	$1,060	$37,158,300	18%	28%	$43,846,794	$47,562,624
	At Grade - Busway/HOV	RF		$1,250	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$7,150	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$6,400	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$4,250	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$11,300	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$28,100	$0	28%	38%	$0	$0
	Subtotal - Double Guideway	RF	55,035		$45,150,300			$53,277,354	$57,792,384
	Subtotal Guideway	**RF[1]**	**55,035**		$45,150,300			**$53,277,354**	**$57,792,384**
	Total Category 10	**RF[1]**	**55,035**		$45,150,300			**$53,277,354**	**$57,792,384**
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**								
	Single Guideway Stations								
	At-Grade Platform	EA		$600,000	$0	18%	28%	$0	$0
	Elevated Platform	EA		$1,650,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$3,700,000	$0	18%	28%	$0	$0
	Subtotal - Single Stations	EA	0		$0			$0	$0
	Double Guideway Stations								
	At-Grade Platform	EA	19	$1,100,000	$20,900,000	18%	28%	$24,662,000	$26,752,000
	Elevated Platform	EA		$3,175,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$7,000,000	$0	18%	28%	$0	$0
	Subtotal - Double Stations	EA	19		$0			$24,662,000	$26,752,000
	Station Facilities								
	Parking Lots	STL		$4,600	$0	18%	28%	$0	$0
	Parking Garages	STL		$16,000	$0	18%	28%	$0	$0
	Pedestrain Overpasses	EA		$1,058,000	$0	18%	28%	$0	$0
	Subtotal - Station Facilities	LS	1		$0			$0	$0
	Total Category 20	**EA**	**19**		$0			**$24,662,000**	**$26,752,000**
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**								
	Yards & Shops								
	Maintenance Facility (per vehicle)	EA	14	$330,000	$4,620,000	18%	28%	$5,451,600	$5,913,600
	Central Radio System	LS		$2,650,000	$0	18%	28%	$0	$0
	Total Category 30	**LS**	**1**		**$4,620,000**			**$5,451,600**	**$5,913,600**

Alternative 4: BRT Tysons to Mark Center without East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
40	**SITEWORK & SPECIAL CONDITIONS**								
	Utility Relocation	LS	1	5.0%	$2,488,515	28%	38%	$3,185,299	$3,434,151
	Demolitions	LS	1	2.0%	$995,406	28%	38%	$1,274,120	$1,373,660
	Roadway Changes	LS	1	15.0%	$7,465,545	28%	38%	$9,555,898	$10,302,452
	Environmental	LS	1	4.0%	$1,990,812	28%	38%	$2,548,239	$2,747,321
	Landscaping	LS	1	3.0%	$1,493,109	28%	38%	$1,911,180	$2,060,490
	Total Category 40	**LS**	**1**		$14,433,387			**$18,474,735**	**$19,918,074**
50	**SYSTEMS**								
	Single Guideway								
	Traffic Signal System	RF		$290	$0	12%	22%	$0	$0
	Communications, Line	RF		$95	$0	12%	22%	$0	$0
	Subtotal - Single Systems	RF	0		$0			$0	$0
	Double Guideway								
	Traffic Signal System	RF	55,035	$380	$20,913,300	12%	22%	$23,422,896	$25,514,226
	Communications, Line	RF		$115	$0	12%	22%	$0	$0
	Subtotal - Double Systems	RF	55,035		$20,913,300			$23,422,896	$25,514,226
	Fare Collection (per station)	EA	19	$150,000	$2,850,000	12%	22%	$3,192,000	$3,477,000
	Total Category 50	**RF**	**55,035**		$23,763,300			**$26,614,896**	**$28,991,226**
	Construction Subtotal (Sum Categories 10 - 50)				$87,966,987			**$128,480,585**	**$139,367,284**
60	**ROW, LAND, EXISTING IMPROVEMENTS**								
	Right-of-Way (10% of Construction)	10.0%			$8,796,699	45%	55%	$12,755,213	$13,634,883
	Total Category 60	**LS**	**1**					**$12,755,213**	**$13,634,883**
70	**VEHICLES**								
	Revenue Vehicles - BRT	EA	15	$860,000	$12,900,000	8%	15%	$13,932,000	$14,835,000
	Revenue Vehicles - Connector Bus	EA		$470,000	$0	8%	15%	$0	$0
	Revenue Vehicles - Radio System	EA	15	$26,500	$397,500	8%	15%	$429,300	$457,125
	Total Category 70	**LS**	**1**		$13,297,500			**$14,361,300**	**$15,292,125**
80	**PROFESSIONAL SERVICES (Calculated on Construction Subtotal)**								
	Preliminary Engineering	4.0%						$5,139,223	$5,574,691
	Final Design	10.0%						$12,848,059	$13,936,728
	Project Management for Design and Co	5.0%						$6,424,029	$6,968,364
	Construction Administration & Managem	8.0%						$10,278,447	$11,149,383
	Insurance	3.0%						$3,854,418	$4,181,019
	Legal; Permits; Review Fees by other a	0.5%						$642,403	$696,836
	Surveys, Testing, Investigation, Inspect	2.0%						$2,569,612	$2,787,346
	Agency Force Account Work	1.0%						$1,284,806	$1,393,673
	Total Category 80	**LS**	**1**					**$43,040,996**	**$46,688,040**
90	**UNALLOCATED CONTINGENCY**								
	Project Reserve	10.0%						$12,848,059	$13,936,728
	Total Category 70	**LS**	**1**					**$12,848,059**	**$13,936,728**
	Total Project	Mile	10.4					**$211,486,153**	**$228,919,061**
		Cost (Million per Mile)						$20,289,759	$21,962,254

Note: 1. Length of overall alternative is based on length along one leg of one-way pairs.

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 5: BRT Tysons to King Street Metro with East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range		Total Amount	
						Low	High	Low	High
10	**GUIDEWAY & TRACK ELEMENTS**								
	Guideway								
	Single Guideway								
	At Grade - Mixed Flow Busway	RF		$340	$0	18%	28%	$0	$0
	At Grade - Dedicated Busway	RF		$880	$0	18%	28%	$0	$0
	At Grade - Busway/HOV	RF		$1,000	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$5,800	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$5,300	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$3,600	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$9,500	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$13,500	$0	28%	38%	$0	$0
	Subtotal - Single Guideway	RF[1]	0		$0				$0
	Double Guideway								
	At Grade - Mixed Flow Busway	RF	27,683	$400	$11,073,200	18%	28%	$13,066,376	$14,173,696
	At Grade - Dedicated Busway	RF	49,370	$1,060	$52,332,200	18%	28%	$61,751,996	$66,985,216
	At Grade - Busway/HOV	RF		$1,250	$0	18%	28%	$0	$0
	Bridge - Dedicated Busway	RF		$7,150	$0	22%	32%	$0	$0
	Aerial - Dedicated Busway	RF		$6,400	$0	22%	32%	$0	$0
	Retained Fill - Dedicated Busway	RF		$4,250	$0	28%	38%	$0	$0
	Retained Cut - Dedicated Busway	RF		$11,300	$0	28%	38%	$0	$0
	Subway - Dedicated Busway	RF		$28,100	$0	28%	38%	$0	$0
	Subtotal - Double Guideway	RF	77,053		$63,405,400			$74,818,372	$81,158,912
	Subtotal Guideway	**RF[1]**	**77,053**		$63,405,400			**$74,818,372**	**$81,158,912**
	Total Category 10	**RF[1]**	**77,053**		$63,405,400			**$74,818,372**	**$81,158,912**
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**								
	Single Guideway Stations								
	At-Grade Platform	EA		$600,000	$0	18%	28%	$0	$0
	Elevated Platform	EA		$1,650,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$3,700,000	$0	18%	28%	$0	$0
	Subtotal - Single Stations	EA	0		$0			$0	$0
	Double Guideway Stations								
	At-Grade Platform	EA	19	$1,100,000	$20,900,000	18%	28%	$24,662,000	$26,752,000
	Elevated Platform	EA		$3,175,000	$0	18%	28%	$0	$0
	Subway Platform	EA		$7,000,000	$0	18%	28%	$0	$0
	Subtotal - Double Stations	EA	19		$0			$24,662,000	$26,752,000
	Station Facilities								
	Parking Lots	STL		$4,600	$0	18%	28%	$0	$0
	Parking Garages	STL		$16,000	$0	18%	28%	$0	$0
	Pedestrain Overpasses	EA		$1,058,000	$0	18%	28%	$0	$0
	Subtotal - Station Facilities	LS	1		$0			$0	$0
	Total Category 20	**EA**	**19**		$0			**$24,662,000**	**$26,752,000**
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**								
	Yards & Shops								
	Maintenance Facility (per vehicle)	EA	16	$330,000	$5,280,000	18%	28%	$6,230,400	$6,758,400
	Central Radio System	LS		$2,650,000	$0	18%	28%	$0	$0
	Total Category 30	**LS**	**1**		**$5,280,000**			**$6,230,400**	**$6,758,400**

Alternative 5: BRT Tysons to King Street Metro with East Falls Church Connection

Mode: BRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
40	**SITEWORK & SPECIAL CONDITIONS**								
	Utility Relocation	LS	1	5.0%	$3,434,270	28%	38%	$4,395,866	$4,739,293
	Demolitions	LS	1	2.0%	$1,373,708	28%	38%	$1,758,346	$1,895,717
	Roadway Changes	LS	1	15.0%	$10,302,810	28%	38%	$13,187,597	$14,217,878
	Environmental	LS	1	4.0%	$2,747,416	28%	38%	$3,516,692	$3,791,434
	Landscaping	LS	1	3.0%	$2,060,562	28%	38%	$2,637,519	$2,843,576
	Total Category 40	**LS**	**1**		$19,918,766			**$25,496,020**	**$27,487,897**
50	**SYSTEMS**								
	Single Guideway								
	Traffic Signal System	RF		$290	$0	12%	22%	$0	$0
	Communications, Line	RF		$95	$0	12%	22%	$0	$0
	Subtotal - Single Systems	RF	0		$0			$0	$0
	Double Guideway								
	Traffic Signal System	RF	77,053	$380	$29,280,140	12%	22%	$32,793,757	$35,721,771
	Communications, Line	RF		$115	$0	12%	22%	$0	$0
	Subtotal - Double Systems	RF	77,053		$29,280,140			$32,793,757	$35,721,771
	Fare Collection (per station)	EA	19	$150,000	$2,850,000	12%	22%	$3,192,000	$3,477,000
	Total Category 50	**RF**	**77,053**		$32,130,140			**$35,985,757**	**$39,198,771**
	Construction Subtotal (Sum Categories 10 - 50)				$120,734,306			**$167,192,549**	**$181,355,980**
60	**ROW, LAND, EXISTING IMPROVEMENTS**								
	Right-of-Way (10% of Construction)	10.0%			$12,073,431	45%	55%	$17,506,474	$18,713,817
	Total Category 60	**LS**	**1**					**$17,506,474**	**$18,713,817**
70	**VEHICLES**								
	Revenue Vehicles - BRT	EA	18	$860,000	$15,480,000	8%	15%	$16,718,400	$17,802,000
	Revenue Vehicles - Connector Bus	EA		$470,000	$0	8%	15%	$0	$0
	Revenue Vehicles - Radio System	EA	18	$26,500	$477,000	8%	15%	$515,160	$548,550
	Total Category 70	**LS**	**1**		$15,957,000			**$17,233,560**	**$18,350,550**
80	**PROFESSIONAL SERVICES (Calculated on Construction Subtotal)**								
	Preliminary Engineering	4.0%						$6,687,702	$7,254,239
	Final Design	10.0%						$16,719,255	$18,135,598
	Project Management for Design and Co	5.0%						$8,359,627	$9,067,799
	Construction Administration & Managem	8.0%						$13,375,404	$14,508,478
	Insurance	3.0%						$5,015,776	$5,440,679
	Legal; Permits; Review Fees by other a	0.5%						$835,963	$906,780
	Surveys, Testing, Investigation, Inspect	2.0%						$3,343,851	$3,627,120
	Agency Force Account Work	1.0%						$1,671,925	$1,813,560
	Total Category 80	**LS**	**1**					**$56,009,504**	**$60,754,253**
90	**UNALLOCATED CONTINGENCY**								
	Project Reserve	10.0%						$16,719,255	$18,135,598
	Total Category 70	**LS**	**1**					**$16,719,255**	**$18,135,598**
	Total Project	Mile	14.6					**$274,661,343**	**$297,310,199**
		Cost (Million per Mile)						$18,820,966	$20,372,962

Note: 1. Length of overall alternative is based on length along one leg of one-way pairs.

