WEST END TRANSITWAY

ALTERNATIVES ANALYSIS REPORT – FINAL

JULY 2016

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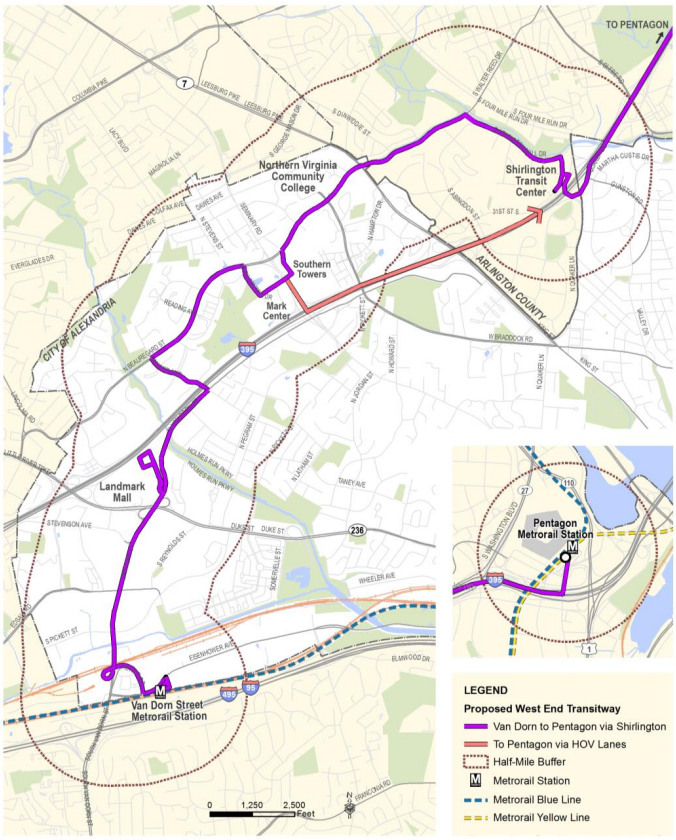
The City of Alexandria is proposing transit improvements along portions of Eisenhower Avenue, Van Dorn Street, Sanger Avenue, Mark Center Drive, and Beauregard Street in the City's West End. The corridor and the project study area are shown in **Figure 1.** The Transitway Corridors Feasibility Study, completed in the fall of 2012, analyzed multiple alignments, termini, transit modes (including bus and rail), cross sections (side-, center-, and median-running), operational (dedicated and shared lane), and service options for the West End Transitway (then referred to as Corridor C).

The Alexandria City Council, on November 17, 2012, approved the Planning Commission's recommendation to approve the alternative of Bus Rapid Transit (BRT) in dedicated lanes from the Van Dorn Street Metrorail Station to the Pentagon. This decision established a Locally Preferred Alternative (LPA) as part of the Federal Transit Administration (FTA) project development process. This enables the metropolitan planning organization to adopt the LPA as part of the long-range transportation plan. The West End Transitway Build Alternative represents a refined version of the Planning Commission's recommendation developed in coordination with the public and local stakeholders.

Figure 1: Project Study Area



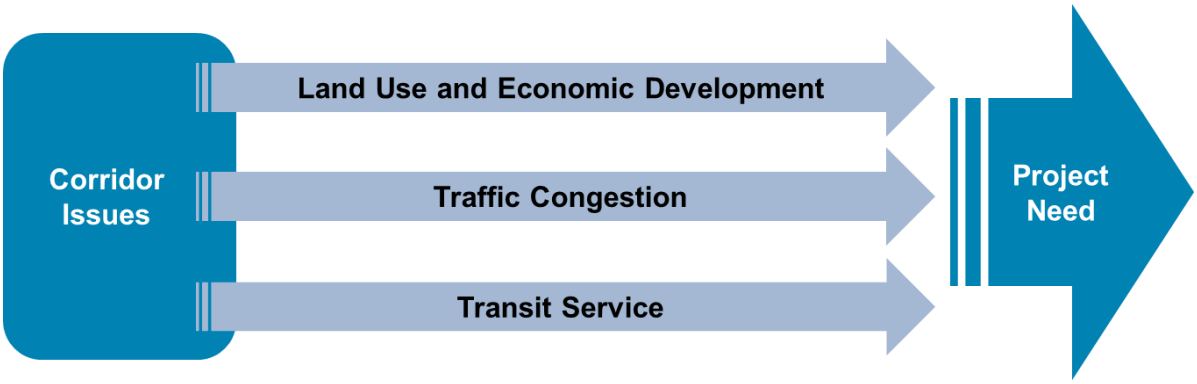
The current phase of the project includes an environmental analysis to meet National Environmental Policy Act (NEPA) requirements. In addition to the environmental documentation, the City of Alexandria chose to pursue the preparation of an Alternatives Analysis (AA) document for the West End Transitway, recognizing the value of the structure and requirements of the formerly required AA process for federal and local decision-making. The AA process effectively concluded on March 29, 2016 when City Council unanimously approved (**Appendix E**) a re-concurrence of the LPA identified by City Council in 2012. This AA document provides an overview of the AA process including the project background, project purpose and need, alternatives development and evaluations, and financial considerations.

Purpose and Need

The West End Transitway responds to issues within the corridor and advances work that upholds and promotes City policies, goals, and plans. The purpose and need of the project is summarized below in **Figure 2** and provided in detail in **Appendix A.** The main objectives of the West End Transitway project are to:

- Support and help catalyze the City's land use and economic development policies and plans
- Manage increase in traffic congestion by providing a high quality, competitive, and reliable transit service
- Improve the quality and effectiveness of transit service

Figure 2: Purpose and Need



Alternatives and Evaluation

The AA process looks at three alternatives:

- The No Build Alternative
- The Transportation System Management (TSM) Alternative
- The Build Alternative

The Build Alternative, as defined in this AA report, was originally based on the Corridor C recommendation from the Transitway Corridors Feasibility Study (2012). While the Transitway

Corridors Feasibility Study was specific in many regards for Corridor C, it left several features for consideration in the current AA. This phase of the project addressed many of the outstanding coordination issues and evaluated the Build Alternative as well as the No Build Alternative and a TSM Alternative. The alternatives evaluated in the West End Transitway AA are listed below. Each alternative is defined in greater detail in **Chapter 2**:

In order to assess each alternative based on its performance, a set of evaluation criteria was developed. While the criteria were developed based on satisfying the project's purpose and need, each evaluation criterion also relates to one of the Federal Transit Administration's (FTA) Project Justification Criteria. FTA uses a defined set of criteria to measure project benefits as part of its New and Small Starts funding application process that could be a potential source of funding for the project. The criteria were broken down into three main categories: transit, other transportation, and land use and economic development. Multiple sub criteria within these categories were evaluated and the scores were averaged for each category. The category scores were summed to a composite score for each alternative. The summary of the analysis is shown below:

Figure 3: Alternatives Analysis Summary

As shown in **Figure 3**, the Build Alternative scores the highest among the studied alternatives. It performs best in each of the categories as compared to the two other alternatives and generally reflects the following:

- A better transit experience for people and a more efficient operation for the service
- Additional multimodal (pedestrian, bicycle, and safety) improvements along the transit corridor
- Greater consistency with adopted plans and higher potential to catalyze growth and create real estate value

Considering multimodal access and accommodation, the Build Alternative provides numerous benefits to transit and other vehicular and non-vehicular users of the corridor. New sidewalks, upgraded streetscapes, enhanced bicycle and pedestrian facilities, and upgraded traffic signals and roadways all are a part of the Build Alternative, but not other alternatives.

The Build Alternative also offers the city considerable environmental benefits. The increase in opportunity for long-term tree canopy coverage is increased through streetscape enhancements in the Build Alternative. Additionally, the Build Alternative's contribution to stormwater quality and quantity management is significant and includes long sections of Van Dorn Street and Beauregard Street. The TSM Alternative would be required to make stormwater improvements only where stations are developed.

Financial Considerations

Both capital and annual operational costs will be included as part of the project and were taken into account as part of the evaluation of the alternatives. Costs shown below for the TSM and Build Alternative represent preliminary costs consistent with the level of planning and engineering to date and include contingency.

- Capital Cost (2015 dollars):
    - TSM Alternative: $51 to $57.5 million
    - Build Alternative: $122.5 to $140 million
- Annual Operating Cost (2015 dollars):
    - TSM Alternative: $6.0 to $9.9 million
    - Build Alternative: $6.7 to $10.2 million.

The West End Transitway Build Alternative has the potential for many funding sources, with the anticipation that the project will not require local funding from the City. In consideration of funding, the assumed sources for the Build Alternative's capital (non-operating & maintenance) funding are regional (NVTA), state, and private funding. Both NVTA 70% funds and any federal transportation funding is highly competitive As currently planned, the NVTA and private funds could be used as sources of local match for federal funding.

Although there is a lower overall cost for the TSM Alternative, the TSM Alternative would not qualify for FTA Capital Investment Grant funds, which could account for a significant portion of the Build Alternative's project costs. Similarly, the TSM Alternative may not be competitive enough to receive regional and state funds made available through the NVTA and Commonwealth processes.

The City of Alexandria will continue to coordinate with NVTA, the FTA, and the private developers to monitor the potential for these primary funding sources. Comparisons with previous and currently planned projects in the NVTA and FTA processes indicate that the West End Transitway will be extremely competitive in achieving this funding. The City of Alexandria will also continue to pursue additional federal and state funding options as the project progresses.

City Approval and Next Steps

The background, analysis, and summaries provided in this report are important framework for the steps ahead for the West End Transitway project.

In February 2016, the City of Alexandria's Transportation Commission endorsed the Build Alternative by an 8-1 vote. Following the Transportation Commission, the project was presented at the City Council Legislative Meeting on March 29, 2016. The City Council, in a unanimous 7-0 vote, passed a resolution of re-concurrence (**Appendix E)** for the West End Transitway LPA originally approved by City Council on November 17, 2012. This decision confirms the Build Alternative as the Locally Preferred Alternative (LPA) for the West End Transitway and as the transit project that the City will carry forward in the next steps of project development.

The City Council, in unanimous 7-0 vote, a passed a resolution of re-concurrence which confirms the Build Alternative as the Locally Preferred Alternative (LPA) for the West End Transitway.

The City of Alexandria's West End Transitway was granted entry into the Project Development (PD) phase under the FTA's Small Starts program in June 2016. Entry into PD formally establishes the City's intent to further develop a transit project in the City and pursue partial federal funds for its implementation.

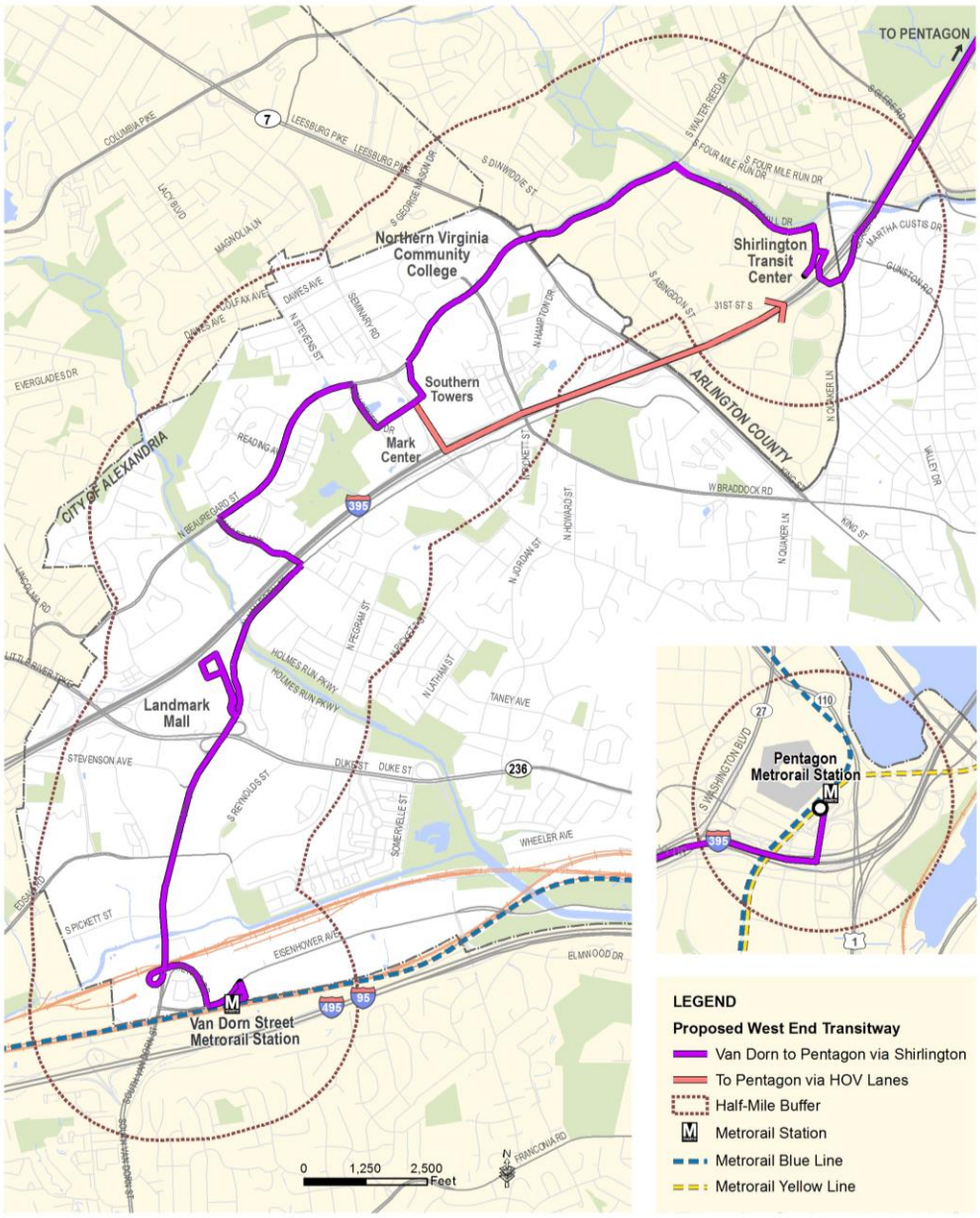
Next steps in the process of bringing a high-capacity transit investment to the City of Alexandria's West End include:

- Completion of National Environmental Policy Act (NEPA) documentation
- Completion of engineering and project delivery actions
- Continued public engagement and coordination with individual stakeholders

1. INTRODUCTION AND PROJECT PURPOSE

The City of Alexandria is proposing transit improvements in the City's West End. The potential improvements are generally between the Van Dorn Street Metrorail Station and the Pentagon. Within the City, transit runs along portions of Eisenhower Avenue, Van Dorn Street, Sanger Avenue, Mark Center Drive, and Beauregard Street. The corridor and the project study area are shown in **Figure 4.**

Figure 4: Project Study Area



The study corridor currently has high transit ridership and continued population and employment growth. Previous studies have focused on the need to improve the speed and capacity of transit service to accommodate greater demand. In recent years, transit connectivity has increased at major residential and employment centers along the corridor such as Southern Towers, Mark Center, and the Pentagon. The West End Transitway, which links the Van Dorn Street Metrorail Station to the Pentagon Transit Center, will provide enhanced travel options between these points as well as additional regional connections.

The West End Transitway responds to issues within the corridor and advances work that upholds and promotes City policies, goals, and plans. The main objectives of the West End Transitway project are to:

- Support and help catalyze the City's land use and economic development policies and plans
- Manage increase in traffic congestion by providing a high quality, competitive, and reliable transit service
- Improve the quality and effectiveness of transit service

The West End Transitway helps the City to meet corridor needs and achieve localized and Citywide goals. **Table 1** summarizes land use and transportation issues in the corridor. A more detailed discussion of the project Purpose and Need can be found in **Appendix A**.

Table 1: Corridor Issues and Needs

	Corridor Issues	Corridor Needs
Land Use and Economic Development	• Future land use changes as proposed in the Landmark/Van Dorn Corridor Plan and the Beauregard Small Area Plan anticipate more than twice the density of existing development patterns • Population within a quarter-mile of the corridor will increase 31 percent • Employment within a quarter-mile of the corridor will increase 33 percent	• Support and promotion of future land use changes envisioned by the Landmark/Van Dorn Corridor Plan and the Beauregard Small Area Plan • Accommodate the mobility needs of new residents and employees in the corridor to create a supportive environment for continued economic development and maintain the area's competitiveness in the region
Traffic Congestion	• Future higher density land uses will result in increased travel demand • Additional planned improvements alone will not solve anticipated future congestion • Traffic congestion leads to delays and unpredictable travel times for motorists • Traffic congestion leads to delays for transit services, increase in transit travel time, reduced service reliability and efficiency, and decreased attractiveness for transit services	• Increase modal choice by providing a fast, reliable, and efficient transit system as an attractive alternative to driving • Provide peak hour congestion relief by reducing private vehicular traffic on the corridor • Reduce effects of congestion including delays and reduced reliability for transit services
Transit Service	• Significant unmet transit demand for trips that begin and end in the study area • Lack of unified transit route along the Van Dorn/Beauregard corridor that results in poor connectivity between home, school, work, and services within the corridor • Presence of a sizeable feeder market to the Pentagon Transit Center	• Provide improved transit capacity and frequency to support existing and future travel demand • Support the needs of the area's transit-reliant population • Enhance regional access by providing better connectivity between activity centers within the corridor • Enhance pedestrian and bicycle access between adjacent neighborhoods and the transit corridor

1.1. Alternatives Analysis Overview

An Alternatives Analysis (AA) is a structured study process to evaluate and compare different transit improvement alternatives. The outcomes of the AA help decision makers make informed decisions and choose among viable approaches that best meet the project's Purpose and Need.

Historically, the AA process was a required part of the Federal Transit Administration (FTA) project development process where federal funds would be used for a transit project. As part of changes associated with the Moving Ahead for Progress in the 21st Century Act (MAP-21), the preparation of an AA document is no longer required; however, federal rules state that a feasibility study of sufficient detail and technical rigor should be prepared to support the local decision-making process toward a preferred alternative.

The Transitway Corridors Feasibility Study, completed in the fall of 2012, analyzed multiple alignment, termini, transit mode (including bus and rail), cross sections (side-, center-, median-running), operational (dedicated and shared lane), and service options for the West End Transitway (then referred to as Corridor C). The City Council, on November 17, 2012, approved the Planning Commission's recommendation to approve the alternative of bus rapid transit (BRT) from Van Dorn Street Metrorail Station to the Pentagon in mostly dedicated lanes. This decision established a Locally Preferred Alternative (LPA) as part of the Federal Transit Administration (FTA) process. The establishment of an LPA enables the metropolitan planning organization to adopt the LPA as part of the long-range transportation plan. The Build Alternative for the West End Transitway is a direct refinement of this recommendation.

Recognizing the value of the structure and requirements of the formerly required AA process for federal and local decision-making, the City of Alexandria chose to pursue the preparation of an AA document for the West End Transitway. The AA process effectively concluded on March 29, 2016 when City Council unanimously approved (**Appendix E**) a re-concurrence of the LPA selection identified made by City Council in 2012. The alternatives evaluated in the West End Transitway AA are listed below in **Table 2**.

Table 2: Overview of Alternatives

Alternative	Description
No Build	• The No Build Alternative is used as a basis of comparison for the TSM and Build Alternatives • Assumes that there are no new fixed guideway transit investment in the corridor and that transit services would operate in shared lanes, similar to current conditions • Includes planned and programed traffic operational and transit service changes
Transportation Systems Management (TSM)	• Includes frequent, continuous transit service along Van Dorn and Beauregard Streets • Does not include major capital investment in new infrastructure for dedicated transit lanes • Significant investment in new, limited stop bus service along the entirety of the corridor, operating in shared lanes • Includes traffic operational enhancements beyond those included in the No Build Alternative to improve transit performance.
Build Alternative	• Includes frequent, continuous transit service along Van Dorn and Beauregard Streets • Transit would use new dedicated lanes for much of the corridor within the City of Alexandria • Same route and stop locations as TSM but includes additional transit infrastructure and operational elements • Significant steps toward the Mature Corridor envisioned by previous local planning efforts • Significant pedestrian, bicycle, and safety improvements throughout the corridor

1.2. Report Organization

This AA report summarizes the most relevant information related to the studied alternatives and evaluation. Additional details of the alternatives and evaluation process are documented in attached technical appendices. The remainder of this document is organized as follows:

- **Section 2: Alternatives Development** describes the process to develop and define the study alternatives. It also provides descriptions of each alternative.
- **Section 3: Alternatives Evaluation** describes the technical evaluation conducted for each alternative and a summary of the results of the evaluation.
- **Section 4: Environmental Considerations** describes the impact and benefits of the three alternatives on the physical and natural environment.
- **Section 5: Financial Considerations** describes the preliminary capital and operating cost estimates from for the three alternatives and discusses potential funding options.
- **Section 6: Alternatives Analysis Summary** is a brief summary of the findings of the AA study at the current phase of the project.
- **Section 7: Next Steps** briefly outlines technical and process steps that follow the current phase of the project.

2. ALTERNATIVES DEVELOPMENT

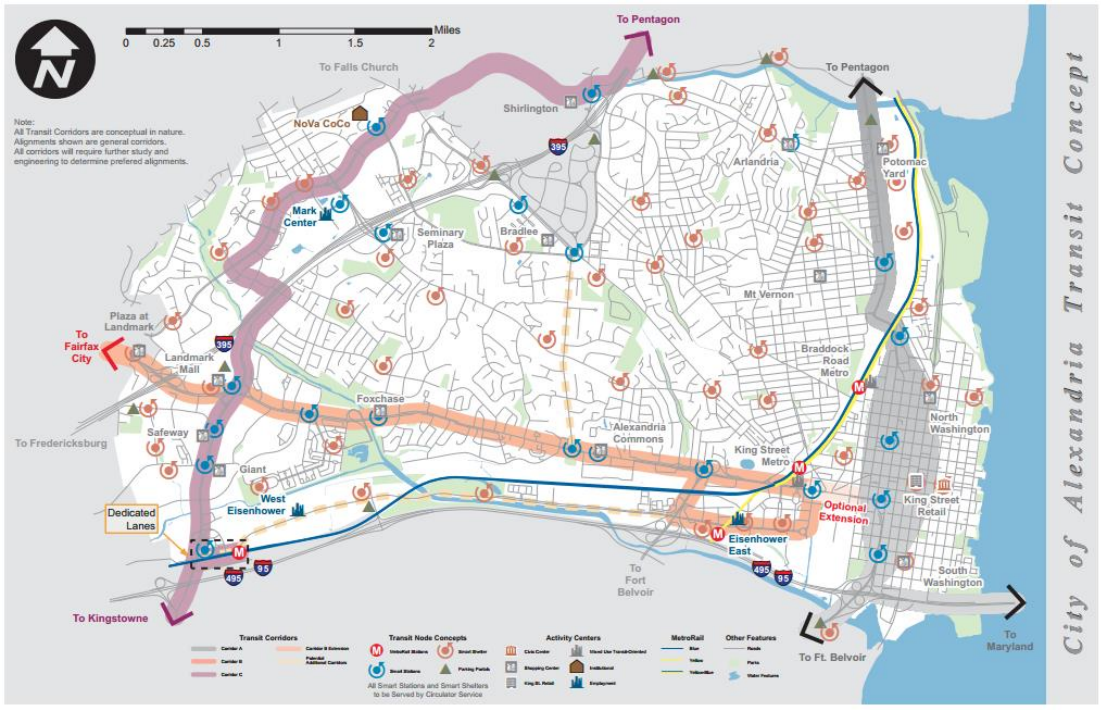
The work currently underway for the West End Transitway builds on incremental high-capacity transit decisions made by the City of Alexandria spanning more than 7 years. The high-level goal of the West End Transitway project is to advance City policy established in the Transportation Master Plan (2008) and reinforced through the added specificity of transit recommendations within the Landmark/Van Dorn Corridor Plan (2009), Transitway Corridors Feasibility Study (2012), and Beauregard Small Area Plan (2012).

2.1. Background

A brief summary of substantive general high-capacity transit studies and recommendations specific to West End Transitway (previously referred to as Corridor C and Van Dorn-Beauregard Corridor) as well as policy direction is below. Each of the studies listed below involved extensive public and stakeholder engagement as well as coordination with key City staff, appointed task forces, and elected officials.

- **Transportation Master Plan (2008)**
  - Identified multimodal transportation principles and future transit corridors, Corridors A, B, and C, (**Figure 5**) with the potential to meet important mobility needs in the City
  - West End Transitway is consistent with the principles outlined in the Transportation Master Plan and the high-capacity transit Corridor C

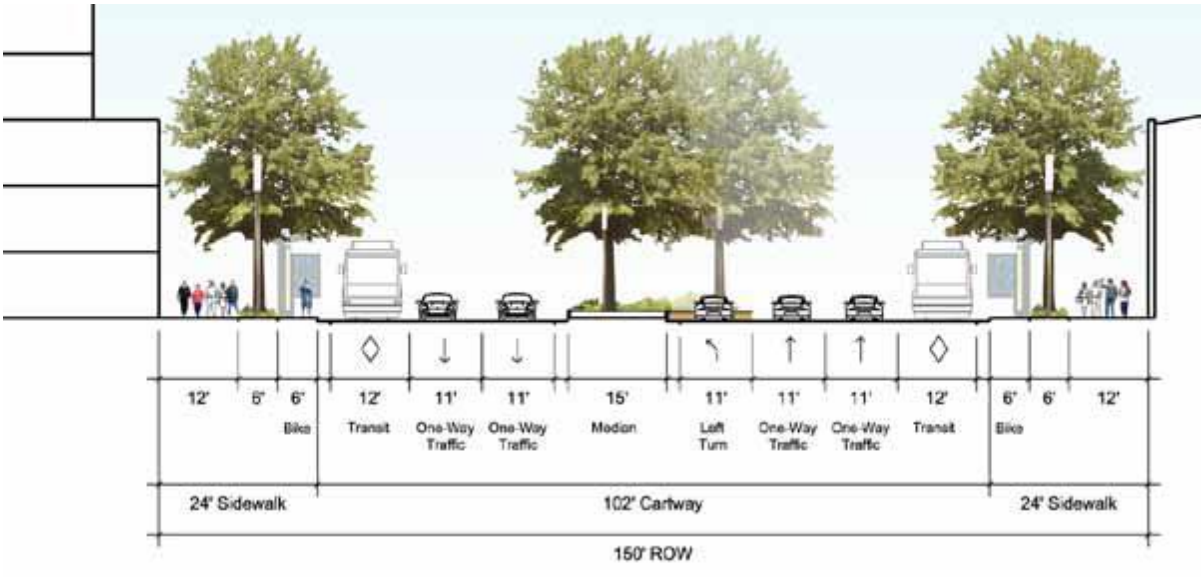
Figure 5: Transportation Master Plan Corridors



Source: City of Alexandria Transportation Master Plan; 2008

- **Landmark/Van Dorn Corridor Plan (2009)**
  - Aimed to create a long-term land use, economic development, and transportation vision for the Landmark/Van Dorn Corridor
  - Identified a preferred cross section for South Van Dorn Street including bidirectional dedicated transit lanes between Landmark Mall and the Van Dorn Street Metrorail Station **(Figure 6)**
  - Showed a short- and long-term route for a new service using portions of South Van Dorn Street and several future streets proposed to be constructed as redevelopment occurs

Figure 6: Landmark/Van Dorn Transit Boulevard Cross Section

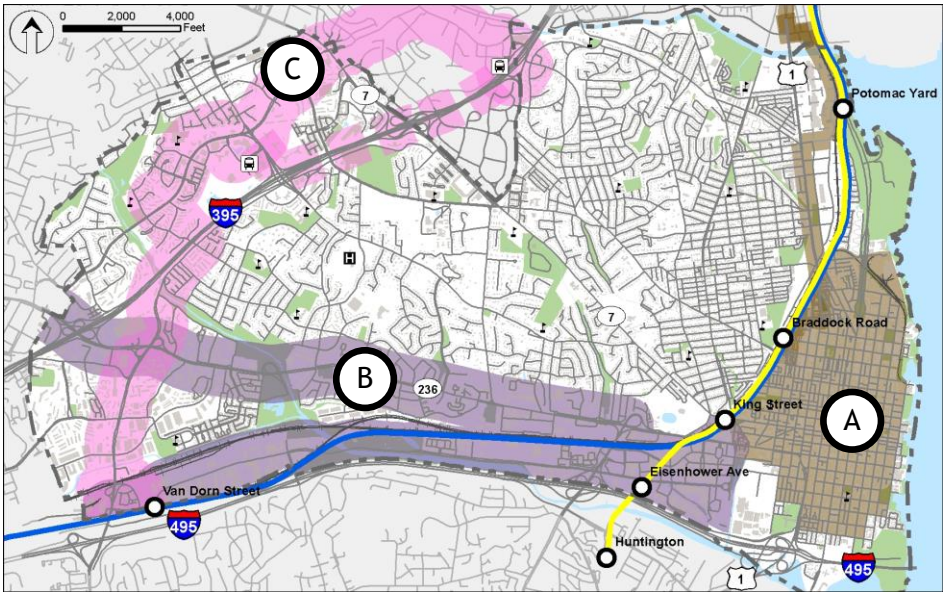


Source: City of Alexandria Landmark/Van Dorn Corridor Plan; 2009

- **Transitway Corridors Feasibility Study (2012)**
  - Built on the principles and concepts identified in the Transportation Master Plan, the Transitway Corridors Feasibility Study evaluated Corridors A, B, and C
  - Analyzed multiple alignment, termini, transit mode (including bus and rail), cross sections (side-, center-, median-running), operational (dedicated and shared lane), and service options for Corridor C
  - Resolutions by the High-Capacity Transit Corridor Work Group, Transportation Commission, Planning Commission, and City Council were passed in support of a recommended alternative of BRT from the Van Dorn Street Metrorail Station, which has been refined to become the Build Alternative for the West End Transitway. The language approved by the City Council on November 17, 2012 is as follows:

    Corridor C – Van Dorn / Beauregard Recommendation***:*** *BRT in Dedicated lanes between the Van Dorn Street Metrorail Station and the Pentagon via Shirlington (Alternative D in the Transitway Corridors Feasibility Study) is the preferred alternative for phased implementation of transit in dedicated lanes in Corridor C until such time that Streetcar (Alternative G in the Transitway Corridors Feasibility Study) may become feasible and can be implemented. The Alternative D alignment should be optimized to better serve the Northern Virginia Community College (NVCC). This course of action is consistent with the Council's recent decision to provide dedicated lane transit along the segment of Corridor A that is north of Braddock Road. Evaluation and analysis will continue of Alternative D in preparation for future implementation of Alternative G. Construction of transit in Corridor C shall be the first priority of Alexandria's transportation projects. Each subsequent corridor shall be evaluated separately regarding the need to acquire additional right-of-way.*

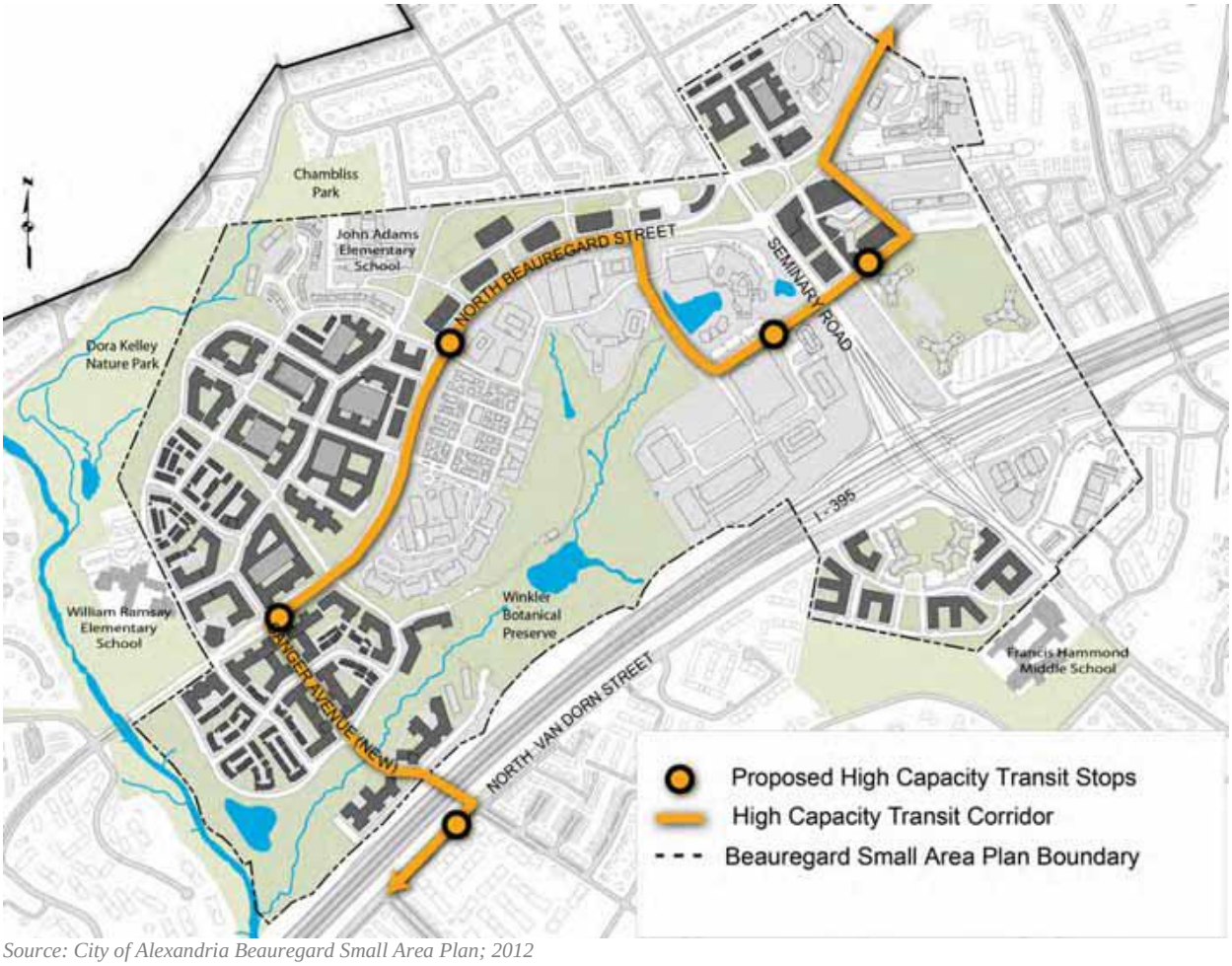
Figure 7: Transitway Feasibility Study Corridors



Source: City of Alexandria Transitway Corridors Feasibility Study; 2012

- **Beauregard Small Area Plan (2012)**
  This small area plan prepared by the City of Alexandria identified a recommended cross section for Beauregard Street and Sanger Avenue to accommodate bidirectional dedicated transit lanes between I-395 and Mark Center Drive. The recommended Beauregard Street cross section and proposed alignment (**Figure 8**) is consistent with the Build Alternative for the West End Transitway.

Figure 8: Beauregard Small Area Plan Transitway Recommendations



Source: City of Alexandria Beauregard Small Area Plan; 2012

2.2. Study Alternatives

The following is a brief summary of the three alternatives that were evaluated within the AA.

No Build Alternative

The No Build Alternative is used as a basis of comparison for the TSM and Build Alternatives. It assumes that no new fixed guideway transit investment would be made in the corridor and that transit services would operate in shared lanes, similar to current conditions.

The No Build Alternative is not a "do nothing" alternative. It includes programmed capital and operational improvements that would enhance transit service within the study corridor. These include transit operational improvements funded by the TIGER grant program such as signal priority and queue jump lanes at selected locations throughout the corridor. The No Build Alternative includes programmed transit service changes to DASH and Metrobus in the study corridor; however, none of these improvements include a continuous transit service between the Van Dorn Street Metrorail Station and the Pentagon, along Van Dorn and Beauregard Streets.

TSM Alternative

The TSM Alternative includes programmed capital, operational, and service modifications within the study corridor. Differing from the No Build Alternative, the TSM Alternative includes additional minor capital and operational improvements along with a new frequent, continuous transit service between the Van Dorn Street Metrorail Station and the Pentagon, along Van Dorn and Beauregard Streets.

Coordinating with this new service, the TSM Alternative transit service would operate in a limited stop configuration to reduce travel time and enhance service efficiency. Like the No Build Alternative, all transit service in the study corridor would operate in general purpose travel (shared) lanes in the TSM Alternative.

Build Alternative

Evolution of Build Alternative

The Build Alternative as defined in this AA was originally based on the Corridor C recommendation from the Transitway Corridors Feasibility Study (2012). While the Transitway Corridors Feasibility Study was specific in many regards for Corridor C, it left several features for consideration in the current AA. Each of the outstanding features, as well as other refinements to the Corridor C recommendation, are resolved and reflected in the currently defined Build Alternative. **Table 3** summarizes these caveats or key considerations and how the current project has addressed these.

Table 3: Summary of Key Project Refinements

Caveats Or Key Item	Action Taken	Transitway Recommendation
Optimize alignment to better serve the Northern Virginia Community College (NVCC)	Evaluated multiple station location and alignment alternatives	To enhance access to NVCC, project includes: • Pedestrian safety/accommodation enhancements at Braddock Road • Stations at Fillmore and Braddock • Build Alternative does not preclude other potential future services from directly serving main campus
Monitor transition from Alternative D (BRT) to Alternative G (Streetcar)	No action required at this time by the current project	• Transportation Commission to discuss when appropriate
Provide adequate bicycle accommodation on South Van Dorn Street	Multiple alternatives evaluated	• Selected cross sectional alternative with multiuse path along one side where corridor is modified • Updated layout to best address comments received (path width, intersection- or driveway-related features) • The Build Alternative adds more than 1.9 miles of bike facilities
Minimize parking/property impacts on Van Dorn Street near Sanger Avenue	Multiple alternatives evaluated	• Selected alternative that reduces parking/property impacts from 33 spaces lost to 3 spaces lost. Land owner (JBG) supports this alternative, as does the community
Minimize right-of-way/property impacts along South Van Dorn Street	Multiple alternatives evaluated	• Establish future policy right-of-way line • Phased cross section implementation establishing location of permanent Transitway and providing minimum adequate bike/pedestrian accommodations through corridor constrictions • Require redevelopment/development to build, provide funds for, and construct full cross section consistent with adopted plans/policies
Minimize residential use parking impacts (overall)	Adjusted alignment and cross section	• Reduced impacts along Van Dorn Street in the vicinity of Stevenson and along Beauregard Street
Establish Landmark Mall-related alignment	Multiple alternatives evaluated	• Alignment will enter mall property and connect to the transit center • Locate station at or adjacent to existing transit center or new transit center included in Landmark Mall redevelopment, whichever is available at implementation
Confirm that Van Dorn Street Metrorail Station has adequate bus capacity	Worked with WMATA on station capacity for buses	• Stop buses within Metrorail station bus facility • Confirmed that station can support Transitway buses
Stormwater compliance	Assessed project's ability to meet current requirements	• Manage stormwater within right-of-way • Identification of specific treatments in specific locations occurs in design phase • May also afford the City stormwater management credits (additional analysis needed in future phases)

Match Beauregard Plan SAP adopted interim right-of-way	Adjusted corridor layout/alignment	• Match Small Area Plan (SAP) interim right-of-way
Optimize southern terminus alignment (Metro Road)	Adjusted corridor alignment	• Two-directional bus routing along Metro Road • Reduced traffic impacts at Van Dorn Road/Eisenhower Avenue • Reduced impacts along Eisenhower Avenue in coordination with property owners
Minimize parking/property impacts at Southern Towers	Developed refined service and station layout configuration	• Refine bus operations and access to transit as well as traffic operations and parking impacts during next phase of design, including a southbound "express" stop at Southern Towers • No expected negative impact to West End Transitway Project or Southern Towers

Physical Configuration

The Build Alternative includes significant capital and operational modifications within the study corridor. It includes the same continuous and frequent transit service between the Van Dorn Street Metrorail Station and the Pentagon, along Van Dorn and Beauregard Streets as the TSM Alternative. However, the capital investment in the Build Alternative consists of intersection and roadway modifications to provide sections of dedicated transit lanes, bicycle facilities, streetscape enhancements, transit stations, and improved sidewalks. Operational investments consist principally of the provision of transit signal priority at nearly all signalized intersections in the corridor and signal preemption at key transition points. **Figure 9** shows the alignment, stations, and proposed locations for dedicated transit lanes in the Build Alternative.

Operations

Figure 10 shows proposed service characteristics (routes and headways) for the Build Alternative during the weekday peak and midday service and **Figure 11** shows the same for weekday evenings and weekends. Additional information on the operational plan is provided in **Appendix B**.

Storage and maintenance of the additional vehicles required for the Build Alternative or the TSM Alternative is assumed at the WMATA Cinder Bed Road facility. The facility, currently under construction to accommodate 160 buses and scheduled to open in 2016, underwent a separate environmental review process and is funded in part by the City of Alexandria. Vehicles associated with the existing Metroway service will be stored and maintained at this facility.

Figure 9: Build Alternative Configuration

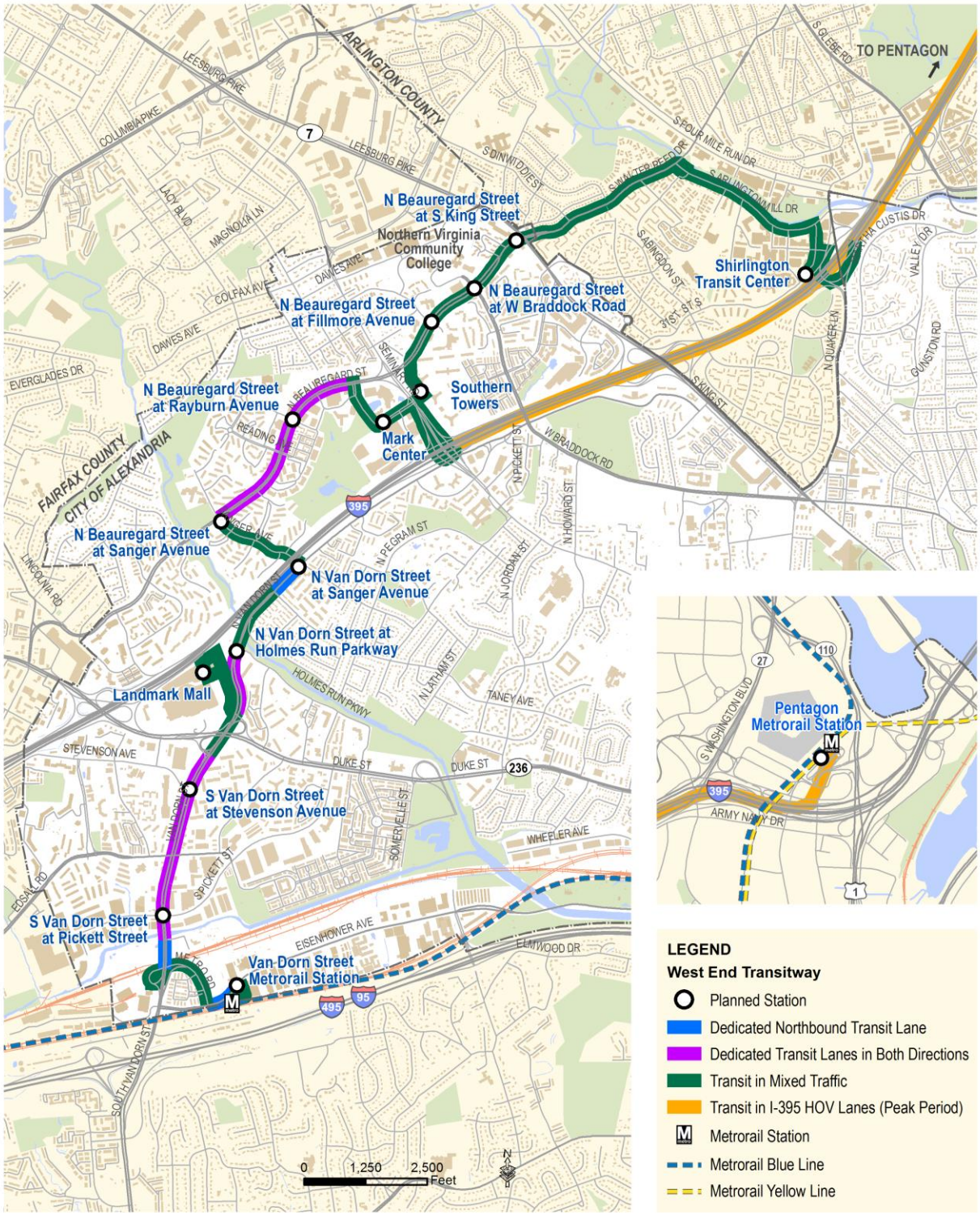


Figure 10: Weekday Peak and Midday Route Patterns and Frequency (TSM and Build Alternatives)

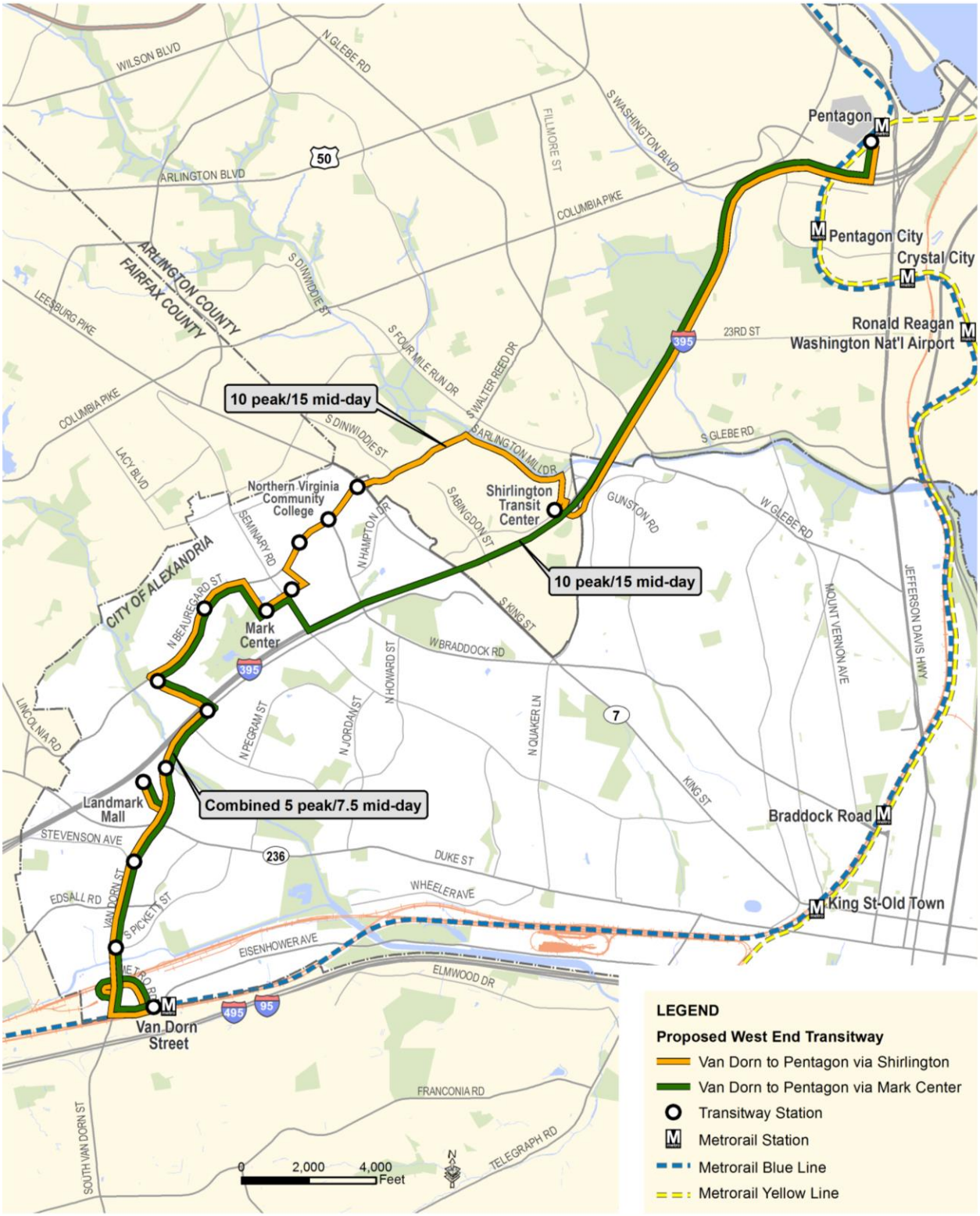
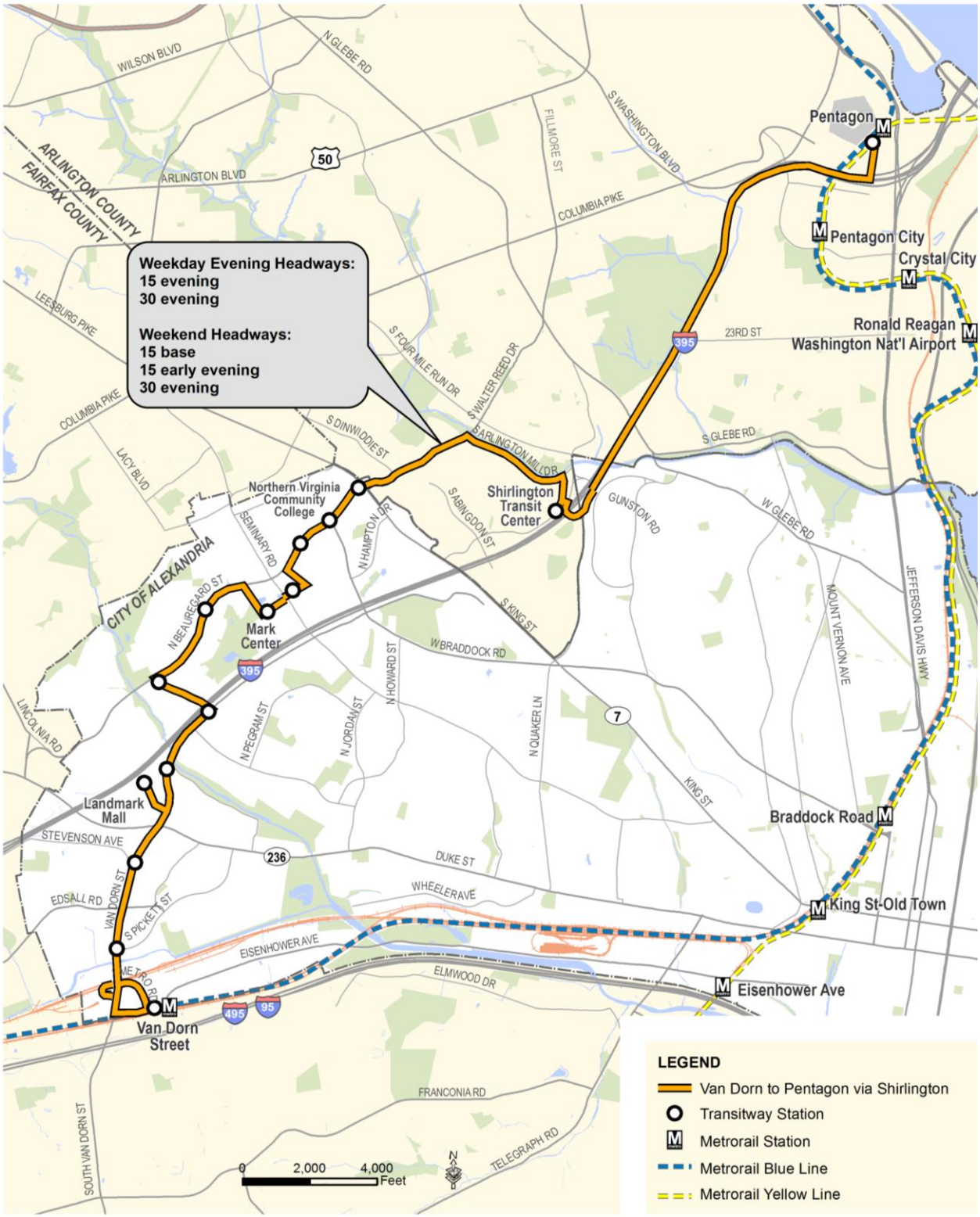


Figure 11: Weekday Evening and Weekend Route Pattern (TSM and Build Alternatives)



2.3. Mature Corridor

It is important to note that in the context of this AA, the Build Alternative has been specifically defined in terms of the project that the City will pursue and can implement in the near-term horizon (approximately 5 years). From a City policy perspective—consistent with the many decisions and plans that City leaders have made and adopted—the Build Alternative is a near-term step toward a "Mature Corridor" scenario that would create a more robust BRT system than the Build Alternative being discussed in the AA.