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 6A: LRT Tysons to Mark Center with East Falls Church Connection - At-Grade

Mode: LRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
10	**GUIDEWAY & TRACK ELEMENTS**								
	Guideway								
	Single Guideway								
	At Grade - Ballasted, Open	RF		$460	$0	18%	28%	$0	$0
	At Grade - Ballasted, In-Street	RF		$550	$0	18%	28%	$0	$0
	At Grade - Embedded, In-Street	RF		$700	$0	18%	28%	$0	$0
	Bridge - Ballasted	RF		$6,700	$0	22%	32%	$0	$0
	Aerial - Direct Fixation	RF		$6,100	$0	22%	32%	$0	$0
	Retained Fill - Ballasted	RF		$3,500	$0	28%	38%	$0	$0
	Retained Cut - Ballasted	RF		$9,000	$0	28%	38%	$0	$0
	Subway - Direct Fixation	RF		$13,000	$0	28%	38%	$0	$0
	Subtotal - Single Guideway	RF[1]	0		$0			$0	$0
	Double Guideway								
	At Grade - Ballasted, Open	RF	43,250	$600	$25,950,000	18%	28%	$30,621,000	$33,216,000
	At Grade - Ballasted, In-Street	RF		$700	$0	18%	28%	$0	$0
	At Grade - Embedded, In-Street	RF	23,130	$950	$21,973,500	18%	28%	$25,928,730	$28,126,080
	Bridge - Ballasted	RF		$8,200	$0	22%	32%	$0	$0
	Bridge - Direct Fixation (Existing Str)	RF		$3,900	$0	22%	32%	$0	$0
	Aerial - Direct Fixation	RF		$7,200	$0	22%	32%	$0	$0
	Retained Fill - Ballasted	RF		$4,000	$0	28%	38%	$0	$0
	Retained Cut - Ballasted	RF		$10,600	$0	28%	38%	$0	$0
	Subway - Direct Fixation	RF		$26,500	$0	28%	38%	$0	$0
	Subtotal - Double Guideway	RF	66,380		$47,923,500			$56,549,730	$61,342,080
	Subtotal Guideway	**RF[1]**	**66,380**		$47,923,500			**$56,549,730**	**$61,342,080**
	Trackwork								
	Single Trackwork								
	Ballasted Track	RF		$300	$0	12%	22%	$0	$0
	Embedded Track	RF		$650	$0	12%	22%	$0	$0
	Direct Fixation Track	RF		$530	$0	12%	22%	$0	$0
	Special Trackwork	LS	1	15.0%	$0	12%	22%	$0	$0
	Subtotal - Single Trackwork	RF	0		$0			$0	$0
	Double Trackwork								
	Ballasted Track	RF	43,250	$600	$25,950,000	12%	22%	$29,064,000	$31,659,000
	Embedded Track	RF	23,130	$1,300	$30,069,000	12%	22%	$33,677,280	$36,684,180
	Direct Fixation Track	RF	0	$1,100	$0	12%	22%	$0	$0
	Special Trackwork	LS	1	15.0%	$8,402,850	12%	22%	$9,411,192	$10,251,477
	Subtotal - Double Trackwork	RF	66,380		$64,421,850			$72,152,472	$78,594,657
	Subtotal Trackwork	**RF**	**66,380**		$64,421,850			**$72,152,472**	**$78,594,657**
	Total Category 10	**RF[1]**	**66,380**		$112,345,350			**$128,702,202**	**$139,936,737**
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**								
	Single Guideway Stations								
	At Grade Side Platform	EA		$2,700,000	$0	18%	28%	$0	$0
	Elevated Side Platform	EA		$16,000,000	$0	18%	28%	$0	$0
	Subway Side Platform	EA		$38,000,000	$0	18%	28%	$0	$0
	Subtotal - Single Stations	EA	0		$0			$0	$0
	Double Guideway Stations								
	At Grade Side Platform	EA	9	$4,700,000	$42,300,000	18%	28%	$49,914,000	$54,144,000
	At Grade Center Platform	EA	12	$4,000,000	$48,000,000	18%	28%	$56,640,000	$61,440,000
	Elevated Side Platform	EA		$24,000,000	$0	18%	28%	$0	$0
	Elevated Center Platform	EA		$20,000,000	$0	18%	28%	$0	$0
	Subway Side Platform	EA		$70,000,000	$0	18%	28%	$0	$0
	Subway Center Platform	EA		$60,000,000	$0	18%	28%	$0	$0
	Subtotal - Double Stations	EA	21		$90,300,000			$106,554,000	$115,584,000
	Station Facilities								
	Parking Lots	STL		$4,600	$0	18%	28%	$0	$0
	Parking Garages	STL		$16,000	$0	18%	28%	$0	$0
	Pedestrain Overpasses	EA		$1,058,000	$0	18%	28%	$0	$0
	Subtotal - Station Facilities	LS	1		$0			$0	$0
	Total Category 20	**EA**	**21**		$90,300,000			**$106,554,000**	**$115,584,000**

Alternative 6A: LRT Tysons to Mark Center with East Falls Church Connection - At-Grade

Mode: LRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**								
	Yards & Shops								
	Maintenance Facility (per vehicle)	EA	12	$2,380,500	$28,566,000	18%	28%	$33,707,880	$36,564,480
	Total Category 30	**LS**	**1**		$28,566,000			**$33,707,880**	**$36,564,480**
40	**SITEWORK & SPECIAL CONDITIONS (Calculated on Total of Categories 10-30)**								
	Utility Relocation	LS	1	12.0%	$27,745,362	28%	38%	$35,514,063	$38,288,600
	Demolitions	LS	1	8.0%	$18,496,908	28%	38%	$23,676,042	$25,525,733
	Roadway Changes	LS	1	20.0%	$46,242,270	28%	38%	$59,190,106	$63,814,333
	Environmental	LS	1	4.0%	$9,248,454	28%	38%	$11,838,021	$12,762,867
	Landscaping	LS	1	3.0%	$6,936,341	28%	38%	$8,878,516	$9,572,150
	Total Category 40	**LS**	**1**		$108,669,335			**$139,096,748**	**$149,963,682**
50	**SYSTEMS**								
	Single Guideway								
	Signal System	RF	0	$320	$0	12%	22%	$0	$0
	Electrification	RF	0	$500	$0	12%	22%	$0	$0
	Communications, Line	RF	0	$230	$0	12%	22%	$0	$0
	Communications, Station	EA	0	$240,000	$0	12%	22%	$0	$0
	Subtotal - Single Systems	RF	0		$0			$0	$0
	Double Guideway								
	Signal System	RF	66,380	$350	$23,233,000	12%	22%	$26,020,960	$28,344,260
	Electrification	RF	66,380	$610	$40,491,800	12%	22%	$45,350,816	$49,399,996
	Communications, Line	RF	66,380	$270	$17,922,600	12%	22%	$20,073,312	$21,865,572
	Communications, Station	EA	21	$400,000	$8,400,000	12%	22%	$9,408,000	$10,248,000
	Subtotal - Double Systems	RF	66,380		$90,047,400			$100,853,088	$109,857,828
	Fare Collection (per station)	EA	21	$530,000	$11,130,000	12%	22%	$12,465,600	$13,578,600
	Total Category 50	**RF**	**66,380**		$101,177,400			**$113,318,688**	**$123,436,428**
	Construction Subtotal (Sum Categories 10 - 50)				$441,058,085			**$521,379,518**	**$565,485,327**
60	**ROW, LAND, EXISTING IMPROVEMENTS**								
	Right-of-Way Allow. (10% of Const.)	10.0%			$44,105,808	45%	55%	$63,953,422	$68,364,003
	Total Category 60	**LS**	**1**					**$63,953,422**	**$68,364,003**
70	**VEHICLES**								
	Revenue Vehicles	EA	12	$4,800,000	$57,600,000	8%	15%	$62,208,000	$66,240,000
	Total Category 70	**LS**	**1**					**$62,208,000**	**$66,240,000**
80	**PROFESSIONAL SERVICES (Calculated on Construction Subtotal)**								
	Preliminary Engineering	4.0%						$20,855,181	$22,619,413
	Final Design	10.0%						$52,137,952	$56,548,533
	Project Management for Design and Construction	5.0%						$26,068,976	$28,274,266
	Construction Administration & Management	8.0%						$41,710,361	$45,238,826
	Insurance	3.0%						$15,641,386	$16,964,560
	Legal; Permits; Review Fees by other agencies, cities	0.5%						$2,606,898	$2,827,427
	Surveys, Testing, Investigation, Inspection	2.0%						$10,427,590	$11,309,707
	Agency Force Account Work	1.0%						$5,213,795	$5,654,853
	Total Category 80	**LS**	**1**					**$174,662,139**	**$189,437,584**
90	**UNALLOCATED CONTINGENCY**								
	Project Reserve	10.0%						$52,137,952	$56,548,533
	Total Category 70	**LS**	**1**					**$52,137,952**	**$56,548,533**
	Total Project	Mile	12.6					**$874,341,031**	**$946,075,447**
		Cost (Million per Mile)						$69,546,861	$75,252,762

Note: 1. Length of overall alternative is based on length along one leg of one-way pairs.

NORTHERN VIRGINIA TRANSPORTATION COMMISSION
ROUTE 7 TRANSIT ALTERNATIVES
Alternative 6B: LRT Tysons to Mark Center with East Falls Church Connection - At-Grade with Partial Elevation

Mode: LRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
10	**GUIDEWAY & TRACK ELEMENTS**								
	Guideway								
	Single Guideway								
	At Grade - Ballasted, Open	RF		$460	$0	18%	28%	$0	$0
	At Grade - Ballasted, In-Street	RF		$550	$0	18%	28%	$0	$0
	At Grade - Embedded, In-Street	RF		$700	$0	18%	28%	$0	$0
	Bridge - Ballasted	RF		$6,700	$0	22%	32%	$0	$0
	Aerial - Direct Fixation	RF		$6,100	$0	22%	32%	$0	$0
	Retained Fill - Ballasted	RF		$3,500	$0	28%	38%	$0	$0
	Retained Cut - Ballasted	RF		$9,000	$0	28%	38%	$0	$0
	Subway - Direct Fixation	RF		$13,000	$0	28%	38%	$0	$0
	Subtotal - Single Guideway	RF[1]	0		$0			$0	$0
	Double Guideway								
	At Grade - Ballasted, Open	RF	40,900	$600	$24,540,000	18%	28%	$28,957,200	$31,411,200
	At Grade - Ballasted, In-Street	RF		$700	$0	18%	28%	$0	$0
	At Grade - Embedded, In-Street	RF	23,130	$950	$21,973,500	18%	28%	$25,928,730	$28,126,080
	Bridge - Ballasted	RF		$8,200	$0	22%	32%	$0	$0
	Bridge - Direct Fixation (Existing Str)	RF		$3,900	$0	22%	32%	$0	$0
	Aerial - Direct Fixation	RF	2,350	$7,200	$16,920,000	22%	32%	$20,642,400	$22,334,400
	Retained Fill - Ballasted	RF		$4,000	$0	28%	38%	$0	$0
	Retained Cut - Ballasted	RF		$10,600	$0	28%	38%	$0	$0
	Subway - Direct Fixation	RF		$26,500	$0	28%	38%	$0	$0
	Subtotal - Double Guideway	RF	66,380		$63,433,500			$75,528,330	$81,871,680
	Subtotal Guideway	**RF[1]**	**66,380**		$63,433,500			**$75,528,330**	**$81,871,680**
	Trackwork								
	Single Trackwork								
	Ballasted Track	RF		$300	$0	12%	22%	$0	$0
	Embedded Track	RF		$650	$0	12%	22%	$0	$0
	Direct Fixation Track	RF		$530	$0	12%	22%	$0	$0
	Special Trackwork	LS	1	15.0%	$0	12%	22%	$0	$0
	Subtotal - Single Trackwork	RF	0		$0			$0	$0
	Double Trackwork								
	Ballasted Track	RF	40,900	$600	$24,540,000	12%	22%	$27,484,800	$29,938,800
	Embedded Track	RF	23,130	$1,300	$30,069,000	12%	22%	$33,677,280	$36,684,180
	Direct Fixation Track	RF	2,350	$1,100	$2,585,000	12%	22%	$2,895,200	$3,153,700
	Special Trackwork	LS	1	15.0%	$8,579,100	12%	22%	$9,608,592	$10,466,502
	Subtotal - Double Trackwork	RF	66,380		$65,773,100			$73,665,872	$80,243,182
	Subtotal Trackwork	**RF**	**66,380**		$65,773,100			**$73,665,872**	**$80,243,182**
	Total Category 10	**RF[1]**	**66,380**		$129,206,600			**$149,194,202**	**$162,114,862**
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**								
	Single Guideway Stations								
	At Grade Side Platform	EA		$2,700,000	$0	18%	28%	$0	$0
	Elevated Side Platform	EA		$16,000,000	$0	18%	28%	$0	$0
	Subway Side Platform	EA		$38,000,000	$0	18%	28%	$0	$0
	Subtotal - Single Stations	EA	0		$0			$0	$0
	Double Guideway Stations								
	At Grade Side Platform	EA	9	$4,700,000	$42,300,000	18%	28%	$49,914,000	$54,144,000
	At Grade Center Platform	EA	12	$4,000,000	$48,000,000	18%	28%	$56,640,000	$61,440,000
	Elevated Side Platform	EA		$24,000,000	$0	18%	28%	$0	$0
	Elevated Center Platform	EA		$20,000,000	$0	18%	28%	$0	$0
	Subway Side Platform	EA		$70,000,000	$0	18%	28%	$0	$0
	Subway Center Platform	EA		$60,000,000	$0	18%	28%	$0	$0
	Subtotal - Double Stations	EA	21		$90,300,000			$106,554,000	$115,584,000
	Station Facilities								
	Parking Lots	STL		$4,600	$0	18%	28%	$0	$0
	Parking Garages	STL		$16,000	$0	18%	28%	$0	$0
	Pedestrain Overpasses	EA		$1,058,000	$0	18%	28%	$0	$0
	Subtotal - Station Facilities	LS	1		$0			$0	$0
	Total Category 20	**EA**	**21**		$90,300,000			**$106,554,000**	**$115,584,000**

Alternative 6B: LRT Tysons to Mark Center with East Falls Church Connection - At-Grade with Partial Elevation

Mode: LRT

Cat. No.	Description	Unit	Quantity	Unit Cost	Base Amount	Contingency Range Low	Contingency Range High	Total Amount Low	Total Amount High
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**								
	Yards & Shops								
	Maintenance Facility (per vehicle)	EA	12	$2,380,500	$28,566,000	18%	28%	$33,707,880	$36,564,480
	Total Category 30	**LS**	**1**		$28,566,000			**$33,707,880**	**$36,564,480**
40	**SITEWORK & SPECIAL CONDITIONS (Calculated on Total of Categories 10-30)**								
	Utility Relocation	LS	1	12.0%	$29,768,712	28%	38%	$38,103,951	$41,080,823
	Demolitions	LS	1	8.0%	$19,845,808	28%	38%	$25,402,634	$27,387,215
	Roadway Changes	LS	1	20.0%	$49,614,520	28%	38%	$63,506,586	$68,468,038
	Environmental	LS	1	4.0%	$9,922,904	28%	38%	$12,701,317	$13,693,608
	Landscaping	LS	1	3.0%	$7,442,178	28%	38%	$9,525,988	$10,270,206
	Total Category 40	**LS**	**1**		$116,594,122			**$149,240,476**	**$160,899,888**
50	**SYSTEMS**								
	Single Guideway								
	Signal System	RF	0	$320	$0	12%	22%	$0	$0
	Electrification	RF	0	$500	$0	12%	22%	$0	$0
	Communications, Line	RF	0	$230	$0	12%	22%	$0	$0
	Communications, Station	EA	0	$240,000	$0	12%	22%	$0	$0
	Subtotal - Single Systems	RF	0		$0			$0	$0
	Double Guideway								
	Signal System	RF	66,380	$350	$23,233,000	12%	22%	$26,020,960	$28,344,260
	Electrification	RF	66,380	$610	$40,491,800	12%	22%	$45,350,816	$49,399,996
	Communications, Line	RF	66,380	$270	$17,922,600	12%	22%	$20,073,312	$21,865,572
	Communications, Station	EA	21	$400,000	$8,400,000	12%	22%	$9,408,000	$10,248,000
	Subtotal - Double Systems	RF	66,380		$90,047,400			$100,853,088	$109,857,828
	Fare Collection (per station)	EA	21	$530,000	$11,130,000	12%	22%	$12,465,600	$13,578,600
	Total Category 50	**RF**	**66,380**		$101,177,400			**$113,318,688**	**$123,436,428**
	Construction Subtotal (Sum Categories 10 - 50)				$465,844,122			**$552,015,246**	**$598,599,658**
60	**ROW, LAND, EXISTING IMPROVEMENTS**								
	Right-of-Way Allow. (10% of Const.)	10.0%			$46,584,412	45%	55%	$67,547,398	$72,205,839
	Total Category 60	**LS**	**1**					**$67,547,398**	**$72,205,839**
70	**VEHICLES**								
	Revenue Vehicles	EA	12	$4,800,000	$57,600,000	8%	15%	$62,208,000	$66,240,000
	Total Category 70	**LS**	**1**					**$62,208,000**	**$66,240,000**
80	**PROFESSIONAL SERVICES (Calculated on Construction Subtotal)**								
	Preliminary Engineering	4.0%						$22,080,610	$23,943,986
	Final Design	10.0%						$55,201,525	$59,859,966
	Project Management for Design and Construction	5.0%						$27,600,762	$29,929,983
	Construction Administration & Management	8.0%						$44,161,220	$47,887,973
	Insurance	3.0%						$16,560,457	$17,957,990
	Legal; Permits; Review Fees by other agencies, cities	0.5%						$2,760,076	$2,992,998
	Surveys, Testing, Investigation, Inspection	2.0%						$11,040,305	$11,971,993
	Agency Force Account Work	1.0%						$5,520,152	$5,985,997
	Total Category 80	**LS**	**1**					**$184,925,107**	**$200,530,886**
90	**UNALLOCATED CONTINGENCY**								
	Project Reserve	10.0%						$55,201,525	$59,859,966
	Total Category 70	**LS**	**1**					**$55,201,525**	**$59,859,966**
	Total Project	Mile	12.6					**$921,897,276**	**$997,436,349**
		Cost (Million per Mile)						$73,329,581	$79,338,113

Note: 1. Length of overall alternative is based on length along one leg of one-way pairs.

Appendix B: TSM and Build Alternative O&M Cost Worksheet

Headway/Frequency Assumptions	Peak Headway (Minutes)	Peak Frequency (Trips/Hour)	Off-Peak Headway (Minutes)	Off-Peak Frequency (Trips/Hour)
TSM Alterative	10	6	15	4
1. BRT from Tysons Corner to Van Dorn Metro with East Falls Church (EFC) Connection	10	6	15	4
2. BRT from Tysons Corner to Mark Center with EFC Connection	10	6	15	4
3. BRT from Tysons Corner to Van Dorn Metro w/o EFC Connection	10	6	15	4
4. BRT from Tysons Corner to Mark Center w/o EFC Connection	10	6	15	4
5. BRT from Tysons Corner to King Street Metro with EFC Connection	10	6	15	4
6. LRT from Tysons Corner to Mark Center with EFC Connection	10	6	15	4

Hours/Day Assumptions	Weekday Hours of Service	Weekday Peak Hours of Service	Weekday Off-Peak Hours of Service	Saturday Hours of Service	Saturday Peak Hours of Service	Saturday Off-Peak Hours of Service	Sunday Hours of Service	Sunday Peak Hours of Service	Sunday Off-Peak Hours of Service	Holiday Hours of Service	Holiday Peak Hours of Service	Holiday Off-Peak Hours of Service
TSM Alterative	20	6	14	18	0	18	18	0	18	18	0	18
1. BRT from Tysons Corner to Van Dorn Metro with East Falls Church (EFC) Connection	22	6	16	22	0	22	22	0	22	22	0	22
2. BRT from Tysons Corner to Mark Center with EFC Connection	22	6	16	22	0	22	22	0	22	22	0	22
3. BRT from Tysons Corner to Van Dorn Metro w/o EFC Connection	22	6	16	22	0	22	22	0	22	22	0	22
4. BRT from Tysons Corner to Mark Center w/o EFC Connection	22	6	16	22	0	22	22	0	22	22	0	22
5. BRT from Tysons Corner to King Street Metro with EFC Connection	22	6	16	22	0	22	22	0	22	22	0	22
6. LRT from Tysons Corner to Mark Center with EFC Connection	22	6	16	22	0	22	22	0	22	22	0	22

Annualization Assumptions	Weekdays/ Year	Saturdays/ Year	Sundays/ Year	Holidays/ Year
TSM Alterative	253	52	52	8
1. BRT from Tysons Corner to Van Dorn Metro with East Falls Church (EFC) Connection	253	52	52	8
2. BRT from Tysons Corner to Mark Center with EFC Connection	253	52	52	8
3. BRT from Tysons Corner to Van Dorn Metro w/o EFC Connection	253	52	52	8
4. BRT from Tysons Corner to Mark Center w/o EFC Connection	253	52	52	8
5. BRT from Tysons Corner to King Street Metro with EFC Connection	253	52	52	8
6. LRT from Tysons Corner to Mark Center with EFC Connection	253	52	52	8

Running Time Assumptions	One-Way Travel Time (Minutes)	Round Trip Travel Time, not including Layover (Minutes)	15% Layover Percentage (added to travel time)	Cycle Time (including Layover)
TSM Alterative	84	168	25	194
1. BRT from Tysons Corner to Van Dorn Metro with East Falls Church (EFC) Connection	67	135	20	155
2. BRT from Tysons Corner to Mark Center with EFC Connection	49	98	15	113
3. BRT from Tysons Corner to Van Dorn Metro w/o EFC Connection	67	135	20	156
4. BRT from Tysons Corner to Mark Center w/o EFC Connection	49	98	15	113
5. BRT from Tysons Corner to King Street Metro with EFC Connection	64	128	19	148
6. LRT from Tysons Corner to Mark Center with EFC Connection	43	85	13	98

Daily Trips Calculation	Weekday Peak Trips	Weekday Off-Peak Trips	Weekday Total Trips	Saturday Peak Trips	Saturday Off-Peak Trips	Saturday Total Trips	Sunday Peak Trips	Sunday Off-Peak Trips	Sunday Total Trips	Holiday Peak Trips	Holiday Off-Peak trips	Holiday Total Trips
TSM Alterative	36	56	92	0	72	72	0	72	72	0	72	72
1. BRT from Tysons Corner to Van Dorn Metro with East Falls Church (EFC) Connection	36	64	100	0	88	88	0	88	88	0	88	88
2. BRT from Tysons Corner to Mark Center with EFC Connection	36	64	100	0	88	88	0	88	88	0	88	88
3. BRT from Tysons Corner to Van Dorn Metro w/o EFC Connection	36	64	100	0	88	88	0	88	88	0	88	88
4. BRT from Tysons Corner to Mark Center w/o EFC Connection	36	64	100	0	88	88	0	88	88	0	88	88
5. BRT from Tysons Corner to King Street Metro with EFC Connection	36	64	100	0	88	88	0	88	88	0	88	88
6. LRT from Tysons Corner to Mark Center with EFC Connection	36	64	100	0	88	88	0	88	88	0	88	88

Annual Revenue Hours and Annual Cost Calculation	Revenue Hours per Weekday	Revenue Hours per Saturday	Revenue Hours per Sunday	Revenue Hours per Holiday	Weekday Annual Revenue Hours	Saturday Annual Revenue Hours	Sunday Annual Revenue Hours	Holiday Annual Revenue Hours	Total Annual Revenue Hours	O&M Cost/Revenue Hour Factor	Annual O&M Cost
TSM Alterative	297	233	233	233	75,259	12,105.60	12,106	1,862	101,333	$ 144.42	$ 14,634,463.72
1. BRT from Tysons Corner to Van Dorn Metro with East Falls Church (EFC) Connection	258	227	227	227	65,358	11,821.33	11,821	1,819	90,820	$ 144.42	$ 13,116,176.26
2. BRT from Tysons Corner to Mark Center with EFC Connection	188	166	166	166	47,648	8,618.13	8,618	1,326	66,210	$ 144.42	$ 9,562,115.60
3. BRT from Tysons Corner to Van Dorn Metro w/o EFC Connection	260	229	229	229	65,780	11,897.60	11,898	1,830	91,406	$ 144.42	$ 13,200,796.75
4. BRT from Tysons Corner to Mark Center w/o EFC Connection	188	166	166	166	47,648	8,618.13	8,618	1,326	66,210	$ 144.42	$ 9,562,115.60
5. BRT from Tysons Corner to King Street Metro with EFC Connection	247	217	217	217	62,407	11,287.47	11,287	1,737	86,718	$ 144.42	$ 12,523,832.82
6. LRT from Tysons Corner to Mark Center with EFC Connection	163	144	144	144	41,323	7,474.13	7,474	1,150	57,421	$ 412.78	$ 23,702,433.01