The Mature Corridor would include elements such as:

- A more extensive system of dedicated transit lanes
- Realignment of Sanger Avenue
- A multimodal bridge between the Van Dorn Street Metrorail station and South Pickett Street
- Enhanced connectivity through the existing Landmark Mall area consistent with Landmark/Van Dorn Plan
- Additional streetscape enhancements
- Comprehensive bicycle and pedestrian enhancements
- Additional transit services

The Build Alternative in this AA is an important first step in achieving the long-term corridor vision defined by City policies and plans. It represents an incremental investment in enhanced transit and multimodal conditions in the corridor and would be built upon as growth and development occur in the corridor. **Figure 12** shows how the alternatives and the Mature Corridor fit together and **Figure 13** shows the vision for the Mature Corridor.

Figure 12: Framing the Alternatives in the Context of the Corridor Long-Term Vision

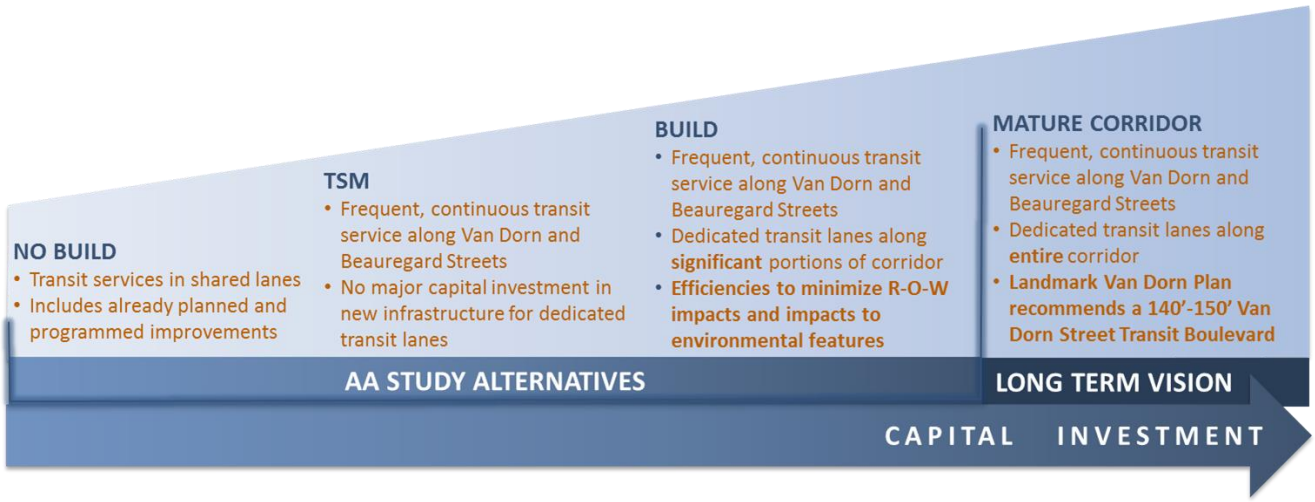
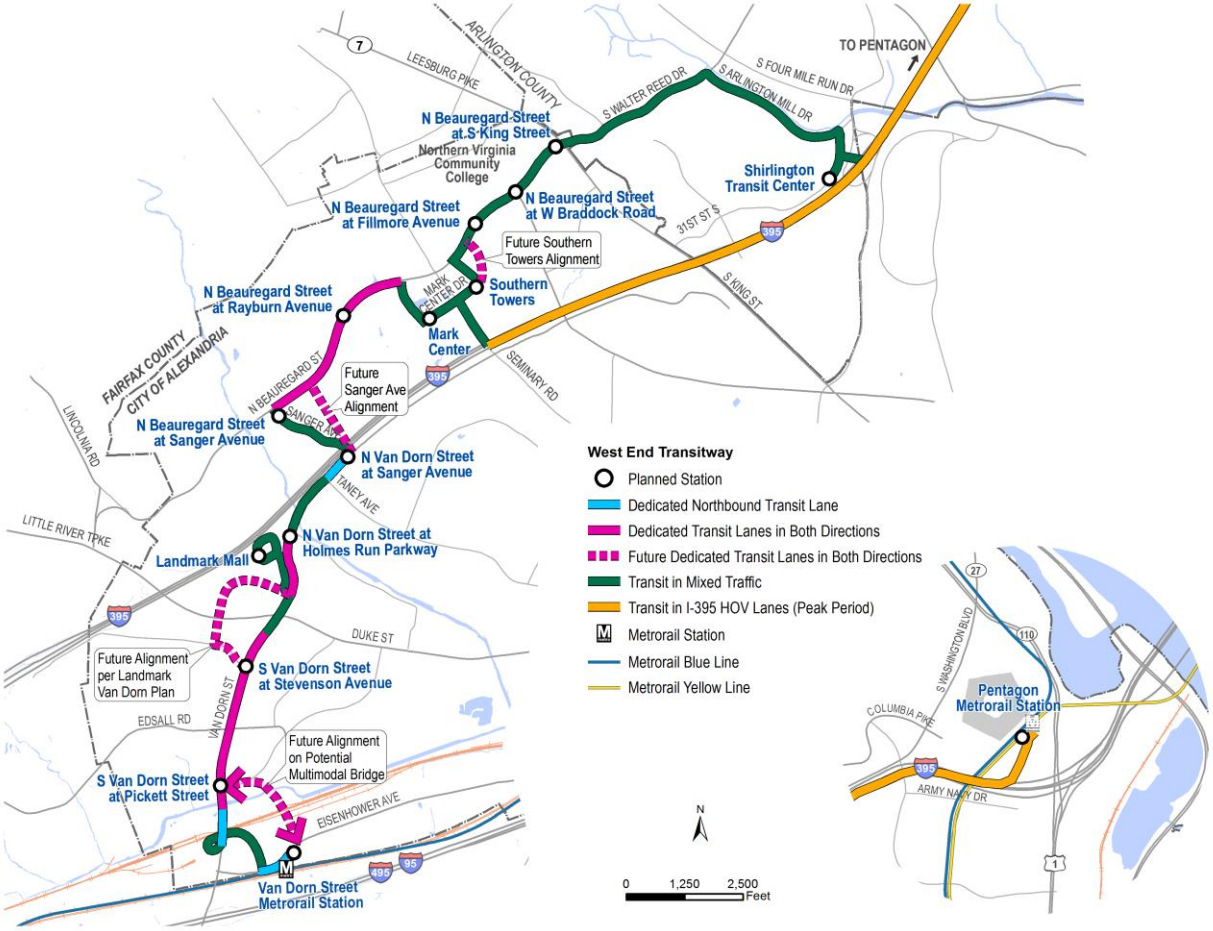


Figure 13: Build Alternative to Mature Corridor Transition



2.4. Summary of Alternatives

Substantive elements of each alternative are summarized and compared in **Table 4**.

Table 4: Summary of System Operations, Infrastructure and Service Elements

Element	No Build Alternative	TSM Alternative	Build Alternative
System Operations Elements			
Transit Signal Priority	Up to 9 locations	Up to 13 locations	Up to 17 locations
Queue Jump Lanes	1 location	1 location	None
Increased Service	Some	Significant	Significant
Transit-Dedicated Lanes	None	None	2.3 miles

Element	No Build Alternative	TSM Alternative	Build Alternative
Stop or Station Improvements	Maintain existing transit stop locations Stop accessibility and amenity improvements currently planned by the City (ongoing program)	New TSM bus routes would stop at new or relocated simple bus stops; locations match Build Alternative station locations; Stop accessibility and amenity improvements currently planned by the City (ongoing program)	New bus stations at all proposed transitway stops that include amenities like real-time passenger information, large shelters, and level or near-level bus boarding.
Vehicle Type	Same as agency fleet	Same as agency fleet	Build Alternative-specific
Infrastructure Elements			
Modifications Planned by Others	▪ Right turn lane at Westbound Edsall Road at S. Van Dorn Street ▪ Intersection reconstruction at North Beauregard Street and Seminary Road	Same as No Build	Same as No Build
Transit Runningway Modifications	None	None	Curbside dedicated lanes (0.4 miles) Median dedicated lanes (1.9 miles)
Other Modifications	None	None	Shared use bicycle/pedestrian path and streetscape improvements (approximately 1.9 miles) Widen sidewalks (approximately 2.3 miles)
Service Elements			
2035 West End Transitway Service	N/A	Two WET routes: ▪ Van Dorn to Pentagon via Shirlington Station ▪ Van Dorn to Pentagon via Seminary Road Weekday service levels for each - 10 peak, 15 midday Weeknight and weekend service levels for Shirlington pattern – 30 in late evening, 15 all other times	Two WET routes: ▪ Van Dorn to Pentagon via Shirlington Station ▪ Van Dorn to Pentagon via Seminary Road Weekday service levels for each - 10 peak, 15 midday Weeknight and weekend service levels for Shirlington pattern – 30 in late evening, 15 all other times
Alignment and Stations	Shared lane service Existing stations	Shared lane service 15 stops	Dedicated transit lane service in some locations 15 new stations

Element	No Build Alternative	TSM Alternative	Build Alternative
Bus Service Span	Existing service	Weekdays: 19 daily hours of operation Weekends: 17 daily hours of operation	Weekdays: 19 daily hours of operation Weekends: 17 daily hours of operation
Travel Time Estimate 2015/2035 (peak period in the peak direction)	Existing service	Van Dorn to Pentagon via Shirlington: 40 minutes/41 minutes Van Dorn to Pentagon via I-395: 33 minutes/34 minutes	Van Dorn to Pentagon via Shirlington: 35 minutes/35 minutes Van Dorn to Pentagon via I-395: 29 minutes/29 minutes
Vehicle Fleet Requirements	Existing service requirements	Weekday peak/fleet vehicles: ▪ 2015: 18/22 ▪ 2035: 19/23	Weekday peak/fleet vehicles: ▪ 2015: 16/20 ▪ 2035: 16/20
2035 Supporting Bus Service	DASH – Same as existing, except: ▪ Improve service on AT1 and AT8 ▪ Truncate AT7 at Van Dorn Metro ▪ Add Van Dorn Circulator Metrobus – Same as existing, except: ▪ Improve service on 7M ART – Same as existing	DASH – Same as existing, except: ▪ Improve service on AT8 ▪ Truncate AT1 and AT5 at Landmark Mall ▪ Truncate AT7 at Van Dorn Metro ▪ Add Van Dorn Circulator Metrobus – Same as existing, except: ▪ Eliminate 7M ▪ Eliminate 7P ART – Eliminate 87X	DASH – Same as existing, except: ▪ Improve service on AT8 ▪ Truncate AT1 and AT5 at Landmark Mall ▪ Truncate AT7 at Van Dorn Metro ▪ Add Van Dorn Circulator Metrobus – Same as existing, except: ▪ Eliminate 7M ▪ Eliminate 7P ART – Eliminate 87X

3. ALTERNATIVES EVALUATION

Each of the defined study alternatives—No Build, TSM, and Build—were evaluated on criteria related to transit performance, effects on transportation modes, and the relationship of each alternative to the land use and economic development outcomes in the study area. This section describes each of the categories and associated evaluation criteria, quantitative and qualitative outcomes, and an overall summary of the performance of each alternative for each category. **Appendix D**, Evaluation of Alternatives Technical Memorandum, provides additional detailed information.

3.1. Evaluation Measures

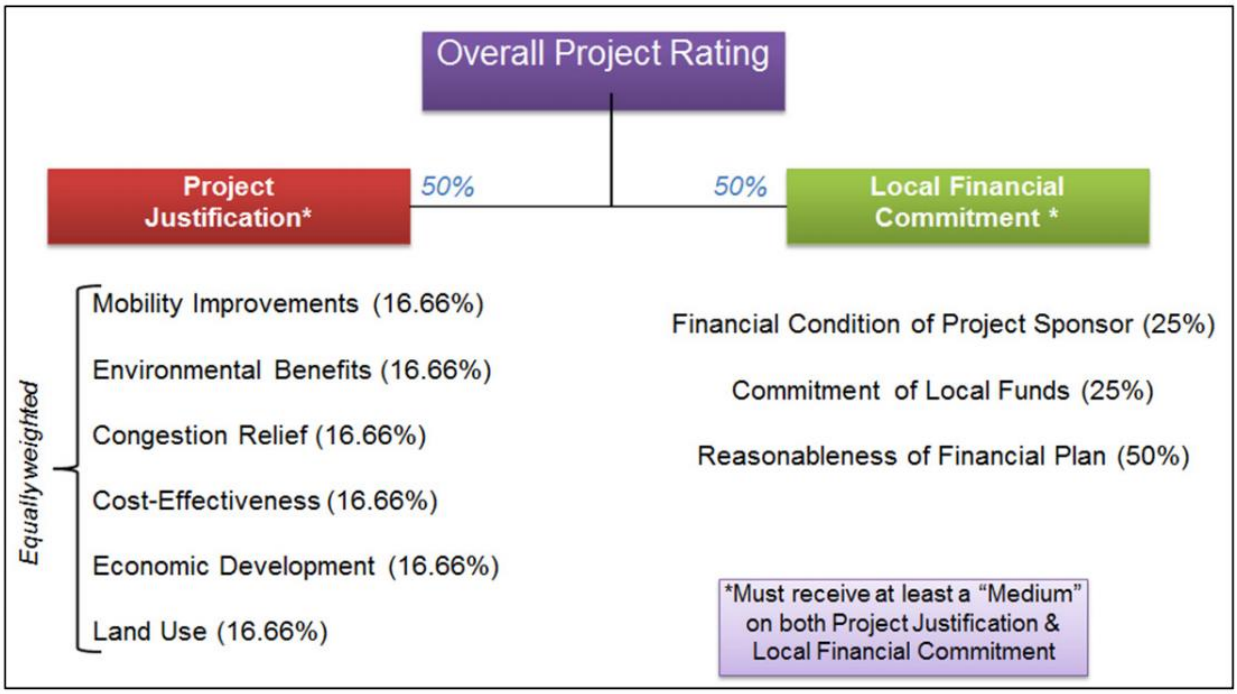
Evaluation measures were developed from the project Purpose and Need. Evaluation measures relate directly to one of the three issues identified as project need for the West End Transitway, and are grouped under transit, other transportation, and land use and economic development measures in **Sections 3.2, 3.3,** and **3.4**, respectively.

Each evaluation criterion also relates to one of FTA's Project Justification Criteria. FTA uses a defined set of criteria to measure project benefits as part of its New and Small Starts funding application process. Because the City may choose to apply for FTA funds for the West End Transitway, these criteria were taken into consideration in developing the project evaluation criteria. The FTA's Project Justification Criteria are the following:

- **Mobility Improvements**: total trips on the project, measured in the current year or for the current year and horizon year
- **Economic Development Effects**: qualitative or quantitative measure of likely future development outcomes resulting from the project
- **Environmental Benefits**: economic measure of emissions, energy use, and safety compared to project costs
- **Cost Effectiveness**: measure of cost, relative to trips that would use the project
- **Land Use**: measure of population and employment density, parking supply, pedestrian facilities, and affordable housing in the project corridor
- **Congestion Relief:** the FTA has not yet issued measurement standards on the congestion relief criteria

It is important to note that the Project Justification Criteria account for only 50 percent of FTA's Summary Rating of a project; local financial commitment accounts for the remaining 50 percent. The FTA New Starts Framework is summarized in **Figure 14.**

Figure 14: FTA New Starts Framework



Scoring Methodology

The measures were developed such that each can be quantitatively measured and the results compared among the three alternatives and evaluated on an individual alternative basis. Quantitative or qualitative information is reported for each measure and scored proportionally on a scale of 0.0 to 1.0. The resulting score for each measure is an average of 2015 and 2035 scores. To obtain the total score for each of the three categories (transit, other transportation, and land use/economic development), the average for each criteria was taken, weighting each criteria equally. To obtain a summary score for each alternative, the three category scores were added together for a composite score.

Table 5: West End Transitway Evaluation Criteria

Project Need	Category	West End Transitway Evaluation Criteria	FTA Criteria					
			Mobility Improvements	Environmental Benefits	Cost Effectiveness	Economic Development	Land Use	Congestion Relief
TRANSIT	Ridership	Corridor daily transit ridership	✓		✓			✓
	Coverage	Residents within station walkshed					✓	
		Jobs within station walksheds					✓	
		Transit dependent households within station walksheds	✓				✓	
	Transit Connectivity	Transit travel time between major corridor and regional origins/destinations	✓					
	Transit Operations	Average transit travel time	✓		✓			✓
		Headway reliability	✓		✓			
		Capacity utilization/peakline loads		✓	✓			
OTHER TRANSPORTATION	Traffic Operations	Intersection delay		✓				✓
		Vehicular travel time		✓				✓
	Bicycles and Pedestrians	Percent of corridor with new/improved sidewalk					✓	
		Percent of corridor with new bicycle facility					✓	
	Capacity	Person throughput	✓					✓
LAND USE AND ECONOMIC DEVELOPMENT	Land Use	Supports planned development projects in the Landmark/Van Dorn and Beauregard Small Area Plans		✓		✓	✓	
		Mixed of land uses				✓	✓	
	Economic Benefit	Level of new development permitted (square feet)		✓		✓	✓	
		Total Change in Tax Revenue		✓		✓	✓	
✓ Indicates that the West End Transitway evaluation criteria relates to FTA Project Justification Criteria								

3.2. Transit Evaluation

This category measures the projected effectiveness of the transit service in the West End Transitway corridor. **Table 6** summarizes the results of the evaluation of alternatives in this category. The scores shown represent averages for 2015 and 2035 as well as averages for the two routes to the Pentagon (using the peak period values). All criteria were weighted equally to obtain the average transit score.

Table 6: Transit Criteria Evaluation Summary

Category	Evaluation Measures	No Build	TSM	Build	No Build	TSM	Build	No Build	TSM	Build
		2015			2035			Score		
Ridership	Corridor daily transit ridership	26,400	30,200	31,700	32,400	39,100	41,000	**0.8**	**0.9**	**1.0**
Coverage	Residents within stop/station walkshed	11,700	28,200	28,200	17,300	39,000	39,000	**0.4**	**1.0**	**1.0**
	Jobs within stop/station walkshed	10,100	17,300	17,300	16,400	27,300	27,300	**0.6**	**1.0**	**1.0**
	Transit-dependent households within stop/station walkshed	700	1,800	1,800	1,100	2,700	2,700	**0.4**	**1.0**	**1.0**
Transit Connectivity	Connectivity between corridor and activity centers (transit travel time in minutes)	71	62	58	69	63	58	**0.8**	**0.9**	**1.0**
Transit Operations	Transit travel time in corridor (minutes)	51.1	36.5	31.7	53.7	37.5	32.0	**0.6**	**0.9**	**1.0**
	Headway reliability (standard deviation, in minutes)	2.7	2.7	2.4	3.0	2.9	2.3	**0.8**	**0.8**	**1.0**
	Utilization (peak transit load)	24	43	52	26	48	50	**0.5**	**0.9**	**1.0**
Average Transit Score								**0.6**	**0.9**	**1.0**

The following is a brief summary of observations of the information shown in **Table 6**:

- Build Alternative has the highest ridership, transit connectivity, shortest transit travel time, most reliability, and has the highest peak load
- TSM and Build Alternatives have comparable coverage to residents, jobs, and transit-dependent populations
- Build Alternative performs the best among the three alternatives

3.3. Other Transportation Evaluation

The category measures the transportation conditions in the corridor for multiple non-transit modes. **Table 7** summarizes the results of the evaluation of alternatives in this category. The scores shown represent averages for 2015 and 2035. All criteria were weighted equally to obtain the Other Transportation score. Additional information is provided in **Appendix D**.

Table 7: Other Transportation Criteria Evaluation Summary

Category	Evaluation Measures	No Build	TSM	Build	No Build	TSM	Build	No Build	TSM	Build
		2015			2035			Score		
Traffic Operations	Intersection performance (total seconds of delay)	745	888	925	818	910	1,042	**1.0**	**0.9**	**0.8**
	Vehicular travel time (minutes)	15.7	16.0	16.5	15.9	16.1	16.5	**1.0**	**1.0**	**1.0**
Bicycles and Pedestrians	New/improved sidewalks (percent of corridor)	0%	0%	49%	0%	0%	49%	**0.0**	**0.0**	**1.0**
	New bicycle facility (percent of corridor)	0%	0%	39%	0%	0%	39%	**0.0**	**0.0**	**1.0**
Capacity	Person throughput (persons per hour)	2,350	2,610	2,835	2,610	2,715	2,940	**0.9**	**0.9**	**1.0**
Average Transportation Score								**0.6**	**0.6**	**1.0**

The following is a brief summary of observations of the information shown in **Table 7**:

- No Build Alternative has the least impact to traffic operations.
- The difference between the No Build and Build Alternative in terms of travel time is less than a minute of additional delay, but the impact of prioritizing through movement along the transitway route is evident from the increased delay at intersections to traffic crossing the corridor
- Build Alternative includes significant improvement to bicycle and pedestrian facilities
- Build Alternative provides the most person capacity in the corridor
- Build Alternative performs the best among the three alternatives.

3.4. Land Use and Economic Development Evaluation

The land use and economic development category measures the compatibility of the proposed transitway with planned land use and the economic benefit of the transitway.

Table 8 summarizes the results of the evaluation of alternatives in this category. Additional information is provided in **Appendix C**.

Table 8: Land Use and Economic Development Criteria Evaluation Summary

Category	Evaluation Measures	No Build	TSM	Build	No Build	TSM	Build	No Build	TSM	Build
		2015			2035			Score		
Land Use	Supports planned development	N/A			0.05	0.50	1.00	**0.1**	**0.5**	**1.0**
Economic Benefit	Permits new development (million square feet)	N/A			4.77	4.77	10.23	**0.5**	**0.5**	**1.0**
	Average percentage of income spent on transportation	N/A			9%	9%	8%	**0.9**	**0.9**	**1.0**
	Pace of New Development in Beauregard Small Area (years to hit development cap)	N/A			14	13	7	**0.5**	**0.5**	**1.0**
Average Land Use and Economic Development Score								**0.5**	**0.6**	**1.0**

The following is a brief summary of observations of the information shown in **Table 6**:

- Build Alternative best supports planned development, permits the most new development at a quicker pace, and has the best potential to save families money on transportation
- Results for the Build Alternative offer significantly higher valuations than the no-build and TSM alternatives. The anticipated amount of net new development is roughly twice that anticipated under the No Build and TSM scenarios. This reflects both greater attraction of new development and a favorable mix of property types.
- The TSM and no-build are relatively equal in most of the categories and the Build Alternative performs the best

3.5. Evaluation Summary

The overall scores for the three categories of measures were aggregated and a summary score developed. Equal weight was given to each category. The aggregated scores and are shown in **Figure 15**. The summary represents a representative average of the alternatives' performance between 2015 and 2035 and takes into account both routes to the Pentagon.

Figure 15: Alternatives Evaluation Scoring Summary

4. ENVIRONMENTAL CONSIDERATIONS

Other factors inform the Alternatives Analysis (AA) beyond those evaluated specifically against the project purpose and need. This section describes potential environmental effects of the three alternatives.

4.1. Impact Summary

An environmental scan was performed to inform the AA and decision-making process for the West End Transitway. As a precursor to the draft environmental document, the Environmental Scan Technical Memorandum summarized the findings of a preliminary environmental analysis across each of the resource areas that were be evaluated in the environmental document.

Following the environmental scan, an Environmental Existing Conditions Report was completed in August 2014 and was the next step in identifying the resource areas and their relevance to the West End Transitway alternatives.

The draft environmental document builds on these documents and provides a comprehensive assessment of reasonably foreseeable direct, secondary, and cumulative environmental impacts associated with the No Build, TSM, and Build Alternatives proposed for the West End Transitway. A summary of potential environmental effects identified in the draft environmental document is summarized below for each resource evaluated:

<u>Social and Economic Resources</u>

- The Build Alternative will have a measurable frontage property impact and is likely to require one property acquisition
- Some change is expected in visual character for Build Alternative; however, long-term negative effects are unlikely due to planned mitigation such as streetscape improvements. These changes are consistent with the City of Alexandria's long-term vision for the corridor.
- Build and TSM Alternatives will benefit the local community (including minority and low-income populations) along the corridor by providing improved transit service

<u>Transportation Network</u>

- All alternatives will have some impact to traffic operations due to the provision of transit signal priority; however, impacts are expected to be minor
- The Build Alternative will have some impact to parking on adjacent commercial and residential properties
- Build and TSM Alternatives will benefit transit operations
- Build Alternative will benefit bicycle and pedestrian conditions

<u>Noise and Vibration</u>

- Unlikely to have an impact in any alternative

Air Quality

- Some benefit may be accrued by the TSM and Build Alternatives due to a reduction in vehicular demand and traffic congestion

Natural Environmental Resources

- Unlikely to have significant impact in any alternative
- The Build alternative has minor, mitigatable impacts to 500-year flood plain and Resource Protection Areas (RPA)

Hazardous and Contaminated Materials

- Build Alternative may affect hazardous and contaminated sites such as former or current auto service and fueling stations, sites with leaking or secure underground storage tanks, and former or current dry cleaners

Construction Effects

- Temporary minor impacts are expected in the Build Alternative

Secondary and Cumulative Effects

- Some secondary effects are anticipated in TSM and Build Alternatives due to additional growth in the corridor including right-of-way acquisition
- Implementation of small area and corridor plans are anticipated in the Build Alternative

Additional information, such as figures and further narrative text, on each of the above resources is provided in the draft environmental document.

5. FINANCIAL CONSITERATIONS

Other factors inform the Alternatives Analysis (AA) beyond those evaluated specifically against the project Purpose and Need. This section summarizes capital, operations, and maintenance costs considerations. The costs presented in this section assume that projects associated with the No Build Alternative are already funded.

5.1. Estimated Project Costs

Capital

A capital cost estimate was prepared for the Build Alternative using the format and procedures currently required for project evaluation by FTA. FTA methodology uses standard cost categories (SCC), grouping costs by various components such as guideway, stations, operations and maintenance facilities, sitework, signalization and communications systems, right-of-way acquisition, and vehicles. Soft costs for professional/technical services are included for items such as engineering, construction services, insurance, and owner's costs. Contingency is included to reflect the current conceptual stage of engineering design. Approximate ranges for capital costs for the TSM and Build Alternative are shown in **Table 9**.

Table 9: Capital Cost Summary

Project Costs (2015 Dollars)	TSM Alternative	Build Alternative
Capital Construction (roadway, stations, systems, right-of-way, and utilities)	$15 to $16 million	$61.5 to $70 million
Fleet (buses including spares)	$19.5 to $22 million	$17 to $19.5 million
Project Development (design, fees, permitting, legal, surveys, testing, etc.)	$4.5 to $5.5 million	$16 to $18.5 million
Contingency	$12 to $14 million	$28 to $32 million
Total Project Cost	**$51 to $57.5 million**	**$122.5 to $140 million**

Operating

In addition to a capital cost estimate, an operating and maintenance (O&M) cost estimate was prepared that reflects the cost to operate, maintain, and administer the West End Transitway service. O&M costs are the annual total incurred of employee earnings and fringe benefits, contract services, materials and supplies, utilities, and other day-to-day expenses.

The O&M cost methodology used for the West End Transitway project is consistent with FTA guidelines. The operating cost includes only the West End Transitway routes and are presented in

Table 10 and represent the range of potential costs, regardless of operator. The West End Transitway operating costs were tabulated based on WMATA's operating costs and are likely to be lower if DASH were to operate the service, rather than WMATA. However, this difference could be offset with the cost of having to add capacity to the existing maintenance facility if DASH were to operate the service. In all cases, the costs of providing West End Transitway service are partially offset by savings resulting from changes to the background bus network to reduce duplicative service (e.g., replacing Metrobus Route 7M with West End Transitway service). A more detailed operational cost breakdown is presented in **Appendix B** and will be refined as the project advances**.**

Table 10: Operational Cost Summary

O&M Costs (2015 Dollars)	TSM Alternative	Build Alternative
Yearly Total O&M Cost	**$6.0 to $9.9 million**	**$6.7 to $10.2 million**

Note: Lower range corresponds to estimated cost for DASH to operate; higher end assumes WMATA operation

5.2. Funding Considerations

The West End Transitway Build Alternative has the potential for many funding sources, with the anticipation that the project will not require local funding from the City. In consideration of funding, the assumed sources for the Build Alternative's capital project (non-operating & maintenance) funding are the following:

- NVTA Regional (70%) funds, including the $2.4 million already committed to the City by NVTA for FY16 to advance the project
- FTA Capital Investment Grant through the Small Starts program
- Other federal sources such as TIGER funds and other federal sources (bus and bus facilities)
- State funds
- Toll revenue
- Private funds

Both NVTA 70% funds and any federal transportation funding is highly competitive. As currently planned, the NVTA and private funds could be used as sources of local match for federal funding.

Although there is a lower overall cost for the TSM Alternative, the TSM Alternative would not qualify for FTA Capital Investment Grant funds, which could account for a significant portion of the Build Alternative's project costs. Similarly, the TSM Alternative may not be competitive enough to receive regional and state funds made available through the Northern Virginia Transportation Authority (NVTA) and Commonwealth.

The strong benefits of the Build Alternative which centers on an improved transit service that moves more people have already indicated that the West End Transitway will be competitive for funding in regional and federal funding pools. The City of Alexandria will continue to pursue additional options for funding including additional federal sources and Commonwealth of Virginia sources.

6. ALTERNATIVES ANAYSIS SUMMARY

The Purpose and Need for the West End Transitway project defined the need to address transit, transportation, and land use and economic development issues in the study corridor. The detailed evaluation conducted using the measures defined in **Section 3** of this document respond directly to the Purpose and Need.

In addition to the measures associated with the Purpose and Need, the AA considered additional factors—capital and O&M costs as well as environmental effects—in the review of the three alternatives. The following briefly summarizes the evaluation of alternatives.

As shown in **Section 3.5** the Build Alternative scores the highest among the studied alternatives. It performs best in each of the categories as compared to the two other alternatives and generally reflects the following:

- **A better transit experience for people and a more efficient operation for the service.** The provision of dedicated transit lanes and more operational improvements at intersections translates to a service that has higher travel speeds, is more reliable, and more attractive to transit users in the study area.

- **Multimodal improvements along the transit corridor.** The Build Alternative includes bicycle and pedestrian infrastructure improvements where streets will need to be reconstructed to accommodate dedicated transit lanes and transit stations. These and other intersection improvements will make the streets safer places to travel, regardless of mode.

- **Greater consistency with adopted plans and higher potential to catalyze growth and create real estate value.** The larger, perceptually more permanent infrastructure and service investment that the Build Alternative represents is most in alignment with adopted plans and therefore has the highest potential to positively influence development markets and growth in real estate values.

The following is summary of high-level observations related to environmental considerations:

- **All the alternatives have minimal environmental effects relative to the scale of the alternative**. The TSM Alternative offers limited environmental benefits, but has little to no impact. While the Build Alternative has minor parking, property, visual, temporary construction, and vehicular operations impacts, it provides measurable benefits to minority and low-income populations, pedestrians and bicycles, and may also benefit air quality.

The following is a summary of high-level observations related to cost and impact considerations:

- **Capital cost of the No Build and TSM Alternatives are the lowest among the alternatives**. The TSM and No Build Alternatives are substantially less costly due to little to no infrastructure build-out and lower-scaled system investment. The capital investments of

the Build Alternative, while principally focused on providing infrastructure and systems to support high-capacity transit operations, also rehabilitates sections of Van Dorn and Beauregard Streets that serve general purpose vehicle traffic and local transit, modernize traffic signals throughout the corridor, and provide new and improved bicycle and pedestrian infrastructure.

- **Operating cost of the TSM and Build Alternative are similar but higher than the No Build.** The No Build Alternative is less costly than the TSM and Build Alternatives. It offers far less transit service and benefit to users (as articulated in Section 3) in the corridor. The annual operations cost of the TSM and Build Alternatives are similar.

7. CITY APPROVAL AND NEXT STEPS

The background, analysis, and summaries provided in the previous sections are important framework for the steps ahead for the West End Transitway project. The evaluations and analyses completed to date have informed additional discussion on the City's preferred policy direction, which is a re-concurrence of the approved resolution from November 2012 supporting Bus Rapid Transit in dedicated lanes where practicable between Van Dorn Street Metrorail Station and the Pentagon. This re-concurrence confirms the Build Alternative as the Locally Preferred Alternative (LPA) for the West End Transitway as part of the FTA process. This confirmation represents the completion of the alternatives analysis phase.

The alternative analysis was presented a series of groups which resulted in the following actions:

- The Policy Advisory Group[1] reconfirmed the 2011 resolution for support, confirmed that follow-up items in that resolution have been addressed, and recommended the defined Build Alternative for the West End Transitway as the preferred approach for high-capacity transit in the corridor.

- On February 17, 2016 a public hearing was held in conjunction with the Transportation Commission meeting. The Transportation Commission endorsed the Policy Advisory Group's recommendation by an 8-1 vote.

- The project was presented at the City Council Legislative Meeting on March 29, 2016. The City Council, in a unanimous 7-0 vote, passed a resolution of re-concurrence (**Appendix E**) for the West End Transitway LPA originally approved by City Council on November 17, 2012. This decision confirms the Build Alternative as the Locally Preferred Alternative (LPA) for the West End Transitway.

- The City of Alexandria's West End Transitway was granted entry into the Project Development (PD) phase under the Federal Transit Administration's (FTA) Small Starts program in June 2016.

Project Development is a milestone that formally establishes the City's intent to further develop a transit project in the City and pursue partial federal funds for its implementation. Upon acceptance of the project by FTA, the City is able to accrue benefit (local match credit) associated with project development-related activities—study, preliminary engineering, right-of-way purchase, final engineering, and similar—expenditures.

[1] *On March 11, 2014, City Council passed a resolution to establish a Van Dorn/Beauregard Transitway Policy Advisory Group to provide input on key deliverables and make project recommendations related to the Van Dorn/Beauregard Transitway Alternatives Analysis (AA) / Environmental Documentation. The group may have differing opinions and not necessarily develop a consensus position, broker a compromise or take formal votes.*

Next steps in the process include:

- Completion of National Environmental Policy Act (NEPA) documentation
- Completion of engineering and project delivery actions
- Continued engagement with the public and project stakeholders

The completion of NEPA documentation has been concurrent with discussions leading to the adoption of the project. The project's currently agreed upon Class of Action with FTA is an environmental assessment (EA); however, discussions with FTA indicate that a categorical exclusion (CE) may be the ultimate Class of Action applied to the project during review. Notification of the satisfactory completion of the NEPA process under either class of action by FTA—finding of no significant impact (FONSI) or CE—would enable the City to pursue federal funds to support the project's implementation.

Following the completion of the NEPA document, the City can pursue engineering and project delivery processes of an appropriate scale and type to implement the preferred transit investment. Typically, engineering occurs in preliminary and final phases and the scope of the effort is tailored to meet the requirements of the City-defined project delivery method for the project, which will be design-build.

The city will continue to engage the community to provide updates on the project progress to date and gain additional information. Further coordination with project stakeholders such as neighboring jurisdictions, FTA, Washington Metropolitan Area Transit Authority, and local property owners will continue as more detailed elements of the project are determined. Examples of these issues include coordination on service operations, vehicle maintenance and storage, and routing and stop configuration at Southern Towers.

Completion of project development and project delivery will lead to an operating transit investment in the West End. The Build Alternative will help the West End progress towards the City's long-term vision by providing high-capacity transit service in dedicated lanes where practicable from the Van Dorn Street Metrorail station to the Pentagon and multimodal improvements for all corridor users. The timing of the operation of the multimodal investment will depend on the project's progress through the set of milestones mentioned above, availability of funding, and project priority by the City.

WEST END TRANSITWAY

Alternatives Analysis – Appendix A

PURPOSE AND NEED TECHNICAL MEMORANDUM

REVISED

MAY 21, 2014

ALEXANDRIA ACCELERATED

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Appendices

1. INTRODUCTION

1.1. Study Overview and Project Purpose

In accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, the Federal Transit Administration (FTA) as lead agency and the City of Alexandria as project sponsor are preparing a combined Alternatives Analysis and Environmental Assessment (AA/EA) for the Alexandria West End Transitway project (previously referred to as the Van Dorn/Beauregard Transitway or Corridor C). The City of Alexandria is proposing transit improvements along Van Dorn and Beauregard Streets in the City's West End that will provide robust high-capacity transit operations using a combination of dedicated and shared lanes and will connect the Landmark/Van Dorn, Alexandria West, Seminary Hills, and Beauregard neighborhoods between the Van Dorn Metrorail station, Shirlington Transit Center, and the Pentagon.

This document presents the issues that are driving the need for transit improvements in the corridor: existing and future land uses, traffic congestion, and transit service. These needs inform the purpose for the project. The purpose of the West End Transitway project is to improve mobility through the corridor by providing a faster, higher-capacity transit "trunk line". The transitway project responds to the City's proposed land use changes, and by coordinating with existing and future regional transit network connections, intends to prompt a mode shift away from private automobile use to transit in order to curtail growth in traffic congestion. The result will be a corridor transportation system that supports adjacent land uses and planned economic development.

1.2. Study Process

The combined AA/EA process will develop a fundable and implementable transit project that can be supported by the communities within the study area. The anticipated outcome of the process of is to advance transit improvements in the corridor toward design and construction.

The AA will evaluate alternative solutions to identify one alternative to be recommended for implementation. Evaluation measures will be based on the project purpose and need, and will include technical measures for features such as travel time and ridership, and qualitative considerations such as contribution to community values and economic development goals. Upon adoption by City Council, the recommended alternative will become the Locally Preferred Alternative (LPA). The LPA will be included in the Financially Constrained Long Range Transportation Plan (CLRP) for the Washington metropolitan region.

The EA, identified by FTA as the appropriate NEPA Class of Action for the project, will comprehensively assess potential socio-economic, environmental and transportation effects of the proposed improvements. The EA process will be complete when the environmental analysis and interagency review find that the project has no significant impacts on the quality of the environment and a formal Finding of No Significant Impact (FONSI) is issued.

The alternatives to be evaluated in the AA/EA include:

- The No Build – or no action – Alternative will assume no major transit investment and will instead focus on existing transit operations and transit improvements already underway.
- The Transportation Systems Management (TSM) Alternative will improve existing transit facilities and operations and identify additional low cost transportation improvements.

- The Build Alternative will assume a Bus Rapid Transit (BRT) investment with high-quality passenger stations and extensive dedicated lanes for transit.

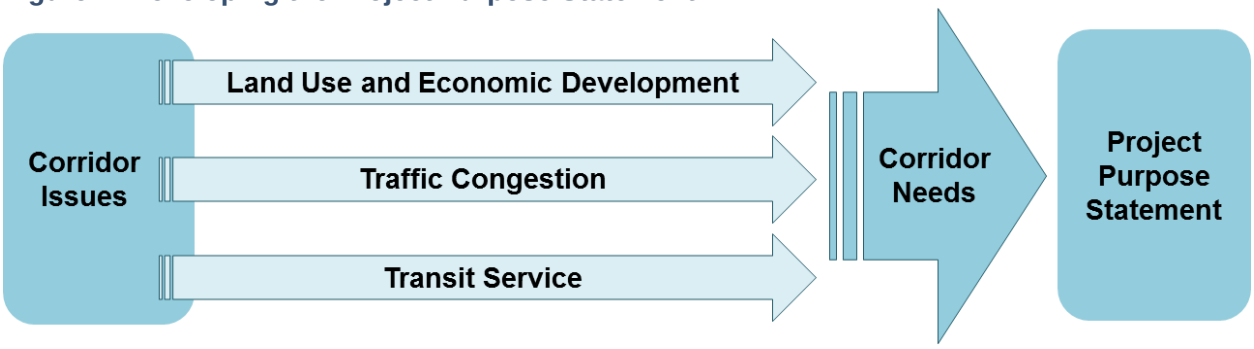
The study will concurrently advance concept design work leading to refined cost estimates for the recommended project. *Refer to* **Appendix A** *for a Summary of the FTA Project Development Process.*

1.3. Purpose of this Document

This Purpose and Need Technical Memorandum provides both an overview of the underlying transit needs in the study area and an overarching purpose statement that will guide the development and evaluation of the project alternatives, specifically relating transit needs in the study corridor to traffic congestion, existing transit services and travel markets, and land use and economic development plans. Corridor issues are established for each of these categories and these in turn help identify corridor needs. The needs also help to set the project purpose statement.

Figure 1 outlines the process for developing the project purpose statement.

Figure 1: Developing the Project Purpose Statement



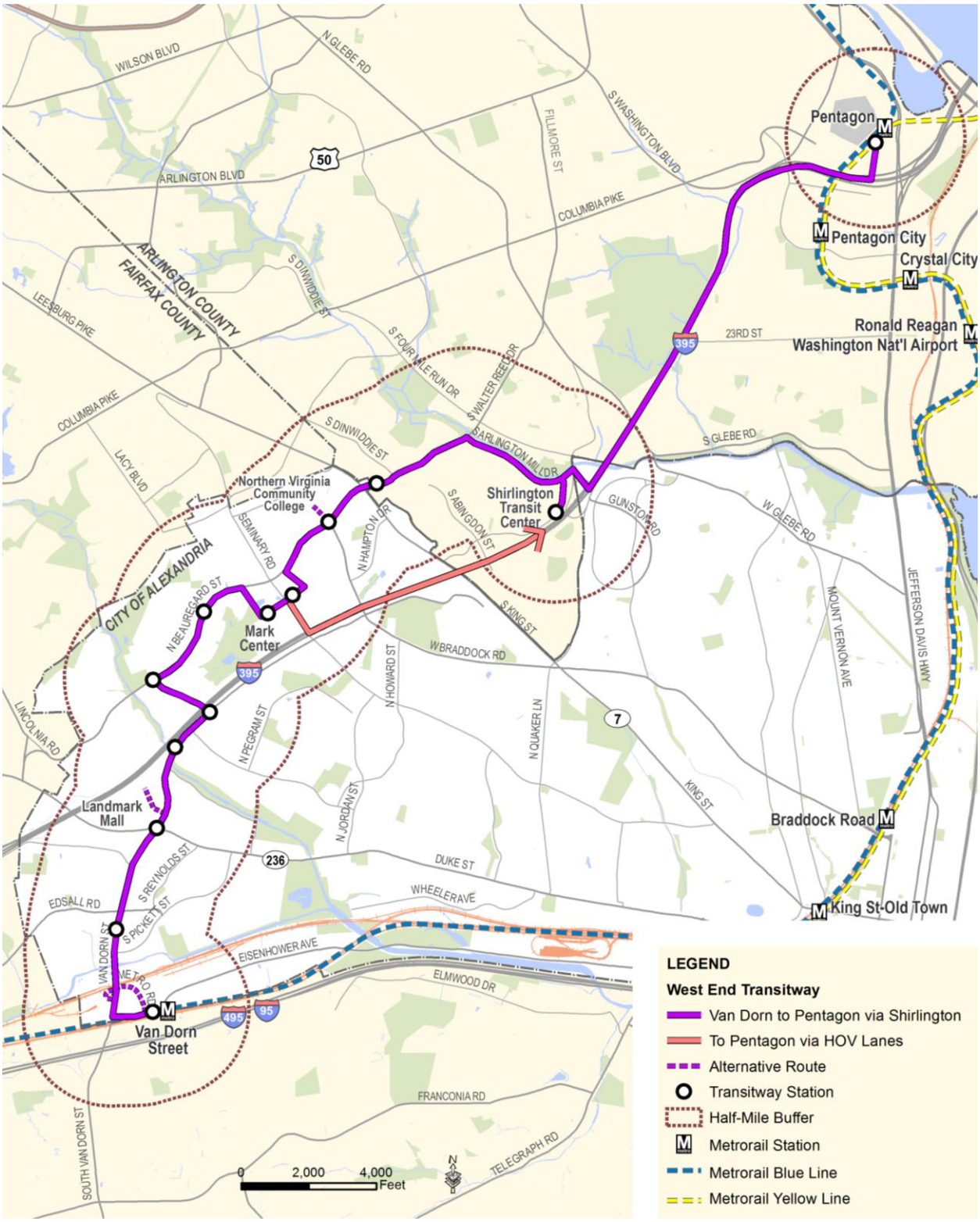
1.4. Project and Study Area Description

The proposed Transitway is located in the Van Dorn/Beauregard corridor in the City of Alexandria, and would continue on through Arlington County to the Pentagon. **Figure 2** shows the study area limits extending approximately 8 miles between the Van Dorn Metrorail station and the Pentagon. The proposed alignment for the corridor originates at the Van Dorn Metrorail station in Alexandria and follows Eisenhower Avenue, Van Dorn Street, Sanger Avenue, Beauregard Street, and Mark Center Drive to the BRAC-133 facility. At this point, the proposed transitway splits into two lines, one traveling through the Shirlington Transit Center and a second which uses the High Occupancy Vehicle (HOV) lanes on I-395 to the Pentagon.

The documentation of the project purpose and need focuses on the area anticipated to be most directly served by the project. This study area includes a half-mile area adjacent to the transit corridor between the Van Dorn Metrorail station and the Shirlington Transit Center and an additional half-mile area around the Pentagon Transit Center.

The Van Dorn-Beauregard Transitway and the study area are shown in **Figure 2**.

Figure 2: Van Dorn-Beauregard Transitway and Study Area



2. CORRIDOR ISSUES

The most important issues that affect transit in the study corridor are existing transit services and regional travel markets, future land use and economic development plans, future travel demand, and the effect of future growth on traffic congestion and transit service. The issues were identified based on an understanding of deficiencies identified from a review of previous studies, regional travel data, and field observations. Key issues are listed in **Table 1**.

New development in the West End will result in increased population, and employment, and increased travel demand. Without additional capacity to accommodate this increase, additional travel demand would result in traffic congestion that would reduce the efficiency and reliability of transit service along the corridor, discourage new transit riders, and thereby further exacerbate traffic congestion and negatively affect economic development in the area.

Table 1: Corridor Issues

	Corridor Issues
Land Use and Economic Development	• Future land use changes as proposed in the Landmark/Van Dorn Corridor Plan and the Beauregard Small Area Plan anticipate more than twice the density of existing development patterns; • Population within a quarter mile of the corridor will increase 31 percent in the next twenty years from 37,100 in 2015 to 48,500 in 2035; and • Employment within a quarter mile of the corridor will increase 48 percent in the next twenty years from 22,500 in 2015 to 33,400 in 2035.
Traffic Congestion	• Future higher density land uses will result in increases in travel demand; • Despite some minor planned capacity improvements with the addition of several new streets, the road network would not adequately meet the anticipated travel demand and result in traffic congestion in the corridor; • Traffic congestion leads to delays and unpredictable travel times for motorists; and • Peak hour traffic congestion leads to delays for transit services, increase in transit travel time, reduced service reliability and efficiency, and decreased attractiveness for transit services.
Transit Service	• Significant unmet transit demand for trips that begin and end in the study area; • Lack of unified transit route along the Van Dorn/Beauregard corridor that results in poor connectivity between home, school, work, and services within the corridor; and • Presence of a sizeable feeder market to the Pentagon Transit Center and Metrorail station.

2.1. Future Land Use and Economic Development

Issues:

- *Future land use changes as proposed in the Landmark/Van Dorn Corridor Plan and the Beauregard Small Area Plan anticipate more than twice the density of existing development patterns;*
- *Population within a quarter mile of the corridor will increase 31 percent in the next twenty years from 37,100 in 2015 to 48,500 in 2035; and*
- *Employment within a quarter mile of the corridor will increase 48 percent in the next twenty years from 22,500 in 2015 to 33,400 in 2035.*

Needs:

- *Plan for future land use changes envisioned by the Landmark/Van Dorn Corridor Plan and the Beauregard Small Area Plan; and*
- *Accommodate the mobility needs of new residents and employees in the area to create a supportive environment for continued economic development and maintain the area's competitiveness in the region.*

Extensive Redevelopment in the Study Area

The corridor continues to grow and develop through changes in land use and zoning. Extensive planning has been conducted in the last decade to enhance the existing character of the study area to a more walkable mixed-use pattern. The Alexandria City Council has approved zoning changes to increase land use density from approximately 5 million square feet to between 11 and 14 million square feet in the Van Dorn/Landmark area, and from 6 million to approximately 12.5 million square feet in the Beauregard area. Specifically, the Van Dorn/Landmark Plan proposes 1.4 million square feet of retail development, 1.7 to 6.8 million square feet of residential (1,545 to 6,200 residential units), 4.0 million square feet of office, and 500 to 700 hotel rooms; the Beauregard Plan proposes redevelopment up to 1.7 million square feet of office, 6,500 new dwelling units, 225,000 square feet of required retail, 255,000 square feet of optional retail and 400,000 square feet of hotel space.

Refer to **Appendix B** *for a summary of prior land use and transportation studies.* While the entire area is anticipated to be redeveloped over time, this growth has already started. Current redevelopment plans under review are listed below and shown in **Figure 3**.

- Landmark Gateway (under construction): Approximately 500,000 square feet of new development; includes 492 residential units.
- JBG Cameron (under preliminary review): Approximately 650,000 square feet of new development; includes 70 townhomes and 400 residential units.
- Washington Suites Apartments (plans approved- under final review): Approximately 225,000 square feet of new development; includes 219 residential units.
- Landmark Mall (plans approved- under final review): A portion of the old mall will be demolished and replaced with 250,000 square feet of new retail; additional 373 residential units.
- JBG Town Center at Reading Avenue and North Beauregard Street (concept plans): The mixed use development will include 405,165 square feet of office, 2,123 residential units, 200,000 square feet of retail and a 126,000-square-foot hotel[1].

[1] http://alexecon.org/real-estate/development-hotspots/beauregard (accessed May 14, 2014)

- Mark Center V (plans approved- under final review): New office space approximately 630,000 square feet.
- Seminary Overlook (under preliminary review): 296 existing residential units to be replaced with 720 units (south of I-395).
- Southern Towers (under preliminary review): New additional development; approximately 400,000 square feet of mixed-use along Seminary Road and Beauregard Street.
- Fillmore Avenue Affordable Housing (concept plans): 200 to 400 affordable housing units.
- Goodwin House (concept plans): 90,000 square feet home for the elderly; includes reprograming and renovating units in an existing building. Future phases of the project would potentially include a new 15-story 290,000 square feet senior housing facility, and a 4+ story 42,500 square feet addition to one of the existing buildings.
- 4600 King Street (under preliminary review): 628,000-square-foot mixed-use project; includes 450 residential units, office space, a 144-key hotel and a 62,000-square-foot grocery store.
- Northern Virginia Community College (NVCC): The redevelopment of the Alexandria campus of NVCC will include a new student housing block, two new academic blocks and the replacement of the existing Tyler Building.

Population and Employment Growth in the Study Area

According to MWCOG's Round 8.2 Land Use Forecast, the 2015 population within a quarter-mile of the proposed transitway between the Van Dorn Metrorail station and the Shirlington Transit Center will comprise approximately 37,000 residents and 22,500 employees. New development in the Landmark/Van Dorn and Beauregard corridors will result in a corresponding growth in population and employment. Population within a quarter-mile of the corridor will increase 30.6 percent compared to 24.4 percent citywide. Likewise, employment in the quarter-mile area will grow by 48.4 percent compared to 42.8 percent citywide. Table 2 shows the projected 2015 and 2035 population, employment and growth within a quarter- and half-mile of the corridor, as well as in the entire City of Alexandria.

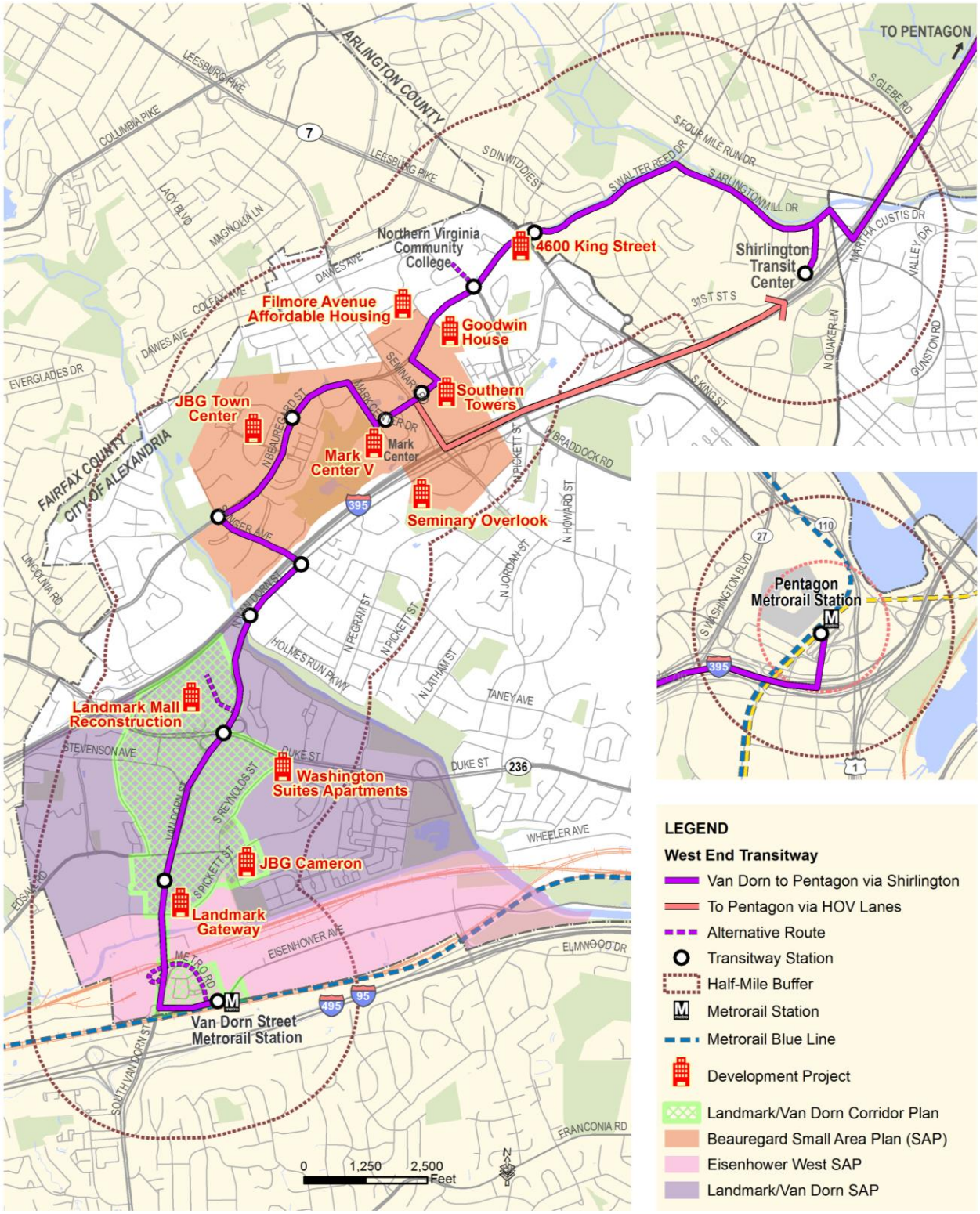
Table 2: Population and Employment Growth in the Study Area

	POPULATION			EMPLOYMENT		
	Within 1/4-mile of the corridor (Van Dorn to Shirlington)	Within 1/2-mile of the corridor (Van Dorn to Shirlington)	City of Alexandria	Within 1/4-mile of the corridor (Van Dorn to Shirlington)	Within 1/2-mile of the corridor (Van Dorn to Shirlington)	City of Alexandria
2015	37,147	76,150	148,500	22,513	36,938	110,200
2035	48,507	94,972	184,700	33,420	54,421	157,400
Growth (percent)	**30.6%**	**24.7%**	**24.4%**	**48.4%**	**47.3%**	**42.8%**

Source: MWCOG's Round 8.2 Land Use Forecast

Given these projected levels of growth, improving corridor mobility and creating better intermodal connections will be key factors in meeting the transportation needs of residents and employees in the corridor.

Figure 3: Proposed Development Plans in the Study Area



2.2. Traffic Congestion

Issues:

- *Future higher density land uses will result in increases in travel demand;*
- *Despite some minor planned capacity improvements with the addition of several new streets in the Landmark/Van Dorn Corridor Plan and the Beauregard Small Area Plan, the road network would not adequately meet the anticipated travel demand and result in traffic congestion in the corridor;*
- *Traffic congestion leads to delays and unpredictable travel times for motorists; and*
- *Peak hour traffic congestion leads to delays for transit services, increase in transit travel time, reduced service reliability and efficiency, and decreased attractiveness for transit services.*

Need:

- *Increase modal choice by providing a fast, reliable and efficient transit system as an attractive alternative to driving;*
- *Reduce effects of traffic congestion including delays and reduced reliability for transit services.*

Traffic congestion affects travel time reliability for private vehicular traffic using major roadways in and through the study area as well as for buses using the study corridor. The study area's frequent interstate congestion induces regional and longer-distance local traffic to divert to Van Dorn Street, Beauregard Street, and South Walter Reed Drive during peak periods and interstate traffic incidents. These local corridors often become over-burdened and experience failing traffic operations as a result.

Increased Travel Demand

More residents and jobs in the future will result in higher travel demand on streets and highways in the study area. According to MWCOG[2] forecasts, between 2015 and 2035, total number of corridor-related trips is expected to increase 18 percent (from 631,600 trips to 742,161) and work trips in the study area are expected to increase 27 percent, from 158,000 trips per day to 201,100.

Currently, six intersections between the Van Dorn Metro and Shirlington operate at a level of service (LOS) of E or F. Increasing numbers of trips will result in noticeably higher traffic volumes throughout the corridor. Based on MWCOG forecasts, a.m. peak volume on northbound Van Dorn Street between Eisenhower Avenue and Sanger Avenue is expected to increase from 35,800 to 39,000 vehicles (growth rate of 9 percent) between 2015 and 2035; southbound growth in the p.m. peak will be lower at 4 percent. The p.m. peak direction (westbound) growth is more evident on Beauregard Street with a growth rate of 14 percent (from 26,400 to 30,000 vehicles) between King Street and Seminary Road, and 15 percent growth rate (from 16,000 to 18,300 vehicles) between Seminary Road and Sanger Avenue. The growth rate in the a.m. peak direction (eastbound) on Beauregard Street will be between 4 and 5 percent between Sanger Avenue and King Street.

[2] *MWCOG version 2.3.52 model runs for year 2015 and 2035*

Limitations of Existing and Planned Street Network

The study area's historic development pattern and accompanying street network are not interconnected or fine-grained. Natural features such as wetlands, topography, and open space, man-made features such as railroads and interstates, as well as the time period in which much of the area was developed, are primary contributors to the street network's deficiencies. The study area has limited redundant arterial and collector routes and relies heavily on a relatively few major streets to carry regional, citywide, and local traffic. The over-reliance on arterials to handle all trip types contributes to congestion on key roadways such as Van Dorn Street, Beauregard Street, Seminary Road, and South Walter Reed Drive. The City of Alexandria's future plans include modest additions to the street network, including a new parallel street north of Beauregard Street and a roundabout with traffic signals – the 'Ellipse' – at the intersection of Beauregard Street and Seminary Road.

Unreliable Travel Time for Private Vehicular Traffic

Table 3 shows the weekday peak period travel time runs on the Van Dorn-Beauregard corridor between Eisenhower Avenue and King Street conducted during the *Transitway Corridors Feasibility Study*. The large variation in a.m. and p.m. speed and travel time on the same segment shows that general traffic flow conditions are unreliable in the study corridor.

Table 3: Weekday Peak Period Travel Times on the Van Dorn/Beauregard Corridor

–	Van Dorn Street/Sanger Avenue/Beauregard Street (Northbound)		Beauregard Street/Sanger Avenue/Van Dorn Street (Southbound)	
	Speed	**Travel Time**	**Speed**	**Travel Time**
A.M. Peak Hour	10.6 mph	19:59 minutes	23.0 mph	8:35 minutes
P.M. Peak Hour	15.6 mph	13:07 minutes	17.9 mph	10:56 minutes

Source: Transitway Corridors Feasibility Study, 2012

MWCOG's fourth quarter *National Capital Region Congestion Report* (2011) quantifies the impact on travel time reliability by noting that travelers using the region's freeway system must budget an average of 202 percent (a.m. peak) to 236 percent (p.m. peak) of their off-peak/free-flow travel time for a trip during the peak period.

Traffic Congestion-related Impacts on Bus Efficiency and Effectiveness

Traffic congestion decreases service efficiency and reduces schedule reliability. Continual lack of transit travel time reliability has been shown to limit the potential of transit to serve a growing ridership base, especially choice riders. WMATA's Priority Corridor Network Plan found that while bus ridership is growing, the ability for transit services to attract additional riders and offer an efficient and competitive service is hindered by roadway traffic congestion. *Refer to* **Appendix C** *for existing traffic conditions at intersections in the study corridor.*

2.3. Transit Service

Issues:

- *Significant unmet transit demand for trips that begin and end in the study area;*
- *Lack of a unified, one seat transit route along the Van Dorn/Beauregard corridor that results in poor connectivity between home, school, work, and services within the corridor;*
- *Presence of a sizeable feeder market to the Pentagon Transit Center and Metrorail station; and*
- *Absence of direct and convenient pedestrian and bicycle connections from adjacent neighborhoods to the Van Dorn/Beauregard corridor discourage the use of transit.*

Needs:

- *Provide improved transit capacity and frequency to support existing and future travel demand, and the study area's transit-reliant population;*
- *Enhance regional access by providing better connectivity between activity centers within the study corridor and the Van Dorn and Pentagon Metrorail stations, and support the feeder market to the Pentagon; and*
- *Enhance pedestrian and bicycle access between adjacent neighborhoods and the transit corridor.*

Unmet Transit Demand in the Corridor

According to MWCOG data (**Table 4**), approximately 360,000 daily trips are generated in the study area daily, of which 12 percent are made on transit. Work trips account for 76 percent of transit trips made from the study area (33,975 of all 44,303 trips). However, only 10,352 of the 111,698 trips generated within the corridor are non-work trips signifying a sizeable latent demand for transit.

Table 4: Trips Generated in the Study Area

Trips from the Corridor to	All Trips			Commute Trips		
	Person-Trips	% of Total	Transit Share	Person-Trips	% of Total	Transit Share
DC Core	24,451	7%	70%	18,757	22%	80%
DC Non-Core	8,931	2%	25%	4,046	5%	45%
Arlington & Falls Church	74,256	21%	14%	17,439	21%	38%
Alexandria	49,842	14%	16%	10,980	13%	46%
Fairfax East	27,366	8%	2%	4,466	5%	11%
Fairfax West	16,060	4%	1%	2,349	3%	6%
Within the Corridor	111,698	31%	2%	10,352	12%	18%
Other Areas	46,556	13%	7%	15,048	18%	20%
Total	**359,161**	**100%**	**12% (44,303)**	**83,437**	**100%**	**41% (33,975)**

Source: MWCOG version 2.3.52 model runs

High Demand for Corridor Work Trips by Transit

Transit service in the study area serves important regional markets via Metrorail at the Van Dorn and Pentagon stations and by bus from the Landmark, Mark Center and Shirlington Transit Centers. The study area also has a higher share of transit-dependent[3] populations compared to the region as shown in **Table 5**.

Of the 360,000 trips generated daily in the study area, approximately 83,000 are work trips. Due to the high presence of transit-dependent populations, 41 percent of all work trips in the corridor are made on transit. Relatively few of the work trips remain in the study area (12 percent), while the majority of the remaining commute trips are destined for areas such as the D.C. Core (22 percent) and Arlington/Falls Church (21 percent).

Table 5: Transit-Dependent Populations

Transit Dependency Indicator	¼ Mile Study Area (Van Dorn to Shirlington)	½ Mile Study Area (Van Dorn to Shirlington)	City of Alexandria	Arlington County	Fairfax County
Zero-Car Households (Percent of Total Households)	1,848 (10.0%)	3,295 (9.0%)	6,241 (9.6%)	10,726 (11.5%)	15,962 (4.1%)
Population Under 18 or Over 65 (Percent of Total Population)	9,804 (24.1%)	19,203 (24.5%)	37,079 (26.4%)	51,299 (24.5%)	369,626 (34.1%)
Population Below Poverty Level (Percent of population for whom poverty status is determined*)	3,813 (9.5%)	7,689 (9.9%)	11,102 (8.0%)	14,935 (7.2%)	59,822 (5.6%)

Source: U.S. Census Bureau, American Community Survey 5-Year Estimates (2008-2012)
**The population for whom poverty is determined is determined by the U.S. Census Bureau. For the ACS 5-Year Estimates (2008-2012), poverty status was determined for all people except for unrelated individuals under 15 years old, and people in institutional group quarters, college dormitories, military barracks, and living situations without conventional housing.*

Latent Demand for Corridor Transit Trips

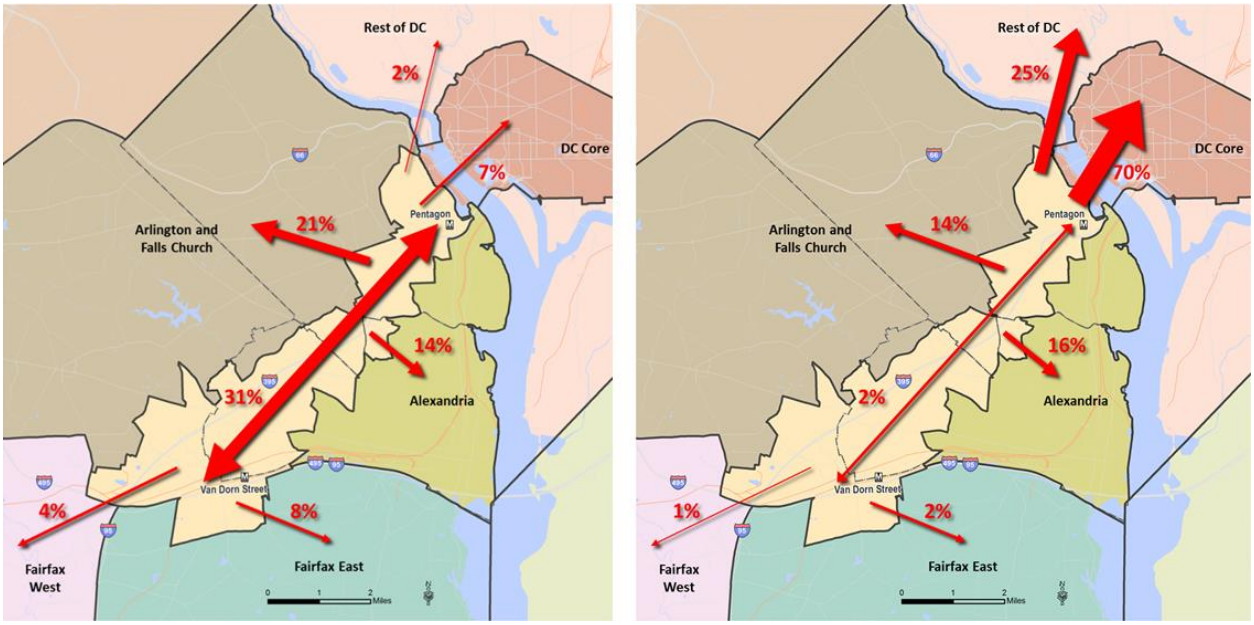
While the demand for work trips in the corridor is high, transit is underutilized for other trip purposes. While over 31 percent of all 360,000 daily trips generated in the corridor stay within the corridor, only 2.4 percent of these use transit (**Figure 4**). On a daily basis, trips from the study are primarily shorter trips: within the study corridor (31 percent), to Arlington/Falls Church (21 percent), and to Alexandria (14 percent).

This low transit usage for trips made within the corridor may be attributable to bus service that is not high-capacity, fast or frequent. Further, existing transit service within the study corridor is fragmented as shown in **Figure 5**.

These current travel patterns within and through the corridor show that there is a need for higher-capacity and higher-speed service that carries the demand for travel within the study corridor.

[3] A "transit-dependent" person is someone who does not have access to a personal automobile and relies on public transit. For this analysis, transit-dependent population percentages were identified using 2008-2012 American Community Survey 5-Year Estimates for: (1) populations without private transportation (zero-car households), (2) populations under age 18 or over age 65, and (3) low-income populations (population below the federally designated poverty level by family size; in 2012, the poverty threshold for a family of four was $23,492).

Figure 4: Comparison of All Trips Originating in the Study Area (left) versus Transit Share of All Trips Originating in the Study Area (right)



High Ridership on Existing Routes

Despite existing services having long headways, especially in the off-peak and reverse as shown in **Table 6**, with limited spans of service and the general lack of transit amenities including shelters at most bus stops, transit boardings at bus stops along the corridor are high. **Table 7** shows the highest daily boardings at bus-stops along the corridor. As a comparison, according to WMATA, the highest daily boardings at bus stops in Virginia in April-May 2014 were at the Metrorail stations. WMATA's daily boardings at all the bays at the Pentagon Transit Center were 7,057; Ballston Metrorail station busbays were 3,246; Rosslyn Metrorail station busbays were 1,843; King Street Metrorail station busbays were 1,410; and Braddock Road Metrorail Station busbays were 663.

Table 6: Weekday Frequencies of Key Bus Routes

Route	Description	Weekday Frequency (in minutes)			Average Weekday Ridership
		Peak Direction	Peak Reverse Direction	Midday/ Off Peak	
Alexandria Transit Company (DASH)					
AT1	Eisenhower/Van Dorn Metro - Seminary Plaza	30	30	30	1,755
AT2	Lincolnia - Braddock Metro	30	30	30	1,902
AT2X	Mark Center - Braddock Metro	20	20	n/a	270
AT5	Landmark Mall/Van Dorn Metro-Braddock Metro	20	30	30	1,835
AT8	Van Dorn Metro/Landmark Mall-King St-Old Town Metro/Old Town	20	20	60	3,201

Route	Description	Weekday Frequency (in minutes)			Average Weekday Ridership
		Peak Direction	Peak Reverse Direction	Midday/ Off Peak	
Washington Metropolitan Area Transit Authority (Metrobus)					
7A,F,Y	Lincolnia-North Fairlington Line	7.5	7.5	20	3,553
7B,C,H,P, W,X	Lincolnia-Park Center-Pentagon Line	5	20	n/a	1,636
7M	Mark Center-Pentagon Line	10	15	15	1,907
8S,W,Z	Foxchase-Seminary Valley Line	5	20	n/a	1,244
25A,C,D,E	Ballston-Bradlee-Pentagon Line	10-15	10-15	60	1,502
25B	Landmark-Ballston Line	30	30	60	1,388

Source: WMATA. DASH

Table 7: Highest Daily Boardings at Bus Stops in the Study Corridor

Rank	Bus Stop Name/Location	Daily Boardings*
1	Mark Center Station (All Bays)	1,025
2	Southern Towers - Berkeley Building	357
3	Southern Towers - Sherwood Building	550
4	Southern Towers - Stratford Building	274
5	Van Dorn Metro Station (All Bays)	720
6	North Beauregard Street and Sanger Avenue	266
7	Landmark Mall	497
8	Northern Virginia Community College	236
9	North Beauregard Street and Morgan Street	97
10	Edsall Road and South Whiting Street	97

Source: WMATA, DASH (2013 - 2014 data)

Existing Bus Network Not Reflective of Travel Patterns

The WMATA Operations Plan for Metrobus in Bus Rapid Transit/Light Rail Transit/Streetcar Corridors (December 2013) found that “there is no current bus route operated either by WMATA or Alexandria’s DASH service that serves the entire [Van Dorn/Beauregard] corridor”. This current transit service in the corridor does not correspond with current and future travel patterns that would connect key activity centers along the Van Dorn/Beauregard corridor. As shown in **Figure 5**, there is good network coverage, providing access for a broad section of the study area, but the service headways are relatively infrequent and the route structure is not clear or easy to understand. The variety of service providers and destinations in the corridor contributes to this difficulty for new transit users or those who would choose transit as a regular mode of travel. Current and anticipated travel patterns indicate a strong directionality for travel along this corridor, and there is an opportunity to develop a “trunk” line with frequent feeder service that could dramatically increase transit mode share.

Figure 5: Existing Transit System in the Study Corridor

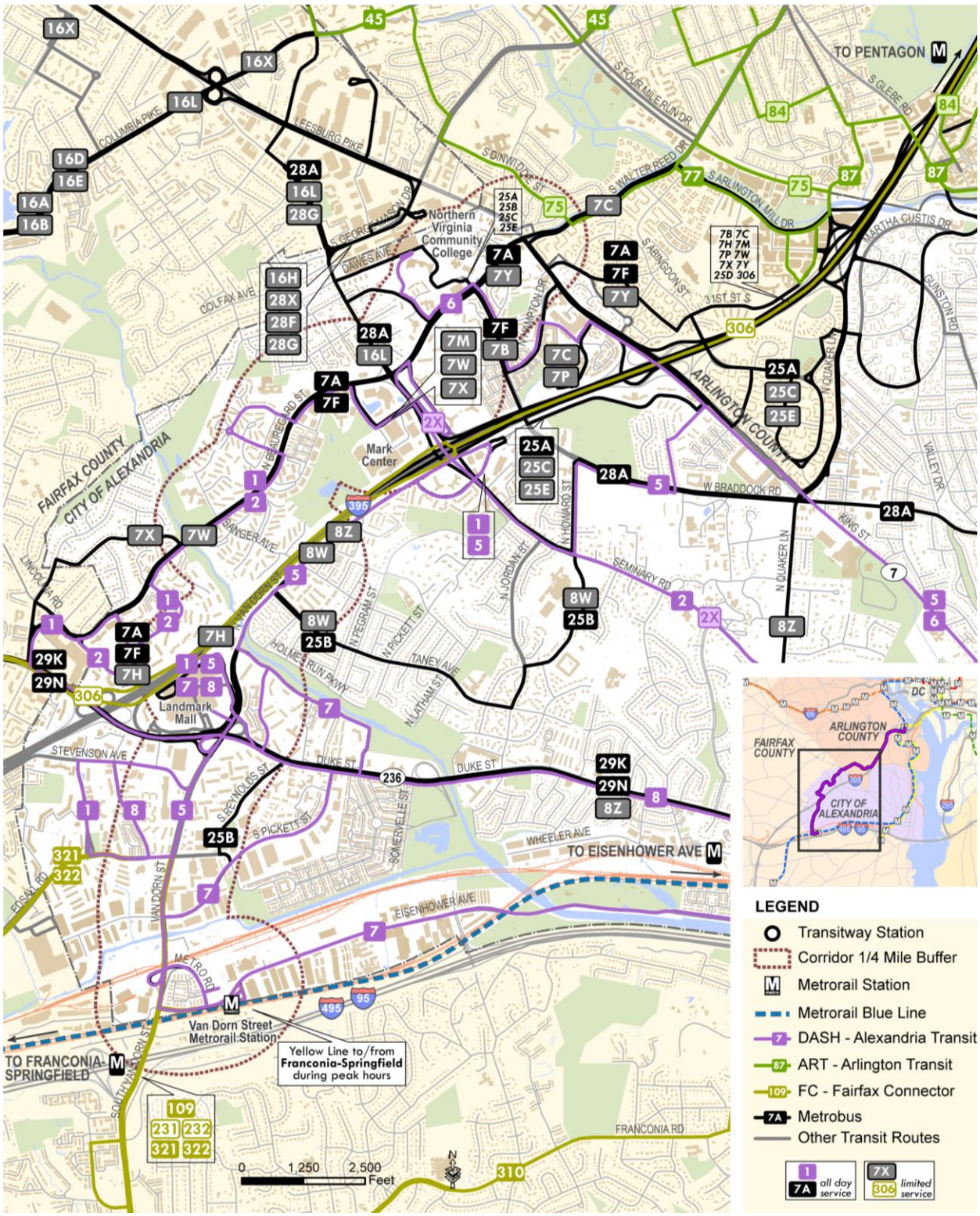
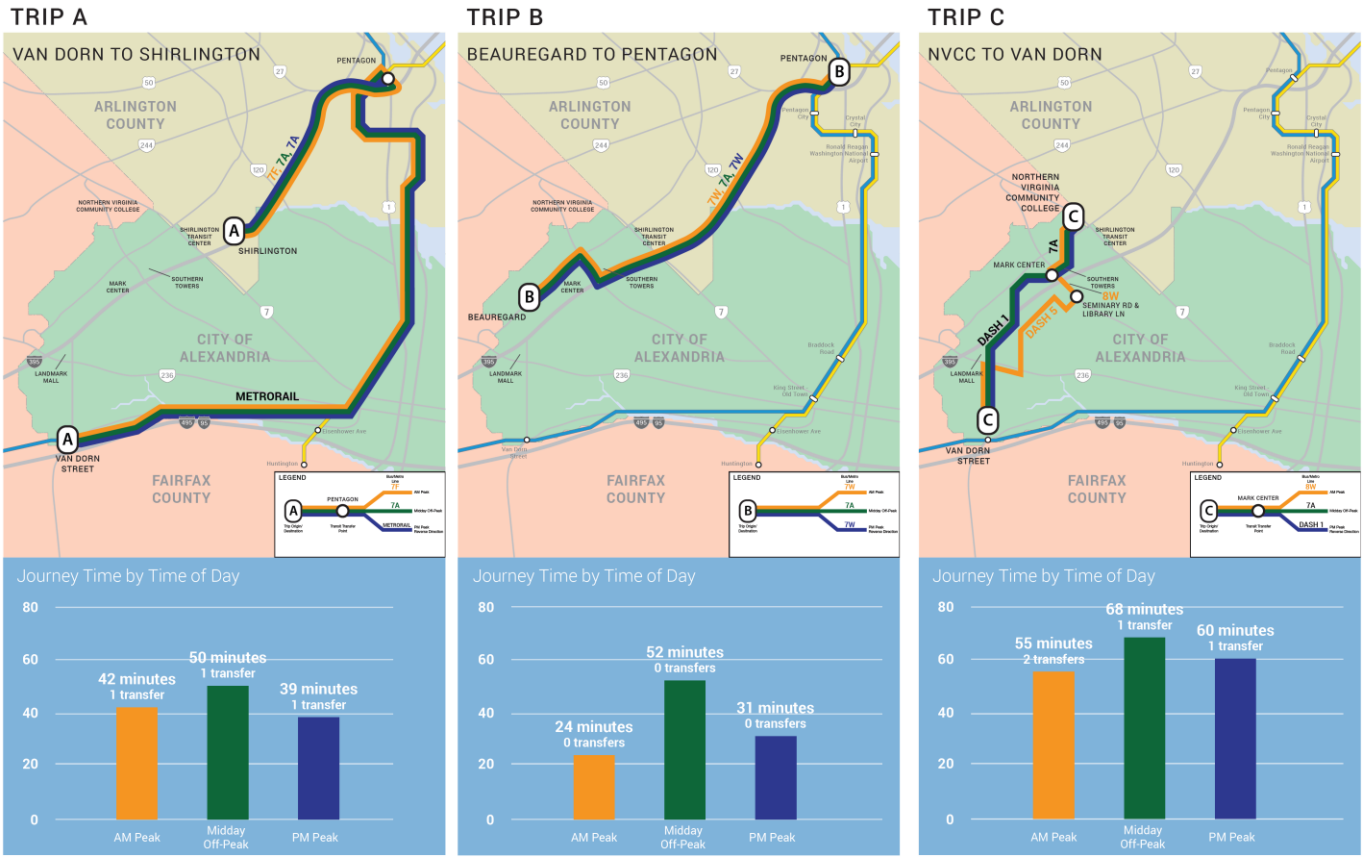


Figure 6 further illustrates the variation in estimated journey time for three sets of example origins and destinations along the corridor using WMATA Trip Planner. The WMATA Trip Planner also shows DASH routes. The exercise used the following assumptions:

- The riders for all the routes lived within 0.15 miles of the bus stop;
- The riders started from their origins at 8:00 a.m., 1:00 p.m., and 5:30 p.m.; and
- Journey time included time waiting for the bus from the start of the trip and time spent in transit.

All three routes showed significant variation in journey time between the a.m. and p.m. peak trips and the midday/off-peak trip, especially between Beauregard Street and the Pentagon.

Figure 6: Current Transit Service- Example Origins and Destinations



Pentagon Feeder Market

The Pentagon Metrorail station is an important access point to the Metrorail system and regional employment and activity centers for the study area. The Pentagon Metrorail station is the first station for 27,500 Metrorail trips generated in the region in the peak period; 42 percent of these trips originate in the study area. Bus is the primary mode (84 percent) for accessing the Pentagon Metrorail station. Almost half (48 percent) of the riders who reach Pentagon station by bus arrive from the study area.

Inadequate Pedestrian and Bicycle Infrastructure

The study corridor generally has a complete network of sidewalks; however, many are narrow, immediately adjacent to vehicular travel lanes, and in poor condition. Bicycle facilities in most of the corridor are limited and not well-connected to one another or important destinations.

Refer to **Appendix D** *for a detailed description of existing transit service in the study corridor.*

3. PROJECT PURPOSE

3.1. Summary of Needs

The combined effect of issues related to land use and economic development, traffic congestion, and transit service as identified in **Section 2** creates a need for improved transportation alternatives and connections in the Van Dorn/Beauregard corridor. High-quality and high-capacity transit options will be necessary to plan for future population and employment growth, existing and future travel demand and congestion relief along the Van Dorn/Beauregard corridor. **Table 8** summarizes the needs along the Van Dorn/Beauregard corridor.

Table 8: Corridor Needs

	Corridor Needs
Land Use and Economic Development	• Plan for future land use changes envisioned by the Landmark/Van Dorn Corridor Plan and the Beauregard Small Area Plan; and • Accommodate the mobility needs of new residents and employees in the area to create a supportive environment for continued economic development and maintain the area's competitiveness in the region.
Traffic Congestion	• Increase modal choice by providing a fast, reliable and efficient transit system as an attractive alternative to driving; • Provide peak hour congestion relief by reducing private vehicular traffic on the corridor; and • Reduce effects of congestion including delays and reduced reliability for transit services.
Transit Service	• Provide improved transit capacity and frequency to support existing and future travel demand, and the study area's transit-reliant population; • Enhance regional access by providing better connectivity between activity centers within the study corridor and the Van Dorn and Pentagon Metrorail stations, and support the feeder market to the Pentagon; and • Enhance pedestrian and bicycle access between adjacent neighborhoods and the transit corridor.

3.2. Project Purpose Statement

The West End Transitway project will improve transit access and mobility by providing a reliable, higher-capacity transit "trunk line" through the corridor. By responding to the City's proposed land use changes, and by coordinating with existing and future regional transit network connections, the project intends to prompt a mode shift to transit in order to curtail traffic congestion. The result will be a corridor transportation system that serves the mobility needs of a growing population and serves as a catalyst for continued economic development.

3.3. Next Steps

Evaluation measures for the project will be developed based on the purpose statement and project needs. Because the City intends to pursue federal funding, the FTA New Starts/Small Starts project justification criteria of mobility improvements, economic development effects, environmental benefits, cost effectiveness, land use, and congestion relief will be used as a primary input in developing the evaluation measures. The alternatives will be evaluated based on the evaluation measures and in connection with environmental documentation. The combined AA/EA document will summarize the findings and recommendations of this effort.

Appendix A: Summary of FTA Project Development Process

With the recent Transitway Corridors Feasibility Study (October 2012), the City of Alexandria completed a critical first step in evaluating and configuring the Van Dorn/Beauregard corridor as a priority corridor for investment in high-capacity, high-quality transit. The City intends to advance the planning process and maintain the project's eligibility for federal funding.

Through the current AA and EA, it is anticipated that the project will advance to the point where it may be approved to enter the FTA Project Development phase. Under the recent MAP-21 federal guidance, Project Development is the first official step for a project seeking New Starts/Small Starts funding from the FTA Capital Investment Program. Given the estimated project cost, the West End Transitway would likely be implemented through Small Starts funding. **Figures A-1** and **A-2** below illustrate the Project Development step and its relationship in time with the other elements of a typical project implementation schedule.

Figure A-1: Context for Project Development, West End Transitway

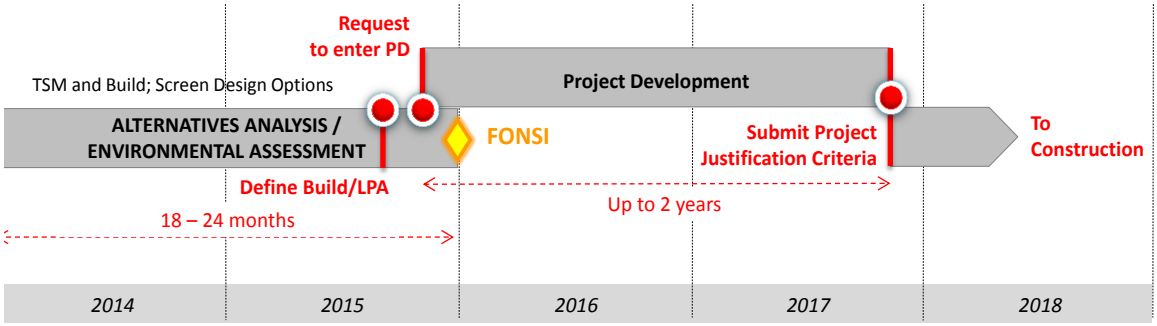
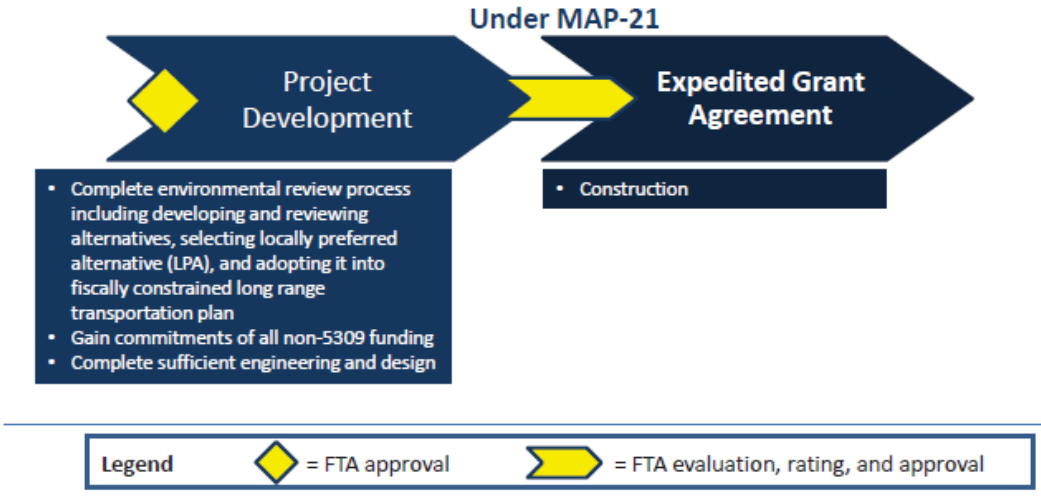


Figure A-2: FTA Small Starts Project Development Process



As the current AA and EA work proceeds, the City of Alexandria will likely request approval to enter Project Development. Pending formal rule-making, FTA has released interim guidance on the requirements to enter Project Development. Whereas under the previous transportation bill, a project was rated and evaluated at this stage, MAP-21 requires[1] a simpler package of material, including:

- Problem description or a statement of purpose and need;
- Project description, along with alternatives being considered;
- Project sponsor description;
- Identification of a cost estimate;
- Identification of whether the project would be a New Starts, Small Starts, or Core Capacity project;
- Identification and documentation of funding to conduct Project Development work;
- If the project is a New Starts or Core Capacity project, an anticipated timeline for completing the project development work within 2 years including:
    - compliance with NEPA and related environmental laws;
    - selection of a locally preferred alternative; adoption of the locally preferred alternative in the fiscally constrained long range transportation plan;
    - completion of the activities required to obtain a project rating under the evaluation criteria outlined in the law; and
    - completion of the readiness requirements for entry into Engineering

As the current study advances, City staff will anticipate the next steps in the process. The FTA Capital Investment Program is highly competitive, with many projects seeking grant funding within constrained congressional budgets. It would benefit the West End Transitway project to seek approval into Project Development as soon as practicable given the current level of conceptual design and the initiation of the AA and EA.

[1] *FTA Capital Investment Program FAQs: http://www.fta.dot.gov/12304_15522.html#what-should*

Appendix B: Prior Studies

Relevant Project Commitments as part of CLRP

The National Capital Region's Financially Constrained Long-Range Transportation Plan (CLRP) identifies all regionally significant transportation projects and programs that are planned for the Washington metropolitan area between 2013 and 2040. The projects and programs that go into the CLRP are developed cooperatively by governmental bodies and agencies represented on the National Capital Region Transportation Planning Board (TPB). The study corridor is included in the CLRP as transit project 18: BRT from Van Dorn Metrorail station to Pentagon Metrorail station (CLRP ID 3094). The anticipated year for implementation is 2016.

Other transit projects relevant to the study area that will be included in the analysis of the No Build Alternative for the West End Transitway are shown in **Table D-1**:

Table D-1: Transit Projects in the Study Area

Project Name	Project Description	CLRP ID
Columbia Pike	Joint project between Fairfax and Arlington Counties along Columbia Pike to bring a streetcar to this heavily used 4.7-mile transit corridor between Pentagon City in Arlington and Skyline in Fairfax County. The streetcar was selected by the Board of each county in 2006 as the Locally Preferred Alternative to provide enhanced transit and promote revitalization and redevelopment of this corridor. For most of its length, the streetcar will run in mixed traffic.	2591
Route 7	In-depth assessment of the transit needs of the Route 7 Corridor from Tysons Corner to Alexandria.	Not in CLRP
Corridor A (US 1)	Currently under construction, the entire project will include buses in dedicated lanes with service from the Braddock Road Metrorail station to Pentagon City. In Alexandria, Section A of project, between the Braddock Road Metro Station and Monroe Avenue, will operate in mixed traffic; Section B, between Monroe Avenue and East Glebe Road with transitions at each end, will construct a bus way in the median of Route 1; Section C, from East Glebe Road to Four Mile Run, will be constructed by the private developer building the new North Potomac Yard mixed used development.	2929
Corridor B (Duke Street)	BRT service featuring limited stops, and possibly some dedicated transit lanes from the King Street Metrorail Station to Landmark primarily using Duke Street. This service may eventually be extended to Fairfax County and the City of Fairfax.	2932

Ongoing Related Studies

The City of Alexandria and regional planning agencies have completed several studies in the corridor that combine land use and transportation planning elements and recommendations. These studies have important implications for the corridor. In some cases they have resulted in specific near-term recommendations and commitments related to the Transitway plan; in other cases they point to long-term needs and infrastructure requirements.