Peak Vehicle and Fleet Requirement Calculation	Peak Vehicles	Fleet Requirement (includes 20% Spare)
TSM Alterative	20	24
1. BRT from Tysons Corner to Van Dorn Metro with East Falls Church (EFC) Connection	16	20
2. BRT from Tysons Corner to Mark Center with EFC Connection	12	15
3. BRT from Tysons Corner to Van Dorn Metro w/o EFC Connection	16	20
4. BRT from Tysons Corner to Mark Center w/o EFC Connection	12	15
5. BRT from Tysons Corner to King Street Metro with EFC Connection	15	18
6. LRT from Tysons Corner to Mark Center with EFC Connection	10	12

Appendix C: Website Comments

Date	Comment
4/20/2015	Residents and business around the Park Center development in Alexandria (@ Park Center Drive & Ford Avenue) are under-served by transit, especially on the weekends.
4/20/2015	while there are certainly a lot of major investments that can be made along the corridor, why not start with cheaper things that can make a substantial difference?
4/20/2015	Light rail would enhance economic activity while improving mobility. One problem, however, is the gaps in density in some areas of rt. 7.
4/21/2015	WHAT ABOUT THE TERRIBLE AND GETTING WORSE BY THE DAY TRAFFIC AROUND 7 CORNERS, BAILEYS CROSSROADS AND RELATED CROSS STREETS. RAPID CORRIDOR TRANSPORTATION BETWEEN ALEXANDRIA AND TYSONS IS NOT ENOUGH. WE NEED TO DEAL WITH EXISTING AND DEVELOPING TRAFFIC AT THE SAME TIME RAPID TRANSIT IS CONSIDERED UP AND DOWN RT 7. WHERE IS THIS IN YOUR SOLUTIONS
4/21/2015	Can the planning include how this could potential link to the Purple Line light rail? Ideally Route 7 would be light rail so eventually the two lines can become part of the same system.
5/1/2015	Please include me in your email distribution list to receive periodic meeting notifications and other study-related material
5/3/2015	I have been working on the issue of having post offices available. I think that the Postal Service should be included in discussing Route 7 transportation.
5/4/2015	Congestion clearly needs to be addressed but I would hope there can be a way to do so without making it more difficult to patronize local businesses along the route.
5/4/2015	Please put a bike path on Route 7 to Spring Hill metro, from Beulah Rd at least.
5/5/2015	1. We need bike trails along Route 7 West of the Spring Hill metro stop, the first stop that has no parking. We need this more than we need bus service along Route 7. f. We need a metro stop at Wolf Trap. Wolf Trap is a major destination, is a National Park, provides ample parking (300+spaces), and is close to the existing metro line.
5/5/2015	Simple solution just add more busses. No need for trains in Leesburg Pike is too expensive for tax payers, every year we pay more and more our salaries don't go up every year . Thank you
5/5/2015	Please put in better walking and biking access from the Route 7 corridor west of Spring Hill Metro. There is no safe way to get there now except by car or (infrequent) bus, and there's no parking. It makes so much sense to be able to bike or walk. Thank you.
5/5/2015	It was incredibly short-sighted to build the Silver Line without adequate parking or improvements to other means of getting to the stations in Tysons. Two things that would help with traffic coming from the West along Rt 7: 1)create a contiguous bike path along Rt 7, and 2)create either a Metro stop at Wolf Trap, or have Metro parking at Wolf Trap with a bus to the Spring Hill station. It's such a waste to have that huge parking lot go unused 90% of the time.
5/6/2015	Strong supporter of transit on corridor - either BRT or LRT
5/11/2015	I live in Tyson's right off Route 7 and work in Alexandria right off Route 7. I usually drive and there are many long lights and difficult intersections to navigate (mostly 7 Corners). Even though it's less than 10 miles one way, it takes a long time. Today I took 28A bus which took close to an hour with the many off shoot Routes off Rt 7. I'm hoping something can be done to make both drive and bus more express like. When I lived in a different state, there was an express road built above a street similar to route 7 without stops and had limited exits. If there were no traffic or long lights, it would take about 10-15 mins to drive. Thanks for looking into ways to improve Rt 7.

Date	Comment
5/11/2015	"The Rt7/Dulles Toll Road project is coming closer to reality. Current plan is for bike/walking path underpasses only on the northern side of route 7, with crosswalks for the southern side path. I would urge you to place these on the southern side, as this is where most of the foot traffic occurs. McLean Bible Church is on the southern side and every Sunday you see people walking from church into Tysons on the southern side. Also, the north side doesn't have direct access for any homes to get to the path. The south side does have residential access directly to the paths. It makes no sense to have the underpasses on the north side where there would be few bikers or pedestrians. Alternatively, an underpass path under Route 7 from the south side to the north side west of the Toll Road for direct access to the underpasses would be another alternative to encourage use and greatly increase safety."
5/19/2015	"I hope Envision Route 7 succeeds. With the cancellation of the streetcar projects along Columbia Pike and Highway 1, I encourage you to explain to the public how Envision Route 7 will be able to overcome the obstacles that the streetcar faced."
6/4/2015	We definitely need a new transit system on Route 7, especially since Metrobus is cutting back on buses in this area.
6/8/2015	Do you have a summary of all of the options that were considered and the high level reasons for why they were dismissed. I am just catching up on the status and just wanted see what was already done.
7/16/2015	I'd like to see a time table so I know what's happening now. Are we in phase 1or phase 2, it's unclear to a visitor to this site where we are.are you still accepting comments -when will it be too late?
8/14/2015	Dedicated transit lanes on Route 7 are a must to provide regional transit in NoVa. The widening planned for Route 7 should be replaced with the transit lanes to minimize the need for ROW. Also please make sure there are good pedestrian and bike facilities on the plan too, this needs to be a multimodal project that enhances transportation for everyone!
8/18/2015	Please add me to the mailing list. The corridor really needs this project. If I use the 28A bus, it takes me almost an hour just to get to the West Falls Church Metro station from the western part of Alexandria. Thanks.
8/20/2015	"Greetings, I'd like to see modern streetcars/light rail vehicles roaming this corridor in the future!"
10/21/2015	I take the bus most workdays from tysons corner to alexandria for work. While it is a loooong ride, I enjoy relaxing. My biggest concern is having to cross street on way home once off bus on rt 7 (near Trader Joe's in Falls Church) - I feel like I'm taking my life in my hands because there is no crosswalk nor signs to consider people crossing the street. This is a huge issue and one that will get worse as people age. Perhaps some signage could be added or something to help the pedestrian and their right of way. Thank you!
10/23/2015	I'm familiar with light rail from Jersey City NJ and love it! Cleaner, quieter and easier to navigate with kids than busses.
11/9/2015	High speed light rail makes the most sense to me. And be sure to connect it to the metro lines. Otherwise it's going to be practically useless for people trying to commute into DC. Take a look at NY subway and rail system. That's a great model to follow.
11/9/2015	Hi, I wasn't able to attend the Alexandria public meeting last week. When will the presentation and other meeting materials be posted to the website?
11/17/2015	"I live in Alexandria and work in Reston. I would absolutely use a route 7 BRT or LRT option to connect me to Tysons as a transit hub. Such an option would also open jobs for me in Tysons. Thank you for studying the area. It is much needed."
4/6/16	Will the dedicated lanes proposed in Tysons Corner be new lanes or replace existing lanes? While I support BRT, if it ends in Tysons corner by replacing existing lanes, it will create a huge bottleneck for those living to the northwest.
4/6/16	LOVE IT!!!
4/13/16	Will real-time arrival digital signs at the bus stops be a part of this project?

Date	Comment
6/4/16	As you can see from my address, I am vitally interested in what you plan for the stretch of Rt. 7 between Rt. 29 and 7 Corners. All I can see that appears definitive in the many materials you have on your website is that the frequency of bus service on Metrobus line 28A would increase. It seems that the BRT route might divert from Rt. 7 at Rt. 29 to go to the East Falls Church Metro station and return somehow to Rt. 7 in the 7 Corners area. However, this diversion is termed “proposed,” or a similar term, in everything I have found. So my question is “what is the status of that route for the BRT?” To include a comment, if an alternative to this route, or, in fact, the primary route, is to put a BRT lane down Rt. 7 between Rt. 29 and 7 Corners, it would be a traffic disaster. Eastbound traffic already backs up westward from Roosevelt St. in both lanes 1/4 mile in the morning and evening rush hours every day and often on the weekends. A BRT lane would compound this problem rather than reducing it. Attempting to add a lane in this area for a BRT would certainly take our front yards, which in most cases are only about 20 feet deep, and destroy our houses’ values. I would certainly join a lawsuit to preempt that if becomes an alternative.
7/10/16	Please Move with the corridor idea ASAP. This has been LONG Overdue initiative.
10/4/16	Exciting!

Appendix D: Newsletters

ENVISION ROUTE 7

VOLUME 1, ISSUE 1 | THE ROUTE 7 CORRIDOR TRANSIT STUDY UPDATE | SPRING 2015

Study will explore options for enhanced transit along Route 7

The Northern Virginia Transportation Commission (NVTC) is conducting a study that will assess the needs of travelers along the Route 7 corridor in Northern Virginia. The Route 7 Corridor Transit Study explores travel in the area between Tysons and the City of Alexandria and will result in the development of potential options to improve mobility and accessibility to and along Route 7.

Enhanced transit service along Route 7 has been a NVTC priority for many years. A high quality transit option can connect people and businesses to economic opportunity, improve regional mobility and help relieve congestion. The objective of this study is to assess the viability of implementing an option for improved transit and, if a feasible project is identified, possibly prepare it for entrance into the Federal Transit Administration's (FTA) Project Development process.

The analysis of traveler needs along Route 7 is being conducted in multiple phases. The first phase of the study included an initial screening and analysis of transit modes and a preliminary look at viability. Based on the Phase I screening process, only two high-capacity transit modes were advanced for further evaluation under the current study: Bus Rapid Transit (BRT) and Light Rail Transit (LRT). Phase II will evaluate these modes and take a more in-depth look at the potential for implementing enhanced transit in the corridor.

Study includes in-depth analysis of travel needs

To help analyze the viability of implementing enhanced transit on Route 7, this study will include:

- :: Ridership Forecasts
- :: Cost Estimates
- :: Funding Options & Strategies
- :: Federal Funding Evaluation
- :: Evaluating the Alternatives
- :: Project Delivery Options

At the end of Phase II, the study will determine if either of the two transit modes identified in Phase I will effectively and efficiently address the existing transportation needs along the Route 7 corridor and accommodate future travel demands. In addition to technical analysis, community input will help guide study decisions by shaping the vision for enhanced transit along the corridor.

Call our comment line at any time and leave us a message: **844 - RT7STUDY**

YOUR INPUT IS NEEDED

Involvement from the community is a critically important part of the Route 7 Corridor Transit Study.

Public meetings will take place at a later point in the study but there are ways you can stay informed and provide your input today:

:: **Visit the study website** at www.EnvisionRoute7.com.

> **Sign up for Email Updates**
Sign up to receive project updates and notices of upcoming meetings.

> **Submit a Question or Comment**
Submit your comments and questions about the study and tell us about your travel needs on Route 7 by pinning your destinations to a map!

> **Request a Presentation**
Request a member of the study team to present to your organization or community group. Visit the website to find out how.

:: **Follow Us**
Follow "EnvisionRoute7" on Facebook, Twitter and Instagram!

www.EnvisionRoute7.com

ENVISION ROUTE 7

VOLUME 1, ISSUE 1 THE ROUTE 7 CORRIDOR TRANSIT STUDY UPDATE SPRING 2015

El estudio explorará opciones para mejorar el tránsito a lo largo de la Ruta 7

La Comisión de Transporte del Norte de Virginia (NVTC, por sus siglas en inglés) está llevando a cabo un estudio que evaluará las necesidades de los viajeros a lo largo del corredor de la Ruta 7 en el norte de Virginia. El Estudio del Tráfico en el Corredor de la Ruta 7 explora los viajes en la zona entre Tysons y la Ciudad de Alexandria y resultará en el desarrollo de opciones potenciales para mejorar la movilidad y accesibilidad a y a lo largo de la Ruta 7.

La mejora en el servicio del tráfico a lo largo de la Ruta 7 ha sido una prioridad de NVTC durante muchos años. Una opción de tránsito de alta calidad puede conectar a las personas y negocios con la oportunidad económica, mejorar la movilidad regional y ayudar a aliviar la congestión. El objetivo de este estudio es evaluar la viabilidad de implementar una opción para mejorar el tránsito y, si se identifica un proyecto viable, posiblemente prepararlo para su entrada al proceso de desarrollo de proyectos de la Administración Federal de Tránsito (FTA, por sus siglas en inglés).

El análisis de las necesidades de los viajeros a lo largo de la Ruta 7 se está llevando a cabo en varias fases. La primera fase del estudio incluyó una revisión y análisis inicial de los modos de tránsito y una vista preliminar a su viabilidad. Con base en el proceso de revisión de la Fase I, solo dos modos de tránsito de alta capacidad fueron admitidos para mayor evaluación bajo el estudio actual: Autobús de Tránsito Rápido (BRT, por sus siglas en inglés) y el Tren Ligero (LRT, por sus siglas en inglés). La Fase II evaluará estos modos y revisará a profundidad el potencial para implementar una mejora al tránsito en el corredor.

El Estudio incluye un análisis a profundidad de las necesidades de viaje

Para ayudar a analizar la viabilidad de implementar una mejora de tránsito en la Ruta 7, este estudio incluirá:

- :: Pronóstico de uso
- :: Estimaciones de costo
- :: Opciones y estrategias de financiamiento
- :: Evaluación de financiamiento federal
- :: Evaluación de alternativas
- :: Opciones de entrega de proyecto

Al final de la Fase II, el estudio determinará si cualquiera de los dos modos de tránsito identificados en la Fase I abordará efectiva y eficientemente las necesidades existentes de transporte a lo largo del corredor de la Ruta 7 y se adecuará a la demanda futura de transporte. Además del análisis técnico, los aportes de la comunidad ayudarán a guiar las decisiones sobre el estudio dando forma a la visión de la mejora al tránsito a lo largo del corredor.

Llame a nuestra línea de comentarios en cualquier momento y déjenos un mensaje:
844 - RT7STUDY

Su opinión es necesaria

La participación de la comunidad es una parte de importancia crítica del Estudio de Tránsito en el Corredor de la Ruta 7.

Se llevarán a cabo reuniones públicas más adelante en el estudio, pero hay maneras en las que puede mantenerse informado y proporcionarnos su opinión ahora:

:: **Visite el sitio web del estudio** en www.EnvisionRoute7.com.

> **Inscribirse para recibir actualizaciones por correo electrónico**
Inscríbase para recibir actualizaciones y avisos sobre próximas reuniones.

> **Envíe una pregunta o comentario**
¡Envíe sus comentarios y preguntas sobre el estudio y háblenos sobre sus necesidades de viaje en la Ruta 7 marcando sus destinos en un mapa!

> **Solicite una presentación**
Solicite que un miembro del equipo del estudio haga una presentación con su organización o grupo comunitario. Visite el sitio web para saber cómo.

:: **Síganos**
¡Siga "EnvisionRoute7" en Facebook, Twitter e Instagram!

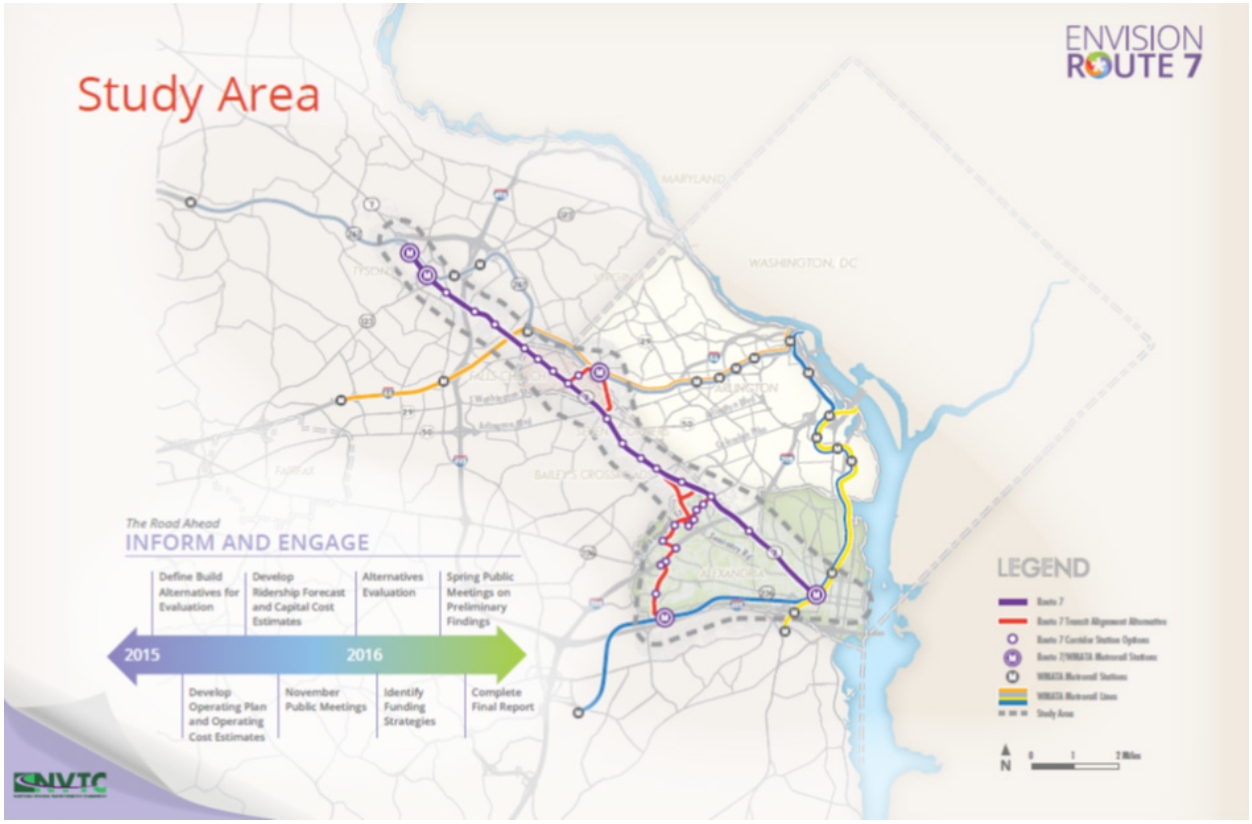
www.EnvisionRoute7.com

Appendix E: Telephone Line Comments

"Hi I am just wanted to leave a comment and I am on your website and also on your email list that I can't take it from Monday Monday through Friday. I'm round trip from Tyson's corner two on the Northern Virginia community college on to Main Street on 28 a bus. The entire way it's it's an hour long and actually I kind of enjoy it it relaxes me very good price so I just wanted to say to you that I am in support of any transportation you can do when I do drive I don't take seven I I go around the belt way which is much longer because seven it's kind of a very painful street to take from Tyson's to Alexandria too many lights in but the boss is very good and I encourage encourage you all to on to develop some sort of transit system that's better than perhaps something they could be even on the street road seven could you could be a bypass up in the air through through going over there this is crossroads with the 77 corners and the village-clusters(?) just to make it a little faster that's an idea because those major major intersections up. Anyway I am all for transportation alternatives through there to include public transportation advancement. I'm not sure what you meant by the light rail but that sounds really great. But anyway I did wanna say that I do produce(?) a week. Most of those days of the five days that you take the 28th at a bus and has been pleased except for that it's a very long trip but actually enjoy it thank you bye bye."

Received: 10/21/2015 at 9:42:56 AM

Appendix F: November 2015 Meeting Exhibits



ENVISION ROUTE 7

Study Questions

What type of transit service would best serve people and businesses in the corridor? Where should it go? How do we make it financially viable?

MODE

Bus Rapid Transit (BRT)

Guideways

- Mixed-flow traffic: Vehicles operate with automobiles in an existing traffic lane.
- Dedicated lanes: Lanes may be physically separated or denoted by pavement or markings.

Vehicles

- Doors on both sides
- 120 persons per vehicle
- All-electric or hybrid power
- Larger windows
- Low-floor boarding/alighting

Light Rail Transit (LRT)

Guideways

- Operates on steel tracks
- Dedicated rights of way: Typically operates in dedicated space. Can include aerial structures to eliminate traffic conflicts.
- Developing technology may allow for in-pavement power or no power in short sections.

Vehicles

- Doors on both sides
- 200 persons per vehicle
- Uses overhead electric wires for power
- Low-floor boarding/alighting

Transportation System Management (TSM) is another alternative being considered. TSM is a low-capital investment strategy that can improve transit system operations. TSM can be implemented using the following techniques:

- Signal improvements, reducing intersection delay
- Service changes
- Queue jumps to bypass traffic at intersections

Common Characteristics

Technology

- Transit signal priority system
- Guidance system
- Automatic vehicle location
- On-board vehicle diagnostics

Branding

- Design elements specific to the service for vehicles, signage, stations, and marketing materials
- Improves recognition of service with consistent, unique graphics
- Attracts new riders

Station Amenities

- Shelters
- Level or near-level boarding
- Off-board fare collection system
- Service-specific branding
- Real-time service display with vehicle location and arrival information

ALIGNMENT AND TERMINI

This study will help identify the final alignment for the service. The western terminus has been identified as the Spring Hill Metrorail Station. An option that provides service to East Falls Church Metrorail Station is being analyzed as a potential mid-corridor connection. Currently, three termini are proposed at the eastern end of the corridor.

- Terminus Option A: Mark Center
- Terminus Option B: Van Dorn Street Metrorail Station
- Terminus Option C: King Street Metrorail Station

FINANCIAL SUSTAINABILITY

This project will require a sustainable financial plan to fund and/or finance the preferred alternative. Dedicated funding sources will need to be identified. The following sources are currently being evaluated:

Federal
- New Starts
- TIGER Grants

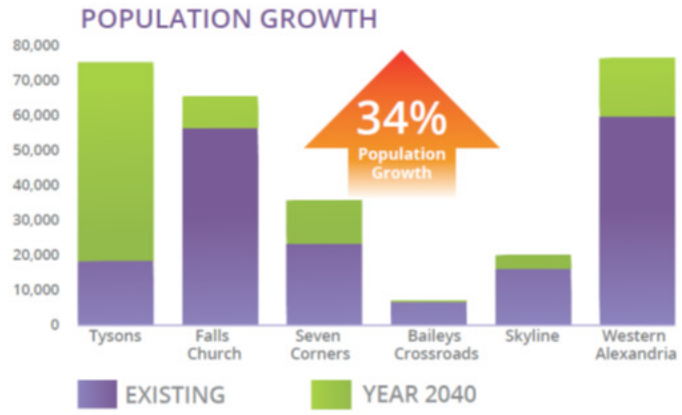
State
- Department of Rail and Public Transportation Capital Assistance Grants
- Commonwealth Transportation Fund
- Public-Private Partnerships

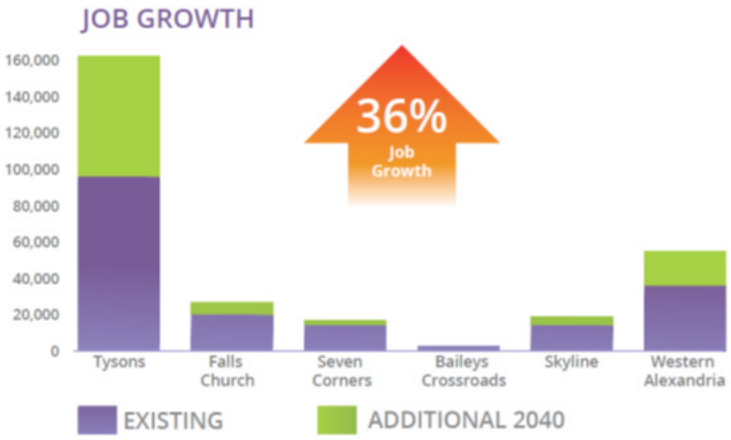
Local
- Motor Vehicle Sales Tax
- Grantor's and Transient Occupancy Taxes
- Value Capture
- Tax Increment Financing

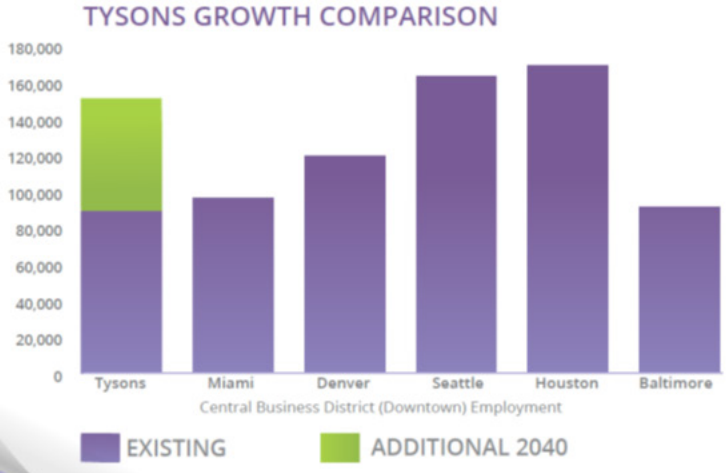
NVTC

ENVISION ROUTE 7

Future Growth Along Route 7







NVTC

ENVISION ROUTE 7

Future Riders, Time Savings, and Costs

TRAVEL DEMAND FORECASTING PROCESS

Travel demand forecasting is a tool used by transportation planners to estimate future use of facilities (transit and highways). The process applies data available from regional and national resources to estimate demand:

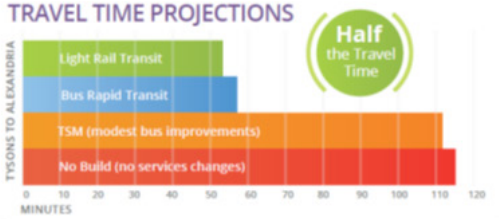
WHY – Trip Generation
Future land use estimates are maintained by Metropolitan Washington Council of Governments (MWCOG)—these estimates identify expected future houses and employment throughout the region. This data set represents an estimate of what the future will look like in the region.