The following sections summarize the previous and ongoing studies listed in **Table D-2**:

Table D-2: List of Ongoing Related Studies

Type of Study	Study Name	Date of Completion
Land Use Studies	Landmark/Van Dorn Corridor Plan	June 2009
	Beauregard Small Area Plan	June 2012
	Eisenhower West Small Area Plan	Ongoing
Transportation Studies	City of Alexandria Comprehensive Transportation Master Plan	Prepared 2008, Amended January 2013
	Transportation Management Plan for BRAC-133 at Mark Center	October 2010
	Alexandria Transitway Corridors Feasibility Study	October 2012
	WMATA Operations Guidelines for Metrobus in BRT, LRT and Streetcar Corridors	December 2013
	MWCOG's Regional Transportation Priorities Plan for the National Capital Region	January 2014
	Fairfax County Transit Network Study	Ongoing
	WMATA Priority Corridors Network Study	Ongoing
	DASH Comprehensive Operations Analysis	Ongoing

LANDMARK/VAN DORN CORRIDOR PLAN (June 2009)

Study Purpose and Goals

This plan expresses a vision for the transformation of the Landmark/Van Dorn corridor into a lively, walkable, urban mixed-use community with two distinctive mixed-use activity centers. The vision includes tree-lined transit boulevards and a new network of local streets.

Travel Patterns

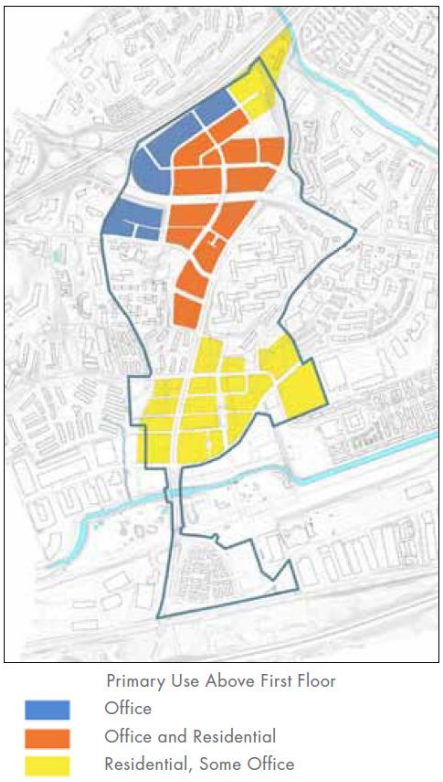
The plan identifies the following in terms of study corridor travel patterns:

- Van Dorn Street is an alternate to I-395 and US 1 during peak periods and congestion;
- The corridor has higher-than average transit use (18.2 percent of residents in the area – 2000 census); and
- Regional connections are provided via Duke Street, I-495, I-395, Van Dorn Street Metrorail station.

Land Use Patterns

Existing	Future
• Approximately 5 million square feet of development • Large, single-use land parcels and extensive surface parking facilities • Primary uses - multifamily residential, Landmark Mall, industrial businesses, service uses, and strip commercial	• Approximately 11-14 million square feet of development • Significant population and employment growth • Compact mixed-use redevelopment • Protection and enhancement of existing residential communities

Conceptual Land Use Plan for the Redevelopment Area



Transportation Deficiencies

- Congestion on major travel routes;
- Automobile-oriented development and lack of interconnected network of streets;
- Insufficient transit service and amenities at stops/stations; and
- Incomplete pedestrian and bicycle networks.

Relevant Recommendations

Land Use	Pedestrian and Bicycle
• West End Town Center (Landmark Mall area) - Regional scale with major office, retail, hotel and residential uses. • Pickett Place - Community-level mixed use center with residential and office uses	• Multimodal Bridge between Pickett Place and the Van Dorn Street Metrorail station • Separated bicycle lanes along Van Dorn Street • Cycle track or path along Duke Street
Transit	**New Streets**
• Transit in dedicated right-of-way consistent with the TMP • Transit transfer center in West End Town Center (Landmark Mall area) • Local circulator and express bus service • Future BRT on Multimodal Bridge between Pickett Place and the Van Dorn Metrorail station	• West End Town Center access crossing Duke Street (grade separated) • "New High Street" connecting Landmark Mall redevelopment to the proposed Town Center, potentially accommodating dedicated transit lanes

Financing

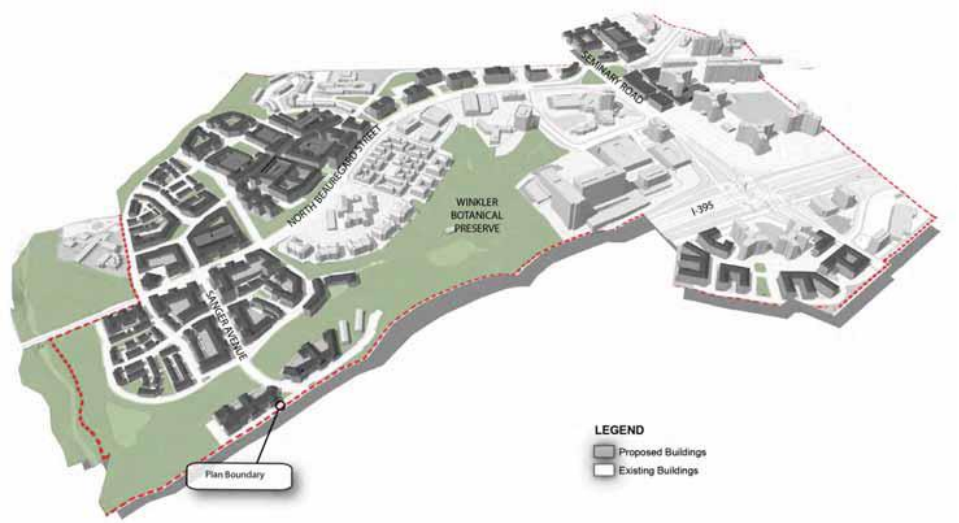
The recommendations of the plan are not financially constrained. The plan identifies a phased approach to implementation which involves developer contributions, the introduction of transit in the corridor, and targeted investment.

- The plan recommends the construction of the dedicated transit lanes at about 25 percent of the increased development.
- The plan recommends the creation of a transportation management district for the area.

BEAUREGARD SMALL AREA PLAN (June 2012)

Study Purpose and Goals

The Plan envisions a series of new urban neighborhoods containing a mix of uses, open spaces, a diversity of housing opportunities, and integrated transit, in a manner that will be compatible with the adjacent neighborhoods.



Travel Patterns

The plan identifies the following in terms of study corridor travel patterns:

- Regional connections exist to I-395 and Arlington County;
- Major activity generators include the Mark Center and Northern Virginia Community College.

Land Use Patterns

Existing	Future
• About 6 million square feet of development • Multiple schools; high density office development in the Mark Center area • Market rate low income housing in parts of the corridor	• About 12.5 million square feet of development • Walkable, mixed-use urban form

Transportation Deficiencies

Existing	Future
• Congestion along major streets • Insufficient transit service and amenities at stations/stops (except the Mark Center Transit Center) • Lack of connected street grid and pedestrian/bicycle facilities	• All transportation improvements, with the exception of the new parallel road north of Beauregard and realigned Sanger Avenue are anticipated to be needed by 2020 with about 2.4 million more square feet of development.

Relevant Recommendations

Land Use	Pedestrian and Bicycle
• Creation of seven distinct urban neighborhoods including the Beauregard Town Center north of Beauregard Street (total of 12.4 million square feet of development) • Higher-density development around future transit stations	• Off-street bicycle facilities along Beauregard Street, Seminary Road, and Sanger Avenue • On-street bike lane on new roadway, north of and parallel to Beauregard Street
Transit	**New Streets**
• High-capacity bus rapid transit service in dedicated lanes along Beauregard Street and serving Mark Center and Southern Towers/Sanger Avenue • Transit stations at Beauregard Street and Sanger Avenue, Beauregard Street and Rayburn Avenue, Mark Center Transit Center, and Southern Towers • Expanded local and circulator transit service	• Ellipse at Seminary Road and Beauregard Street to improve traffic flow, including new signalized intersections • New street, north of and parallel to Beauregard Street • Connected street grid within Town Center and other communities • Relocated Sanger Avenue

Financing

- The plan recommends and developers have agreed to contribute $153.8 million (2011 dollars) for public improvements to implement the plan.
- For the first 12 years of the plan, real estate tax revenue from the plan area ($81 million) will be also used for the public improvement projects.

EISENHOWER WEST SMALL AREA PLAN (Ongoing)

In May 2013, the Alexandria City Council identified the Eisenhower West Small Area Plan (SAP) as the major planning effort to begin in FY 2014. The small area planning process began in early 2014 and is anticipated to be complete 18 months later in mid-late 2015.

An associated Eisenhower West Transportation Study is anticipated to be complete by Spring 2015. The Transportation Study will serve as the transportation element/analysis of the SAP, which will include the analysis of various land use scenarios to be further explored in the SAP, and will conduct additional analysis of the multi-modal bridge concept that was recommended in the Landmark/Van Dorn Corridor Plan (adopted in 2009) to identify a more specific alignment. The multi-modal would provide a direct connection between the Van Dorn Metrorail station and Pickett Street, and serve future anticipated development.

CITY OF ALEXANDRIA COMPREHENSIVE TRANSPORTATION MASTER PLAN
(Prepared 2008, Amended January 2013)

Study Purpose and Goals

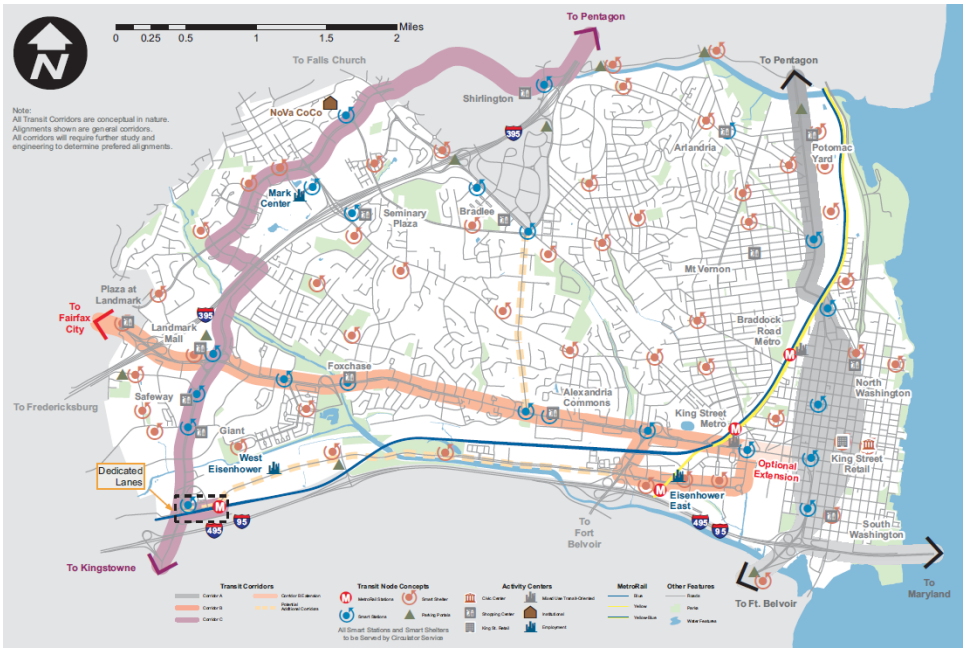
The Transportation Master Plan (TMP) outlines the future of Alexandria's transportation system. The goal of the TMP is to successfully integrate biking, walking, and transit together, providing connectivity and accessibility to all of Alexandria's recreational, cultural, and economic assets, as well as the assets of the greater Northern Virginia region. The plan's transit concept goal is to ensure that people can travel into, within and out of Alexandria by providing a mass transit system that combines different modes of travel into a seamless, comprehensive and coordinated effort.

Relevant Recommendations

The TMP designates three primary transit corridors in the City:

- Corridor A in the vicinity of Route 1;
- Corridor B in the general vicinity of Duke Street; and
- Corridor C in proximity to Van Dorn/Beauregard, connecting Kingstowne and points south with the Pentagon. The designation of Corridor C was the beginning of the process which has led to this Alternatives Analysis.

City of Alexandria Transit Concept



The original TMP recommended a feasibility study for the three corridors. The *Transitway Corridors Feasibility Study,* completed in 2012, provided updated recommendations for each transit corridor, which were amended into the TMP in January 2013.

Financing

The TMP outlines the process for implementation of transit lines. The TMP identifies the possibility of receiving FTA funds, in addition to other federal and state funding for the transit process but does not specifically identify a preferred method for the Van Dorn/Beauregard corridor.

TRANSPORTATION MANAGEMENT PLAN FOR BRAC-133 AT MARK CENTER (October 2010)

Study Purpose and Goals

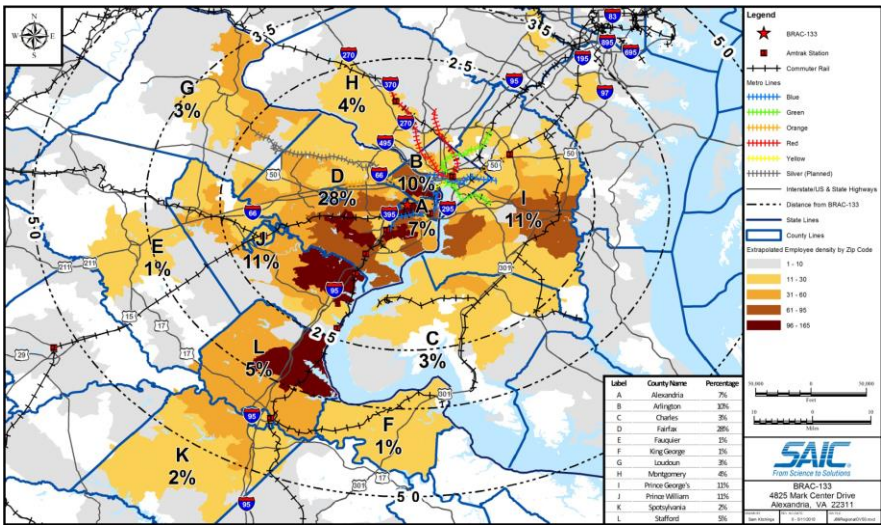
Recommendation No. 133 of the Department of Defense's Base Realignment and Closure (BRAC) Commission called for relocation and consolidation of various defense agency personnel and activities from space within the National Capital Region to Fort Belvoir. A portion of this relocation was established in the Mark Center development in Alexandria and the site named BRAC-133. The goals of the Transportation Management Plan for the BRAC 133 site were:

- To achieve 40 percent or more non- single occupancy vehicles (SOV) person - trips to the site to minimize traffic impacts on the neighboring community.
- To facilitate tenant mobility to the site by providing a viable transportation program to help employees choose appropriate commute methods for getting to Mark Center.

Travel Patterns

- Majority of the 6,400 employees (71 percent) commute from within Virginia.
- 45 percent of the Mark Center's employees commute from Fairfax County (28 percent); Arlington County (11 percent) and Alexandria (7 percent).
- Nearly one-third of employees ride Metrorail; 9 percent using Metrorail as their primary mode and 21 percent use Metrorail along with other modes.
- Over one-fifth of employees utilize bus transit; 5 percent using bus transit as their primary mode and16 percent using bus transit along with other modes.

BRAC-133 Employee Population Densities



Relevant Recommendations

- A publicly-accessible Transit Center with five bus-bays was designed as part of the site planning for BRAC-133.
- A key component of the TMP's demand management strategies is a shuttle program that connects the Transit Center to five key Metrorail stations: Pentagon, King Street, Ballston, West Falls Church, and Franconia - Springfield Metrorail stations.

ALEXANDRIA TRANSITWAY CORRIDORS FEASIBILITY STUDY (October 2012)

Study Purpose and Goals

The purpose of this study was to advance the Alexandria TMP's planning and general policy ideas on high-capacity transit in Corridor A (North-South, US 1), Corridor B (Duke Street), and Corridor C (Van Dorn/Beauregard). The transitway study evaluated whether high-capacity transit would be appropriate on each corridor; if found to be feasible, the corridor's alignment was refined, a transit mode technology recommendation was made, and cost and implementation implications identified. This summary focuses on the portion of the study pertaining to Corridor C.

Travel Patterns

- Major existing travel destinations along the corridor include Northern Virginia Community College, Landmark Mall, Shirlington, Beauregard Town Center, the Mark Center area, Southern Towers, and the Van Dorn Metrorail station
- The corridor has regional connections to the Pentagon, Pentagon City, and Crystal City and Washington, D.C. via I-395 and Metrorail Blue and Yellow lines, and Tysons Corner via the Capital Beltway (I-495) and I-395.

Land Use

- Generally suburban in character with strip commercial, mid-rise office buildings, shopping center/mall, and residential buildings set-back from public right of way.
- Residential uses vary widely –townhomes, multifamily garden-style apartments, and large mid-rise apartment/condominium buildings.
- Environmental features include Holmes Run, Backlick Run, and Lucky Run.

Transportation Deficiencies

- Peak period congestion on Van Dorn Street, Sanger Avenue, Seminary Road and Beauregard Street in the Mark Center vicinity.
- Limited transit service within the corridor.
- Inadequate sidewalks and limited bicycle facilities in the corridor.

Transitway Alternatives Considered

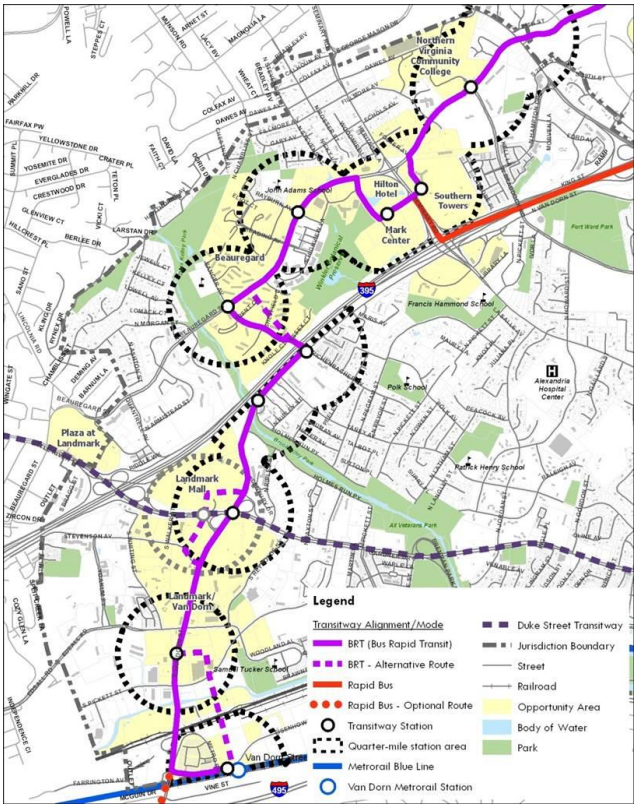
- Northern termini at Pentagon, Pentagon City, Columbia Pike, and Shirlington; southern termini at Van Dorn Metrorail station and Kingstowne in Fairfax County.
- Transit mode technology evaluated included streetcar, BRT, rapid bus, and standard bus.
- Runningway configuration studied mixed flow, partially dedicated and principally dedicated (median, center, and curb/side-running).
- Station spacing evaluated were ¼ mile, $^1/_3$ mile, and ½ mile or more.

Evaluation of Alternatives

A preliminary screening evaluated seven alternatives. The second screening analyzed three build alternatives and a baseline condition. Screening criteria, developed based on FTA standards, were analyzed qualitatively and quantitatively. The Project Advisory Committee, also known as the Corridor Work Group selected BRT operating in a median-running transit-exclusive guideway as the preferred alternative. The Work Group included the condition that the corridor should be considered for an upgrade to streetcar in the future, if feasible.

Relevant Recommendations

Alternative D. BRT operating along a mostly transit-exclusive guideway connecting to the Pentagon and Shirlington.



- Median-running dedicated transitway on Van Dorn Street between Eisenhower Avenue and Stevenson Avenue
- Mixed flow operation on Stevenson Avenue and in the short-term, through Landmark Mall
- Curb-running dedicated lane operation on Van Dorn Street between Landmark Mall and Sanger Avenue
- Median-running dedicated transitway on relocated Sanger Avenue between Van Dorn Street and Beauregard Street (initially mixed-flow on existing Sanger Avenue)
- Median-running dedicated transitway on Beauregard Street between Sanger Avenue and Mark Center Drive
- Mixed flow operation on Mark Center Drive
- Dedicated lane operation through Southern Towers
- Mixed flow operation on Beauregard Street from Southern Towers to Route 7
- Real-time service information, station infrastructure, transit signal priority, level boarding, and other features

Financing

The study outlined potential funding sources for the transitway. Likely funding sources include:

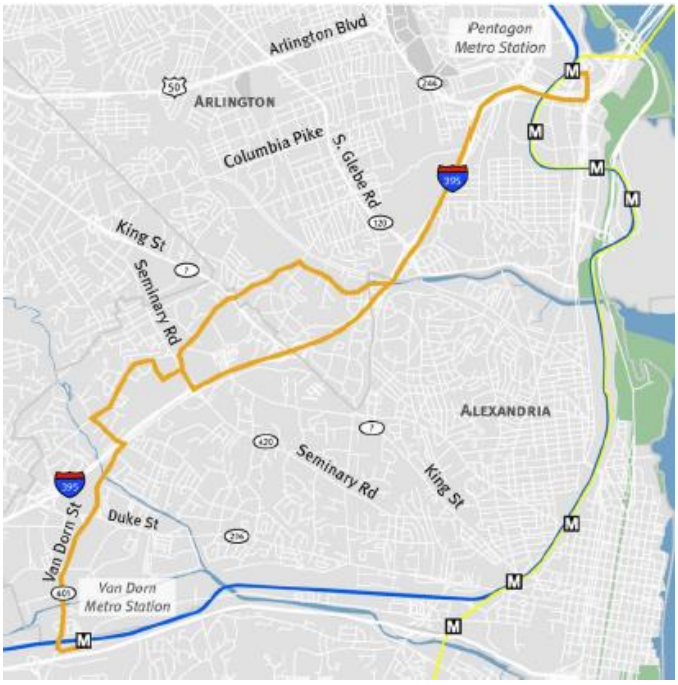
- Federal: Section 5309 New Starts, Small Starts, Discretionary Bus and Fixed Guideway Modernization Programs; Section 5307 Urbanized Area Formula Grant Program; FTA Section 5308 Clean Fuels; FHWA Congestion, Mitigation, and Air Quality (CMAQ) Program
- State, Regional, Local Funds: Tax revenues; Tax increment financing; Developer agreements/proffers; Farebox revenue; and Northern Virginia Transportation Authority funds

WMATA OPERATIONS GUIDELINES FOR METROBUS IN BRT, LRT, AND STREETCAR CORRIDORS (December 2013)

Study Purpose and Goals

This study addressed the best way to coordinate new service modes with WMATA's existing bus transit system (i.e., Metrobus) to optimize rider mobility and system efficiency. It is intended to be a toolbox for planners, guiding them through the decision making process as they plot the service profiles for new projects.

The study chose one representative corridor for each mode. The Van Dorn/Beauregard corridor was chosen for BRT service. This summary focuses on this corridor.



Services Evaluated

- Metrobus - Route 25B and 7 series
- DASH - AT1, AT2, AT5, AT8

Relevant Recommendations

- Runningways
  - Curb bus lane transitways can be used by all buses
  - Median runningways cannot be used by local bus services
- Schedule Coordination
  - Based on characteristics of the individual runningway and services
  - Timetable based schedules – BRT services should be scheduled to fill in gaps between Metrobus series 7 services
- Fare Media and Collection Coordination
  - Use and provide incentives for SmarTrip usage and next generation contactless fare technology
  - Off-board fare collection at BRT stations that Metrobus and BRT services share
  - On-board fare collection at local only stops

Financing

- Potential Cost Savings
  - Eliminate Metrobus Route 7C
  - Reduce frequency of Metrobus Route 7W
  - Running time savings from BRT treatments
  - Use savings to increase service on Metrobus Route 25B

MWCOG'S REGIONAL TRANSPORTATION PRIORITIES PLAN FOR THE NATIONAL CAPITAL REGION (January 2014)

Study Purpose and Goals

MWCOG's *Regional Transportation Priorities Plan* (RTPP) identified strategies with the greatest potential to meet the region's most significant transportation challenges. The RTPP is intended to be a policy guide for state, regional, and local leaders when considering regional needs and identifying transportation improvements to advance to implementation, specifically into the CLRP.

Land Use Pattern Findings

Regional land use-related challenges identified in the RTPP are as follows:

- Limited development around many Metrorail stations
- Lack of coordination between housing and job location
- Threatened environmental quality
- Inadequate open space

Transportation Deficiencies

The following are regional transportation challenges were identified in the RTPP:

- Roadway congestion and bottlenecks
- Transit crowding
- Inadequate bus service
- Metrorail repair needs
- Roadway repair needs
- Pedestrian and bicyclist safety
- Travel time reliability

Relevant Recommendations

The following recommended strategies are relevant to the West End Transitway Plan:

Near Term (1 to 5 years)	Ongoing (requires continuing attention and investment)	Long Term (10 to 30 years)
• Improve access to transit stops and stations • Promote commute alternatives Expand pedestrian and bicycle infrastructure	• Apply priority bus treatment • Ensure accessibility for persons with disabilities, low incomes, and limited English proficiency	• Provide enhanced circulation within activity centers • Implement BRT systems, particularly in places that are unlikely to be serviced by rail, and other cost-effective transit alternatives

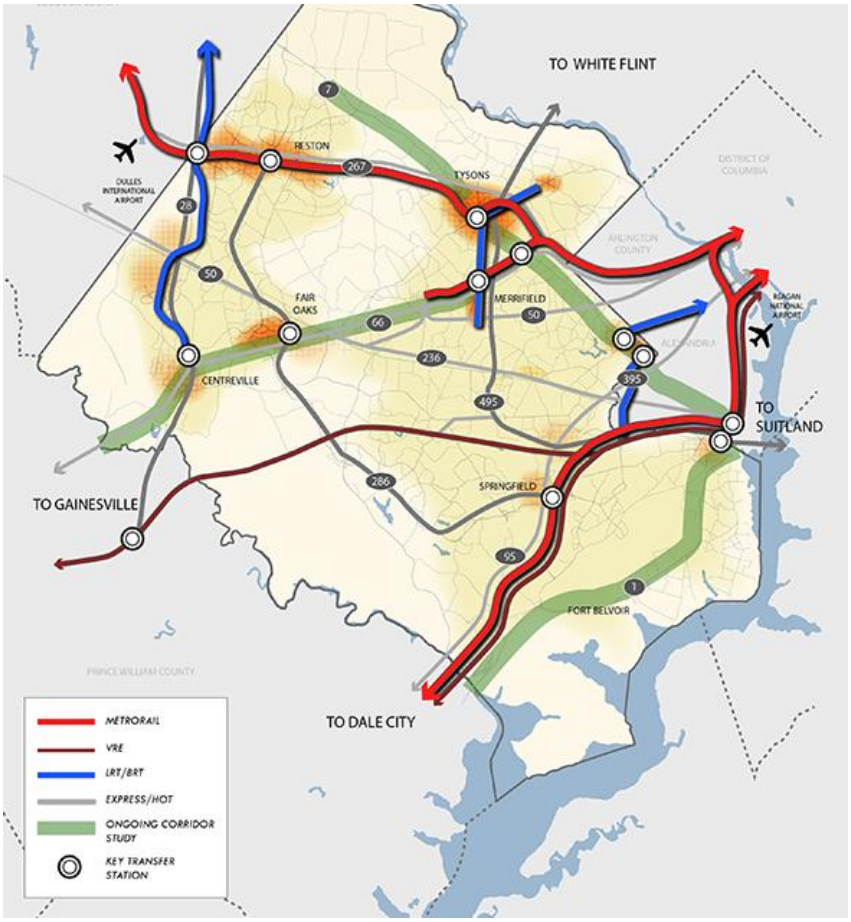
FAIRFAX COUNTY TRANSIT NETWORK STUDY (Ongoing)

Study Purpose and Goals

The Fairfax County Department of Transportation (FCDOT) is conducting the Countywide Transit Network Study to determine the type of transit systems needed to accommodate desired economic growth and mobility throughout the county over the next several decades. The study will develop recommendations for Metrorail extensions, streetcar and light rail transit, bus rapid transit, and rapid bus. The study also will include a phasing plan.

Relevant Recommendations

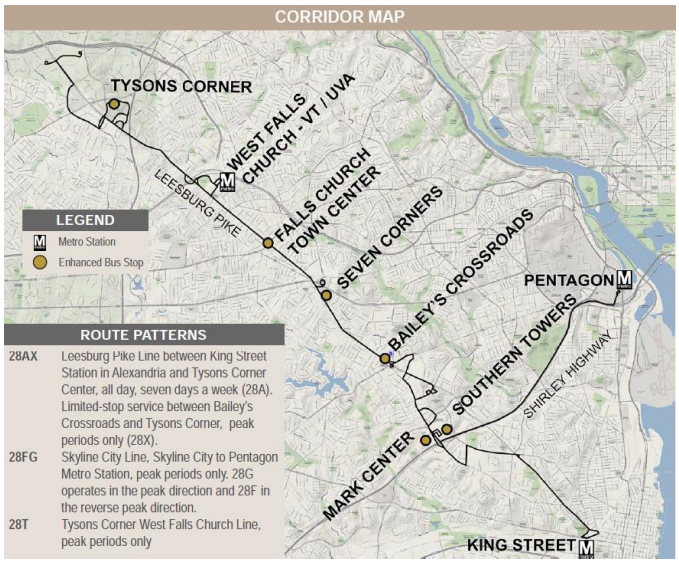
- The study recognizes the Van Dorn/Beauregard corridor as a critical regional transit initiative. Additional project recommendations that are geographically related to the corridor include:
  - Metrorail Blue Line extension to Potomac Mills shopping center
  - High-capacity transit on US 1 (mode undefined – Virginia Department of Rail and Public Transportation study is ongoing)
  - High-capacity transit on Route 7 (mode undefined – Northern Virginia Transportation Commission study is ongoing)
  - Express bus service on Route 236 (Duke Street/Little River Turnpike)
  - Express bus service on I-395 (Duke Street/Little River Turnpike)



WMATA PRIORITY CORRIDORS NETWORK STUDY (Ongoing)

Study Purpose and Goals

The Metrobus Priority Corridor Network (PCN) is a strategy for improving bus service in the Washington region quickly and efficiently. It will provide a flexible plan that can be implemented in stages with immediate payoff. The PCN will improve bus service travel times, reliability, capacity, productivity and system access. The plan includes 24 corridors across the region and will impact half of all bus riders in the current Metrobus system. All bus services along these corridors will be made faster and more comfortable through the implementation of improvements to runningways, amenities, technology, buses, branding, and storage/maintenance facilities.



This summary focuses on two of the corridors that are geographically related to the West End Transitway corridor—Route 7 (Leesburg Pike) and Route 236 (Little River Turnpike/Duke Street).

Transit Use

- Little River Turnpike/Duke Street Corridor (Metrobus 29 Series)
  - Existing weekday boardings (2013): 3,300
  - City of Fairfax to Old Town Alexandria
- Leesburg Pike Corridor (Metrobus 28 Series)
  - Average weekday boardings (2010): 5,300

Alternatives Considered

- Little River Turnpike/Duke Street Corridor (Metrobus 29 Series)
  - Discontinue service to Landmark Mall for time savings
  - Create limited-stop segment in Alexandria to reduce travel times
  - Implement Metro Extra Service (with stop at Landmark Mall)
  - Restructure local service (to include new routes to Pentagon)

Relevant Recommendations

- Combine 28A and 28B to new Route 28 from Tysons Corner to the King Street Metro via Mark Center and Southern Towers
- Create a new Metro Extra 28X route that travels from Tysons Corner to Southern Towers/Mark Center

DASH Comprehensive Operations Analysis (Ongoing)

The planning process began in January 2013. The study includes an in-depth review of DASH's transit system that will complete a detailed market, service and operational review and will develop short- and long-term recommendations for the existing system with feedback from the community in the planning process.

By collecting and analyzing ridership data on all of its routes, markets and service performance, the COA will develop and update both short- and long-range service and route plans. The intent of the study is to achieve the following:

- Answers to how DASH can best serve existing and potential customers within its financial and operational capacity;
- Enhancement of public mobility while improving system performance and sustainability; and
- A platform for growth that builds advocacy for continued and increased investment in public transit.

Appendix C: Existing Traffic Conditions

Current traffic and pedestrian volumes at Corridor Intersections

Turning movement counts were measured at 46 study area intersections (**Figure B-1**) during the a.m. and p.m. peak periods (6:00 a.m. - 9:00 a.m. and 3:00 p.m. to 6:00 p.m.). Traffic at locations 1 through 7 was counted in September 2012, and at intersections 8 through 37 in March 2014. Key findings from the data collection effort are summarized below and shown in **Table B-1**:

- A number of intersections have high volumes (over 10,000) of vehicles in either the a.m. or p.m. peak periods:
  - South Van Dorn Street and I-95 – I-495 Ramps
  - South Van Dorn Street and Vine Street / McGuin Drive
  - South Van Dorn Street and Eisenhower Avenue
  - South Van Dorn Street and Metro Road Ramps
  - South Van Dorn Street and Courtney Avenue
  - South Van Dorn Street and South Pickett Street
  - South Van Dorn Street and Edsall Road
  - Mark Center Avenue and Seminary Road
  - Beauregard Street and Seminary Road
  - Beauregard Street and King Street
- 19 of the 46 intersections have high pedestrian volumes of over 100 pedestrians per peak period
- Four intersections have both high pedestrian volumes (over 100 in the peak period) and high traffic volumes (over 10,000):
  - South Van Dorn Street and Metro Road Ramps
  - South Van Dorn Street and Edsall Road
  - Mark Center Avenue and Seminary Road
  - Beauregard Street and King Street
- The intersection of Mark Center Avenue and Mark Center Drive has over 500 pedestrians during the peak periods
- Only six of the 46 intersections in the corridor are unsignalized

Figure C-1: Traffic Count Locations

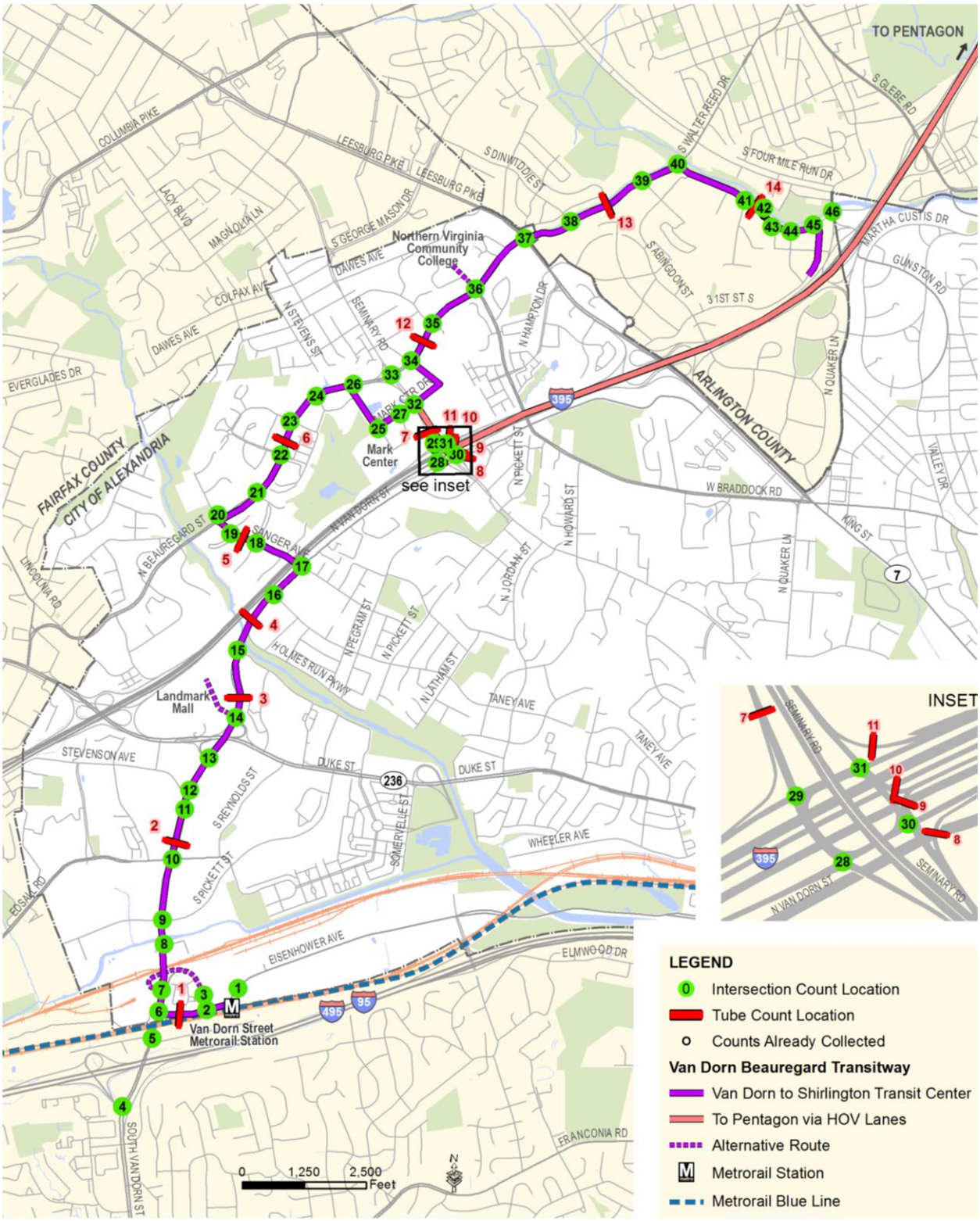
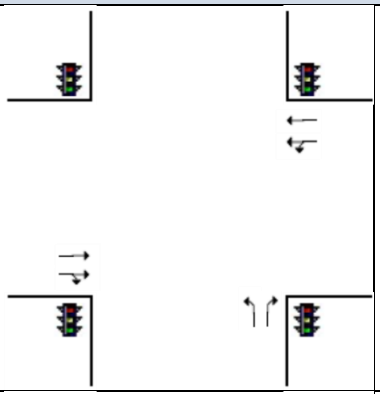
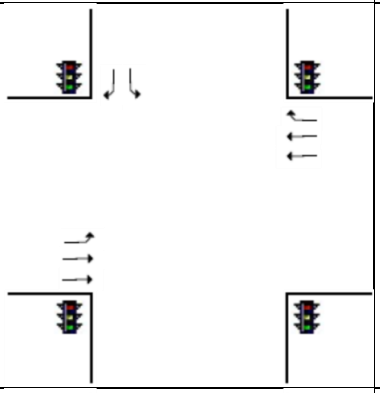
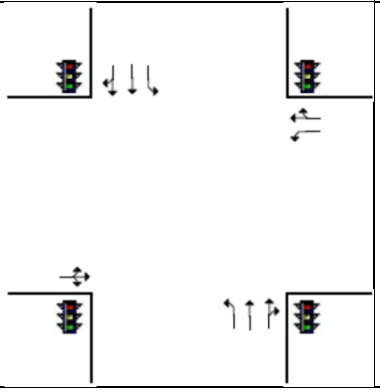
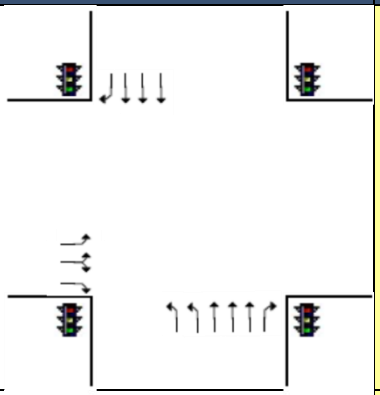
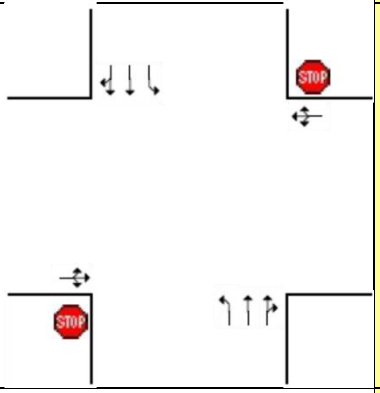
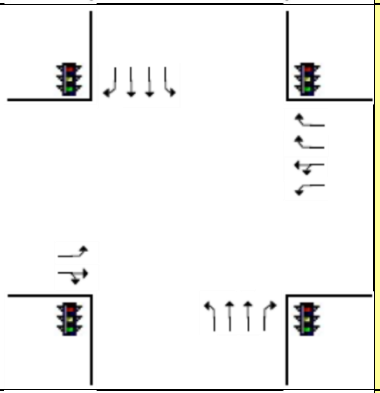
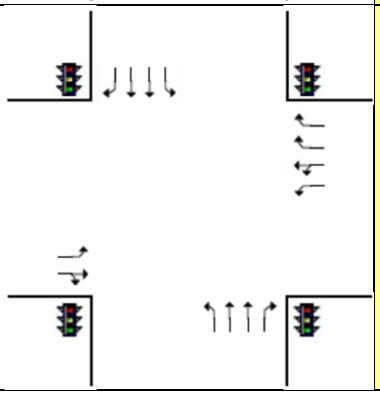
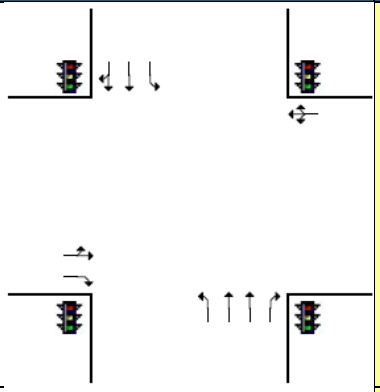
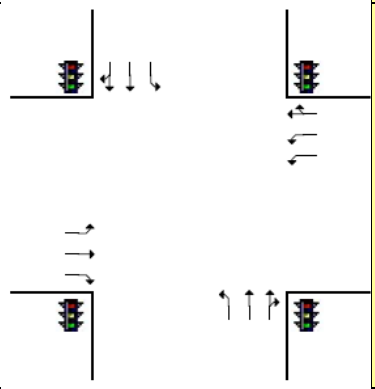
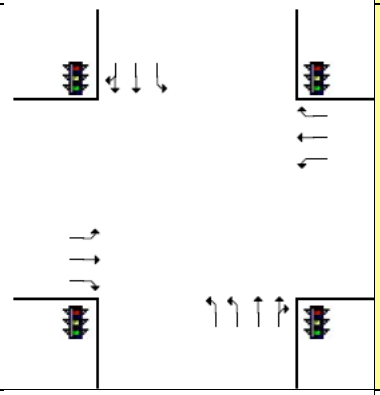
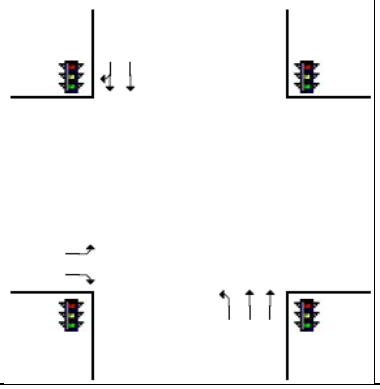
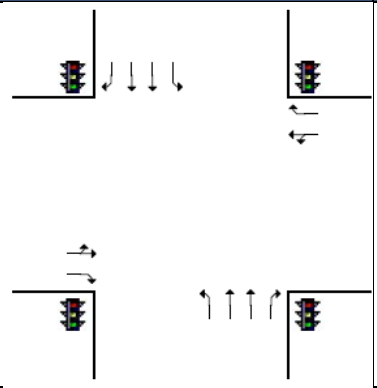
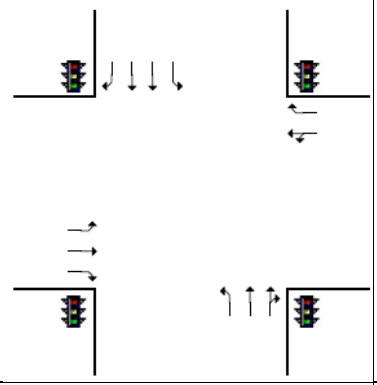
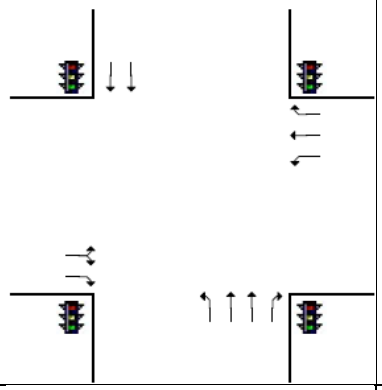
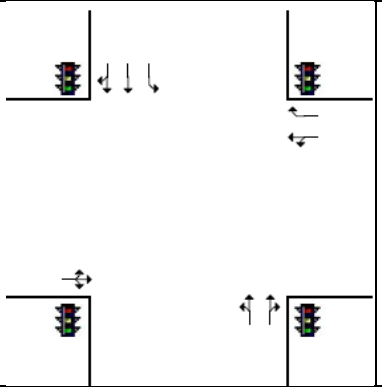


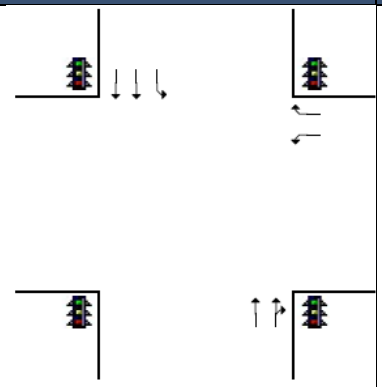
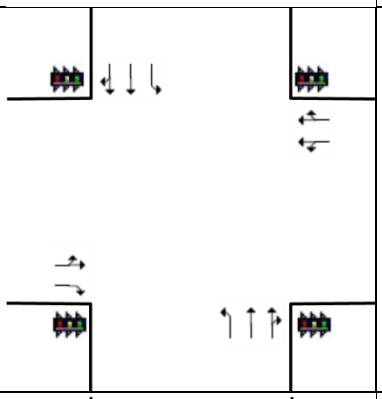
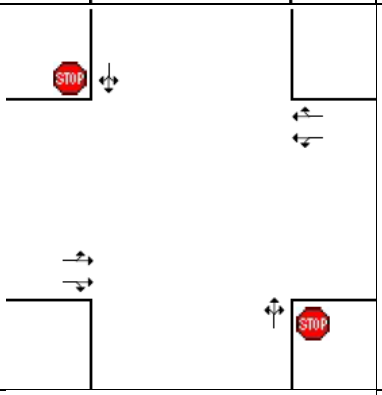
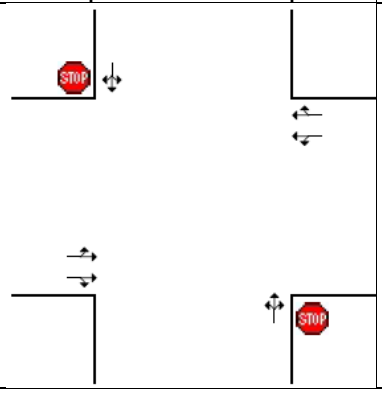
Table C-1: Traffic Intersections - Summary of Existing Conditions

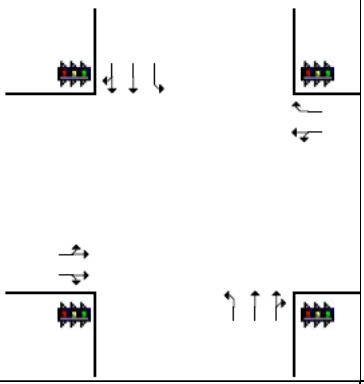
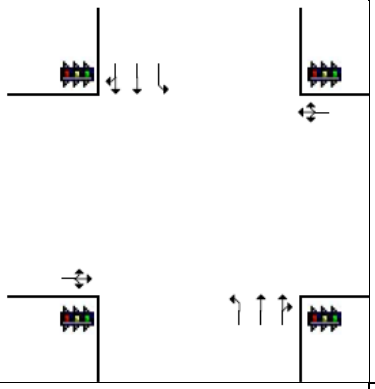
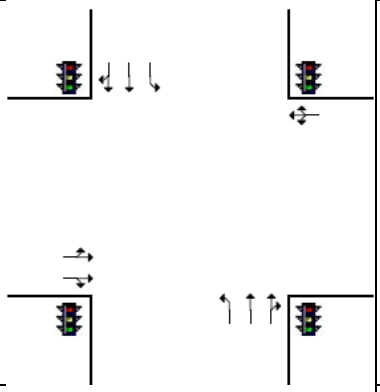
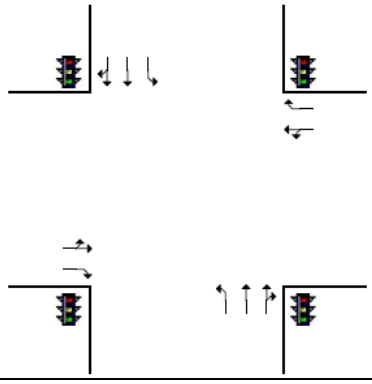
#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
	City of Alexandria				
1	Bus Loop Entrance		2,379 / 3,784	1,322 / 1,411	145 / 166
2	Metro Rd and Eisenhower Ave		2,668 / 4,483	1,477 / 1,705	63 / 123
3	Metro Rd and Van Dorn Kiss and Ride		1,121 / 1,940	638 / 729	82 / 121

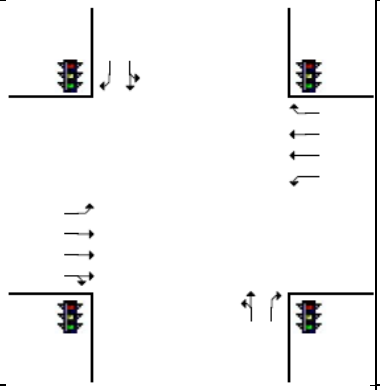
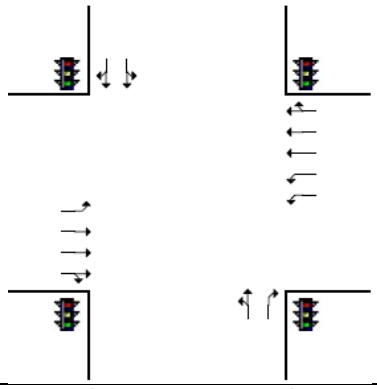
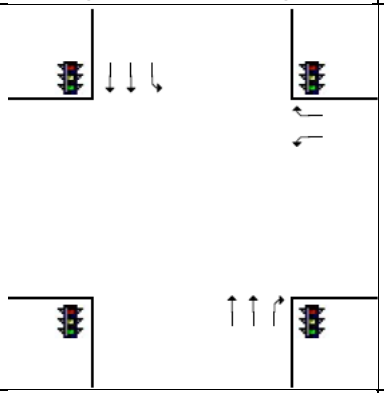
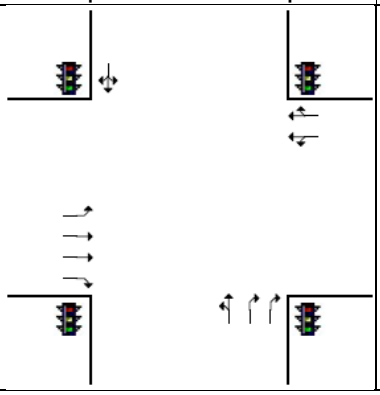
#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
4	S Van Dorn St and I-95 – I-495 Ramps		9,342 / 15,992	4,864 / 5,625	0 / 4
5	S Van Dorn St and Vine St / McGuin Dr		6,159 / 10,461	3,217 / 3,657	24 / 37
6	S Van Dorn St and Eisenhower Ave		7,808 / 12,935	4,074 / 4,581	6 / 25
7	S Van Dorn St and Metro Rd Ramps		7,474 / 12,133	3,894 / 4,251	30 / 117

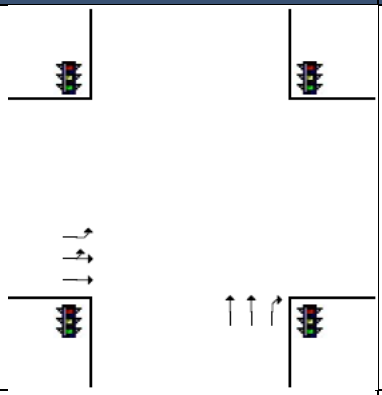
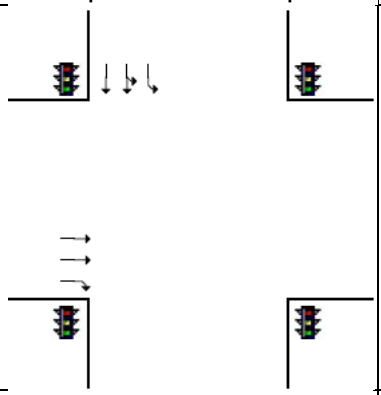
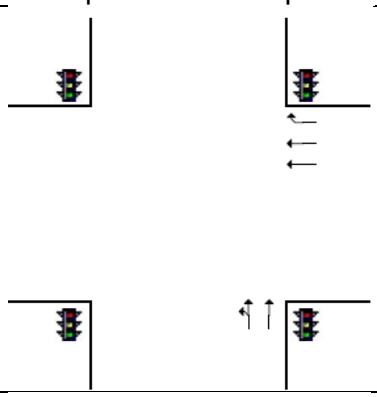
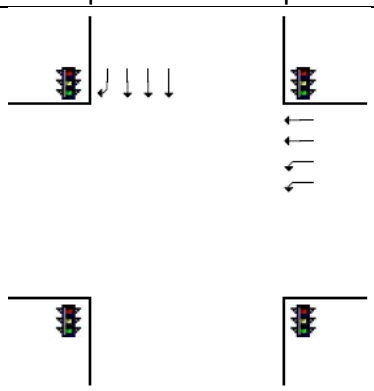
#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
8	S Van Dorn St and Courtney Ave		9,604 / 10,887	3,677 / 3,987	32 / 53
9	S Van Dorn St and S Pickett St		10,089 / 11,770	3,876 / 4,269	23 / 56
10	S Van Dorn St and Edsall Rd		9,345 / 11,355	3,674 / 4,211	45 / 109
11	S Van Dorn St and Van Dorn Plaza Ent		6,518 / 7,881	2,469 / 2,934	11 / 33

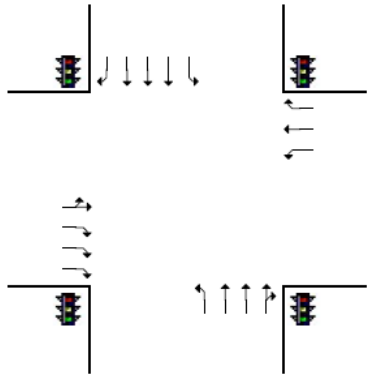
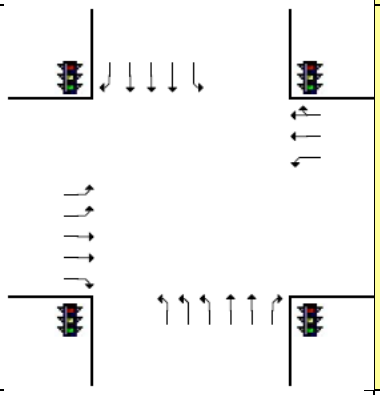
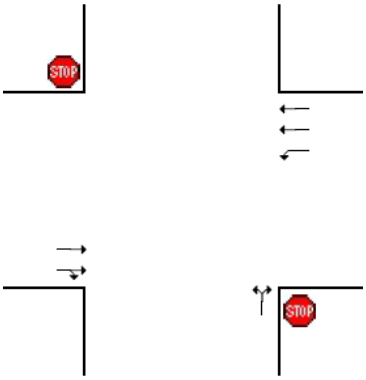
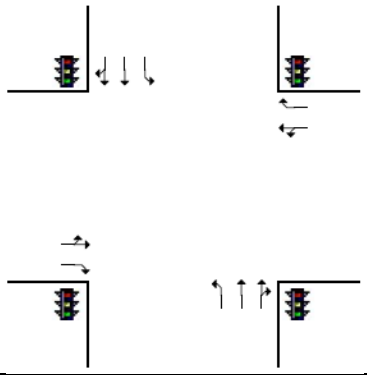
#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
12	S Van Dorn St and Stevenson Ave		7137 / 8335	2769 / 3120	7 / 74
13	S Van Dorn St and Duke St (Ramp)		6941 / 7500	2708 / 2778	0 / 9
14	N Van Dorn St and Duke St (Ramp)		6827 / 7235	2735 / 2670	7 / 18
15	N Van Dorn St and Holmes Run Pkwy		6626 / 6832	2732 / 2637	9 / 16

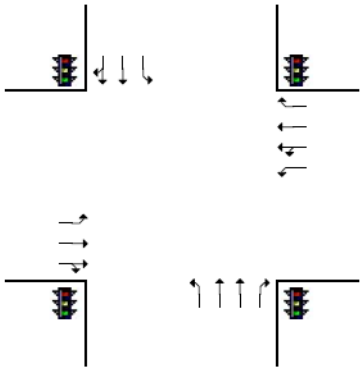
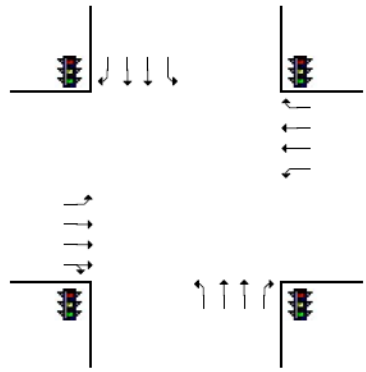
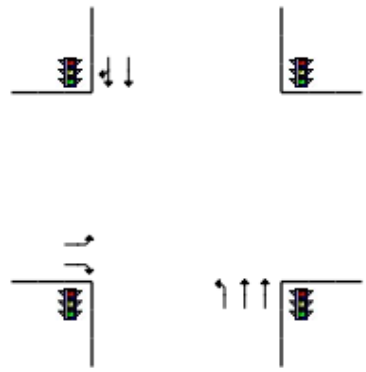
#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
16	N Van Dorn St and Taney Ave		6928 / 7028	2873 / 2694	76 / 75
17	N Van Dorn St and Richenbacher Ave/Sanger Ave		7113 / 7256	2989 / 2957	114 / 160
18	Sanger Ave and Bradford Ct/Sheffield Ct		2427 / 3244	1035 / 1168	71 / 164
19	Sanger Ave and Trent Ct		2215 / 3004	935 / 1088	164 / 240

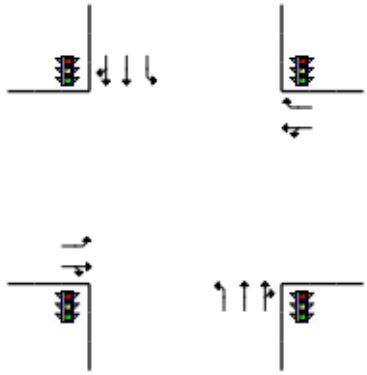
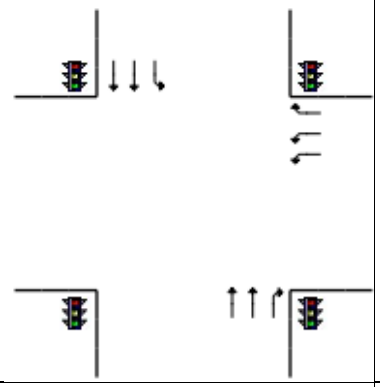
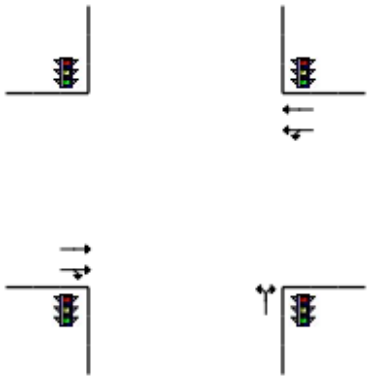
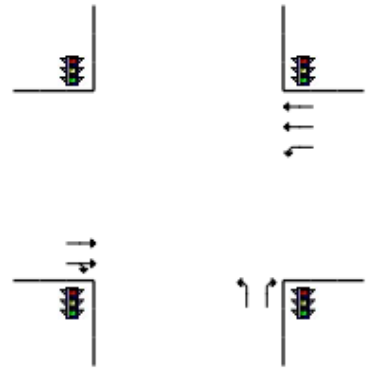
#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
20	Beauregard St and Sanger Ave		5440 / 6769	2409 / 2543	305 / 312
21	Beauregard St and Roanoke Ave		4647 / 5695	1925 / 2127	57 / 162
22	Beauregard St and Reading Ave		5164 / 6322	2160 / 2403	71 / 157
23	Beauregard St and Rayburn Ave		5516 / 6255	2451 / 2318	114 / 86

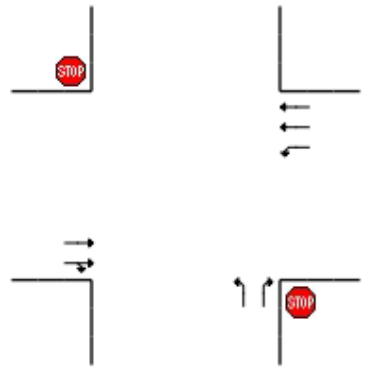
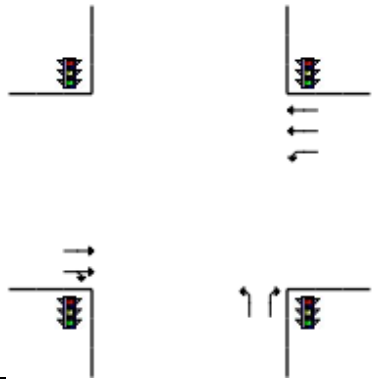
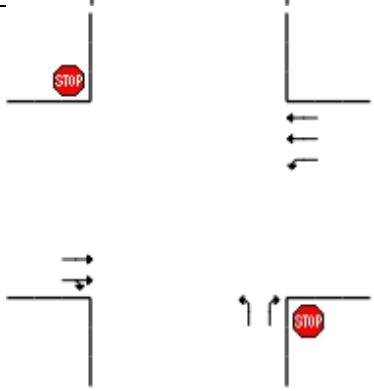
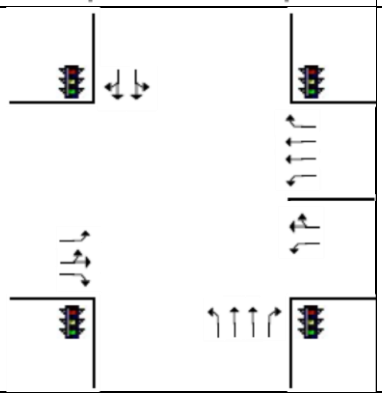
#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
24	Beauregard St and N Highview Ln		5225 / 6430	2253 / 2389	48 / 119
25	Beauregard St and Mark Center Dr		6429 / 7083	2766 / 2603	43 / 121
26	Mark Center Ave and Mark Center Dr		2556 / 2604	1082 / 1054	550 / 645
27	Mark Center Ave and Driveway		2292 / 3318	940 / 1326	184 / 278

#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
28	Seminary Rd and I-395 Rotary (SE)		5472 / 5262	2235 / 1906	2 / 1
29	Seminary Rd and I-395 Rotary (SW)		4147 / 5506	1500 / 2037	0 / 0
30	Seminary Rd and I-395 Rotary (NE)		3858 / 5121	1556 / 1735	0 / 2
31	Seminary Rd and I-395 Rotary (NW)		3971 / 6724	1555 / 2374	0 / 0

#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
32	Mark Center Ave and Seminary Rd		10086 / 12467	4039 / 4582	101 / 165
33	Beauregard St and Seminary Rd		10475 / 13098	4357 / 4708	25 / 58
34	Beauregard St and the Southern Towers		2355 / 3242	1110 / 1221	29 / 23
35	Beauregard St and Fillmore Ave		2335 / 3201	1091 / 1202	50 / 86

#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
36	Beauregard St and W Braddock Rd		3570 / 4473	1600 / 1768	69 / 99
37	Beauregard St and King St		9440 / 12547	4029 / 4652	54 / 158
	Arlington County				
38	Walter Reed Dr and S Dinwiddie St		3583 / 4293	1707 / 1698	34 / 56

#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
39	S Walter Reed Dr and S Wakefield St		4422 / 5145	2132 / 2047	84 / 173
40	S Walter Reed Dr and S Arlington Mill Dr		5053 / 6105	2225 / 2448	67 / 347
41	S Arlington Mill Dr and S Taylor St		2511 / 3202	937 / 1264	111 / 481
42	S Arlington Mill Dr and Village Shirlington Ent		2135 / 3226	860 / 1273	67 / 197

#	Intersection	Lane Configuration and Signalization	Total Volume Peak Period (AM/PM)	Total Peak Hour Volumes (AM/PM)	Total Pedestrians Peak Period (AM/PM)
43	S Arlington Mill Dr and Campbell Ave		2098 / 3036	836 / 1190	142 / 380
44	S Arlington Mill Dr and S Randolph St		2262 / 3251	880 / 1280	59 / 263
45	S Arlington Mill Dr and S Quincy St		2280 / 3619	895 / 1433	90 / 334
46	S Arlington Mill Dr and S Shirlington Rd		4681/ 6386	1845 / 2464	87 / 94

Appendix D: Existing Transit and Regional Travel Markets

Regional Travel Markets

Figure D-1 shows the West End Transitway and the communities anticipated to be most directly served by the project. Five transit centers, the Van Dorn Metrorail station, the Landmark Mall Transit Center, Mark Center Transit Center, Shirlington Transit Center, and the Pentagon Transit Center, currently connect these communities to the region. For the purposes of this document, these communities are referred to as the *corridor communities,* which together and within a half-mile buffer of the proposed alignment, comprise the study area. Additional communities surrounding the study area will be included in documentation where appropriate. The communities are listed below.

Corridor Communities (Study Area)

- City of Alexandria
  - Landmark/Van Dorn
  - Alexandria West
  - Beauregard
- Arlington County
  - Claremont
  - Shirlington

Adjacent Communities

- City of Alexandria
  - Seminary Hill
- Arlington County
  - Douglas Park
  - Fairlington
  - Nauck
- Fairfax County
  - Annandale
  - Bailey's Crossroads
  - Springfield/Franconia

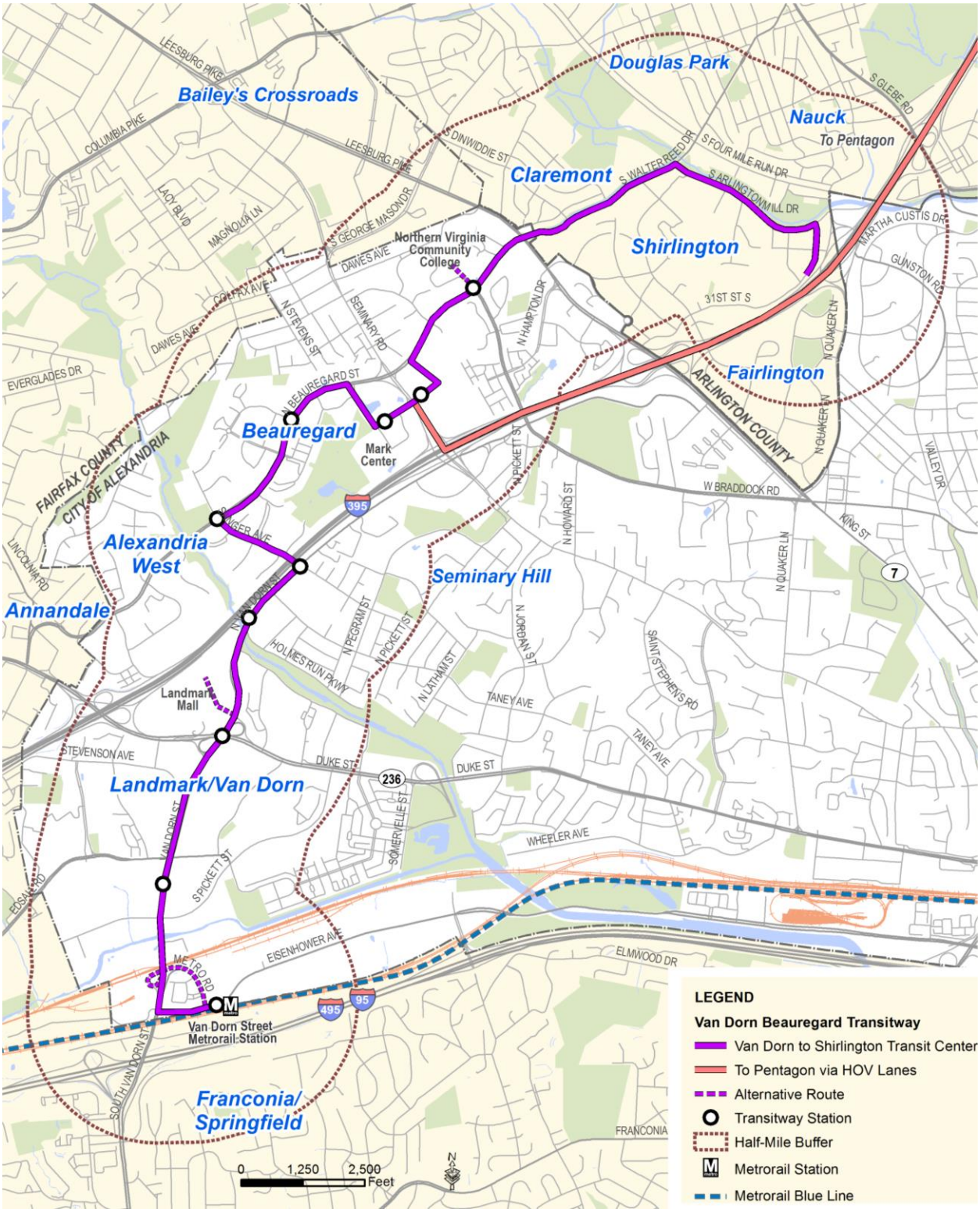
Connections to major activity centers

The Van Dorn/Beauregard corridor is an important linkage between the Van Dorn Metrorail station and Pentagon. It directly serves and connects to a number of major activity centers between these two points including the Landmark Mall, Mark Center, Northern Virginia Community College and Shirlington. Through potential transfers between the planned transitway corridor and existing transit lines (Metrorail Blue Line and many local/regional bus transit services), regional access for the study corridor would increase.

Direct Connections

The corridor already serves significant residential and commercial development. Adopted plans within the corridor will significantly increase development intensity along Van Dorn and Beauregard streets over time.

Figure D-1: Corridor and Adjacent Communities



According to MWCOG Round 8.2 Estimates and Projections, the 2015 population and employment within a half-mile of the proposed West End Transitway is 76,000 and 37,000, respectively. Employment at the Mark Center recently increased by more than 6,000 employees with the BRAC-133 facility (Washington Headquarter Services). Existing major development and activity centers along the corridor are shown in **Figure D-2** and include:

- Eisenhower West
- Landmark Mall and surrounding commercial and residential developments
- Mark Center
- Southern Towers
- Northern Virginia Community College
- Shirlington
- Pentagon

The City of Alexandria's Beauregard and Landmark/Van Dorn Small Area Plans anticipate nearly 20 million square feet of new development in the corridor in the next 30 years.

Regional Connections

The corridor also connects to the regional bus and rail network and other potential future transit corridors. These connections would provide a linkage between the study area and regional activity centers outside the corridor (**Figure D-3**).

Connections to the regional bus and rail network are provided via transit centers at the Van Dorn Metrorail station (bus and rail), Landmark Mall (bus), Mark Center (bus), Shirlington (bus), and the Pentagon (bus and rail). Connecting with the regional bus network would afford the corridor connectivity to greater Alexandria, Arlington County, Fairfax County, and the District of C olumbia. Some major regional activity centers in these areas include:

- The Pentagon
- Rosslyn/Ballston Corridor
- Bailey's Crossroads
- Crystal City
- Old Town Alexandria
- Eisenhower East
- Tysons Corner
- Fort Belvoir (North Area)
- Merrifield/Dunn Loring

Connections to the regional rail network at the Pentagon and Van Dorn Metrorail stations would extend the study corridor's access throughout the region and to major intermodal terminals at the region's international airports and passenger rail stations.

Future high-capacity transit corridor projects along US 1 (the Crystal City/Potomac Yard Transitway), Columbia Pike, Duke Street, and Route 7 could expand the reach of the Van Dorn/Beauregard corridor to major activity centers in Alexandria, Arlington County, and Fairfax County that are not well-served by high-capacity transit currently.

Figure D-2: Corridor Activity Centers

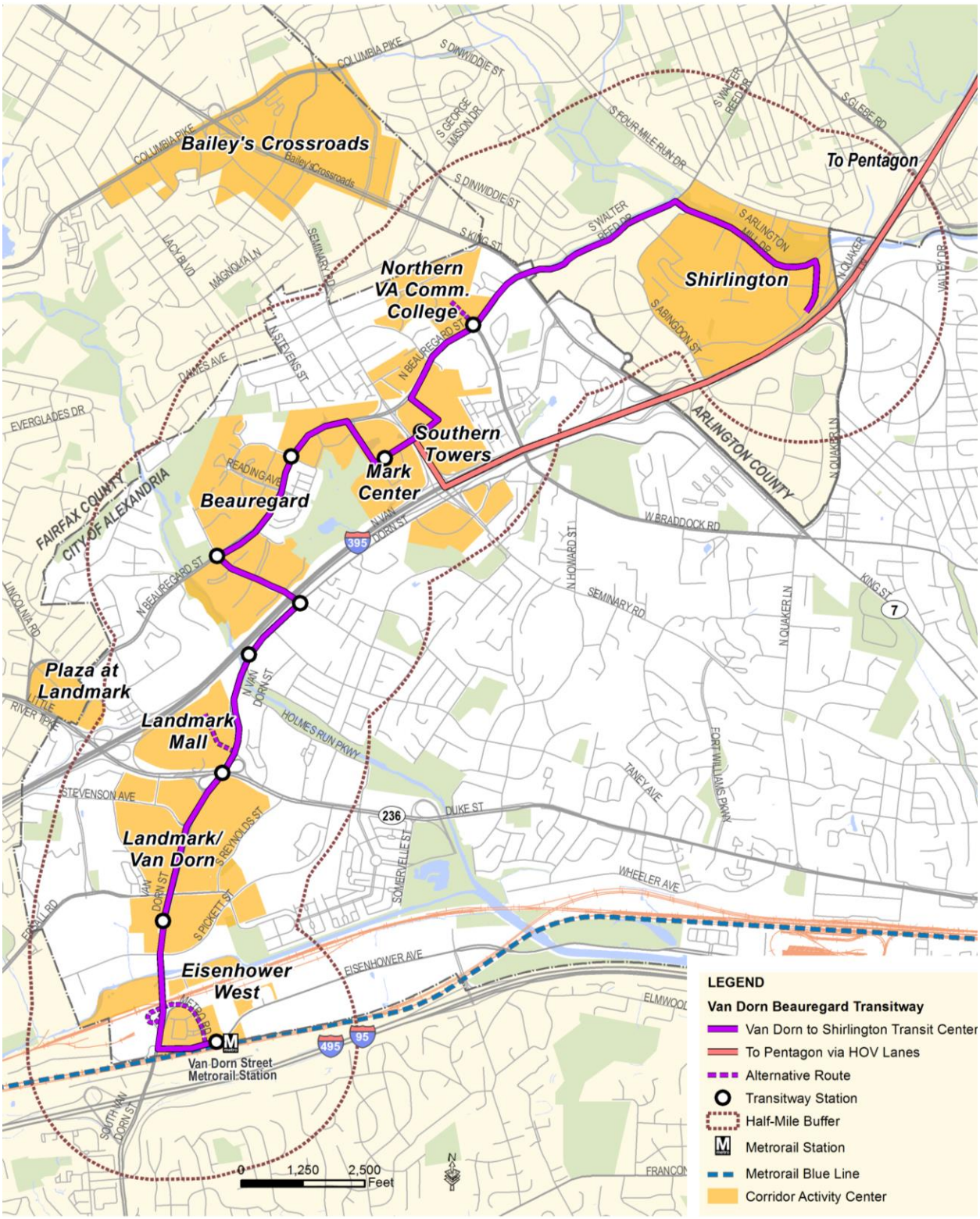
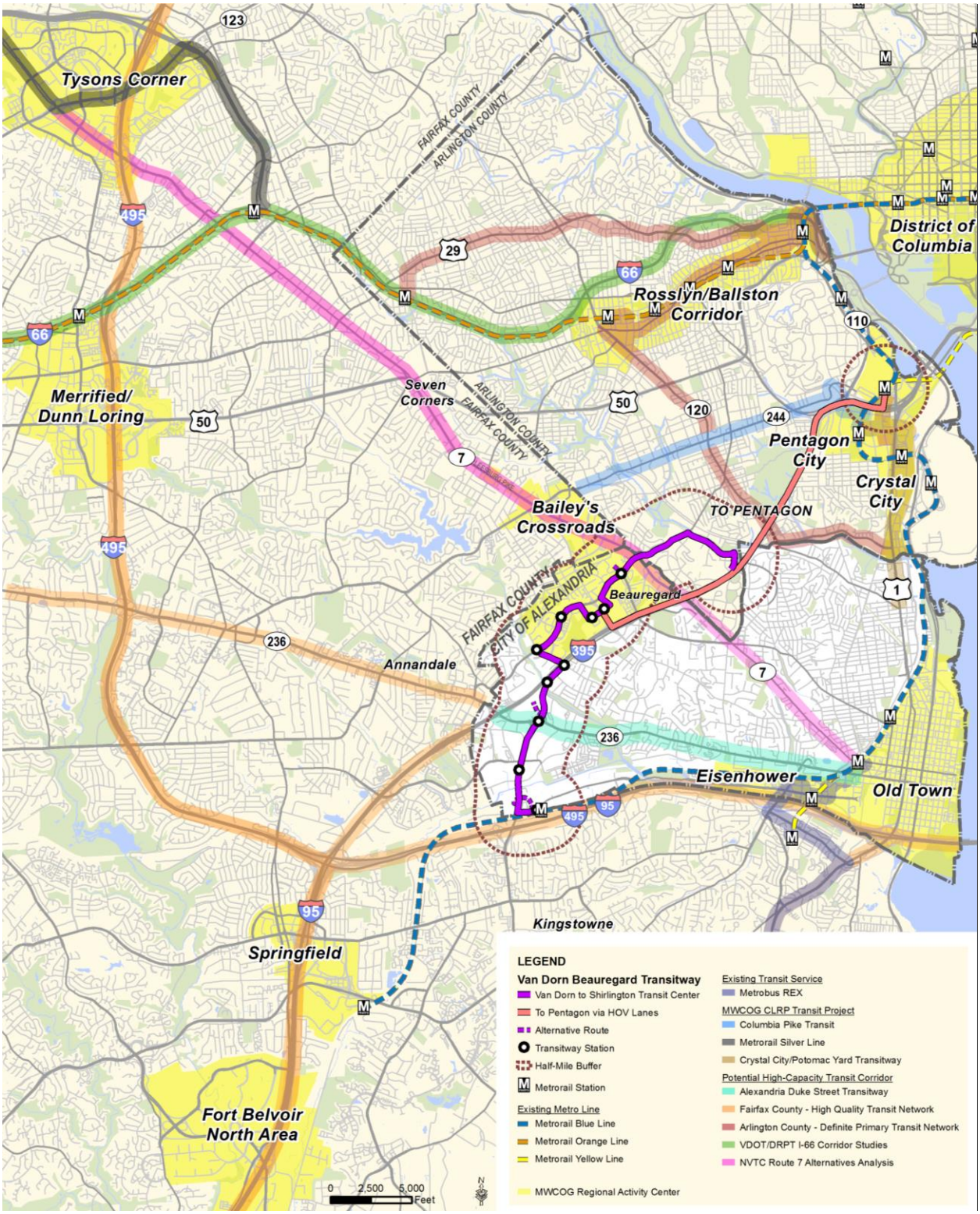


Figure D-3: Regional Activity Centers and Transit Connections



Note: Future transit corridors and alignments are subject to change based on further planning studies.

Regional Demand and Travel Patterns

Total Daily Travel

Table D-1 shows the total daily trips to and from the study corridor (including the Pentagon). Key findings are summarized below:

- Approximately 360,000 daily trips are generated from the study corridor; 12 percent of them are made on transit
- Approximately 407,000 daily trips are made to the study corridor (primarily originating outside the corridor); 8 percent are made on transit
- Over 31 percent of the daily trips generated from the study corridor stay within the corridor, although very few of these "internal" trips use transit (only 2.4 percent); the vast majority of these trips within the corridor (over 90 percent) are non-work trips
- On a daily basis, trips from the study are primarily shorter trips: within the study corridor (31 percent), to Arlington/Falls Church (21 percent), and to the rest of Alexandria (14 percent)

Table D-1: Total Daily Trips From and To the Corridor

	All Trips FROM the Corridor			All Trips TO the Corridor		
	Person-Trips	% of Total	Transit Share	Person-Trips	% of Total	Transit Share
DC Core	24,451	7%	70%	4,356	1%	58%
DC Non-Core	8,931	2%	25%	14,022	3%	35%
Arlington & Falls Church	74,256	21%	14%	76,245	19%	11%
Alexandria	49,842	14%	16%	42,387	10%	14%
Fairfax East	27,366	8%	2%	33,823	8%	5%
Fairfax West	16,060	4%	1%	29,103	7%	2%
Within the Corridor	111,698	31%	2%	111,698	27%	2%
Other Areas	46,556	13%	7%	95,720	23%	8%
Total	**359,161**	**100%**	**12%**	**407,353**	**100%**	**8%**

Source: 2015 data, WMATA's Regional Transit System Plan

Commute Trips

Table D-2 shows the total commute trips to and from the study corridor (including the Pentagon). Key findings are summarized below:

- 83,000 daily work trips are generated from the study corridor; 41 percent are made on transit. Relatively few of the commuter trips remain in the study corridor (12 percent), while the remaining commute trips are destined for areas such as the D.C. Core (22 percent) and Arlington/Falls Church (21 percent)
- Commute trips account for the majority of transit trips made from the study area (over 76 percent)
- The major commuter destination in the study corridor is the Pentagon, accounting for 41 percent of the work trips made to the study corridor

Table D-2: Total Commute Trips From and To the Corridor

	Commute Trips FROM the Corridor			Commute Trips TO the Corridor		
	Person-Trips	% of Total	Transit Share	Person-Trips	% of Total	Transit Share
DC Core	18,757	22%	80%	902	1%	92%
DC Non-Core	4,046	5%	45%	3,967	4%	72%
Arlington & Falls Church	17,439	21%	38%	13,351	14%	34%
Alexandria	10,980	13%	46%	5,864	6%	45%
Fairfax East	4,466	5%	11%	7,541	8%	20%
Fairfax West	2,349	3%	6%	6,267	7%	8%
Within the Corridor	10,352	12%	18%	10,352	11%	18%
Other Areas	15,048	18%	20%	45,257	48%	15%
Total	**83,437**	**100%**	**41%**	**93,501**	**100%**	**23%**

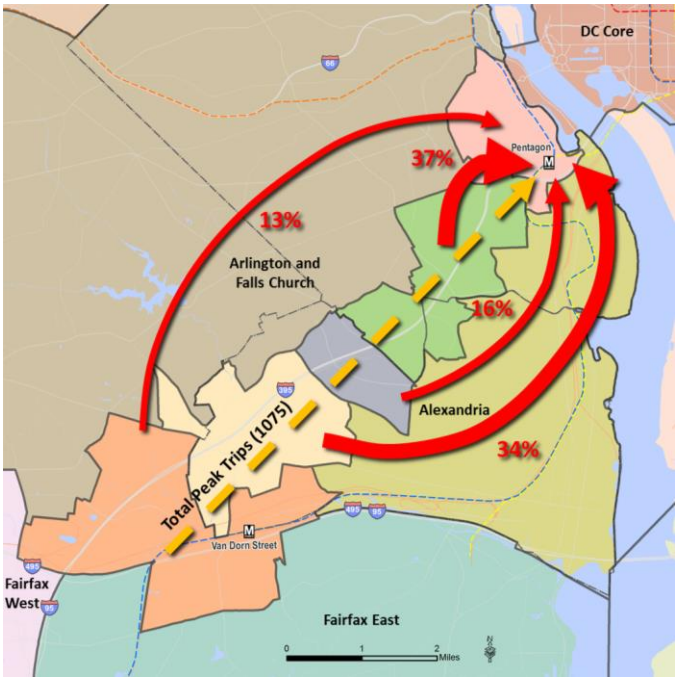
Source: 2015 data, WMATA's Regional Transit System Plan

Feeder Market

The study area shows strong usage of the Pentagon Metrorail station as an access point to the Metrorail system (see **Figure D-4**). Many residents in the study area use transit service in the study corridor to access destinations removed from the study corridor such as D.C. and Arlington.

- Pentagon station is the first Metrorail station for 27,500 transit trips generated from the region in the peak period. 42 percent of these trips are generated in the study area.
- Bus is the dominant access mode (84 percent) for Pentagon station. Almost half (48 percent) of the riders who reach Pentagon station by bus are coming from the study area.

Figure D-4: Commute Trips to the Pentagon Metrorail Station



Source: 2015 data, WMATA's Regional Transit System Plan

The following briefly summarizes regional and local (corridor-specific) travel patterns related to the Van Dorn/Beauregard corridor:

Regionally-Oriented Trips

- **Trips out of the corridor to employment centers to the east (core of region)** - Depending on the point of origin and destination for the trip, people in the corridor generally travel toward I-495 (and Eisenhower Avenue and Van Dorn Metrorail station) or I-395 (and Beauregard Street/Walter Reed Drive and Mark Center Transit Center) for trips bound eastward. The Van Dorn Metrorail station offers travelers an opportunity to transfer to a high-speed transit mode for trips along a portion of the I-495 corridor, trips oriented toward the core, and those destined for the Jefferson Davis Highway (US 1) corridor. Along I-395, travelers rely on standard bus services to connect with employment centers to the east.
- **Trips into the corridor's major commercial areas (primarily Mark Center area) from the region** - Interstate-395 and the Mark Center Transit Center are the primary inbound travel routes/facilities for the Mark Center area. Considerable office space is already located along N. Beauregard Street (vicinity of Seminary Road) and more is planned in the future. There is strong connectivity between Department of Defense facilities in the region's core and the facility at the Mark Center. Increased high-quality transit connectivity to and access between major employment centers in the region's core and the Mark Center area have the potential to help manage traffic impacts associated with employment growth in the area over-time.
- **Regional trips through the corridor (no origin or destination within the corridor) traveling to major employment centers to the east (core of region)** - Van Dorn Street, Beauregard Street, and Walter Reed Drive are relievers and local mobility routes paralleling or serving a complementary route to I-395 and I-495. They are frequently congested during peak travel periods in the peak direction. In the a.m. peak period, Van Dorn Street, Walter Reed Drive and Beauregard Street experience congestion in the north- and eastbound direction. In the p.m. peak period, each of these corridors experiences an increase in traffic and at-times, congestion in the south- and westbound direction. Incidents (lane blockages, closures, and weather-related events) on I-395 and I-495 tend to significantly worsen traffic conditions on each of these corridors due to the diversion of traffic associated with incidents.

Locally-Oriented Trips

- **Trips between neighborhoods and activity centers** - Activity centers within the study corridor are diverse, relatively well-defined, and in many cases physically separated. Schools, transportation hubs (Mark Center, Landmark Mall bus transfer center, and Van Dorn Metrorail station), and commercial centers are important destinations that provide the community services, access to the larger region, and employment opportunities.
- **Trips between corridor neighborhoods (communities) and commercial centers in adjacent jurisdictions** - The West End of Alexandria has a convenient geographic relationship to nearby activity centers in Arlington County and Fairfax County. Activity nodes such as Skyline, Kingsdowne, and Bailey's Crossroads (Fairfax County) and Shirlington (Arlington County) offer corridor community residents with services and amenities not found within the Beauregard/Van Dorn corridor.

Transit Network

The corridor is currently served by WMATA Metrorail and Metrobus services, DASH bus routes, Fairfax Connector, and Arlington Transit (ART) bus routes, as shown in **Figure D-5.** The western terminus of the corridor is served by Metrorail's Blue Line, and Yellow Line "Rush Plus" service at the Van Dorn Metrorail station. Two key bus transfer points are also located in the corridor at Landmark Mall and Mark Center. DASH, Metrobus, Fairfax Connector, and ART routes provide local route services in the corridor, with a number of routes providing express service on I-395 to the Pentagon Metrorail station utilizing the HOV lanes. The corridor is also served by private shuttles in the Mark Center area.

WMATA Metrorail Service

The Blue Line serves the Van Dorn Metrorail station at the western terminus of the corridor, as does the Yellow Line during the peak periods. The Blue Line operates from Franconia-Springfield in Fairfax County through Alexandria, Arlington County, and Washington, D.C. to Largo Town Center in Prince George's County. Blue Line weekday train frequencies are 6-minutes in the peak periods and 12-minutes in the midday. During peak periods, the Yellow Line operates every 6 minutes from Franconia-Springfield in Fairfax County through Alexandria, Arlington County, and Washington, D.C. to Greenbelt in Prince George's County.

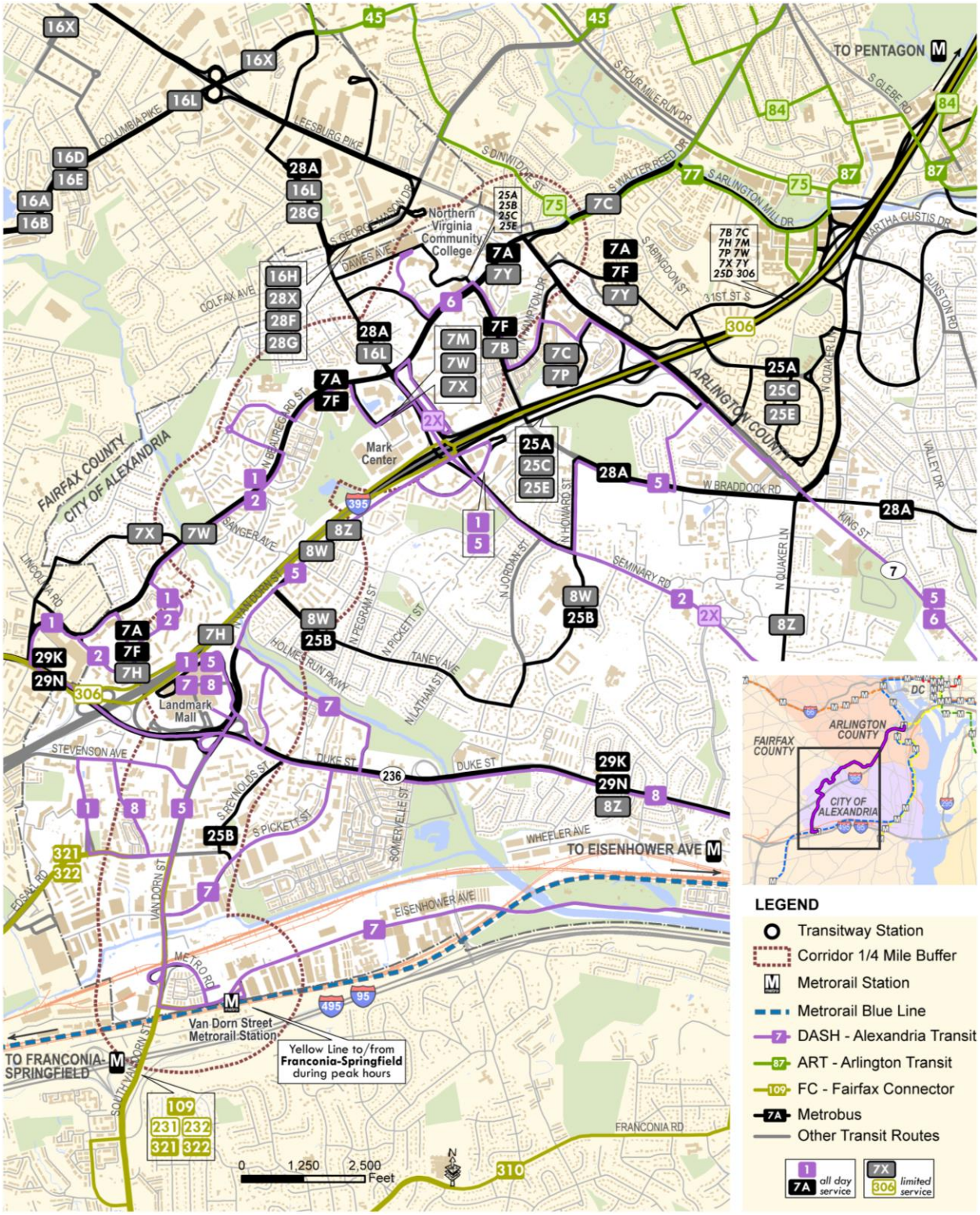
Table D-3 shows key statistics for the Van Dorn Metrorail station. The average weekday boardings in FY 2013 at the station were 3,380 (weekday bus boardings at the Pentagon Metrorail station were 16,324). There are a total of 407 parking spaces at the station. Six bus bays serve Metrobus, DASH, and Fairfax Connector buses, as detailed later in this section.

Table D-3: Van Dorn Metrorail Station Characteristics

Average Weekday Boardings	3,380
All-Day Parking Spaces	361
Short-Term Metered Parking Spaces	46
Bus Bays	6
Access Mode Share	
Bus	28%
Shuttle	18%
Drive/Carpool	19%
Kiss & Ride	18%
Walk	14%
Bicycle	1%
Taxi	1%

Source: WMATA

Figure D-5: Existing Transit Services



DASH, Metrobus, Fairfax Connector, and ART Bus Service

Extensive bus service currently exists within the corridor in addition to routes that cross the corridor. There is no single bus route that runs the entirety of the corridor.

Table D-4 presents a summary of route key route service characteristics, current average weekday ridership volumes, and performance. Of the DASH routes, AT8 and AT2X are the most productive in terms of riders per revenue hour at 43.4 and 30.6 riders per hour, respectively. All other DASH routes have between approximately 22 and 26 riders per hour.

Of the Metrobus routes, by far the most productive is the 7M at 59.2 riders per revenue hour. The other 7 series routes and the 8 series routes are also strong performers with 37 to 38 riders per revenue hour. The 25 series routes have 24 to 25 riders per revenue hour.