WHERE – Trip Distribution
MWCOG develops an understanding of trip patterns in the region by conducting a household travel survey. This data is used as an input to define future trip patterns for all modes.

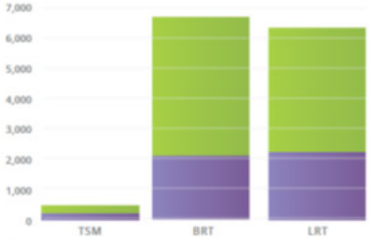
HOW – Mode Choice
MWCOG has surveyed people in the region, asking them how they make decisions about mode of travel. This information is used to estimate future mode choice (transit, drive, walk, bike)

WHICH WAY – Assignment
Once trip patterns are defined, the assignment step estimates the path each traveler will take to get to his or her destination, taking into account travel time along various options.

TRAVEL TIME PROJECTIONS



2040 NEW DAILY TRANSIT TRIPS WITHIN THE CORRIDOR



CAPITAL COSTS

Capital costs are one-time, fixed costs associated with building the service line. Major capital costs associated with a new transit system include:

- **Physical construction of the alignment:** additional roadways, steel rails (LRT), and lane reconfiguration
- **Stations and stops:** structures, shelters, seats, and amenities
- **Right-of-way purchase:** buying land for the route, stations or stops
- **Site work:** demolition, road work, and utility relocation
- **Systems:** communications, signals, electrification (LRT), and fare collection
- **Vehicles**
- **Maintenance facilities**
- **Professional services:** engineers, architects, lawyers, and permitting fees

ALIGNMENT CAPITAL COST ESTIMATES

The capital costs of the seven various alignment or mode options have been estimated based on comparable systems nationally. The estimates below have been tailored to account for mode type, alignment length, and location.

	Route Miles	Stations	Capital Costs (millions)	Cost Per Mile (millions)
BRT - Tysons to Van Dorn with EFC connection (Alt. 1)	15.2	24	$305.74	$20.10
BRT – Tysons to Mark Center with EFC connection (Alt .2)	12.5	21	$266.28	$21.24
BRT – Tysons to Van Dorn w/o EFC connection (Alt. 3)	13.1	22	$267.36	$20.41
BRT – Tysons to Mark Center w/o EFC connection (Alt. 4)	10.4	19	$227.90	$21.86
BRT – Tysons to King Street Metro with EFC connection (Alt. 5)	14.6	19	$295.27	$20.23
LRT At-Grade – Tysons to Van Dorn with EFC connection (Alt. 6)	12.6	21	$946.08	$75.25
LRT (Alt. 6) At-grade with elevated rails	12.6	21	$997.44	$79.34

EFC – East Falls Church Metro Station

Downton bus stop with off-board fare collection, shelter, and real-time information

BRT stop requiring significant roadway redesign in a downtown

Modern, high capacity vehicle

SIMILAR PROJECTS THROUGHOUT THE REGION

Various BRT and LRT projects have been proposed or constructed throughout the region. Below are several capital cost estimates, which include construction and real estate costs.

	Route Miles	Capital Costs (millions)	Cost Per Mile (millions)
LRT – Purple Line – Maryland	16.2	$2,448	$151
LRT – Virginia Beach Transit Extension – Virginia	3.1	$279	$90
BRT – Corridor Cities Transitway – Maryland	9.0	$545	$61
BRT – GRTC Pulse – Richmond, Virginia	7.6	$54	$7
BRT – Route 1 Metroway – Alexandria, Virginia	0.8	$23	$21

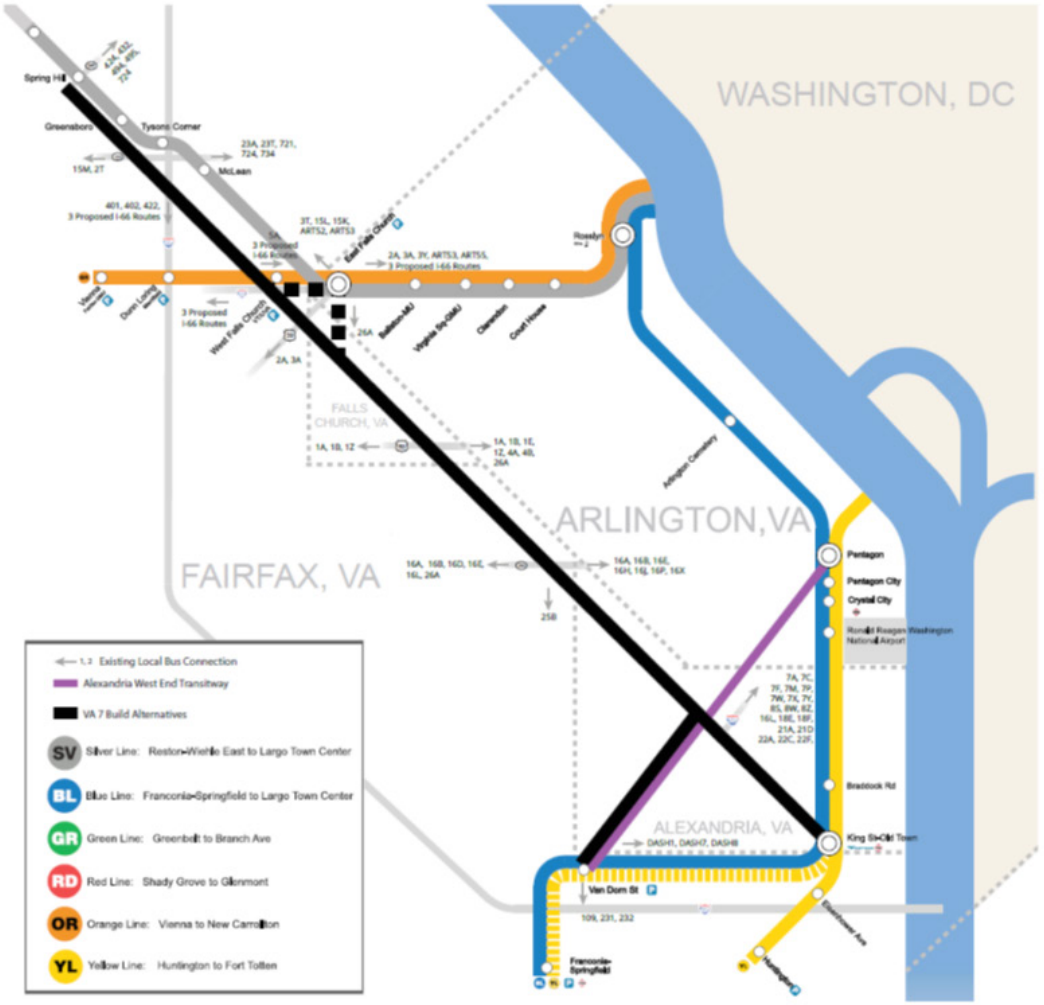
WMATA's Metroway

MTA's Proposed Purple Line

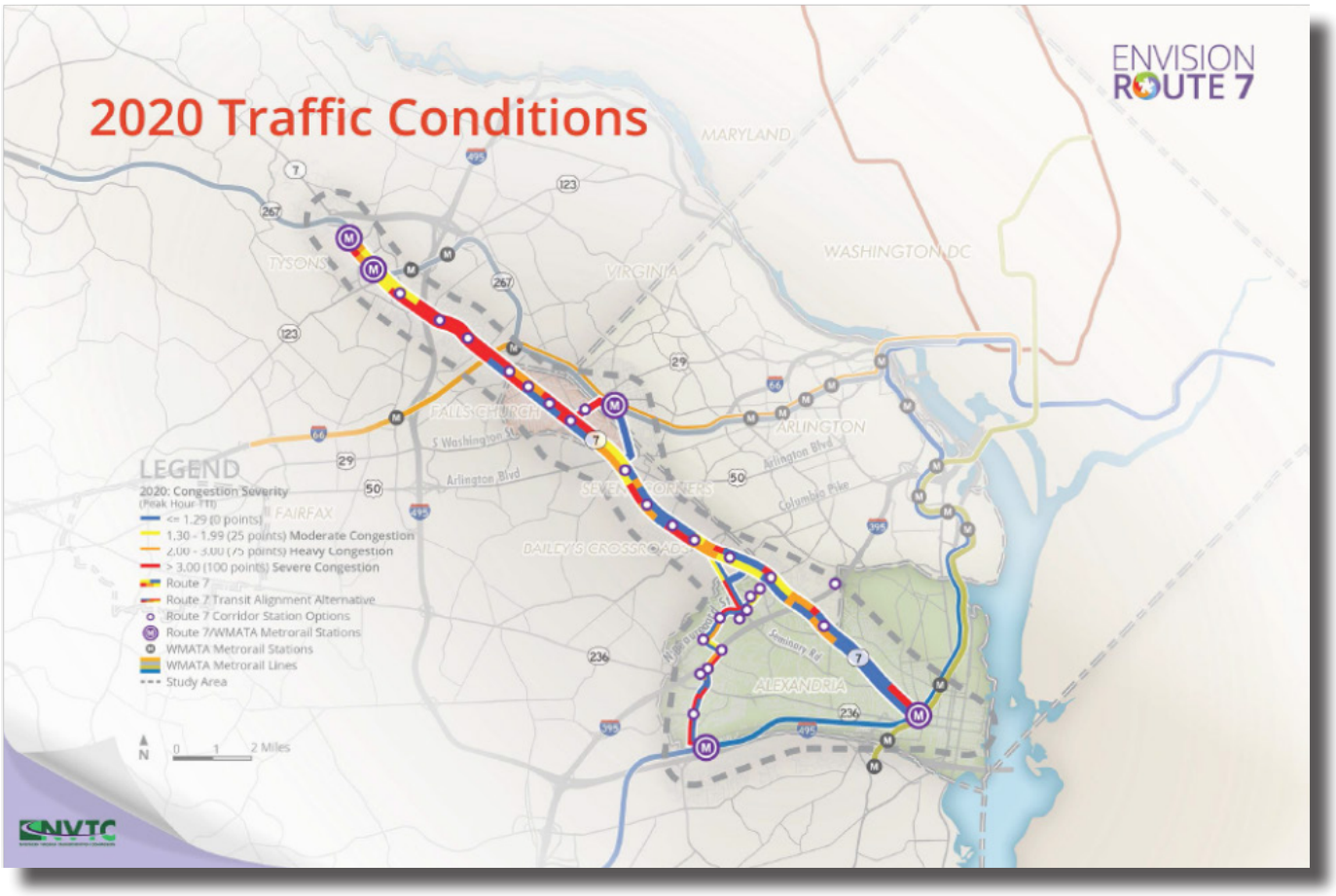
NVTC

ENVISION ROUTE 7

An Integrated Transit Services Network



NVTC


2020 Traffic Conditions
ENVISION ROUTE 7
MARYLAND
WASHINGTON, DC
VIRGINIA
TYSONS
FALLS CHURCH
ARLINGTON
SEVEN CORNERS
BAILEY'S CROSSROADS
ALEXANDRIA
FAIRFAX
LEGEND
2020: Congestion Severity
(Peak Hour TTI)
<= 1.29 (0 points)
1.30 - 1.99 (25 points) Moderate Congestion
2.00 - 3.00 (75 points) Heavy Congestion
> 3.00 (100 points) Severe Congestion
Route 7
Route 7 Transit Alignment Alternative
Route 7 Corridor Station Options
Route 7/WMATA Metrorail Stations
WMATA Metrorail Stations
WMATA Metrorail Lines
Study Area
N
0 1 2 Miles
NVTC