Table D-4: Corridor Route Characteristics and Performance in Fall 2013

Route	Description	Weekday Freq.		Avg. Weekday Ridership	Weekday Rev. Hrs.	Weekday Riders per Rev. Hr.
		Peak	Midday			
Alexandria Transit Company (DASH)						
AT1	Eisenhower/Van Dorn Metro - Seminary Plaza	30	30	1,755	67.2	26.1
AT2	Lincolnia - Braddock Metro	30	30	1,902	83.8	22.7
AT2X	Mark Center - Braddock Metro	3 round trips/hr	n/a	270	8.8	30.6
AT5	Landmark Mall/Van Dorn Metro - Braddock Metro	20 pk dir/ 30 rev pk dir	30	1,835	85.0	21.6
AT8	Van Dorn Metro/Landmark Mall - King St-Old Town Metro/Old Town	20	60	3,201	73.8	43.4
Washington Metropolitan Area Transit Authority (Metrobus)						
7A,F,Y	Lincolnia-North Fairlington Line	7.5	20	3,553	91.3	38.9
7B,C,H,P,W,X	Lincolnia-Park Center-Pentagon Line	5 pk dir/ 20 rev pk dir	n/a	1,636	43.7	37.4
7M	Mark Center-Pentagon Line	10 pk dir/ 15 rev pk dir	15	1,907	32.2	59.2
8S,W,Z	Foxchase-Seminary Valley Line	5 pk dir/ 20 rev pk dir	n/a	1,244	32.0	38.8
25A,C,D,E	Ballston-Bradlee-Pentagon Line	10-15	60	1,502	57.0	26.4
25B	Landmark-Ballston Line	30	60	1,388	57.9	24.0

Bus routes that provide service to the heart of the corridor area and serve major activity centers and travel sheds in the corridor are described below. It should be noted that other routes traverse the study area.

DASH Bus Routes

AT1 - This route begins near Seminary Road and I-395 (Seminary Plaza) and travels through the Mark Center. It continues south along Beauregard Street with deviations at Rayburn/Reading Avenues and Quantrell/Armistead Avenues. At Duke Street, the route turns east to the Landmark Mall Transit Center. It then continues south along Van Dorn Street with a deviation at Stevenson Avenue, Yoakum Parkway and Edsall Road. Route AT1 ends at the Van Dorn Metrorail Station. On weekends, Route AT1 does not operate through the Mark Center, and service at the south end is extended to the Eisenhower Metrorail station (the AT7 that operates on Eisenhower Avenue does not operate on weekends).

Service frequencies are generally 30 minutes during the day on weekdays and 60 minutes on weekday evenings, Saturdays and Sundays. The span of service is 6 a.m. to 11 p.m. on weekdays, 7 a.m. to 11 p.m. on Saturdays and 9 a.m. to 8 p.m. on Sundays.

AT2/AT2X - This route begins at the Landmark Mall Transit Center and follows Lincolnia Road to Beauregard Street. The route continues north along Beauregard, with the same deviations as Route AT1 (Quantrell/Armistead Avenues and Rayburn/Reading Avenues). Route AT2 travels through the Mark Center, then follows Seminary Road, Janneys Lane and King Street to the King Street Metrorail Station. Service continues along King Street and Fairfax Street, eventually ending at the Braddock Road Metrorail station. An express route (AT2X) provides supplemental service between King Street Station and the Mark Center on weekdays in the peak periods only.

Service frequency on the full local route is 30 minutes on weekdays and 60 minutes on weekday evenings and weekends. The express route operates three round trips each hour in the peak periods, resulting in a 10-minute service between the King Street Metrorail station and Mark Center from 6 a.m. to 9 a.m., and from 3 p.m. to 6 p.m. The local route's span of service is 6 a.m. to 11 p.m. on weekdays, 7 a.m. to 11 p.m. on Saturdays and 8 a.m. to 8 p.m. on Sundays.

AT5 - This route begins at the Van Dorn Metrorail station and generally follows Van Dorn Street to King Street. The route deviates from Van Dorn Street at Duke Street, Ripley Street Holmes Run Parkway and accesses Seminary Road via Kenmore Avenue. It continues to King Street via Howard Street, Braddock Road, Early Street and Menokin Drive. Route AT5 continues on King Street to the King Street Metrorail station, then on King Street and Fairfax Street, eventually ending at the Braddock Road Metrorail station.

Weekday peak period service frequencies are generally 20 minutes in the peak direction and 30 minutes in the reverse peak direction (peak direction is to King Street Metrorail station in the morning and from King Street Metrorail station in the afternoon). Weekday frequencies the rest of the day are 30 minutes, with 60-minute frequencies in the evening. Saturday frequencies are 30 minutes during the day and 60 minutes in the evening. Sunday frequencies are 60 minutes during the day.

AT8 - This route begins at the Van Dorn Metrorail station and follows the Van Dorn corridor to Landmark Plaza, deviating at Edsall Road, Whiting Street, and Stevenson Avenue. From Landmark Plaza, Route AT8 follows Duke Street to King Street Metrorail station, eventually ending at Fairfax Street and Madison Street in Old Town Alexandria. Two routes – a full-route pattern and a shorter route - operate between Landmark Mall and King Street Metrorail station.

On weekdays, the full route operates at 20-minute frequencies in the peak periods and 60-minute frequencies the rest of the day. The short route operates at 20-minute frequencies in the peak periods and 60-minutes frequencies during the day, resulting in a combined 10-minute peak/30-

minute midday frequency. On weekends, both the full and short turn routes operate at 60-minute frequencies, resulting in a combined 30-minute frequency. Only the full route pattern operates in the evening. Route AT8 operates a full span of service, with weekday service from approximately 5 a.m. to midnight, Saturday service from approximately 6:30 a.m. to midnight, and Sunday service from approximately 7:00 a.m. to 11:30 p.m.

Other DASH routes that traverse the corridor area include:

- AT6 between Northern Virginia Community College and the King Street and Eisenhower Metrorail stations
- AT7 between Nannie Lee Center to Landmark Mall via Eisenhower Avenue, and runs between the Van Dorn Metro to the Landmark Mall in the study area

WMATA Metrobus Lines:

7A,F,Y – Lincolnia-North Fairlington Line - Routes 7A and 7F begin at Landmark Plaza near I-395 and Little River Turnpike. Both routes follow Beauregard Street to the Mark Center. Route 7Y begins at Southern Towers. The three routes continue north to the Shirlington Transit Center, continuing on I-395 to the Pentagon Metrorail station. Select trips continue into Washington, D.C. to Federal Triangle.

The combined frequency for these three routes average 7.5-minutes during the weekday peak periods, 20-minutes during the weekday midday period, and 15 to 30-minutes during the weekday evening periods. Morning inbound service and afternoon outbound service does not go beyond Southern Towers. On Saturdays, only the 7A and 7F operate at a combined 30-minute frequency. On Sundays, only the 7A operates at a 40-minute frequency.

7B,C,H,P,W,X – Lincolnia-Park Center-Pentagon Line – These routes also operate in the Beauregard/I-395 corridor, with all service going to/from the Pentagon Metrorail station. These routes operate weekdays only in the peak periods only. Route patterns that directly impact this corridor are Routes 7W, 7X and 7B. Routes 7W and 7X begin near the Little River Turnpike/Lincolnia Road area and follow Beauregard Street to the Mark Center and Southern Towers. These routes then access I-395 at Seminary Road and continue to the Pentagon Metrorail station. Route 7W has 12 morning inbound and 13 afternoon outbound trips. Route 7X has 8 A.M. inbound and 10 p.m. outbound trips. Route 7B starts at Southern Towers and travels north on Beauregard Street, Braddock Road and Hampton Drive to King Street, where it then gets on I-395 to the Pentagon Metrorail station. Route 7B has 5 morning inbound and 5 afternoon outbound trips.

7M – Mark Center-Pentagon Line - This route operates service between the Mark Center and the Pentagon Metrorail station via I-395. Service is provided weekdays only. In the peak periods, Route 7M operates at 10-minute frequencies in the peak direction and 15-minutes in the reverse peak direction (peak direction is inbound in the morning and outbound in the afternoon). All other times, the route operates at 15-minute frequencies.

8S,W,Z – Foxchase-Seminary Valley Line – These routes also operate in the Beauregard/I-395 corridor, with all service going to/from the Pentagon Metrorail station. These routes operate weekdays only in the peak periods only. Route patterns that directly impact this corridor are Routes 8W and 8Z. Route 8W begins at the Mark Center and follows Seminary Road, Howard Street and Taney Avenue to Van Dorn Street. This route gets on I-395 at Seminary Road, with service to the

Pentagon Metrorail Station. Route 8Z begins at Quaker Lane and Osage Street, travels south on Quaker Lane, west on Duke Street and Holmes Run Parkway to Van Dorn Street. This route also gets on I-395 at Seminary Road with service to the Pentagon Metrorail Station. The combined peak period frequency of these routes is generally 5-10 minutes in the weekday peak periods in the peak direction.

25A,C,D,E – Ballston-Bradlee-Pentagon Line - Routes 25A and E provide service between the Ballston-MU and Pentagon Metrorail Stations, with mid-route service to the Alexandria NVCC campus. Route 25A operates in the peak periods and Route 25E operates in the midday period. Routes 25C and 25D provide service between the NVCC campus and the Pentagon Metrorail Station. The combined peak period frequency of these routes is generally 10-15 minutes in the weekday peak periods and 60-minutes in the midday and evening periods. On Saturdays and Sundays, only Route 25A operates at 60-minute frequencies.

25B – Landmark-Ballston Line - Route 25B operates in the peak periods only between the Van Dorn Metrorail Station and the Ballston-MU Metrorail Station. This route generally follows the Van Dorn Street corridor to Tanney Avenue (with a stop at the Landmark Mall). From Tanney Avenue, the route follows Jordan Street and Howard Street to Seminary Road. Route 25B then continues along the Seminary Road Corridor to NVCC, continuing on to the Ballston-MU Station. Weekday service frequencies are generally 30-minutes in the peak periods and 60-minutes in the midday and evening periods. Saturday frequencies are generally 60-minutes. No Sunday service is provided on this line.

Other Metrobus lines that traverse the corridor area include:

- 16L – Annandale-Skyline City-Pentagon Line
- 18E,F – Springfield Line
- 21A,D – Landmark-Pentagon Line
- 28A – Leesburg Pike Line
- 28F,G – Skyline City Line
- 28X – Leesburg Pike Limited Line
- 29K,N – Alexandria-Fairfax Line

<u>Fairfax Connector Routes:</u>

Six Fairfax Connector routes traverse the corridor area. These include the following three routes that serve areas south of the corridor and terminate at the Van Dorn Metrorail station:

- 109 – Rose Hill Line
- 231 – Kingstowne Line (counterclockwise)
- 232 – Kingstowne Line (clockwise)

The following additional routes serve limited locations in the southern portion of the corridor:

- 306 – GMU-Pentagon Line
- 321 – Greater Springfield Circulator (counterclockwise)
- 322 – Greater Springfield Circulator (clockwise)

Arlington Transit (ART) Routes

The following two ART routes traverse the corridor area in the portion of the alignment in Arlington County and serve the Shirlington Bus Station:

- 75 – Shirlington-Wakefield H.S. - Carlin Springs Rd.- Ballston - Virginia Square
- 77 – Shirlington - Lyon Park - Court House

Transfer Facilities

In addition to the Van Dorn Metrorail station, there are two other transfer points along the corridor in Alexandria. **Table D-5** presents the corridor routes served by the Van Dorn Metrorail Station, Landmark Mall Transit Center, and Mark Center Transportation Center.

Landmark Mall is an important bus transfer point for both DASH and Metrobus. It serves four DASH routes and three Metrobus routes. The Mark Center Transportation Center opened in August 2011 to serve the BRAC-133 opening. This transfer point includes 5 bus bays and one stop across the street serving three DASH routes and seven Metrobus routes, as well as private DoD shuttles.

Table D-5: Transfer Points and Connecting Corridor Bus Routes

Transfer Point	Connecting Corridor Routes	Provider
Van Dorn Metrorail	AT1	DASH
	AT5	DASH
	AT7	DASH
	AT8	DASH
	25B	Metrobus
	FC 109	Fairfax Connector
	FC 231	Fairfax Connector
	FC 232	Fairfax Connector
	FC 321	Fairfax Connector
	FC 322	Fairfax Connector
Landmark Mall Transit Center	AT1	DASH
	AT5	DASH
	AT7	DASH
	AT8	DASH
	25B	Metrobus
	29K	Metrobus
	29N	Metrobus
Mark Center Transit Center	AT1	DASH
	AT2	DASH
	AT2X	DASH
	7A	Metrobus
	7F	Metrobus
	7W	Metrobus
	7X	Metrobus
	7M	Metrobus
	8W	Metrobus
	28X	Metrobus

Private Shuttle Bus Operations

Several private shuttles serve the Van Dorn Metrorail station for surrounding residential communities. A number of private shuttle operators provide transit services within the corridor area today from the Mark Center area and the NVCC campus.

Private shuttle service is also provided between the Mark Center Transit Center and the Franconia-Springfield Metrorail Station every 20 to 25 minutes. Also in the larger Mark Center area, Duke Realty operates the Mark Center Express. This shuttle provides transportation between the Mark Center Transit Center and the Pentagon City Metrorail station in the morning and afternoon peak periods every 20 minutes. It also circulates within the larger Mark Center development with stops at key locations both north and south of Beauregard Street. Further to the west along Sanger Avenue, the Lynbrook and Meadow Creek apartments offer complimentary shuttle service to the Pentagon City Metrorail station.

Northern Virginia Community College also provides the NOVA shuttle. Routes B and C serve the Alexandria campus. Route B travels from the Alexandria Campus to NVCC's Arlington Center and the Ballston-MU Metrorail station. Route C travels from the Alexandria Campus to NVCC's Annandale campus and the Braddock Road Metrorail Station.

WEST END TRANSITWAY

Alternatives Analysis – Appendix B

SYSTEM PLAN AND OPERATIONAL SUMMARY

FEBRUARY 26, 2016

ALEXANDRIA ACCELERATED

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Table of Contents

Figures

Tables

1. INTRODUCTION

This memo describes the transit service elements proposed with each alternative; an overview of local and regional bus service characteristics under the No Build, TSM, and Build Alternatives; and operating and maintenance (O&M) cost methodology and estimates.

2. ALTERNATIVES EVALUATED

The alternatives evaluated in the West End Transitway Alternatives Analysis are described below.

- **No Build**: The No Build Alternative assumes that no new fixed guideway transit investment in the corridor and that transit services would operate in shared lanes, similar to current conditions.
- **Transportation Systems Management (TSM):** The TSM Alternative includes frequent, continuous transit service along Van Dorn and Beauregard Streets, but does not include major capital investment in new infrastructure for dedicated transit lanes and transit stations. The TSM Alternative includes a significant investment in new, limited-stop bus service along the entirety of the corridor. Transit service in this alternative would continue to operate in shared lanes. The TSM Alternative includes traffic operational enhancements over and above those included in the No Build Alternative to improve transit performance (e.g., transit signal priority).
- **Build Alternative**: Like the TSM Alternative, the Build Alternative includes frequent, continuous transit service along Van Dorn and Beauregard Streets. It follows the same transit route, has the same stop locations and the same transit signal priority improvements as the TSM Alternative, but relies on a combination of infrastructure and operational elements to enhance transit operations. Along significant portions of the corridor, dedicated lanes would be constructed for transit vehicles to improve travel speeds. Transit stations at each stop would include platforms level with bus entry doors and ticket vending machines (TVMs), allowing faster boarding. Refer to **Figure 1** for an overview of the proposed runningway characteristics.

3. SERVICE PLAN

The addition of a new transit service along Van Dorn and Beauregard Streets would be accompanied by some service changes to existing local and regional transit services operating in the corridor. The service plans for each alternative are summarized below.

3.1. 2015 and 2035 No Build Alternatives

- 2015 No Build Alternative consists of the existing transit system
- 2035 No Build Alternative reflects transit service changes identified in the DASH Comprehensive Operations Analysis (COA) which are the most likely to be implemented by 2035, as well as transit service changes to other bus routes in the corridor identified in MWCOG's 2035 travel demand model

3.2. 2015 and 2035 TSM Alternatives

- **Key transit service**: Proposed West End Transitway service which provides limited stop bus service along Van Dorn and Beauregard Streets
    - **Service Pattern:** Two service route patterns on weekdays during the peak and midday periods (**Figure 2**):
        - Van Dorn Metro to Pentagon via Shirlington Station
        - Van Dorn Metro to Pentagon via Seminary Road

      Only one of these service patterns, from Van Dorn Metro to Pentagon via Shirlington Station, is proposed to operate during weekday evenings and on weekends (**Figure 2).**
    - **Service headways**: Range from 10 minutes in the peak (5 minutes combined) to 15 minutes in the midday (7.5 minutes combined) when both patterns are operating (**Figure 2**). Weekday evening and weekend headways range from 15 to 30 minutes (**Figure 3**).
- **Local and regional services:** Some changes proposed to local and regional services operating in the corridor designed to complement the key transit service.
- Refer to **Table 1** for a general summary of service elements.

3.3. 2015 and 2035 Build Alternatives

- **Key transit service**: Proposed West End Transitway service which improves the limited stop bus service in the TSM Alternative, but with significant segments of dedicated lanes, as well as transit stations:
    - **Service Pattern:** Same as the TSM Alternative (**Figures 2** and **3**).
    - **Service headways**: Same as the TSM Alternative (**Figures 2** and **3**).
- **Local and regional services:** Some changes proposed to local and regional services operating in the corridor designed to complement the key transit service
- Refer to **Table 1** for a general summary of service elements

Figure 1: Build Alternative Runningway Configuration

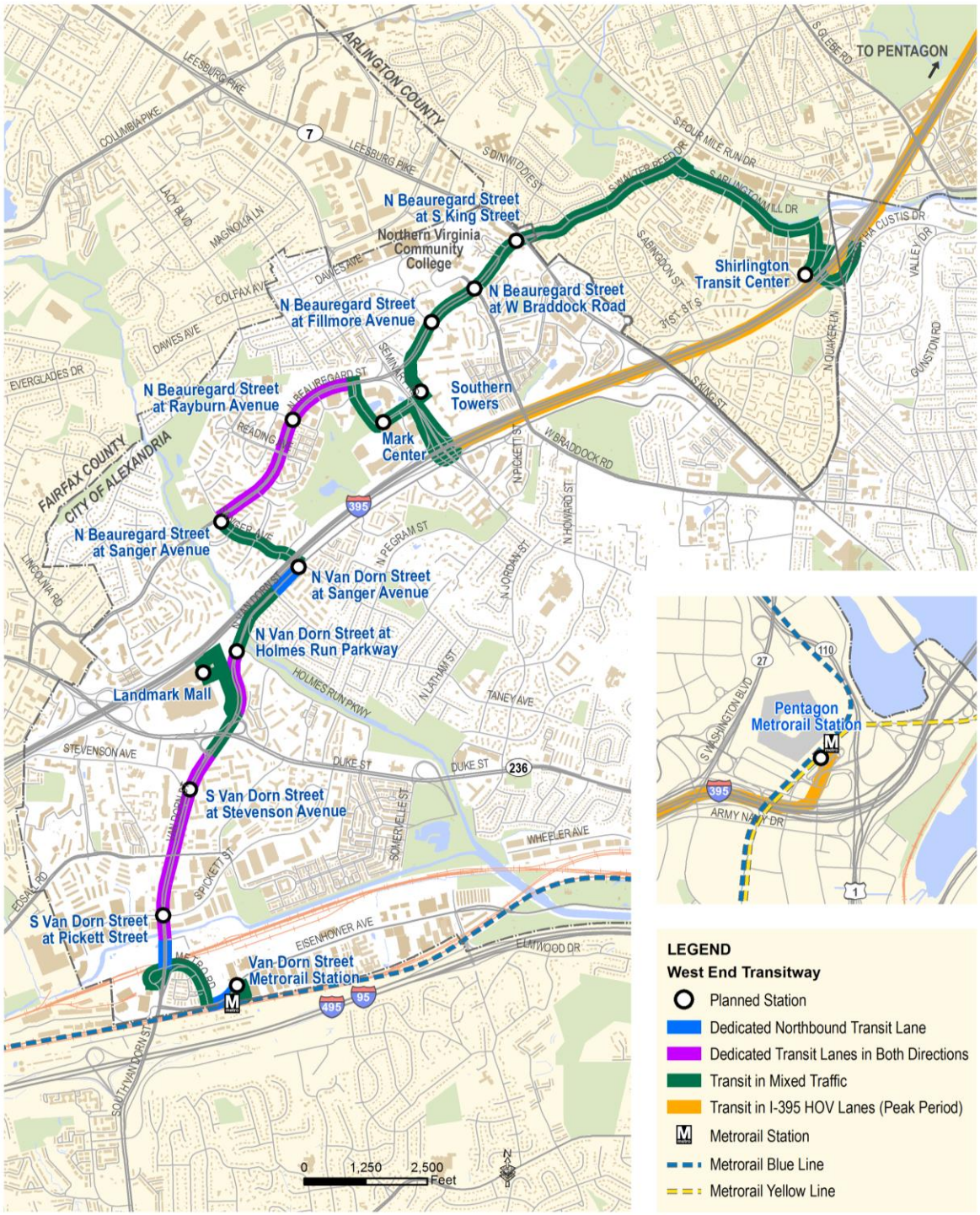

Figure 2: Weekday Peak and Midday Route Patterns (TSM and Build Alternatives)

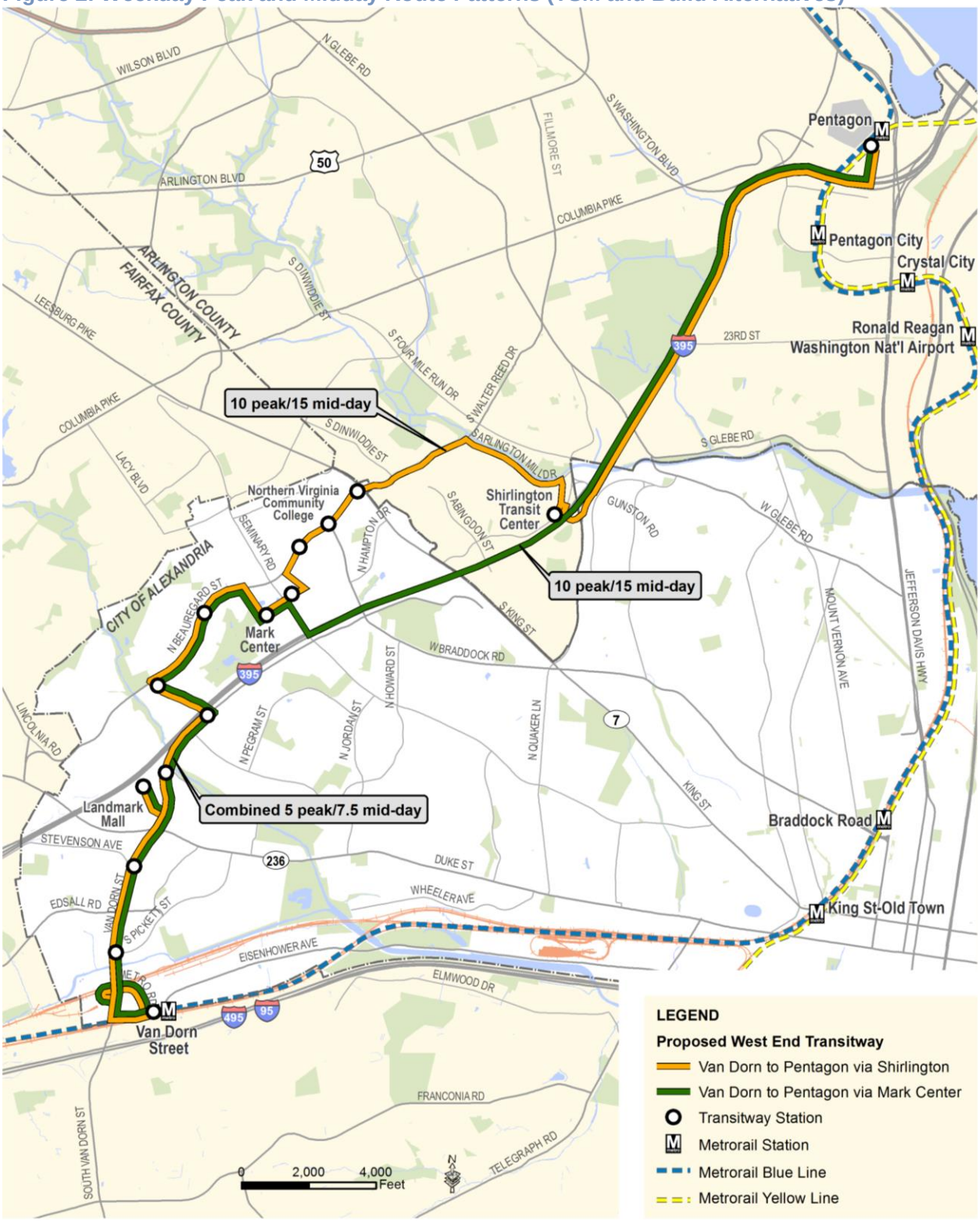

Figure 3: Weekday Evening and Weekend Route Pattern (TSM and Build Alternatives)

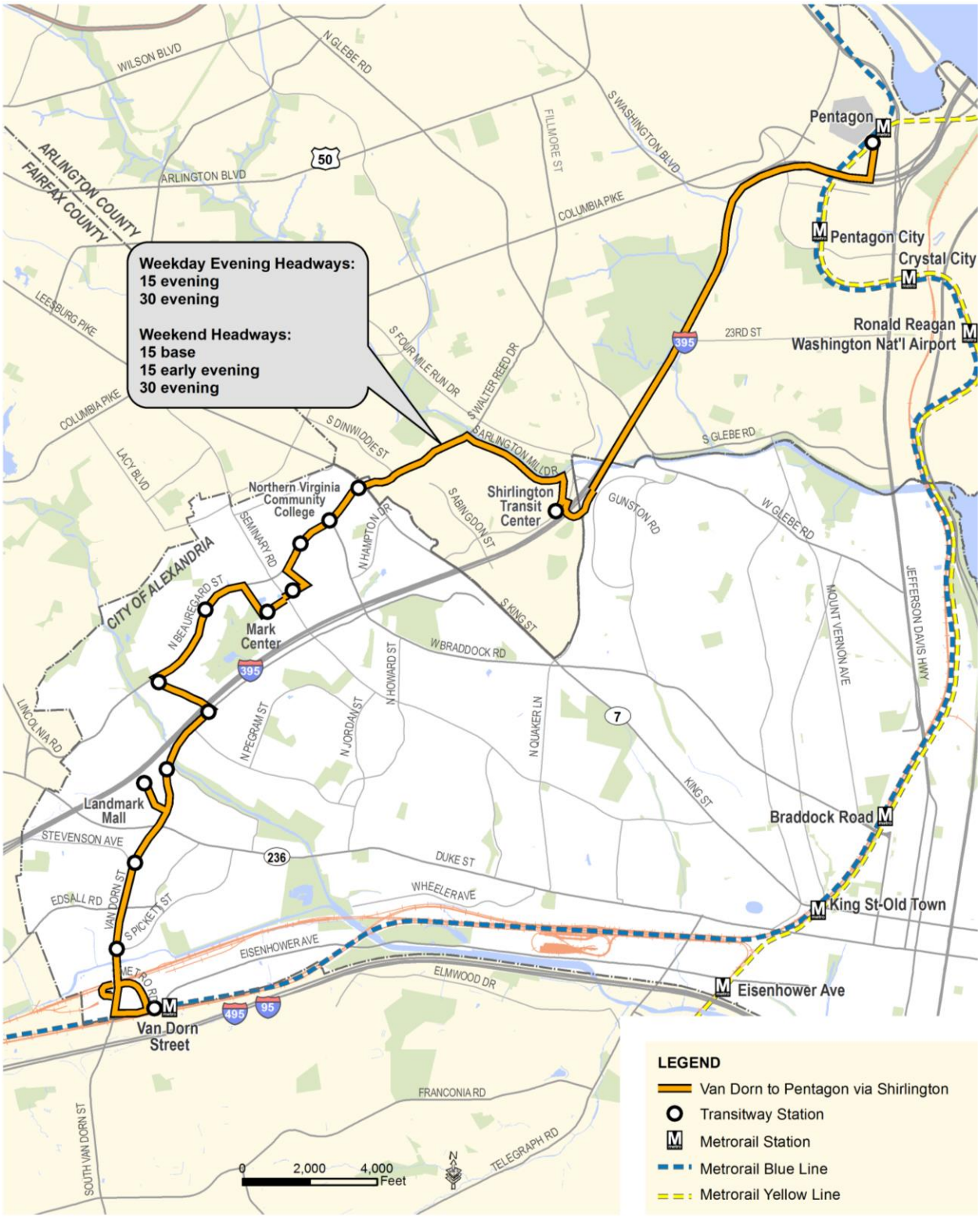

Table 1: Summary of Service Elements

Service Element	No Build Alternative	TSM Alternative	Build Alternative
2015 and 2035 WET Service	N/A	Two WET routes: ▪ Van Dorn to Pentagon via Shirlington Station ▪ Van Dorn to Pentagon via Seminary Road Weekday service levels for each - 10 peak, 15 midday Weeknight and weekend service levels for Shirlington pattern – 30 in late evening, 15 all other times	Two WET routes: ▪ Van Dorn to Pentagon via Shirlington Station ▪ Van Dorn to Pentagon via Seminary Road Weekday service levels for each - 10 peak, 15 midday Weeknight and weekend service levels for Shirlington pattern – 30 in late evening, 15 all other times
WET Alignment and Stops	N/A	Shared lanes 15 stops	Dedicated transit lanes in some locations 15 stations
WET Span of Service	N/A	Weekdays: 19 daily hours of operation Weekends: 17 daily hours of operation	Weekdays: 19 daily hours of operation Weekends: 17 daily hours of operation
WET Vehicle Requirements	N/A	Weekday peak/fleet vehicles: ▪ 2015: 18/22 ▪ 2035: 19/23	Weekday peak/fleet vehicles: ▪ 2015: 16/20 ▪ 2035: 16/20
WET Annual Revenue Hours	N/A	▪ 2015: 74,960 ▪ 2035: 76,970	▪ 2015: 64,740 ▪ 2035: 64,740
2015 Changes to Background Bus Service	Same as existing service as of August 1, 2014	DASH – Same as existing, except: ▪ Truncate AT1 and AT5 at Landmark Mall Metrobus – Same as existing, except: ▪ Eliminate 7C ▪ Eliminate 7M ART: Eliminate 87X	DASH – Same as existing, except: ▪ Truncate AT1 and AT5 at Landmark Mall Metrobus – Same as existing, except: ▪ Eliminate 7C ▪ Eliminate 7M ART: Eliminate 87X
2035 Changes to Background Bus Service	DASH – Same as existing, except: ▪ Improve service on AT1 and AT8 ▪ Truncate AT7 at Van Dorn Metro ▪ Add Van Dorn Circulator Metrobus – Same as existing, except: ▪ Improve service on 7M ART: Same as existing	DASH – Same as existing, except: ▪ Improve service on AT8 ▪ Truncate AT1 and AT5 at Landmark Mall ▪ Truncate AT7 at Van Dorn Metro ▪ Add Van Dorn Circulator Metrobus – Same as existing, except: ▪ Eliminate 7C ▪ Eliminate 7M ART: Eliminate 87X	DASH – Same as existing, except: ▪ Improve service on AT8 ▪ Truncate AT1 and AT5 at Landmark Mall ▪ Truncate AT7 at Van Dorn Metro ▪ Add Van Dorn Circulator Metrobus – Same as existing, except: ▪ Eliminate 7C ▪ Eliminate 7M ART: Eliminate 87X

4. VEHICLE MAINTENANCE AND STORAGE

Storage and maintenance of the additional vehicles required for the Build Alternative or the TSM Alternative is assumed at the WMATA Cinder Bed Road facility. The facility, currently under construction to accommodate 160 buses and scheduled to open in 2016, underwent a separate environmental review process and is funded in part by the City of Alexandria. Vehicles associated with the existing Metroway service will be stored and maintained at this facility.

5. OPERATIONS AND MAINTENANCE COSTS ESTIMATES

Operating and maintenance (O&M) costs are expressed as the annual total incurred employee earnings and fringe benefits, contract services, materials and supplies, utilities and other day-to-day expenses. This section describes the O&M cost methodology used and presents the results.

5.1. Summary of O&M Cost Methodology

- Consistent with FTA guidelines which promote using fully-allocated, resource build-up spreadsheet cost models for each mode (*Procedures and Technical Methods for Transit Project Planning*).
- Uses a line item format where each expense incurred is driven by a key supply variable
- Background bus service estimates based on unit costs derived from service providers' recent actual experience *(2013 National Transit Database)*, inflated to 2015.
- West End Transitway Service estimates add expenses related to maintaining equipment and facilities specific to each alternative. Two estimates developed assuming either DASH or WMATA will operate service.

5.2. O&M Cost Estimates

Table 2 and **Table 3** present the annual O&M estimates produced by each alternative model run for the years 2015 and 2035, respectively. As would be expected, West End Transitway costs are estimated to be significantly lower if DASH were to operate the service, rather than WMATA. By itself, West End Transitway O&M costs range from approximately $6.0 million to $6.7 million if DASH were to operate it vs. $9.9 million to $10.2 million for WMATA operations. In all cases, the costs of providing West End Transitway service are partially off-set by savings resulting from changes to the background bus network to reduce duplicative service (e.g., replacing Metrobus Route 7M with West End Transitway service).

As a result, the incremental costs of the TSM Alternatives compared to the No Build Alternatives range from approximately $2.6 million to $3.9 million if DASH were to operate the service vs. $6.6 million to $7.8 million for WMATA operations. Similarly, the incremental costs of the Build Alternatives compared to the No Build Alternatives range from approximately $3.1 million to $4.5 million if DASH were to operate the service vs. $6.7 million to $8.1 million for WMATA operations.

Table 2: 2015 Operations & Maintenance Cost Estimates

Service Element	No Build Alternative	TSM Alternative	Build Alternative
Background Bus			
Total Costs	$17,806,100	$15,654,500	$15,654,500
Change from No Build	*N/A*	*($2,151,600)*	*($2,151,600)*
West End Transitway Total Costs			
If DASH Operates:	$0	$6,008,200	$6,680,600
If WMATA Operates:	$0	$9,925,700	$10,230,400
Total Costs (Background Bus and West End Transitway)			
If DASH Operates West End Transitway:			
Total Costs	$17,806,100	$21,662,700	$22,335,100
Change from No Build	*N/A*	*$3,856,600*	*$4,529,000*
If WMATA Operates West End Transitway:			
Total Costs	$17,806,100	$25,580,200	$25,884,900
Change from No Build	*N/A*	*$7,774,100*	*$8,078,800*

Table 3: 2035 Operations & Maintenance Cost Estimates

Service Element	No Build Alternative	TSM Alternative	Build Alternative
Background Bus			
Total Costs	$24,208,900	$20,646,400	$20,646,400
Change from No Build	*N/A*	*($3,562,500)*	*($3,562,500)*
West End Transitway Total Costs			
If DASH Operates:	$0	$6,122,300	$6,680,600
If WMATA Operates:	$0	$10,126,800	$10,230,400
Total Costs (Background Bus and West End Transitway)			
If DASH Operates West End Transitway:			
Total Costs	$24,208,900	$26,768,700	$27,327,000
Change from No Build	*N/A*	*$2,559,800*	*$3,118,100*
If WMATA Operates West End Transitway:			
Total Costs	$24,208,900	$30,773,200	$30,876,800
Change from No Build	*N/A*	*$6,564,300*	*$6,667,900*

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WEST END TRANSITWAY

Alternatives Analysis – Appendix C

DEVELOPMENT POTENTIAL ANALYSIS TECHNICAL MEMORANDUM

DRAFT

FEBRUARY 22, 2016

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1. EXECUTIVE SUMMARY

This analysis explores the potential economic impact of the proposed Alexandria West End Transitway. The new Transitway service and infrastructure will contribute to the West End's attractiveness as a place to live and work. Development activity and property values along the project corridor will increase, providing additional tax revenue to the City.

The West End Transitway will provide properties within ½ mile of the guideway greater access to other parts of the corridor and to the broader metropolitan area. As a result, the corridor will become more attractive to both residents and commercial enterprises than it would be without this improvement to local accessibility. Development levels and the pace of development in the corridor are likely to increase with the introduction of BRT service, tempered by the overall health of the local economy and fluctuations in the local business cycle. An increase in development levels would in turn raise the overall value of properties. Additionally, empirical research on the economic impact of BRT access and the value of walkable community centers indicates that existing properties will appreciate in value. Together with new development, this will increase the property tax revenue for the City.

Table 1 summarizes the results of the analysis for the area within ½ mile of the Transitway for No Build, Transportation Systems Management (TSM) and Build Alternatives. The analysis quantifies two main areas of economic value:

- Net new development in the corridor, and
- Increased value (property premium effect) of existing development.

Values for the Build Alternative are presented as a range with the lower number assuming no change in quality of new construction and higher number assuming a change in quality. Table 2 outlines the three scenarios on change in quality. Total change in tax revenue in Table 1 is shown with a conservative 2% property premium, as well as a 4% property premium, to present a range.

Table 1: Development Potential Analysis Summary (2015 to 2034, unless otherwise noted)

	No Build	TSM	Build
Projected Net Additional New Development (millions of square feet)	4.8	4.8	10.2
Projected Value of Net Additional New Development (M $)	$901.8	$899.2	$1,871.6 - $2,097.2
Current Value of Development in the Corridor (M 2015 $)	$6,857.3	$6,857.3	$6,857.3
Percent Growth in Value of Net New Development (%)	13.2%	13.1%	27.3% - 30.6%
Tax Revenue from Additional New Development ($M)	$77.1	$78.0	$133.1 - $150.6
Tax Revenue from 2-4% Property Premium on Existing Development (2019-2034, M $)*	$0	$0	$20.6 - $41.3
Total Change in Tax Revenue (4% premium, M $, undiscounted)	$77.1	$78.0	$174.4 - $191.8
Total Change in Tax Revenue (2% premium, undiscounted)	$77.1	$78.0	$153.7 - $171.2

Source: AECOM Analysis

**For the property premium, 2015 values were grown to 2019 to account for the real change in the underlying value between the 2015 period for which we have assessment data and 2019, the year in which we assume the property premium impact would occur. A. CAGR of 4.4% was applied to those 4 years, sourced from the FHFA Purchase-Only House Price seasonally adjusted Index--a repeat-purchase index-- for the Washington-Arlington-Alexandria MSA (Q3 1991- Q3 2015). The property premium is assumed to take effect in 2019, 1 year before the opening of the Transitway, and tax revenue assumed to be collected from 2019 through 2034.*

Note: Results contingent on the construction of the entire corridor. Future phasing may change the results of the analysis.

Note: Lower bound of the range for the Build Alternative assumes no change in quality, and upper bound assumes an optimistic scenario in change in quality of new construction within the corridor.

Table 2: Scenarios on Change in Quality of New Construction

Land Use Type	Scenario 1 – No Change	Scenario 2 - Conservative	Scenario 3 - Optimistic
Residential	No markup	10%	15%
Office	No markup	No markup	No markup
Retail	No markup	10%	15%
Other (Hotel)	No markup	5%	5%

Source: AECOM Analysis

Development is projected to come online in increments, with the full effect captured at the end of the 2015 -2034 analysis period. Transit investments may also change the quality or durability of new construction through greater developer investment in the corridor, characterized by a higher value per square foot of new development in the corridor.

Note that the TSM results in slightly lower increases in valuations relative to the No Build, a counter-intuitive result. This outcome reflects the pattern of anticipated demolitions and an altered mix of residential and commercial construction. Given that these are long-term projections with many uncertainties, the TSM outcome is similar to the No Build for all practical purposes.

Results for the Build Alternative offer significantly higher valuations. These gains reflect both increases to the values of existing properties—over $300 million corridor-wide when assuming a 4% property premium—as well as $1.8 to $2.0 B in net new development. The anticipated amount of net

new development is roughly twice that anticipated under the No Build and TSM Alternatives. This reflects both greater attraction of new development and a favorable mix of property types.

Over the last five years office development in the broader DC Metro region has continued to come on line, bringing the total area of development to more than 274 million square feet. However, demand for office space has not kept up with the supply that is coming on to the market, leading to rising vacancy rates throughout the region. While vacancies in the broader DC region rose from 18% to 23% between 2011 and 2015, vacancies in West Alexandria rose from 18% to 40%, leading to a steep decline in the absorption rate and asking rent per square foot. With demand for new office space in the corridor remaining tepid, the introduction of a BRT service and enhanced connectivity to the region will increase attractiveness of West Alexandria locations and may help bring vacancy rates in West Alexandria closer to the regional average. The current high office vacancy rate and evolving trends in declining office space use per employee weaken the near term potential for new office construction in the corridor.

The property premium analysis reflects small incremental increases in value for all property types when a premium transit investment such as the Build Alternative is introduced. The increased convenience of access to housing and employment along the corridor translates into higher value for properties within walking distance of transit. For this analysis the property premium is estimated at 4% based on a review of relevant literature and discussion with City of Alexandria Planning and Zoning staff. A 2% property premium was also calculated to present a range.

The balance of this technical memorandum describes the assumptions and methodology applied to derive these projections.

2. INTRODUCTION

This memorandum describes the technical approach, methods, and results of the analysis of future development potential for the Alexandria West End Transitway project area—with three candidate levels of transit investment. The three candidate levels of investment are the No Build, Transportation Systems Management (TSM), and Build Alternatives. The purpose of the development potential analysis is to estimate development effects of each alternative, measured by additional square feet of development by property type, as well as potential associated value and tax revenue. This information will help compare the No Build, TSM, and Build Alternatives.

This evaluation of development potential is informed by FTA's New Starts/Small Starts Project Justification Criteria for Economic Development and Land Use. Specifically, the findings are anticipated to be useful in support of the optional "additional quantitative analysis (scenario based estimate)" outlined in the current FTA New Starts/Small Starts Policy Guidance. The development value, property tax base impacts, property tax revenues, and land uses for each alternative relate to their capability to support multimodal transportation, meet sustainability and livability objectives, and achieve affordable housing goals set by the jurisdictions.

2.1. Project Description

Study Overview and Project Background

In accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, the Federal Transit Administration (FTA) as lead agency and the City of Alexandria as project sponsor are preparing an Alternatives Analysis (AA) and environmental documentation for the West End Transitway project. The City of Alexandria is proposing transit improvements along Van Dorn and Beauregard Streets in the City's West End that will provide robust high-capacity transit operations between the Van Dorn Metrorail station, Shirlington Bus Station, and the Pentagon using a combination of dedicated and shared lanes.

The purpose of the AA and environmental documentation process is to refine development of a fundable and implementable transit project that can be supported by the communities within the study area. The primary goal is to advance the agreed-upon transit improvements in the corridor toward design and construction. Evaluation measures are based on the project purpose and need, and include technical measures for features such as travel time and ridership, and qualitative considerations such as contribution to community values and economic development goals. With re-concurrence by City Council, the recommended alternative will become the Locally Preferred Alternative (LPA) for the purpose of the environmental document.

The environmental documentation assesses the potential socio-economic, environmental and transportation effects of the proposed improvements.

The alternatives to be evaluated in the AA and environmental documentation include:

- The No Build Alternative assumes no major transit investment. It includes existing transit operations and transit improvements already underway
- The TSM Alternative improves existing transit facilities and operations, and identifies additional low cost transportation improvements
- The Build Alternative is a Bus Rapid Transit (BRT) investment with high-quality passenger stations and extensive dedicated lanes for transit

The study concurrently advances concept design work and refined cost estimates for the recommended project.

Project and Study Area Description

The West End Transitway corridor is located in the City of Alexandria and Arlington County. The corridor extends approximately 8 miles between the Van Dorn Metrorail station and the Pentagon. The proposed Transitway alignment originates at the Van Dorn Metrorail station in Alexandria and follows Eisenhower Avenue, Metro Road, Van Dorn Street, Sanger Avenue, Beauregard Street, and Mark Center Drive to the BRAC-133 facility. At this point, the transitway splits into two lines, one travelling through Southern Towers, along Beauregard Street, and then entering Arlington County and expressing to the Shirlington Bus Station, and a second which uses the High Occupancy Vehicle (HOV) lanes on I-395 to the Pentagon. **Figure 1** shows the proposed alignment and stop locations.

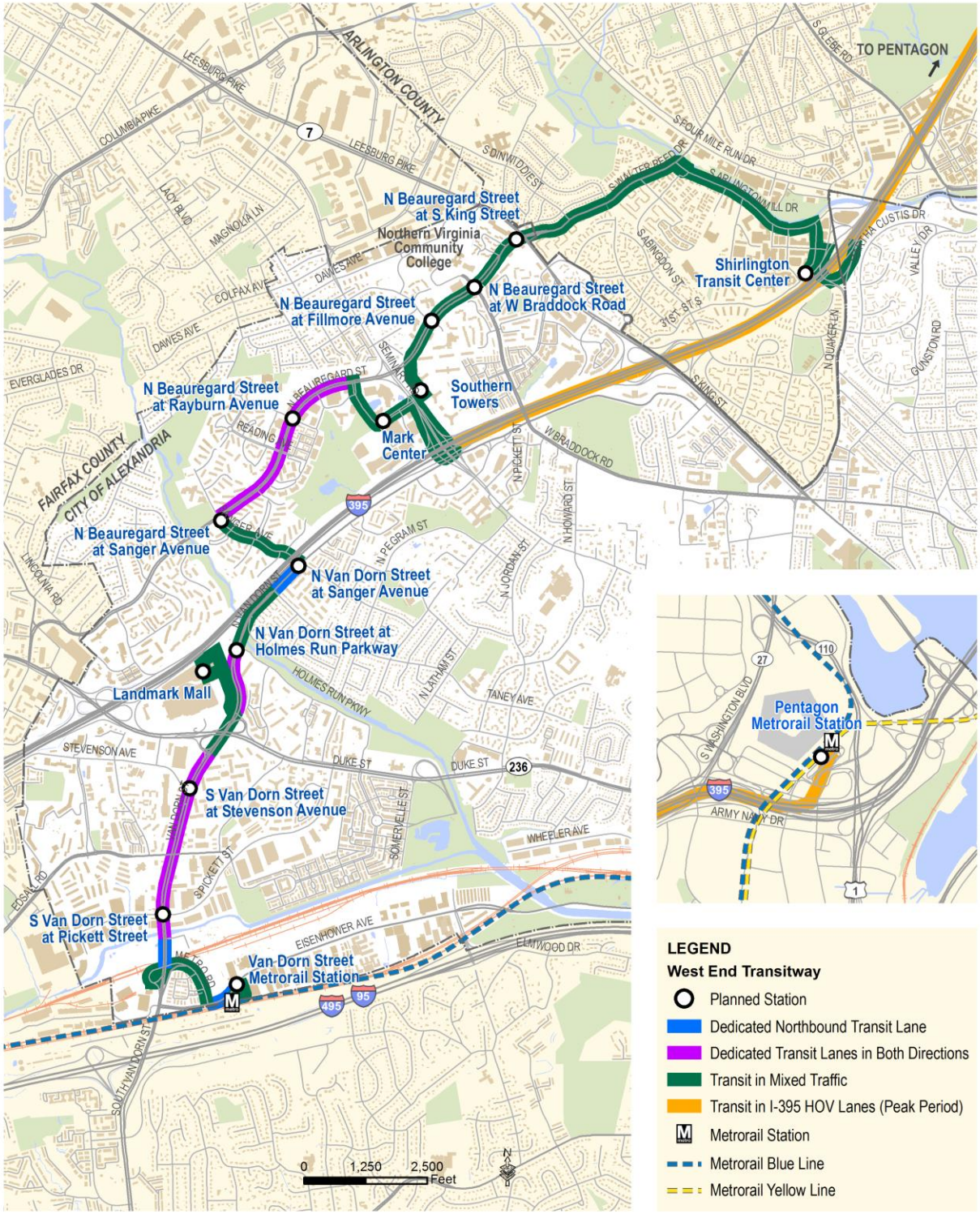
This study area is generally described as the half-mile area adjacent to the transit corridor between the Van Dorn Metrorail station and the Shirlington Transit Center, and an additional half-mile area around the Pentagon. Specifically, for this analysis, sub-areas have been identified within a half-mile of the transit corridor as described in **Section 3.1**.

2.2. Report Organization

The remainder of this technical memorandum reflects the development potential analysis process and is organized as follows:

- **Section 3** describes the methodology used to perform the analysis; and
- **Section 4** describes the findings of the analysis for both half-mile and quarter-mile radii.

Figure 1: Proposed Alignment and Stop Locations



3. METHODOLOGY

This section describes the methodology used to conduct the development potential analysis for the study area. The analysis is structured to assess the market outcomes associated with construction and operation of the Alexandria West End Transitway. Specifically, the analysis considers whether property values would change within ½ mile of the guideway with greater access to the corridor as well as the broader metropolitan economy. With implementation of the Transitway, the corridor would become more attractive to both residents and commercial enterprises than it would without this improvement to local accessibility. Development volumes and the pace of development in the corridor are likely to increase with the introduction of BRT service, tempered by the overall health of the local economy and fluctuations in the local business cycle, raising the overall value of properties. Additionally, empirical economic research on the economic impact of BRT access and the value of walkable community centers indicates that there are often positive impacts on existing property values associated with such investments. Existing properties will appreciate in value, reflecting that premium. Together with new development, this will increase the property tax revenue for the City.

3.1. Defining the Study Sub-Areas and Collecting Feedback from Jurisdictions

To assess the development potential along the corridor, the corridor was split into 12 sub-areas corresponding to the jurisdictions and neighborhood plans. The sub-areas are presented in **Table 3** and shown in **Figure 2**. The Metropolitan Washington Council of Governments (MWCOG) 8.2 forecast for population and employment was used for initial work and MSWCOG 8.4 forecast was used for analytical projections.

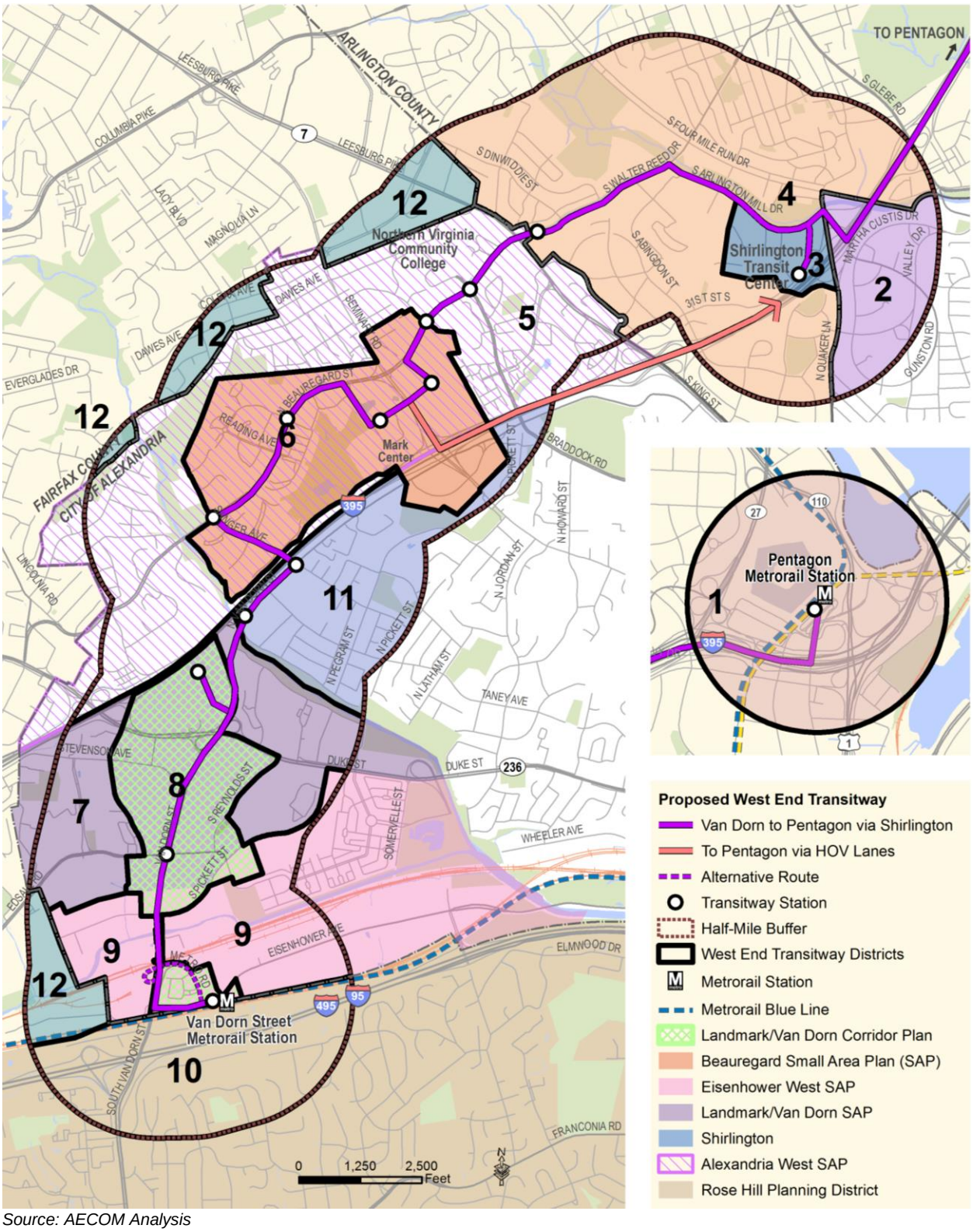
Table 3: Sub-Areas along the Corridor Used for the Analysis

Sub-Area Number	Sub-Area Name
1	Pentagon
2	Alexandria West
3	Shirlington
4	Arlington County
5	Northern Virginia Community College and Vicinity
6	Beauregard Small Area
7	North Landmark
8	Landmark Van Dorn Corridor Plan Area
9	Eisenhower West Small Area
10	Rose Hill Planning District
11	Seminary Hill
12	Fairfax County

Source: AECOM Analysis

The City of Alexandria, Fairfax County and Arlington County were contacted for guidance on adjusting the MWCOG 8.2 forecast for each of the proposed alternatives. The guidance received from Arlington County indicated that no additional development is anticipated in connection with plans for the West End Transitway. Review of plans for the Rose Hill Planning District (sub-area 10) and the rest of Fairfax County (sub-area12) within the study area indicated that no additional development is anticipated in Fairfax County in connection with the Transitway. Therefore, the analysis of additional development potential was restricted to the portion of the Transitway that lies within the City of Alexandria.

Figure 2: Sub-Areas within the Corridor Quarter Mile Radius



Source: AECOM Analysis

Property types were aggregated into five categories:

- Single Family Residential
- Multifamily Residential
- Office
- Retail
- Other (hotel as well as any other property)

The City of Alexandria provided anticipated square feet of development for each land use type for the No Build and Build Alternatives within half-mile and quarter-mile radii, as well as guidance on the likely development response for TSM. The City used the MWCOG 8.4 forecast as a base and applied the following assumptions to develop their projections:

- For the No Build Alternative, development between 2019 and 2035 was slowed by 1-4 years to reflect the current slower growth trends. All development projected beyond 2035 was slowed by 5 years.
- For the Build Alternative, development between 2019 and 2035 was accelerated by 1-5 years to reflect the anticipated response to the transitway investment. All development projected beyond 2035 was accelerated by 6 years.
- For TSM Alternative, development will stay at No Build levels with the exception of the Beauregard Small Area, which will experience additional growth amounting to 10% of the difference between the Build and No Build levels of development[1].

The square feet of development were provided in 5 year increments for the duration of the analysis period. The complete set of existing real estate assessment data for the City of Alexandria was not available; therefore it was not possible to develop an accurate baseline of existing square footage. To address this issue, the methodology was adjusted to only analyze net new development between 2015 and 2034 in the sub-areas. This modified methodology satisfies the original purpose of the analysis, and allows a comparison of potential impacts on development for each alternative. It also accounts for the cap on development in the Beauregard Small Area without the addition of a Transitway in the No Build and TSM Alternatives.

For the No Build and TSM Alternatives, a cap on total new development was implemented for the Beauregard Small Area, — set at 1,500,000 square feet without the enhanced transit connection[2].

Single Family and Multifamily Residential property projections were provided in the form of unit counts. Average square footage per single-family and multifamily unit was assigned to estimate the total anticipated square feet of development of residential property based on the *Annual Characteristics of New Housing* (U.S. Census Bureau, 2013) and adjusted in accordance to recommendations provided by the City of Alexandria's Planning and Zoning Office to better

[1] *City of Alexandria's Real Estate Office, personal communication, October 20, 2015*

[2] *p. 67 Staff Recommendations for CDD #21*

represent the conditions along the corridor[3]. This value was set at 2,000 square feet for a single-family unit and at 950 square feet for a multifamily unit.

3.2. Adjustment for Regional Trends

Over the last five years office development in the broader DC Metro region has continued to come on line, rising to more than 274 million square feet. However, demand for office space has not kept up with the supply that is coming on to the market, leading to rising vacancy rates throughout the region. According to the CoStar Group, vacancy rates for office development in the DC Metro region have been rising since 2011, going from approximately 18% to nearly 23% in 2015[4]. The trend of rising vacancies is much more pronounced in West Alexandria, where vacancy rates have risen sharply starting in 2011, going from being below the regional average of 18% to nearly 40% in 2015. Over the same time period, absorption of office space has sharply declined in West Alexandria, as has the gross asking rent per square foot.

The market conditions of both West Alexandria and the broader DC Metro region indicate that demand for new office space in the near term will be tepid, and the development response in the corridor will be muted until absorption rates rise and vacancies fall. Therefore, projections of office space in the corridor have been further reduced compared to other alternatives per feedback from the City of Alexandria Office of Planning and Zoning. For both No Build and Build alternatives, office development projections were delayed by an additional 3 years from the 2019-2024 increment onward. Office development projections for the final increment (2029-2034) were delayed by an additional 8 years.

3.3. Development Scenarios for Each Alternative

After the 2034 anticipated square feet of development for No Build, TSM, and Build, Alternatives was calculated for each land use type, valuation scenarios were developed for each Alternative.

Developing Valuations for Each Alternative

The value per square foot of each type of development was derived using the 2015 assessment data for the corridor from the Alexandria Office of Real Estate Assessments, shown in **Table 4**. These values were then applied to the square footage projections to obtain total valuations for the corridor in 2015 dollars.

Table 4: Value per Square Foot of Development by Land Use Type (2015)

Land Use Type	Price per Square Foot
Single Family Residential	$277.65
Multifamily Residential	$175.12
Office	$159.09
Retail	$99.08
Other (Commercial, Hotel & Lodging)	$167.95

Source: City of Alexandria's Real Estate Assessment Database

[3] *City of Alexandria's Planning and Zoning Office, personal communication, October 16, 2015*

[4] *CoStar Property. CoStar Realty Information, Inc. 2015.*

In addition, three scenarios regarding the change in quality or durability of construction were developed for this analysis. Change in quality is reflected as a change in the value per square foot of new development.

- Scenario 1 reflects no change in quality in the corridor
- Scenario 2 is a conservative scenario, showing a small increase in quality in the corridor
- Scenario 3 is an optimistic scenario, showing a larger increase in quality in the corridor

Table 5 below shows the markup in price per square foot applied to each property type under Scenarios 2 and 3. These scenarios were developed based on feedback from the City of Alexandria Office of Real Estate Assessments and applied only to the Build Alternative.

Table 5: Assumptions for Change in Quality of Construction along the Transitway for the Build Alternative

Land Use Type	Scenario 1 – No Change	Scenario 2 - Conservative	Scenario 3 - Optimistic
Residential	No markup	10%	15%
Office	No markup	No markup	No markup
Retail	No markup	10%	15%
Other (Hotel)	No markup	5%	5%

Source: City of Alexandria's Office of Real Estate Assessments

In total, five scenarios were tested: one with no change in quality for No Build, one with no change in quality for TSM, and three for Build:

- No Build scenario assuming no change in quality
- TSM scenario assuming no change in quality
- Build Scenario 1 assuming no change in quality
- Build Scenario 2 with a cautiously optimistic increase in quality
- Build Scenario 3 with an optimistic increase in quality

3.4. Calculating Tax Yields

Once the valuations were developed, tax yields were calculated for the five scenarios by applying the tax rate for each property type to the valuations. Tax rates for the City of Alexandria were used. Because there are no special tax districts along the corridor, standard tax rates were used for the entire corridor. In 2015 the City of Alexandria set the tax rate for all property at $1.043 per $100. For this analysis, tax rates were held constant between now and 2034.

4. FINDINGS

The development analysis for the No Build, TSM and Build Alternatives was conducted for the half-mile distance from the Transitway and then replicated for a quarter-mile distance to provide a more accurate picture of concentrations of anticipated development. The analysis found that most of the net new development and consequently, the majority of tax revenue generated by new development, would occur between the quarter-mile and half-mile radii of the Transitway stations.

The detailed findings of the half-mile analysis and a summary of the quarter-mile analysis are below. The detailed quarter-mile analysis is included as **Appendix A** of this memorandum.

No Build Alternative

• 4.8 million square feet of net new development by 2034, valued around $903 million in 2015 dollars

• $77.1 million in cumulative tax revenue generated (2015 -2034)

TSM Alternative

• 4.8 million square feet of net new development by 2034, valued around $901 million in 2015 dollars

• $78 million in cumulative tax revenue generated (2015 -2034)

Build Alternative

• 10.2 million square feet of net new development by 2034, valued between $1.8 and $2.1 billion in 2015 dollars

• $133.1-$150.6 million in cumulative tax revenue generated (2015 -2034)

4.1. New Development within Half-Mile Radius of the Transitway

Analysis of development within a half-mile distance from the Transitway consists of the following:

- Projecting growth in square footage of new development by 2034;
- Growth of total property values associated with the new development by 2034; and
- Tax revenue growth associated with the new development.
- Property premium and the tax revenue it will generate under the Build Alternative associated with existing properties along the corridor.

4.1.1. Growth in Square Footage of New Development

The analysis projected square feet of new development for each of the three alternatives within the half-mile radius of the Transitway. **Table 6** shows the anticipated new development from 2015 to 2034 by land use type for the No Build, TSM, and Build Alternatives.

Separate projections were made for all new development versus tax exempt development for the No Build, TSM and Build Alternatives. Approximately 1 percent of the total additional square footage within a half-mile of the corridor was found to be tax-exempt for all three alternatives, demonstrating that the majority of new development in the corridor would be generating tax revenue. The analysis also found that in the No Build and TSM Alternatives, 75 percent of all new development along the corridor would be multifamily residential. However, in the Build Alternative, multifamily residential development would only comprise approximately

68 percent of all new development. Commercial development comprises no more than a fifth of all net new development under all Alternatives.

Table 6: Net New Development within Half- Mile of the Transitway - No Build, TSM and Build Alternatives (2015 to 2034)

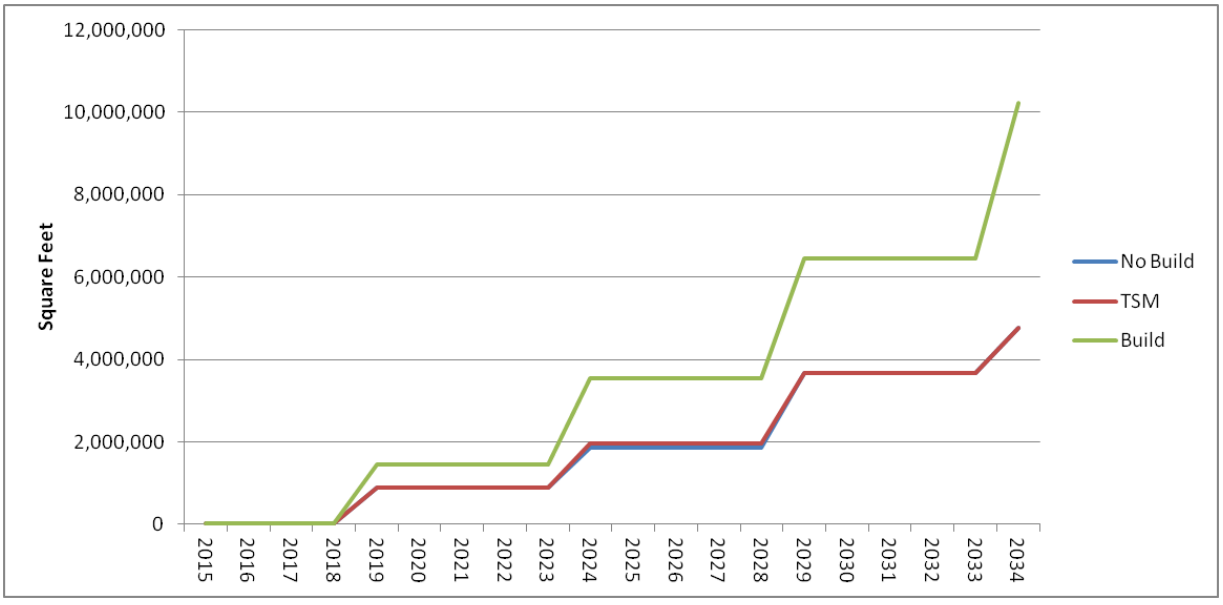
Land Use Type	Square Footage of Total New Development (Taxable & Tax-Exempt)		
	No Build	**TSM***	**Build**
Single Family Residential	532,000	515,000	1,026,000
Multifamily Residential	3,573,000	3,579,000	6,891,000
Office	996,000	990,000	1,984,000
Retail	-380,000	-367,000	-136,000
Other (Commercial, Hotel & Lodging)	55,000	59,000	323,000
Other (exempt)	-10,000	-10,000	140,000
Total (Non-exempt)	4,776,000	4,776,000	10,088,000
Total	**4,766,000**	**4,766,000**	**10,228,000**

Source: AECOM Analysis and City of Alexandria Office of Planning and Zoning

Note: TSM results in same square footage of new development but a different mix of development.

Figure 3 graphically shows a comparison of the total new development anticipated from the No Build, TSM and Build Alternatives.

Figure 3: Net New Development within Half- Mile of the Transitway - No Build, TSM and Build Alternatives (2015 to 2034)

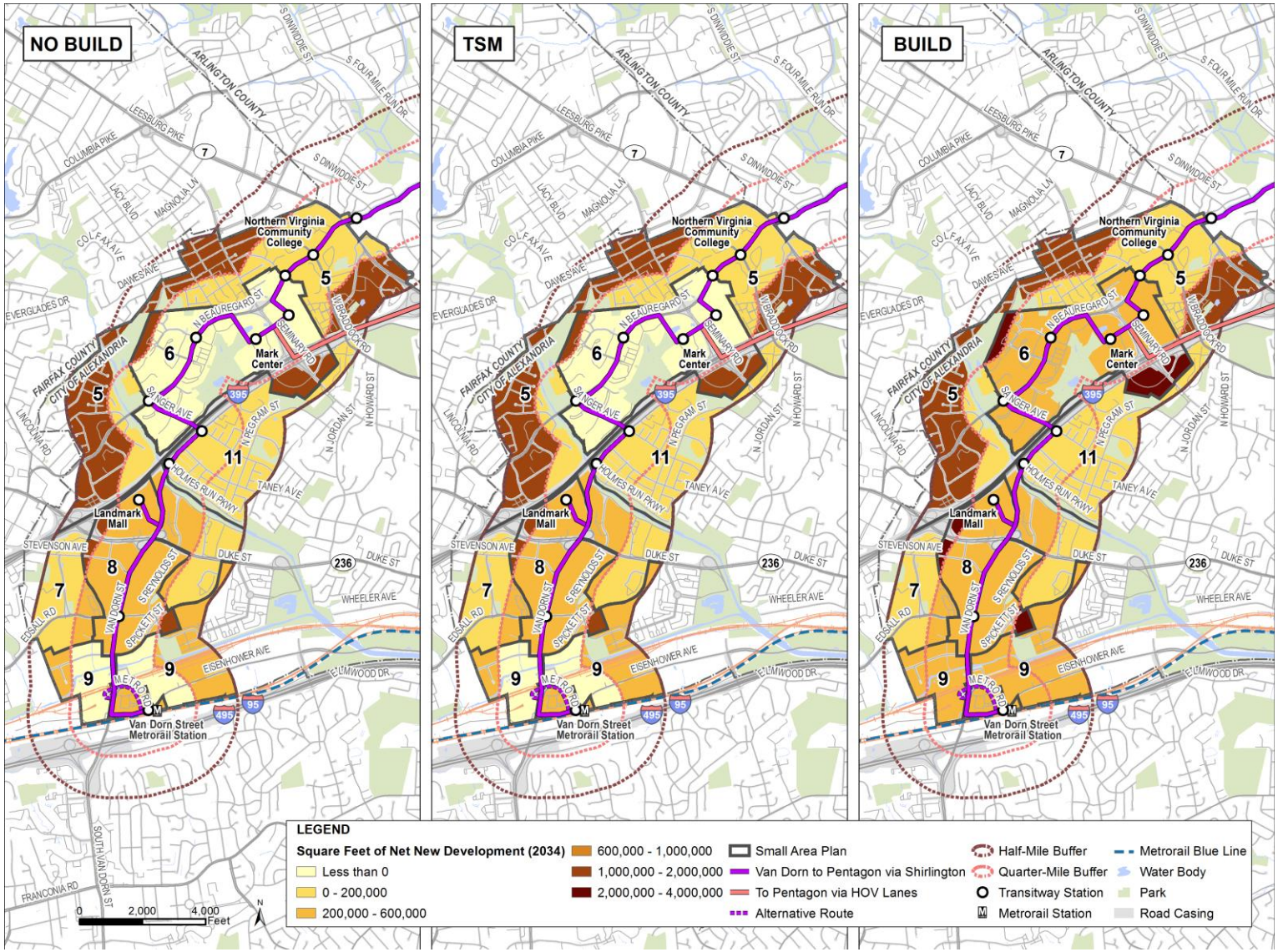


Source: AECOM Analysis and City of Alexandria Office of Planning and Zoning

Comparing the three alternatives, the Build Alternative would yield significantly more growth than both the No Build and the TSM Alternatives. Through 2034, the TSM Alternative only yields the same net growth as the No Build Alternative, while providing a different mix of land uses than the No Build Alternative. This is because the development cap in the Beauregard Small Area Plan is

reached before the end of the analysis period in both No Build and TSM Alternatives. In comparison, the Build Alternative yields more than double the growth of the No Build Alternative. **Figure 4** compares the areas within a half-mile radius of the transitway that are projected to experience the most development across Alternatives. The area between ¼ and ½ mile radius is projected to see the most growth. While Landmark Mall falls within both the inner and outer quarter mile of the half-mile radius from the Transitway, for the purpose of the analysis, projected development for Landmark Mall was assigned to the outer quarter mile. A comparison of square feet of net new residential and commercial development across alternatives can be found in **Appendix B**.

Figure 4: Square Feet of Total Net New Development (2034)



Source: AECOM Analysis

4.1.2. Property Value Growth

By 2034 the No Build and TSM Alternatives will grow the tax base in the corridor by about $900 million, and the Build Alternative will grow it by $1.9 - $2.1 billion, all in 2015 dollars. In 2014 the City of Alexandria's residential and commercial property tax base was $35.3 billion[5]. Within ½ mile radius of the planned transitway, total taxable property is valued at $5.2 billion in 2015, meaning that under the No Build and TSM Alternatives, total value of development is projected to increase by approximately 17%, while under the Build Alternative it is projected to increase by 36% - 40%.

For the No Build Alternative, the analysis assumed no change in quality of development in the corridor. **Table 7** shows the value of anticipated new development by property type.

Table 7: Value of Additional Development by Property Type within Half-Mile of the Transitway - No Build Alternative (in 2034)

Property Type	Property Value
Single Family Residential	$147,656,000
Multifamily Residential	$625,790,000
Office	$158,514,000
Retail	-$37,629,000
Other (Commercial, Hotel & Lodging)	$9,164,000
Other (exempt)	-$1,679,000
Total -Non-Exempt	$903,495,000
Total	**$901,815,000**

Source: AECOM Analysis

For the TSM Alternative the analysis assumed no change in quality of development in the corridor. **Table 8** shows the value of anticipated new development by property type within the corridor in 2034 for the TSM Alternative.

Table 8: Value of Additional Development by Property Type within Half-Mile of the Transitway - TSM Alternative (in 2034)

Property Type	Property Value
Single Family Residential	$142,988,000
Multifamily Residential	$626,821,000
Office	$157,532,000
Retail	-$36,389,000
Other (Commercial, Hotel & Lodging)	$9,934,000
Other (exempt)	-$1,679,000
Total -Non-Exempt	$900,886,000
Total	**$899,206,000**

Source: AECOM Analysis

For the Build Alternative, three scenarios were developed as described in the methodology section:

[5] *City of Alexandria Comprehensive Annual Financial Report. June 30, 2014. http://www.alexandriava.gov/uploadedFiles/finance/info/CAFR14%20with%20cover.pdf*

- Scenario 1: assuming no change in quality
- Scenario 2: a conservative scenario that assumes the lower bound of the recommendations on change in quality provided by the City
- Scenario 3: an optimistic scenario that assumes the upper bound of the recommendations on change in quality provided by the City

Table 9 shows the value of anticipated new development by property type within the corridor in 2034 for the Build Alternative.

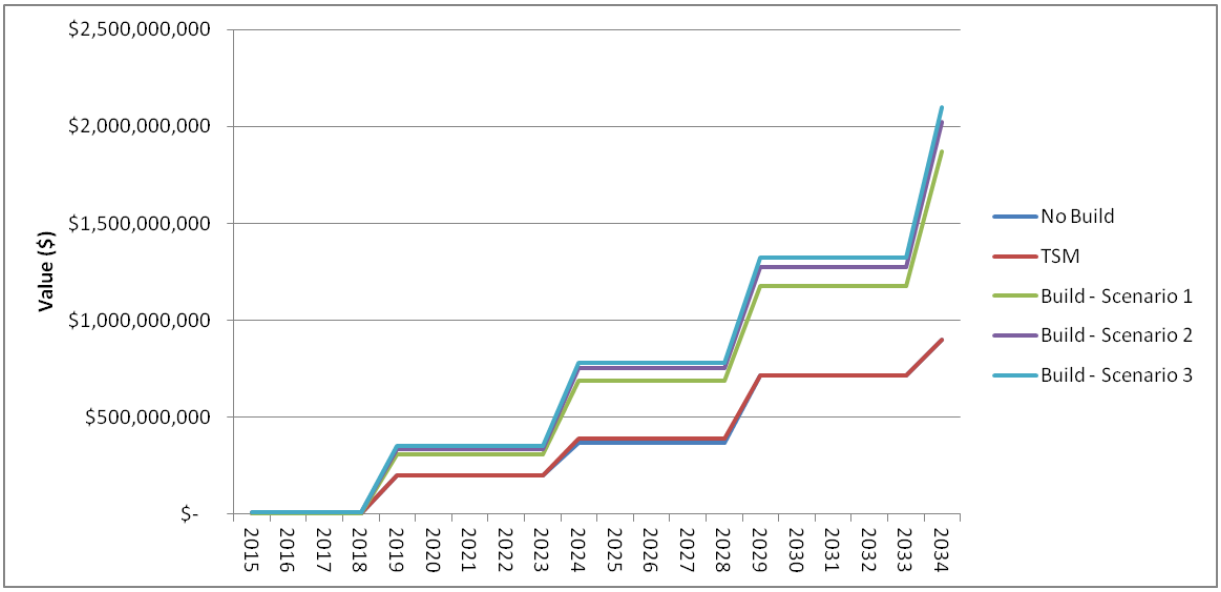
Table 9: Value of Additional Development by Property Type within Half-Mile of the Transitway - Build Alternative (Scenarios 1, 2 and 3 in 2034)

Land Use Type	Property Value		
	Build - Scenario 1 (no change in quality)	**Build - Scenario 2 (conservative estimate of change in quality – up to +10%)**	**Build - Scenario 3 (optimistic estimate of change in quality – up to +15%)**
Single Family Residential	$284,867,000	$313,354,000	$327,597,000
Multifamily Residential	$1,206,821,000	$1,327,503,000	$1,387,844,000
Office	$315,660,000	$315,660,000	$315,660,000
Retail	-$13,449,000	-$14,794,000	-$15,467,000
Other (Commercial, Hotel & Lodging)	$54,191,000	$56,900,000	$56,900,000
Other (exempt)	$23,513,000	$24,689,000	$24,689,000
Total -Non-Exempt	$1,848,089,000	$1,998,622,000	$2,072,534,000
Total	**$1,871,602,000**	**$2,023,311,000**	**$2,097,223,000**

Source: AECOM Analysis

Figure 5 shows the comparison of total property value projections in the corridor in 2034 for the five scenarios analyzed under the No Build, TSM and Build Alternatives.

Figure 5: Total Value of Additional Development within Half-Mile of the Transitway – No Build, TSM and Build Alternatives (in 2034)



Source: AECOM Analysis

4.1.3. Tax Revenue Growth

Under the No Build Alternative, the total tax revenue as a result of estimated new development in the corridor is projected to be $9.4 million in 2034. The cumulative tax revenue from new construction between 2015 and 2034 is expected to be $77.1 million undiscounted and $51.8 million discounted at 3%. These values were calculated in 2015 dollars. **Table 10** shows the tax revenue generated by property type as a result of new construction for the No Build Alternative.

Table 10: Tax Revenue in 2015 Dollars from New Construction within Half-Mile of the Transitway - No Build Alternative (2015-2034)

	Tax Revenue
Tax Revenue 2034	$9,423,000
Cumulative Tax Revenue (2015-2034)	$77,056,000
Discounted Cumulative Tax Revenue (2015-2034; discounted at 3%)	$51,823,000

Source: AECOM Analysis

Table 11 shows the tax revenue generated by property type as a result of new construction for the three scenarios used in the analysis of the TSM Alternative.

Table 11: Tax Revenue in 2015 Dollars from New Construction within Half-Mile of the Transitway - TSM Alternative Scenarios 1-3 (2015-2034)

	Tax Revenue
Tax Revenue 2034	$9,396,000
Cumulative Tax Revenue (2015-2034)	$77,992,000
Discounted Cumulative Tax Revenue (2015-2034; discounted at 3%)	$52,517,000

Source: AECOM Analysis

Table 12 shows the tax revenue generated by property type as a result of new construction for the three scenarios used in the analysis of the Build Alternative.

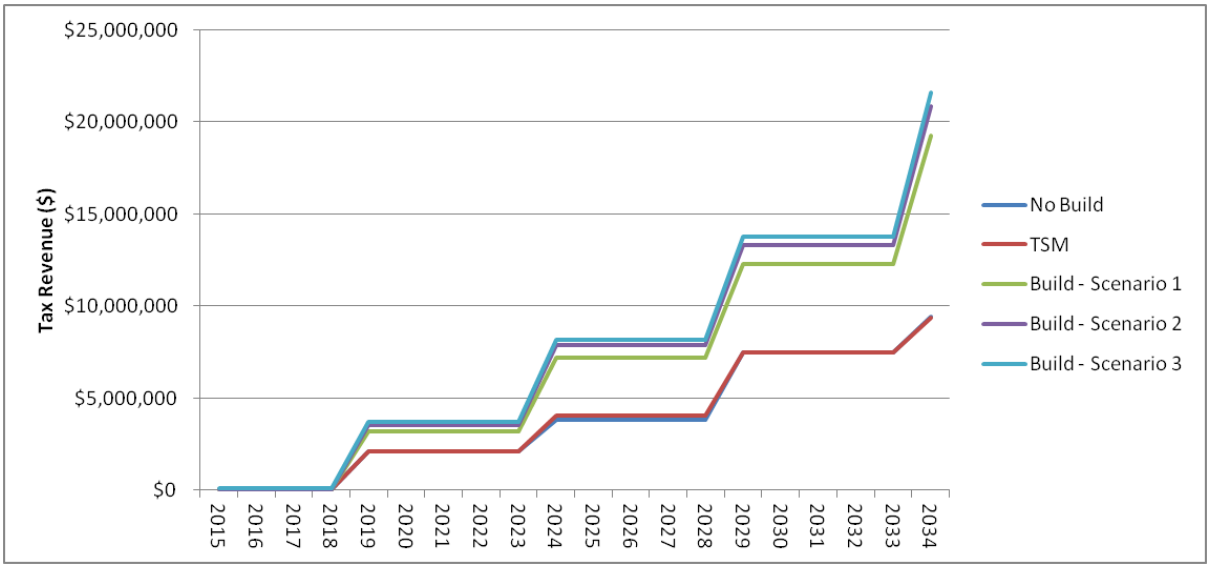
Table 12: Tax Revenue in 2015 Dollars from New Construction within Half-Mile of the Transitway - Build Alternative Scenarios 1-3 (2015-2034)

	Build - Scenario 1 (no change in quality)	Build - Scenario 2 (conservative estimate)	Build - Scenario 3 (optimistic estimate)
Tax Revenue 2034	$19,276,000	$20,846,000	$21,617,000
Cumulative Tax Revenue (2015-2034)	$133,092,000	$144,740,000	$150,552,000
Discounted Cumulative Tax Revenue (2015-2034; discounted at 3%)	$89,103,000	$96,992,000	$100,942,000

Source: AECOM Analysis

Figure 6 shows the comparison of annual tax revenue anticipated as a result of new development in the corridor in 2034 for the five scenarios analyzed under the No Build, TSM and Build Alternatives.

Figure 6: Comparison of Annual Tax Revenue within Half-Mile of the Transitway- No Build, TSM and Build Alternatives Scenarios 1-3 (2015-2034)



Source: AECOM Analysis

4.2. New Development within Quarter-Mile Radius of the Transitway

The analysis found that majority of new development will occur between ¼ and ½ mile radius of the transitway, with only about 6-15 percent of all new development occurring within a quarter-mile radius of the transitway, depending on the Alternative. **Figure 4 in Section 4.1** shows the detailed overview of development within half and quarter mile. The detailed quarter-mile analysis is summarized in **Table 13** and included as **Appendix A** of this memorandum.

Table 13: Summary of Quarter-Mile Radius Analysis

	Square Feet of New Development	Development Scenario	Value of New Development in 2034	Annual Tax Revenue from New Construction (2034)	Cumulative Tax Revenue from New Construction (2015-2034)*
No Build	278,000	No Change	$95,411,000	$995,000	$20,034,000
TSM	336,000	No Change	$105,510,000	$1,100,000	$21,193,000
Build	1,555,000	Scenario 1 – No Change in Quality	$312,122,000	$3,255,000	$33,073,000
		Scenario 2 – Conservative Estimate	$334,464,000	$3,488,000	$36,400,000
		Scenario 3 – Optimistic Estimate	$346,396,000	$3,613,000	$38,223,000

** Revenue undiscounted*

Note: All values in 2015 dollars

Source: AECOM Analysis

4.3. Property Premium Effect in the Corridor

The operation of the Alexandria West End Transitway would provide the property parcels within ½ mile of the guideway with greater access to the corridor as well as the broader metropolitan economy. As a result, residents and commercial enterprises will be willing to pay a premium for the locations where access is improved relative to the No Build and TSM Alternatives. Empirical economic research on the economic impact of BRT access and the value of walkable community centers indicates that there are often positive impacts on property values associated with such investments. In addition, recent research has demonstrated a "walkability premium" for commercial real estate investments ranging between one and nine percent, depending on property type.

For the Alexandria West End Transitway Build Alternative, the analysis applies a modest four percent increase in property values within ½ mile of the Build Right of Way (ROW) given the findings in the empirical economic literature. A two percent increase was also applied for comparison and to present a range. Because there is uncertainty, the study applies a modest range of 2-4%, which is below that assumed for the Boston Silver Line BRT, which had a premium of 7.6%. Additionally, a January 2012 DC Streetcar study expected property premiums along transit corridors to be in the range of 2 - 10% (depending on conditions in the corridor) and a survey of DC area developers completed for the WMATA Surface Transit AA expected a 10% property premium within a quarter mile of BRT stations.

The increase in property values immediately adjacent to the Build ROW results in an increase in the tax base for the City of Alexandria, which translates into an increase in the annual property tax revenues received by the City. An estimate of the potential increase in annual property tax revenues for the City of Alexandria associated with existing properties (does not include any new development or large scale redevelopment projects in the corridor) is also shown in **Table 14**. The property tax estimate is based on the 2015 residential tax rates for the City of Alexandria. In order to adjust the 2015 period for which we have assessment data to 2019 (the year in which we assume the property premium impact would occur) a CAGR of 4.4% was applied to those years, based on the long-term performance of the FHFA Purchase-Only House Price seasonally adjusted Index—a repeat-purchase index—for the Washington-Arlington-Alexandria MSA (Q3 1991-Q3 2015). This adjustment was made because the underlying value of the properties would increase in this intervening time in real terms as the economy develops. The property premium is assumed to take effect in 2019, one year before the opening of the Transitway, when construction is well underway and developers would be anticipated to begin their response. Because there are uncertainties concerning the timing of the premium, amount of the premium, growth in value prior to the premium impact occurring, the analysis was done assuming a 2 percent premium and a 4 percent premium to provide a range of the likely outcome and tax revenue assumed to be collected from 2019 through 2034.

Table 14: Property Premium and Tax Revenue Impacts on Existing Properties within ½ Mile of the Transitway (2015 $)

Radius	Total Value in 2015 ($M)	Total Value in 2019 ($M)	Total Taxable Value in 2019 ($M)	Property Premium	Property Premium Benefit ($M, on all properties)	Additional Annual Tax Revenue in 2019 ($, on taxable properties)
First Quarter Mile	$4,646	$5,519	$3,769	4%	$221	$1,572,565
Second Quarter Mile	$2,211	$2,627	$2,417	4%	$105	$1,008,538
Half Mile 4% (Corridor Total)	**$6,857**	**$8,146**	**$6,187**	**4%**	**$326**	**$2,581,103**
First Quarter Mile	$4,646	$5,519	$3,769	2%	$110	$786,283
Second Quarter Mile	$2,211	$2,627	$2,417	2%	$53	$504,269
Half Mile 2% (Corridor Total)	**$6,857**	**$8,146**	**$6,187**	**2%**	**$163**	**$1,290,551**

Source: AECOM Analysis

Note: For the property premium, 2015 values were grown to 2019 to account for the real change in the underlying value between the 2015 period for which we have assessment data and 2019, the year in which we assume the property premium impact would occur. A CAGR of 4.4% was applied to those 4 years, sourced from the FHFA Purchase-Only House Price seasonally adjusted index—a repeat purchase index—for the Washington-Arlington-Alexandria MSA (Q3 1991 – Q3 2015). The property premium is assumed to take effect in 2019, 1 year before the opening of the Transitway, which construction is underway and developers would be anticipated to begin their response. Tax revenue is assumed to be collected from 2019 through 2034.

5. COMPARISON TO SMALL STARTS/NEW STARTS GUIDELINES

The FTA New Starts/Small Starts Guidelines evaluate projects on a number of quantitative and qualitative criteria for land use and economic development, including land use and corridor policies and station area zoning. This preliminary analysis provides an initial assessment of project performance against selected quantitative criteria.

5.1. Land Use

The land use assessment looks at the overall corridor area served by the project and evaluates the corridor on a number of quantitative and qualitative criteria, including:

- Existing corridor and station area development, measured by population density and employment served by the system*
- Existing corridor and station area development character
- Existing station area pedestrian facilities, including access for person with disabilities
- Existing corridor and station area parking supply, measured by the cost of parking, and parking spaces per employee
- Proportion of existing legally binding affordability restricted housing in the corridor compared to the proportion of legally binding affordability restricted housing in the counties in which the project travels

Those criteria estimated in this memo are indicated with an asterisk. The evaluation process looks at CBD commercial Floor Area Ratio (FAR), other commercial FAR, residential dwelling units per acre, CBD parking spaces per 1,000 square feet and other parking spaces per 1,000 square feet. The guidelines are outlined in **Table 15.**

Table 15: FTA New Starts/Small Starts Quantitative Rating Guide

	Existing Land Use				Corridor Policies and Station Area Zoning				
	Station Area Development		Parking supply		Station Area Development			Parking Supply	
Rating	Employment Served by the System[1]	Average Population Density (persons/sq. mile)[2]	CBD Typical Cost per Day[3]	CBD Spaces Per Employee[4]	CBD comm. FAR[5]	Other comm. FAR[6]	Residential dwelling units per acre	CBD spaces per 1,000 square feet	Other spaces per 1,000 square feet
High	> 220,000	> 15,000	> $16	< 0.2	> 10.0	> 2.5	> 25	< 1	< 1.5
Medium-High	140,000-219,999	9,600 - 15,000	$12 - $16	0.2 – 0.3	8.0 - 10.0	1.75 - 2.5	15 - 25	1 - 1.75	1.5 - 2.25
Medium	70,000-139,999	5,760 – 9,599	$8 - $12	0.3 – 0.4	6.0 - 8.0	1.0 - 1.75	10 - 15	1.75 - 2.5	2.25 - 3.0
Medium-Low	40,000-69,999	2,561 – 5,759	$4 - $8	0.4 – 0.5	4.0 - 6.0	0.5 - 1.0	5 - 10	2.5 - 3.25	3.0 - 3.75
Low	<40,000	< 2,560	< $4	> 0.5	< 4.0	< 0.5	< 5	> 3.25	> 3.75

[1] The employment breakpoints are based on the Institute for Transportation Engineer's document entitled "A Toolbox for Alleviating Traffic Congestion," which suggests minimum non-residential development concentrations of 20 million square feet for frequent local bus service and 35 million square feet for light rail service. At 500 square feet per employee, these figures are equivalent to 40,000 and 70,000 employees, respectively. The total employment served includes employment along the entire line on which a no-transfer ride from the proposed project's stations can be reached.

[2] The average population density breakpoints are based on the Institute for Transportation Engineer's document entitled "A Toolbox for Alleviating Traffic Congestion," which suggests light rail and frequent bus service requires a minimum of 9 to 15 dwelling units per acre. This data has been used to inform the medium breakpoint shown.

[3] CBD core (not fringe parking)

[4] Average across CBD

[5] CBD core area

[6] Elsewhere in corridor (typical for commercial districts)

Source: FTA New Starts/Small Starts Guidelines, August 2013

Based on the MWCOG 8.2 forecast, the employment served by the system in the corridor is estimated at 103,074 in 2015. This would assign the project a “Medium” rating based on this criteria. By 2035 it is projected to be 120,703 for the No Build Alternative and 138,330 for the Build Alternative. Average population density within the corridor is 11,239 people per square mile in 2015, assigning the project a “Medium-High” rating based on the criteria. In 2035 population density is projected to be 13,578 people per square mile for the No Build Alternative. For the Build Alternative, the population density is projected to be 14,358 people per square mile.

Currently, the corridor’s gross density of residential units per acre is estimated to be 8.28 units per acre. Gross density is calculated by dividing the total number of residential dwelling units by the total developable area, measured in acres. The corridor’s net density in 2015, calculated by dividing the total number of residential dwelling units by the total developable residential area measured in acres, is estimated to be 19.46. Based on the development projections provided by the City, the gross density along the corridor can be expected to be 12.36 units per acre in 2034 under the Build Alternative.

The corridor’s commercial FAR, defined as building gross floor area divided by the total area of the lot, is 0.64 in 2015, giving the corridor a Medium-Low rating. It must be mentioned that there are several areas along the corridor that have commercial FAR over 1.0. Commercial properties included auto dealerships, city government buildings, hotels, extended stay hotels, federal buildings, financial institutions, general commercial properties, jr office buildings, office buildings, office/commercial warehouses, repair services, restaurants/fast food, service stations, shopping centers, nursing homes, and industrial properties.

Table 16 below summarizes the results of the quantitative land use analysis for the corridor and the anticipated ratings for FTA Net Starts/Small Starts. The results of the quantitative analysis paired with qualitative criteria, are used to determine the total score of the project. Because qualitative criteria were not evaluated at this time, the total score is currently not available.

Table 16: Summary of Anticipated FTA New Starts/Small Starts Quantitative Land Use Ratings

Existing Land Use Criteria	2015	Rating
Employment served by the System	103,074	Medium
Average Population Density (persons/sq. mile)	11,239	Medium-High
Residential Dwelling Units Per Acre (gross density)	8.28	Medium-Low
Residential Dwelling Units Per Acre (net density)	19.46	Medium-High
Commercial FAR in the Corridor	0.64	Medium-Low

Source: AECOM Analysis

The Land Use and Economic Development criteria also evaluate the half-mile corridor share of “legally binding affordability restricted” housing and how it compares with the share of affordable housing throughout the counties or jurisdictions through which the project travels. According to FTA, a legally binding affordability restriction is considered “a lien, deed of trust, or other legal instrument attached to a property and/or housing structure that restricts the cost of the housing units to be

affordable to renters and/or owners with incomes below 60 percent of the area median income for a defined period of time."[6] The break points for shares of "legally binding affordability restricted" housing are outlined in **Table 17.**

Table 17: FTA New Starts/Small Starts Guidelines—Break Points for Affordable Housing

Rating	Proportion of legally binding affordability restricted housing in the project corridor compared to the proportion in the counties through which the project travels
High	> 2.50
Medium-High	2.25 – 2.49
Medium	1.50 - 2.24
Medium-Low	1.10 - 1.49
Low	< 1.10

Source: FTA New Starts/Small Starts Guidelines

The Beauregard Small Area Plan, adopted in 2012, recommends having 800 committed affordable and workforce housing units as redevelopment occurs within the area, with 599 of them being new[7]. This would ensure that at least 32% of the redeveloped units are affordable housing units. Affordable housing is defined as housing that costs no more than 30% of a household's gross monthly income before taxes. The households that are targeted for rental properties have incomes that are 60% of Area Median Income. Workforce rental housing is defined as housing that targets moderate income households that have incomes that are 60% - 80% of the Area Median Income[8]. While the Beauregard Small Area is one of the largest sources of market affordable and workforce housing units in Alexandria, none of the units are dedicated affordable units[9]. Based on this information, the affordable housing in the Beauregard Small Area does not qualify "legally binding affordability restricted" housing. Making the affordable housing in the area legally binding would help obtain credit for affordable housing in the FTA evaluation, thus improving the overall score of the project.

5.2. Economic Development

The economic development assessment is comprised of a number of qualitative evaluations, including:

- Concentration of development around established activity centers and regional transit
- Land conservation and management
- Plans and policies to increase corridor and station area development
- Plans and policies to enhance transit-friendly character of corridor and station area development
- Plans to improve pedestrian facilities, including facilities for persons with disabilities
- Parking policies

[6] *FTA, Guidelines for Land Use and Economic Development Effects for New Starts and Small Starts Projects. August 2013. http://www.fta.dot.gov/documents/Land_Use_and_EconDev_Guidelines_August_2013.pdf*

[7] *p. 150, Beauregard Small Area Plan. City of Alexandria. June 16, 2012*

[8] *p. 13 City of Alexandria Housing Master Plan. City of Alexandria. December 14, 2013*

[9] *p. 82, Beauregard Small Area Plan. City of Alexandria. June 16, 2012*

- Existing and proposed zoning regulations that allow densities supportive of transit
- Zoning ordinances that enhance transit oriented character of stations
- Zoning allowances for reduced parking and traffic mitigation
- Outreach to government agencies and the community in support of transit-supportive planning
- Regulatory and financial incentives to promote transit-supportive development
- Efforts to engage the development community in station area planning and transit-supportive development

At the time of the analysis, the qualitative criteria were not evaluated.