ENVISION ROUTE 7

Capital and Operating Costs

CAPITAL COSTS

Capital costs are one-time, fixed costs associated with building the service line. Major capital costs for a new transit system include:

- Physical construction of the alignment: additional roadways, steel rails (LRT), and lane reconfiguration
- Stations and stops: structures, shelters, seats, and amenities
- Right-of-way purchase: buying land for the route, stations or stops
- Site work: demolition, road work, and utility relocation
- Systems: communications, signals, electrification (LRT), and fare collection
- Vehicles
- Maintenance facilities
- Professional services: engineers, architects, lawyers, and permitting fees

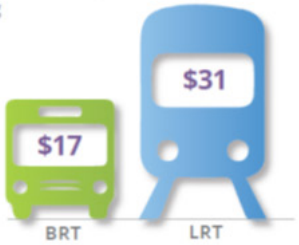
Downtown bus stop with off-board fare collection, shelter, and real-time information

BRT stop requiring significant roadway redesign in a downtown

Modern, high capacity vehicle

ANNUAL OPERATING COSTS (MILLIONS)

Projected annual operating costs are an important measure of the long-term viability of a high-capacity transit system. Comparable national systems were used to develop cost estimates for LRT and BRT.



ALIGNMENT CAPITAL COST ESTIMATES

The capital costs of the seven alignment/mode options have been estimated based on comparable systems nationally. The estimates below have been tailored to account for mode type, alignment length, and location.

	Route Miles	Stations	Capital Costs (millions)	Cost Per Mile (millions)
BRT - Tysons to Van Dorn Street Metrorail Station with EFC connection (Alt. 1)	15.2	24	$305.74	$20.10
BRT - Tysons to Mark Center with EFC connection (Alt. 2)	12.5	21	$266.28	$21.24
BRT - Tysons to Van Dorn Street Metrorail Station w/o EFC connection (Alt. 3)	13.1	22	$267.36	$20.41
BRT - Tysons to Mark Center w/o EFC connection (Alt. 4)	10.4	19	$227.90	$21.86
BRT - Tysons to King Street Metrorail Station with EFC connection (Alt. 5)	14.6	19	$295.27	$20.23
LRT At grade - Tysons to Mark Center with EFC connection (Alt. 6)	12.6	21	$946.08	$75.25
LRT - Same as Alt. 6 above, but with two elevated rail sections near EFC (Alt. 7)	12.6	21	$997.44	$79.34

EFC - East Falls Church Metrorail Station

SIMILAR PROJECTS THROUGHOUT THE REGION

Various BRT and LRT projects have been proposed or constructed throughout the region. Below are several capital cost estimates, which include construction and real estate acquisition.

	Route Miles	Capital Costs (millions)	Cost Per Mile (millions)
LRT - Purple Line - Maryland	16.2	$2,448	$151
LRT - Virginia Beach Transit Extension - Virginia	3.1	$279	$90
BRT - Corridor Cities Transitway - Maryland	9.0	$545	$61
BRT - GRTC Pulse - Richmond, Virginia	7.6	$54	$7
BRT - Route 1 Metroway - Alexandria, Virginia	0.8	$23	$21
BRT - West End Transitway	5.3	$140	$26

WMATA's Metroway

MTA's Proposed Purple Line

NVTC

ENVISION ROUTE 7

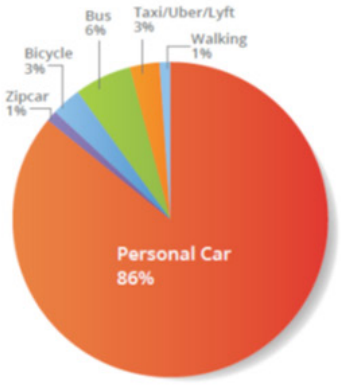
Public Input

OUTREACH TO COMMUNITY ORGANIZATIONS

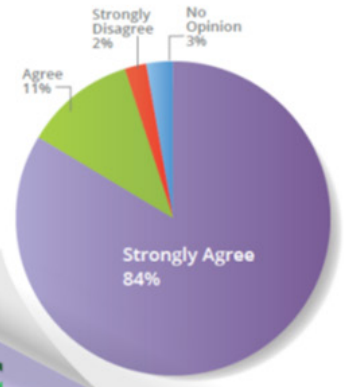
- Alexandria Transportation Commission
- Arlington Transportation Commission
- Bailey's Crossroads Rotary Club
- Bailey's Crossroads/Seven Corners Revitalization Corporation
- Coalition for Smarter Growth
- Fairfax County Transportation Advisory Committee
- Falls Church Chamber of Commerce
- Falls Church City Council & Citizens Advisory Committee on Transportation
- Falls Church League of Women Voters
- League of Women Voters of the National Capital Area Transportation Forum
- Mason District Land Use Council
- McLean Citizens Association
- Sierra Club

RESULTS OF WEBSITE POLLS

"What is the primary mode of transportation you use to traverse Route 7?"



"Is improved transit service needed along the Route 7 Corridor?"



NVTC

SOME COMMUNITY COMMENTS

Comments received on-line through our crowdsource map

A proper mass transit system connecting Alexandria and Tysons via route 7 is overdue....
– Columbia Pike

Local residents want better transportation corridors and better commercial options....
– Seven Corners Center

Very heavy intersection with existing heavily used bus routes already on site.
– Route 7 (Leesburg Pike) and Patrick Henry Drive

Alexandria end point is way more preferable to Eisenhower.
– King Street and Park Center Drive

I agree that this intersection is a nightmare for pedestrians, cars, and bicycles. It needs to be redone.
– Intersection of King Street, North Quaker Lane and West Braddock Road

McLean Bible Church hosts thousands of people on Sundays and hundreds every other day of the week... It would be good to improve its accessibility to transit.
– McLean Bible Church

Study should look at all of 7 from Leesburg to Alexandria, and look at a new line along this area.
– Loudoun Street and King Street

Simply eliminating left turns on Route 7 in Falls Church—except where a separate left-turn lane exists—could dramatically improve the flow of traffic.
– Falls Church

Please connect the patchwork of bike paths along Rt.7 to Colvin Run Mill, so that people living so near the Spring Hill station are able to get to the station, and use the Metro.
– Route 7 (Leesburg Pike)

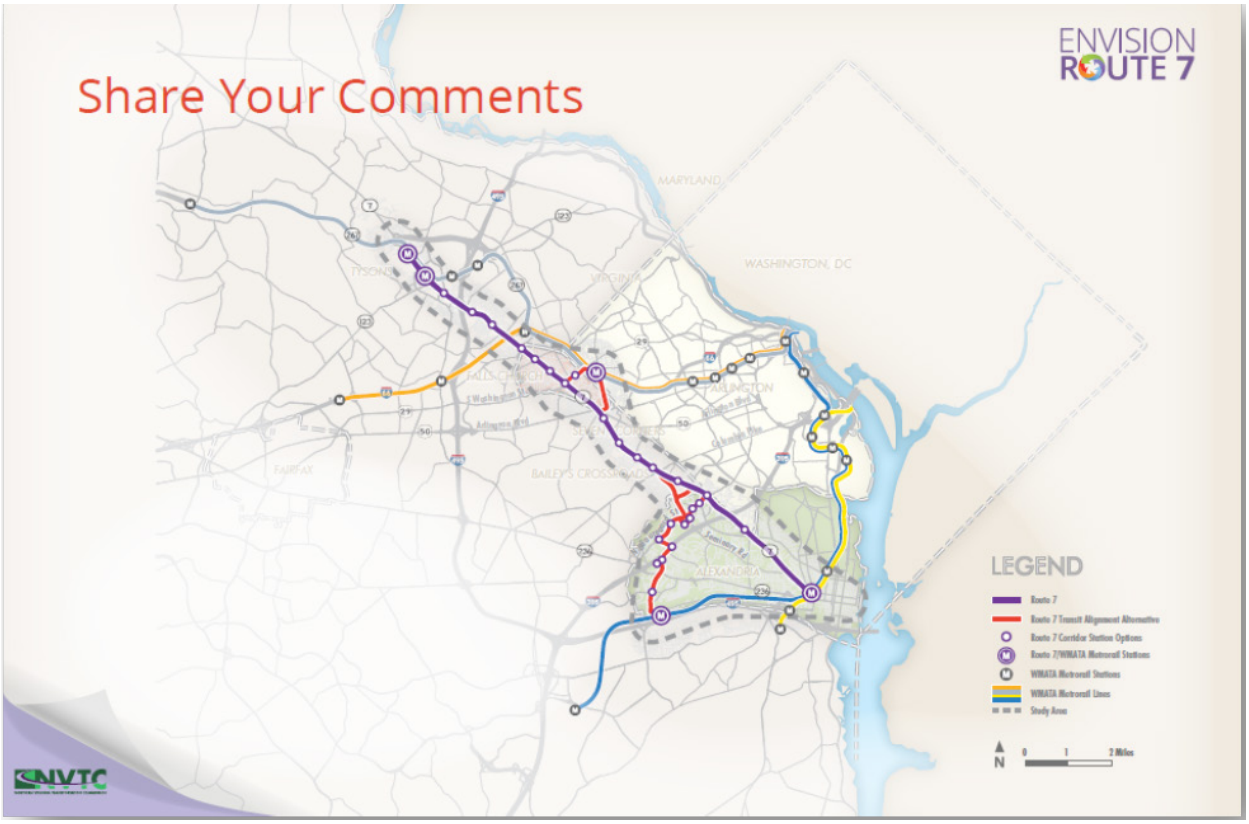
There are so many businesses to serve and a population that readily uses transit. It's time to capitalize on these two factors to enhance access and improve the transit, pedestrian, and bike amenities. High quality transit (streetcar, light rail, etc) should be thoroughly explored.
– Route 7 (Leesburg Pike) and South George Mason Drive

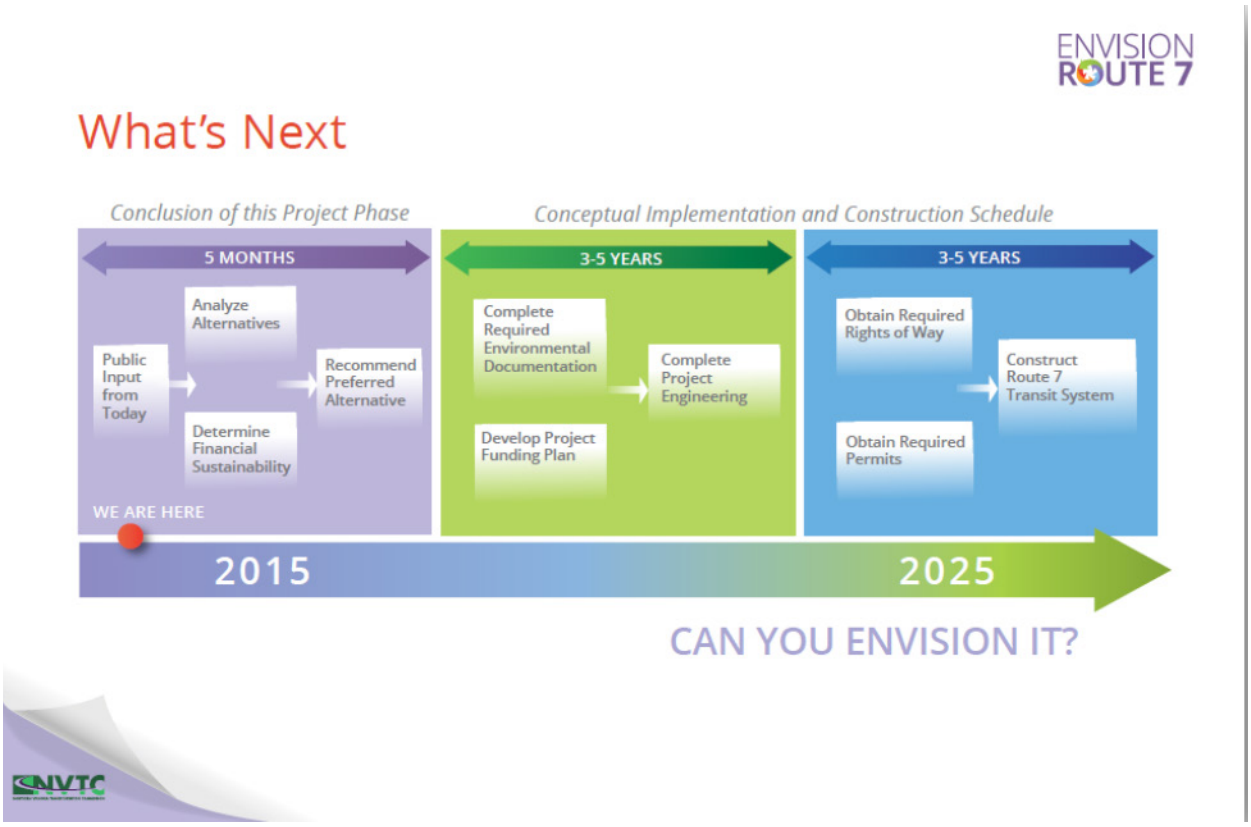
I think a great way to start would be to install BRT in mixed siding and dedicate transit lanes (transit and HOV) for them wherever possible until additional space can be obtained for pure bus only lanes.
– King Street

Thinking long term, would it make sense... to consider possible/eventual expansion of the system to Loudoun?
– Route 7

To make the transit work well, the street will need to be rebuilt to make it much more walkable with fewer travel lanes, widened sidewalks and enhanced crossings.
– Route 7 (Leesburg Pike) and Glen Forest Drive

We desperately need mass transit options in the Seven Corners area.
– Seven Corners Center

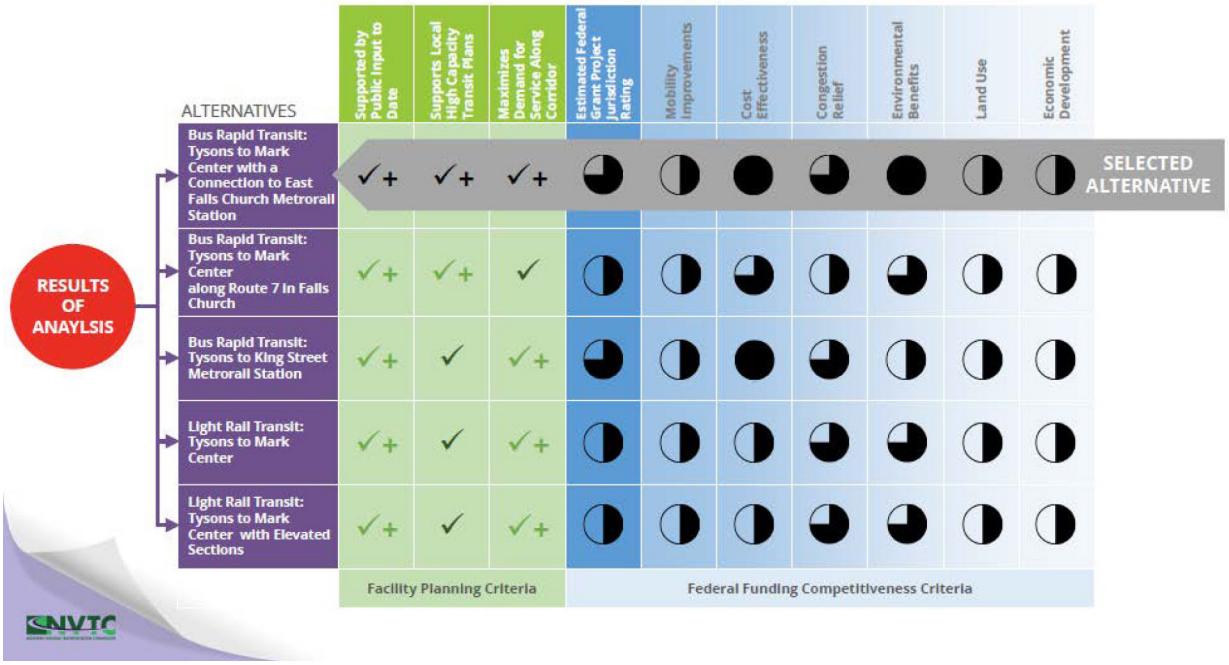

ENVISION ROUTE 7
Share Your Comments
MARYLAND
WASHINGTON, DC
ALEXANDRIA
LEGEND
NVTC

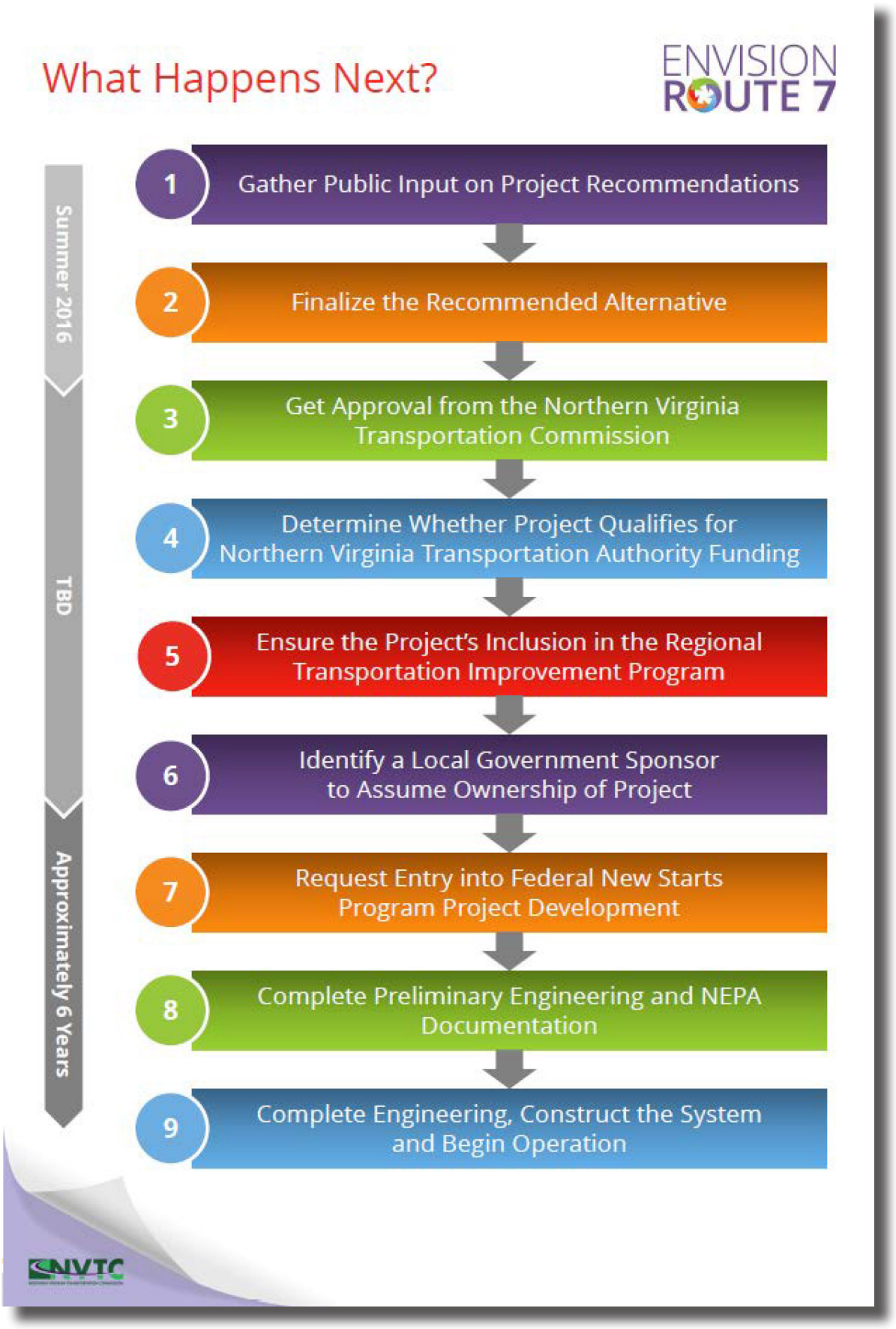

ENVISION ROUTE 7
What's Next
Conclusion of this Project Phase
Conceptual Implementation and Construction Schedule
5 MONTHS
Analyze Alternatives
Public Input from Today
Recommend Preferred Alternative
Determine Financial Sustainability
WE ARE HERE
3-5 YEARS
Complete Required Environmental Documentation
Complete Project Engineering
Develop Project Funding Plan
3-5 YEARS
Obtain Required Rights of Way
Construct Route 7 Transit System
Obtain Required Permits
2015
2025
CAN YOU ENVISION IT?
NVTC

Appendix G: June 2016 Meeting Exhibits

Comparison of Project Alternatives for Planning, Implementation, and Federal Funding Viability

ENVISION ROUTE 7




What Happens Next?
ENVISION ROUTE 7
Summer 2016
TBD
Approximately 6 Years
1 Gather Public Input on Project Recommendations
2 Finalize the Recommended Alternative
3 Get Approval from the Northern Virginia Transportation Commission
4 Determine Whether Project Qualifies for Northern Virginia Transportation Authority Funding
5 Ensure the Project's Inclusion in the Regional Transportation Improvement Program
6 Identify a Local Government Sponsor to Assume Ownership of Project
7 Request Entry into Federal New Starts Program Project Development
8 Complete Preliminary Engineering and NEPA Documentation
9 Complete Engineering, Construct the System and Begin Operation
NVTC

Appendix H: Flip Chart Comments

November 10, 2015 Meeting:

- Bike plan between Tysons and City of Falls Church
- The corridor should be more pedestrian friendly
- Strongly favor BRT – construction costs, operating and maintenance costs, flexibility
- BRT or not – lights along route 7 need to be synchronized and it can only help BRT
- Important to connect to Tysons at multiple points and integrate with bus and circulator service as well as silver line
- Are you exploring a business improvement district or tax allocation district to fund part of project?
- BRT must have dedicated lanes to be effective in fostering compact, walkable development
- Should the study look at a combo of service options BRT/LRT? Due to job growth + pop + 7 corner preference is LRT.
- Connect to E.Fall Church Metro
- Web forum needed
- Bus fuel should use clean energy, electric hybrid or natural gas
- Design/Brancling element to attract riders – fewer signs, no smoke, clean, fast.
- Bike lane between Tysons Corner and City of Falls Church to connect the two cities not only with car or bus
- Make the pedestrian crossing safer, especially the one at 495 entrance from Rt. 7
- LRT option is much more attractive from the economic development stand point
- Complete streets approach shall be used
- I personally would utilize LRT but not BRT

November 18, 2015 Meeting:

- For this area, BRT makes more sense e.g.
  - cost to tax payer – LRT 3 times more expensive for little travel time distance
  - use of BRT lanes when necessary for emergencies – police, snow routes
  - rails could become a safety and maintenance issue
- Around here, BRT would flow better with traffic vs. LRT w/o dedicated lane, and dedicated lanes w/o expanding roadway will cram traffic into fewer lanes. Look at DC street car debacle and Arlington Columbia Pike cancellation. Alex Metroway seems to work. End Alex as close to OT as possible; dumping at Eisenhower won't work unless you have a frequent 5 min shuttle to get there.
- Let's looks for an alternative between the Orange line (TSM) and the Blue (BRT) that would be effective and affordable.
- Job creation should be a measure
- Why no growth potential identified for Bailey's? Seems ripe for mixed use. Huh!!: 534 acres Bailey's 77 acres – Seven Corners
- Blue seems inappropriate – understated – for peak traffic between Bailey's and Seven Corners. Red much of the afternoon and definitely rush hour.
- How realistic is it to assume East Falls Church Metro and 7 Corners are linked?
- How does the Columbia Pike trolley impact the Bailey's projections?
- How does Seven Corners redevelopment fit into these proposals?
- Terminate at both King Street and MARC Center
- Yes! Please implement ASAP! This corridor really needs this.

- Transit with stops spaced ½ - 1 mile is not transit we need on Rt. 7. We need conventional affordable bus service with local and express services.
- Existing transit riders need better facilities!!
- University competition to be creative and design new stops
- Common sense connect to East Falls Church