Appendix A: New Development within Quarter-Mile Radius of the West End Transitway

Figure A-1 shows the 12 sub-areas that are included within the quarter-mile study area. The sub-areas are presented in **Table A-1.**

Table A-1: Sub-Areas along the Corridor Used for the Analysis

Sub-Area Number	Sub-Area Name
1	Pentagon
2	Alexandria West
3	Shirlington
4	Arlington County
5	Northern Virginia Community College and Vicinity
6	Beauregard Small Area
7	North Landmark
8	Landmark Van Dorn Corridor Plan Area
9	Eisenhower West Small Area
10	Rose Hill Planning District
11	Seminary Hill
12	Fairfax County

Source: AECOM Analysis

Analysis of development within the quarter-mile radius of the Transitway consisted of projecting growth of square footage of new development in 2034, growth of property values in the corridor associated with new development in 2034, and tax revenue growth associated with new development in the corridor.

Growth of Square Footage of New Development

The analysis projected square feet of new development for each of the three alternatives within the quarter-mile radius of the Transitway. **Table A-2** shows the anticipated new development from 2015 to 2034 by land use for the No Build, TSM and Build Alternatives.

Separate projections were made for all new development versus tax exempt development for the No Build, TSM and Build Alternatives. All of new development within quarter mile of the Transitway in the corridor would be generating tax revenue.

Comparing the three alternatives, the Build Alternative would yield significantly more growth than both the No Build and the TSM Alternatives. Through 2034, the TSM Alternative only yields an additional 21 percent over the No Build Alternative. In comparison, the Build Alternative yields over 5 times more development than the No Build Alternative.

As most projected new development is concentrated between ¼ and ½ mile, the pace of development within ¼ mile of the Transitway, illustrated in **Figure A-1,** differs from the pace of development for the entire corridor.

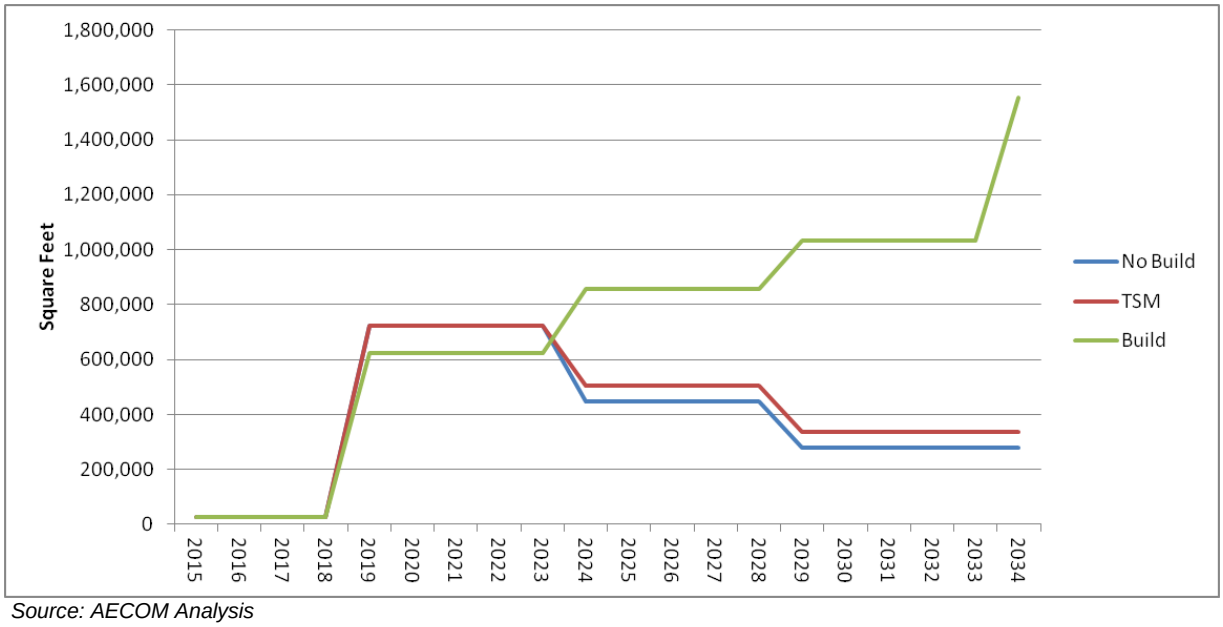
Table A-2: Additional Net New Development within Quarter-Mile of the Transitway - No Build, TSM and Build Alternatives (2015 to 2034)

Land Use Type	Square Footage of Total New Development (Taxable & Tax-Exempt)		
	No Build	TSM	Build
Single Family Residential	228,000	228,000	228,000
Multifamily Residential	521,000	578,000	1,192,000
Office	0	0	653,000
Retail	-289,000	-289,000	-338,000
Other(Commercial, Hotel & Lodging)	-181,000	-181,000	-181,000
Other(exempt)	0	0	0
Total(Non-exempt)	278,000	336,000	1,555,000
Total	**278,000**	**336,000**	**1,555,000**

Source: AECOM Analysis

Figure A-1 graphically shows a comparison of the total new development anticipated from the No Build, TSM and Build Alternatives.

Figure A-1: Total Additional Net New Development for No Build, TSM, and Build Alternatives within Quarter-Mile Radius



Source: AECOM Analysis

Property Value Growth

For the No Build Alternative, one scenario was analyzed anticipating no change in quality in the corridor. **Table A-3** shows the value of anticipated new development by property type.

Table A-3: Value of Additional Net New Development by Property Type within Quarter-Mile of the Transitway - No Build Alternative (in 2034)

Property Type	Property Value
Single Family Residential	$63,304,000
Multifamily Residential	$91,169,000
Office	$0
Retail	-$28,634,000
Other (Commercial, Hotel & Lodging)	-$30,427,000
Other (exempt)	$0
Total -Non-Exempt	$95,411,000
Total	**$95,411,000**

Source: AECOM Analysis

For the TSM Alternative there was only one scenario anticipating no change in quality in the corridor. **Table A-4** shows the value of anticipated new development by property type within a quarter-mile of the corridor in 2034 for the TSM Alternative.

Table A-4: Value of Additional Net New Development by Property Type within Quarter-Mile of the Transitway - TSM Alternative (in 2034)

Property Type	Property Value
Single Family Residential	$63,304,000
Multifamily Residential	$101,267,000
Office	$0
Retail	-$28,634,000
Other (Commercial, Hotel & Lodging)	-$30,427,000
Other (exempt)	$0
Total -Non-Exempt	$105,510,000
Total	**$105,510,000**

Source: AECOM Analysis

For the Build Alternative, three scenarios were developed as described in the methodology section:

- Scenario 1: assuming no change in quality
- Scenario 2: a conservative scenario that assumes the lower bound of the recommendations on change in quality provided by the City
- Scenario 3: an optimistic scenario that assumes the upper bound of the recommendations on change in quality provided by the City

Table A-5 shows the value of anticipated new development by property type within a quarter-mile of the corridor in 2034 for the Build Alternative.

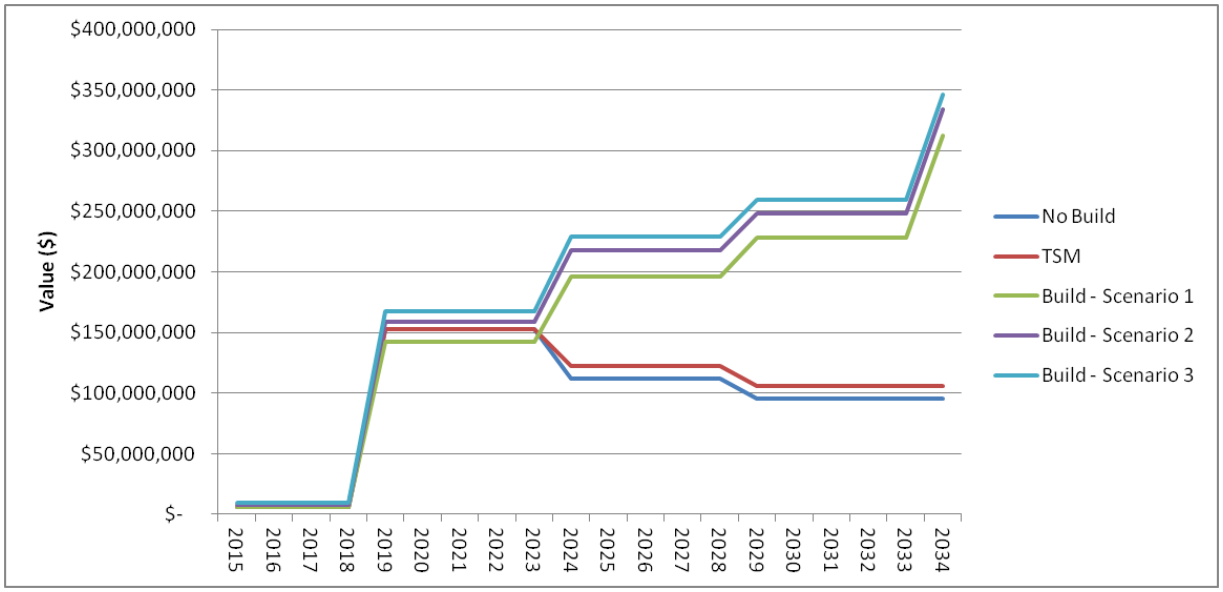
Table A-5: Value of Additional Net New Development by Property Type within Quarter-Mile of the Transitway - Build Alternative (Scenarios 1, 2 and 3 in 2034)

Land Use Type	Property Value		
	Build - Scenario 1 (no change in quality)	**Build - Scenario 2 (conservative estimate of change in quality)**	**Build - Scenario 3 (optimistic estimate of change in quality)**
Single Family Residential	$63,304,000	$69,634,000	$72,799,000
Multifamily Residential	$208,790,000	$229,669,000	$240,108,000
Office	$103,915,000	$103,915,000	$103,915,000
Retail	-$33,459,000	-$36,805,000	-$38,478,000
Other (Commercial, Hotel & Lodging)	-$30,427,000	-$31,948,000	-$31,948,000
Other (exempt)	$0	$0	$0
Total -Non-Exempt	$312,122,000	$334,464,000	$346,396,000
Total	**$312,122,000**	**$334,464,000**	**$346,396,000**

Source: AECOM Analysis

Figure A-2 shows the comparison of total property value projections in the corridor in 2034 for the five scenarios analyzed under the No Build, TSM and Build Alternatives.

Figure A-2: Total Value of Additional Net New Development within Quarter-Mile of the Transitway – No Build, TSM and Build Alternatives (in 2034)



Source: AECOM Analysis

Tax Revenue Growth

Under the No Build Alternative, the total tax revenue as a result of the expected development within the first quarter mile radius of the Transitway is projected to be $0.9 million in 2034. The cumulative tax revenue from new construction between 2015 and 2034 is expected to be $20 million undiscounted and $14.8 million discounted at 3%. These values were calculated in 2015 dollars. **Table A-6** shows the tax revenue generated by property type as a result of new construction for the No Build alternative.

Table A-6: Tax Revenue in 2015 Dollars from New Construction within Quarter-Mile of the Transitway - No Build Alternative (2015-2034)

	Tax Revenue
Tax Revenue 2034	$995,000
Cumulative Tax Revenue (2015-2034)	$20,034,000
Discounted Cumulative Tax Revenue (2015-2034; discounted at 3%)	$14,815,000

Source: AECOM Analysis

Table A-7 shows the tax revenue generated by property type as a result of new construction for the TSM Alternative.

Table A-7: Tax Revenue in 2015 Dollars from New Construction within Quarter-Mile of the Transitway - TSM Alternative Scenarios 1-3 (2015-2034)

	Tax Revenue
Tax Revenue 2034	$1,100,000
Cumulative Tax Revenue (2015-2034)	$21,193,000
Discounted Cumulative Tax Revenue (2015-2034; discounted at 3%)	$15,584,000

Source: AECOM Analysis

Table A-8 shows the tax revenue generated by property type as a result of new construction for the three scenarios used in the analysis of the Build Alternative.

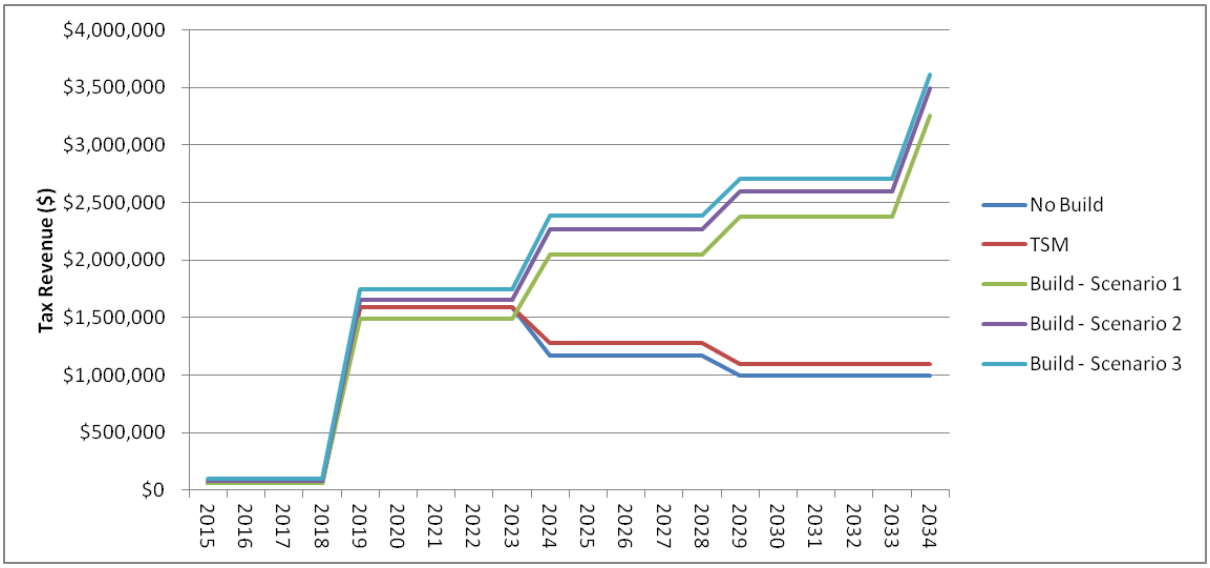
Table A-8: Tax Revenue in 2015 Dollars from New Construction within Quarter-Mile of the Transitway - Build Alternative Scenarios 1-3 (2015-2034)

	Build - Scenario 1 (no change in quality)	Build - Scenario 2 (conservative estimate)	Build - Scenario 3 (optimistic estimate)
Tax Revenue 2034	$3,255,000	$3,488,000	$3,613,000
Cumulative Tax Revenue (2015-2034)	$33,073,000	$36,400,000	$38,223,000
Discounted Cumulative Tax Revenue (2015-2034; discounted at 3%)	$23,152,000	$25,530,000	$26,841,000

Source: AECOM Analysis

Figure A-3 shows the comparison of annual tax revenue anticipated as a result of new development within a quarter-mile of the corridor in 2034 for the five scenarios analyzed under the No Build, TSM and Build Alternatives.

Figure A-3: Comparison of Annual Tax Revenue within Quarter-Mile of the Transitway- No Build, TSM and Build Alternatives Scenarios 1-3 (2015-2034)

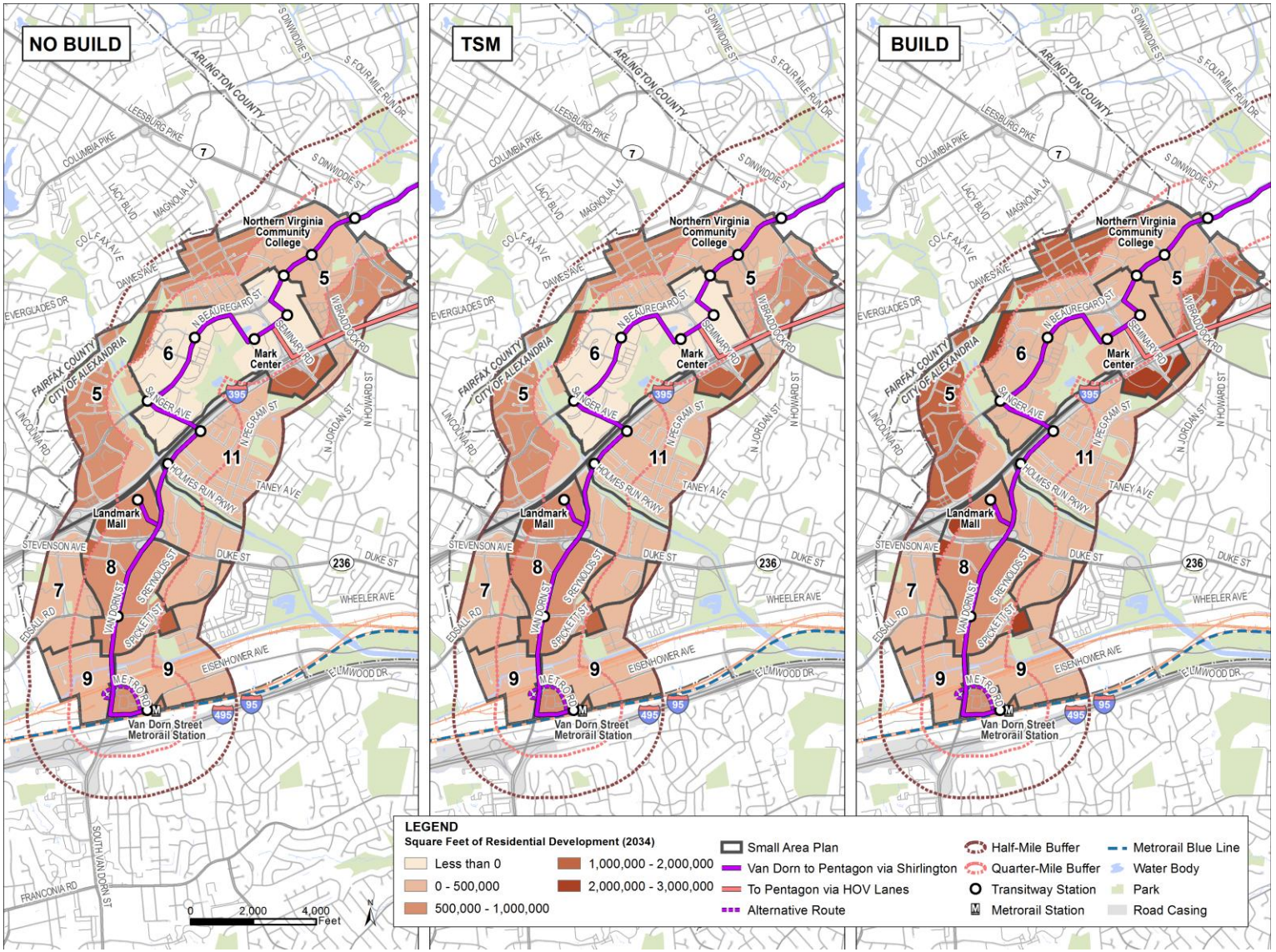


Source: AECOM Analysis

Appendix B: Supplementary Information

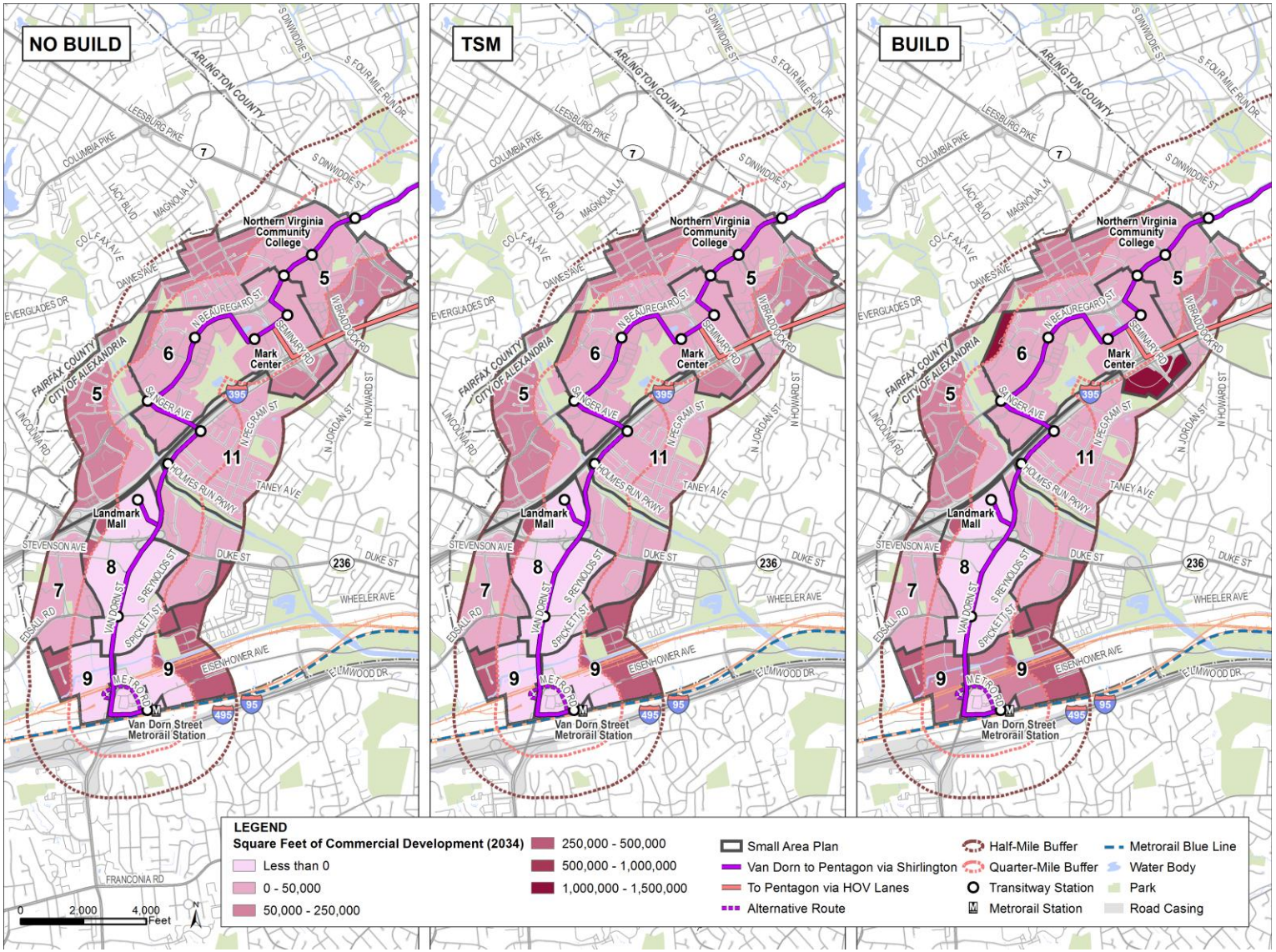
This appendix provides supplementary information obtained during the analysis, including total square feet of net new residential and commercial development by small area and distance from the Transitway.

Figure 7: Square Feet of Total Net New Residential Development (2034)



Source: AECOM Analysis

Figure 8: Square Feet of Total Net New Commercial Development (2034)



Source: AECOM Analysis

Appendix C: Alexandria West End Transitway Housing and Commuting Affordability Analysis

Methodology

Together, housing and transportation make up a significant portion of a household's expenses. A large share of transportation expenses are incurred as a result of commuting to and from work. Furthermore, distance and commuting costs are major determinants when choosing a place to live. This analysis measures the effect of transit improvements on housing and commuting affordability by measuring the share of the median household income devoted to housing and commuting expenses for each of the Alternatives. The Alternatives considered were the No Build, Transportation Systems Management (TSM), Build, and Build with Transit Oriented Development (TOD).

This analysis was modeled after The Center for Neighborhood Technology's Housing + Transportation Affordability Index[10]. Unlike in the Housing + Transportation Index, the transportation cost for this analysis was restricted to only consider commuting expenses and did not include leisure-based transportation costs. The analysis was done on a Census block group level for the corridor.

Median household income data were obtained from the 2012 American Community Survey (ACS) 5 Year Estimates.[11] For block groups where ACS data was unavailable, values were estimated based on the values in surrounding Census block groups. The total annual cost of housing was computed by taking the median cost of home ownership per month and the median monthly rent, both obtained from the ACS, and multiplying each by the share of homeowners and renters within each block group, which was also obtained from the ACS. Added together, the resulting median cost of housing for the month was then annualized, thus providing the annual housing cost per household.

Transportation costs were computed using the annual household cost of driving a vehicle combined with the annual household cost of using public transportation. The annual household cost of driving a vehicle was comprised of the annual household auto ownership cost and annual cost of vehicle miles traveled (VMT). The annual auto ownership cost was derived by multiplying the number of commuter vehicles per household, as obtained from ACS at the Census tract level, by the AAA Annual Cost of Owning a Vehicle, which amounted to $6,058 per year per vehicle in 2013.[12] This cost includes full-coverage insurance, license, registration, taxes, depreciation, and finance charges.

The VMT cost was calculated by multiplying the commuting VMT per household by the cost of driving per mile. The commuting VMT per household was determined by multiplying the average commute distance for the areas, provided by U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD), by the number of commuting vehicles per household, which was derived by dividing ACS's data on the aggregate number of commuting vehicles in a Census tract by the number of households in each Census tract. Census tract-level data was used because Census

[10] *H+T Affordability Index*. Center for Neighborhood Technology. http://htaindex.cnt.org/

[11] *American Community Survey*. U.S. Census Bureau, American Community Survey Office. http://www.census.gov/acs/www/

[12] 2013. *Your Driving Costs*. AAA. http://newsroom.aaa.com/wp-content/uploads/2013/04/YourDrivingCosts2013.PDF

block group-level data was unavailable. The commuting VMT per household was annualized assuming a 5 day workweek and 51 work weeks per year. The 51-week year is used to account for major holidays that affect commuting behavior. The cost of driving per mile was obtained from AAA's 2013 Your Driving Costs report[2] and adjusted for the regional cost of gas using U.S. Energy Information Administration's (EIA)'s Gasoline and Diesel Fuel Update for the Central Atlantic Region[13]. Multiplying the annual commuting VMT by the adjusted cost of driving per mile results in the vehicle operating costs.

The annual cost of taking transit was calculated by multiplying the number of annual transit trips per household by the average fare. The average fare was set at $1.75 one-way, based on the fare for DASH and Metrobus services, and the anticipated fare for Route 1 Metroway BRT service.

Presently, the corridor has good bus service and high ridership. In order to measure the effects improvements in the corridor, existing trips were removed from the ridership totals. For the No Build Alternative, it was assumed that there were no transit trips taken. For the TSM and Build Alternatives, daily projected ridership for the corridor was used to determine the average transit trips per household for each Census block group. The auto VMT avoided by transit riders was calculated using LEHD's data on the average commute distance in the area and the average transit trips per household[14]. Transit expenses were then calculated using the $1.75 one-way fare for the Route 1 Metroway BRT service. VMT avoided and transit expenses were annualized by assuming a 5 day workweek and 51 workweeks per year. The annualized VMT avoided were then subtracted from the commuting VMT per household for the No Build Alternative to determine the commuting VMT per household under the Build Alternative.

For the Build Alternative, the number of vehicles per household was reduced by 14%, in accordance with guidelines provided by the Victoria Transport Policy Institute[15]. This reflects the difference in auto ownership between areas that have good transit and areas that do not. It was assumed that TSM would not have any effect on car ownership.

Another Build Alternative was conducted assuming Transit Oriented Development (TOD) around rail station areas, and a property premium assumed with it. Under this Build Alternative, the auto ownership per household was reduced by 47% compared to the No Build Alternative, in accordance to guidelines provided by the Victoria Transport Policy Institute[16]. In addition, a property premium was applied to reflect the change in property value as a result of transit improvements. The property premium used in this analysis amounted to 4% based on the corridor-wide Development Potential evaluation.

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[13] *Weekly Retail Gasoline and Diesel Prices, Lower Atlantic. U.S. Energy Information Administration. http://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_r1z_a.htm*

[14] *OnTheMap.* U.S. Census Bureau, Center for Economic Studies. http://onthemap.ces.census.gov/

[15] *2014. Transit Oriented Development. Using Public Transit to Create More Accessible and Livable Neighborhoods. Victoria Transport Policy Institute. http://www.vtpi.org/tdm/tdm45.htm*

[16] *The TOD described by the Victoria Transport Policy Institute is characterized by grid street pattern, higher densities, limited surface parking, pedestrian and bicycle oriented design, mixed housing types, horizontal and vertical mixed use, and the presence of office and retail property. While there are plans in place to foster TOD along the corridor, it is uncertain whether all these characteristics will be present. Therefore, the TOD scenario acts as a best case scenario for housing and commuting affordability in the corridor.*

This analysis assumed no changes in the average household income, costs of fuel, employment, or housing.

Results

In order to estimate the change in affordability of housing and commuting that results from the TSM and Build Alternatives, Census block groups along the Transitway were analyzed. The entire study area is comprised of 57,567 households. Because block groups (which are have irregular spatial footprints) are the spatial unit of analysis, the impact does not neatly fall within the ¼ or ½ mile boundary used elsewhere in the study. Generally, the block groups overlap with the ¼ mile boundary and extend somewhere between the ¼ and ½ mile boundary.

Under the No Build Alternative, average housing costs along the entire corridor comprise 24.22% of the median annual household income and commuting costs comprise 8.22% of the median household income. Together housing and transportation comprise 32.44% of the median annual household income. The City of Alexandria's portion of the corridor has the highest cost of commuting as a percentage of income out of the 3 jurisdictions that are included in the study area, comprising 9.07% of the median household income. This higher percentage is largely driven by a lower median income than in portions of the corridor that fall within Arlington and Fairfax Counties. **Table A-12** contains a detailed summary of the housing and commuting costs for the portion of the study area within the City of Alexandria.

Under the TSM Alternative, average housing costs along the entire corridor comprise 24.22% of the median annual household income and commuting costs comprise 8.20% of the median household income. Together housing and transportation comprise 32.42% of the median annual household income. This represents an estimated savings of $17 per household, relative to the No Build. **Tables A-12 to A-14** show costs and savings for residents along the Alexandria, Arlington, and Fairfax portions of the corridor.

Under the Build Alternative, average housing costs along the entire corridor comprise 24.22% of the median annual household income and commuting costs comprise 7.14% of the median household income. Together housing and transportation comprise 31.36% of the median annual household income. This represents an estimated savings of $903 per household, relative to the No Build.

Under the Build Alternative with TOD, average housing costs along the entire corridor comprise 24.77% of the median annual household income, commuting costs comprise 4.35% of the median household income. Together housing and transportation comprise 29.12% of the median annual household income. This represents an estimated savings of $2,777 per household, relative to the No Build.

The development of TOD in the study area will provide commuting cost savings to residents through reduced car ownership, and will increase home values, providing a wealth effect to the approximately 41% of households along the corridor that are homeowners. There are already plans

in place along the corridor to facilitate TOD, making its development in the study area very likely. For example, one of the goals of the Beauregard Small Area Plan is to foster TOD. The Plan makes parking recommendations aimed at encouraging the use of public transportation and spurring TOD[17]. Additionally, a development cap is applied to the Beauregard Small Area, and will only be lifted with the implementation of a BRT service within the corridor[18]. Other plans have also made TOD a priority; the Landmark Van Dorn Corridor Plan aims to increase the share of commuters in the planning area using transit through development of TOD and implementation of reliable transit service[19].

Table A-9 summarizes the results of the analysis. **Table A-10** shows the savings under each scenario for housing and commuting costs. **Table A-11** shows the savings under each scenario for commuting costs only. **Table A-12, Table A-13, and Table A-14** the estimated housing and commuting costs by Alternative and jurisdiction.

[17] *p. 51 Beauregard Small Area Plan City of Alexandria. June 16, 2012*

[18] *City of Alexandria's Planning and Zoning Office, personal communication, October 16, 2015*

[19] *p. 88 Landmark Van Dorn Corridor Plan. City of Alexandria. June 13, 2009*

Table A-9: Estimated Annual Housing and Commuting Cost within the Study Area by Alternative

Alternative	H+T Costs as Percent of Income	H Costs as Percent of Income	Commuter T Cost as Percentage of Income
No Build	32.44%	24.22%	8.22%
TSM (2035)	32.42%	24.22%	8.20%
Build (2035)	31.36%	24.22%	7.14%
Build (2035) – TOD	29.12%	24.77%	4.35%

Source: AECOM Analysis

Table A-10: Estimated Decrease of Housing and Commuting Cost by Alternative

Alternative	H+T Costs Savings (%)	Annual H+T Costs Savings per Household ($)
No Build	0.00%	$0
TSM (2035)	0.06%	$17
Build (2035)	3.33%	$903
Build (2035) - TOD	10.23%	$2,777

Source: AECOM Analysis

Table A-11: Estimated Decrease in Commuting Cost by Alternative

Alternative	Commuting Costs Savings (%)	Annual Commuting Costs Savings per Household ($)
No Build	0.00%	$0
TSM (2035)	0.24%	$17
Build (2035)	13.14%	$903
Build (2035) – TOD	47.13%	$3,241

Source: AECOM Analysis

Table A-12: Estimated Annual Housing and Commuting Cost within the Alexandria Portion of the Study Area by Alternative

Alternative	H+T Costs as Percent of Income	Annual Commuting Costs Savings per Household ($)	H Costs as Percent of Income	Commuter T Cost as Percentage of Income
No Build	33.24%	$0	24.17%	9.07%
TSM (2035)	33.22%	$22	24.17%	9.04%
Build (2035)	31.97%	$975	24.17%	7.79%
Build (2035) - TOD	29.57%	$2,796	24.78%	4.80%

Source: AECOM Analysis

Table A-13: Estimated Annual Housing and Commuting Cost within the Arlington County Portion of the Study Area by Alternative

Alternative	H+T Costs as Percent of Income	Annual Commuting Costs Savings per Household ($)	H Costs as Percent of Income	Commuter T Cost as Percentage of Income
No Build	30.45%	$0	23.64%	6.81%
TSM (2035)	30.44%	$8	23.64%	6.81%
Build (2035)	29.49%	$867	23.64%	5.85%
Build (2035) - TOD	27.69%	$2,483	24.09%	3.60%

Source: AECOM Analysis

Table A-14: Estimated Annual Housing and Commuting Cost within the Fairfax County Portion of the Study Area by Alternative

Alternative	H+T Costs as Percent of Income	Annual Commuting Costs Savings per Household ($)	H Costs as Percent of Income	Commuter T Cost as Percentage of Income
No Build	34.12%	$0	26.45%	7.67%
TSM (2035)	34.11%	$10	26.45%	7.66%
Build (2035)	33.27%	$691	26.45%	6.82%
Build (2035) - TOD	30.98%	$2,539	26.92%	4.06%

Source: AECOM Analysis

WEST END TRANSITWAY

Alternatives Analysis – Appendix D

ALTERNATIVES EVALUATION TECHNICAL MEMORANDUM

REVISED:

APRIL 21, 2016

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Figures

Tables

Appendix

1. INTRODUCTION

This technical memorandum describes the evaluation measures and evaluation results of the West End Transitway alternatives: No Build, Transportation System Management (TSM), and Build. The alternatives are described in detail in the *Alternatives Analysis Report*. Conditions were analyzed for the base year (2015) and future year (2035).

The alternatives evaluation has been prepared as a step in the Alternatives Analysis (AA) study process that will ultimately lead to the selection of a recommended alternative that would be selected by local officials as the Locally Preferred Alternative (LPA). This technical memo addresses the following:

- Evaluation Measures: relationship to the project Purpose and Need and Federal Transit Administration (FTA) Project Justification Criteria;
- Alternatives Evaluation: description of each evaluation measure, measurement method, and evaluation results; and
- Alternatives Evaluation Summary: cumulative summary of all evaluation measures for each alternative.

2. EVALUATION MEASURES

Project evaluation measures were developed to assist City staff and decision-makers in their selection of an LPA for the West End Transitway. The project evaluation measures relate directly to the project Purpose and Need. The Purpose and Need takes into account the underlying needs in the study area and serves as a framework within which the alternatives are developed and then evaluated.

2.1. Project Purpose and Need

As defined in the *Purpose and Need Technical Memorandum*, the issues that are driving the need for transit improvements in the West End Transitway corridor are the following:

- Transit service not frequent or direct enough to meet potential corridor demand;
- Land use and development leading to the need for increased transportation capacity; and
- Increasing traffic congestion, leading to intersection delay for automobiles and transit vehicles.

The purpose of the West End Transitway project is to improve transit access and mobility through the corridor by providing a faster, higher-capacity transit line. The transitway project responds to the City's proposed land use changes, and by coordinating with existing and future regional transit network connections, intends to prompt a mode shift away from private automobile use to transit. This shift to transit will help curtail growth in traffic congestion. The result will be a corridor transportation system that serves the mobility needs of a growing population and serves as a catalyst for continued economic development.

2.2. Evaluation Measures

Evaluation measures were developed from the project Purpose and Need. Each evaluation measure relates directly to one of the identified issues. The measures were developed such that each can be quantitatively measured and the results may be compared among the three alternatives as well as evaluated on an individual alternative basis. Evaluation measures are shown in **Table 1**.

2.3. FTA Project Justification Criteria

The Federal Transit Administration (FTA) uses a defined set of criteria to measure project benefits as part of its New Starts and Small Starts funding application process. Since the City may choose to apply for FTA funds for the West End Transitway, these criteria were taken into consideration in developing the project evaluation criteria. FTA's Project Justification Criteria are the following:

- **Mobility Improvements**: total trips on the project, measured in the current year or for the current year and horizon year
- **Economic Development Effects**: qualitative or quantitative measure of likely future development outcomes resulting from the project
- **Environmental Benefits**: an economic measure of emissions, energy use, and safety compared to project costs
- **Cost Effectiveness**: a measure of cost relative to trips that would use the project
- **Land Use**: a measure of population and employment density, parking supply, pedestrian facilities, and affordable housing in the project corridor
- **Congestion Relief:** the FTA has not yet issued rulemaking on the congestion relief criteria

It is important to note that the Project Justification Criteria account for only 50 percent of FTA's Summary Rating of a project; local financial commitment accounts for the remaining 50 percent.

The relationships between the West End Transitway evaluation criteria and FTA Project Justification Criteria are shown in **Table 1**.

Table 1: West End Transitway Evaluation Criteria

Project Need	Category	West End Transitway Evaluation Criteria	FTA Criteria					
			Mobility Improvements	Environmental Benefits	Cost Effectiveness	Economic Development	Land Use	Congestion Relief
TRANSIT	Ridership	Corridor daily transit ridership	✓		✓			✓
	Coverage	Residents within station walkshed					✓	
		Jobs within station walksheds					✓	
		Transit dependent households within station walksheds	✓				✓	
	Transit Connectivity	Transit travel time between major corridor and regional origins/destinations	✓					
	Transit Operations	Average transit travel time	✓		✓			✓
		Headway reliability	✓		✓			
		Capacity utilization/peakline loads		✓	✓			
TRANSPORTATION (OTHER MODES)	Traffic Operations	Intersection delay		✓				✓
		Vehicular travel time		✓				✓
	Bicycles and Pedestrians	Percent of corridor with new/improved sidewalk					✓	
		Percent of corridor with new bicycle facility					✓	
	Capacity	Person throughput	✓					✓
LAND USE AND ECONOMIC DEVELOPMENT	Land Use	Supports planned development projects in the Landmark/Van Dorn and Beauregard Small Area Plans		✓		✓	✓	
		Mixed of land uses				✓	✓	
	Economic Benefit	Level of new development permitted (square feet)		✓		✓	✓	
		Potential to increase pace of retail development		✓		✓	✓	
✓ Indicates that the West End Transitway evaluation criteria relates to FTA Project Justification Criteria								

3. ALTERNATIVES EVALUATION

Each West End Transitway evaluation measure is described below, including a discussion of how each alternative was measured within it.

3.1. Scoring Methodology

Values for each alternative and measure were computed for the base year (2015) and a future year (2035). The calculated value representing the best condition for each criterion was then assigned the normalized score of 1.0 and the other two alternatives were calculated as a percentage of that value.

For certain criteria such as transit travel time or headway reliability where a lower value is better, the lowest value was assigned the normalized score of 1.0. For other criteria where higher values indicate a better condition, the highest value was assigned a normalized score of 1.0. The resulting score for each criterion is an average of the 2015 and 2035 scores, if both years are applicable.

Within the evaluation categories (transit, transportation--other modes, and land use and economic development) the normalized scores for each criterion were averaged to calculate an overall score for the category. This approach results in each category being given equal weight. **Appendix 1** contains the summary of the scoring.

3.2. Transit Evaluation

This category measures the projected effectiveness of the transit service in the West End Transitway corridor. **Table 2** summarizes the results of the evaluation of alternatives in this category.

Table 2: Transit Criteria Evaluation Measures Summary

Category	Evaluation Measures	No Build 2015	TSM 2015	Build 2015	No Build 2035	TSM 2035	Build 2035	No Build Score	TSM Score	Build Score
Ridership	Ridership (average weekday bus riders in the West End corridor)	26,400	30,200	31,700	32,400	39,100	41,000	**0.8**	**0.9**	**1.0**
Coverage	Residents within stop/station walkshed	11,700	28,200	28,200	17,300	39,000	39,000	**0.4**	**1.0**	**1.0**
	Jobs within stop/station walkshed	10,100	17,300	17,300	16,400	27,300	27,300	**0.6**	**1.0**	**1.0**
	Transit-dependent households within stop/station walkshed	700	1,800	1,800	1,100	2,700	2,700	**0.4**	**1.0**	**1.0**
Regional Transit Connectivity	Connectivity between corridor and regional activity centers (transit travel time in minutes)	71	62	58	69	63	58	**0.8**	**0.9**	**1.0**
Transit Operations	Speed (corridor transit travel time in minutes)	51.1	36.5	31.7	53.7	37.5	32.0	**0.6**	**0.9**	**1.0**
	Reliability (variation from scheduled headway in minutes)	2.7	2.7	2.4	3.0	2.9	2.3	**0.8**	**0.8**	**1.0**
	Capacity Utilization (persons per bus at peak loading point)	24	43	52	26	48	50	**0.5**	**0.9**	**1.0**
Average Transit Score								**0.6**	**0.9**	**1.0**

As shown in **Table 2**, the transit category is based on four evaluation factors:

Ridership

Ridership measures the average daily bus ridership in the study corridor. Ridership includes the West End Transitway (TSM and Build Alternatives) plus local bus service (all routes that operate in the corridor). The ridership evaluation measure is expressed in terms of average weekday bus riders.

Ridership is forecasted using the regional travel demand model as described in the *Transportation Effects Technical Memorandum*.

Coverage

Coverage quantifies the population and jobs served by the study corridor. This factor measures the residents, transit-dependent residents, and jobs within a 5-minute walk of existing bus stops (No

Build Alternative) and a 10-minute walk of proposed transitway stations (TSM and Build Alternatives). This is based on an assumption that transit users will walk farther to access the high-quality and more frequent transit service provided by the TSM and Build Alternatives. The coverage evaluation measure is expressed in terms of residents, jobs, and transit-dependent households within the walkshed.

The 5- and 10-minute walksheds (walking areas) were developed using walking speed assumptions in combination with existing and programmed sidewalk and trail networks in each station area. MWCOG Round 8.2 forecasts were used to calculate 2015 and 2035 residents and jobs in the walkshed. Transit-dependent households are based on the 2012 American Community Survey (ACS) data for zero-car households.

Regional Transit Connectivity

Regional transit connectivity measures transit access between major corridor and regional activity centers. The coverage evaluation measure is expressed in transit travel time (in minutes).

Connectivity between activity centers is measured using average transit travel time between a representative subset of origins and destinations in the peak and off-peak periods. Representative trip pairs measured:

- S. Van Dorn Street at Pickett Street station to Bailey's Crossroads
- N. Van Dorn Street at Holmes Run Parkway station to Crystal City
- N. Beauregard Street at Rayburn Avenue station to Springfield Town Center

Operations

Operations measures the speed, reliability, capacity, and utilization of the transit service.

Speed

Speed measures the average of travel time of bus trip in the corridor. The speed evaluation measure is expressed in terms of average transit travel time in minutes.

The average travel time for a bus trip in the corridor is evaluated using a transportation operations model (VISSIM) as described in the *Transportation Effects Technical Memorandum*. The bus travel time for the TSM and Build Alternatives is an average of the two proposed West End Transitway route patterns. Travel time was calculated for the a.m. and p.m. peak periods for 2015 and for the a.m. peak period for 2035. The route measured is between the Van Dorn Metrorail station and the Pentagon. Under the TSM and Build Alternatives for 2035, a number of intersections are given transit signal priority (TSP) through Van Dorn and Beauregard Streets, which generally assists the transit vehicles in sustaining speeds near 2015 levels even in the TSM Alternative.

Reliability

Reliability measures the likelihood that buses will arrive at the scheduled times. It is expressed in terms of the average deviation from scheduled headway in minutes.

The headway deviation is measured by simulating buses in the transitway corridor in a transportation operations model as described in the *Transportation Effects Technical Memorandum*. Deviations from the scheduled headway result due to variations such as traffic delays and passenger arrivals. The deviation from the scheduled headway amongst the simulated buses is averaged.

Capacity Utilization

Capacity utilization is a measure of the number of people on a bus in the corridor. The utilization measure is expressed in terms of the number of people on a bus at the peak load point of the route.

Utilization is measured by taking the forecast number of transit passengers per trip in the peak period at the maximum load point in the corridor. The 2015 No Build uses AT1 results from the DASH COA, as this route is the closest existing route to the proposed West End Transitway. For 2035 No Build, this number was increased by 10 percent. Loadings for the TSM and Build Alternatives were developed using ridership forecasts as described in the *Transportation Effects Technical Memorandum*.

3.3. Transportation Evaluation (Other Modes)

The category measures the transportation conditions in the corridor for multiple non-transit modes.

Table 3 summarizes the results of the evaluation of alternatives in this category.

Table 3: Transportation Criteria Evaluation Measures Summary

Category	Evaluation Measures	No Build	TSM	Build	No Build	TSM	Build	No Build	TSM	Build
		2015			2035			Score		
Traffic Operations	Intersection performance (total seconds of delay)	745	888	925	818	910	1,042	**1.0**	**0.9**	**0.8**
	Vehicular travel time (minutes)	15.7	16.0	16.5	15.9	16.1	16.5	**1.0**	**1.0**	**1.0**
Bicycles and Pedestrians	New/improved sidewalks (percent of corridor)	0%	0%	49%	0%	0%	49%	**0.0**	**0.0**	**1.0**
	New bicycle path (percent of corridor)	0%	0%	39%	0%	0%	39%	**0.0**	**0.0**	**1.0**
Capacity	Person throughput (persons per hour)	2,350	2,610	2,835	2,610	2,715	2,940	**0.9**	**0.9**	**1.0**
Average Transportation Score								**0.6**	**0.6**	**1.0**

As shown in **Table 3**, the transit category is based on three evaluation factors:

Traffic Operations

Traffic operations measures intersection performance and vehicular travel time.

Intersection Performance

Intersection performance measures the level of delay at all intersections in the study corridor between the Van Dorn Metrorail station and Shirlington Transit Center. It is expressed in terms of the total number of seconds of intersection delay for all movements at all corridor intersections.

Intersection performance is measured in the a.m. and p.m. peak periods for 2015 and for the a.m. peak period for 2035. It is computed using the transportation operations model as described in the *Transportation Effects Technical Memorandum*. Under the TSM and Build Alternatives for 2035, a number of intersections are given TSP for movements along van Dorn and Beauregard Streets which diminishes performance of cross-street movements and increases the total delay at intersections.

Vehicular Travel Time

Vehicular travel time is a measure of the average time it would take to travel along the corridor. It is expressed in minutes.

Vehicular travel time is measured based on the total northbound travel time from the intersection of Van Dorn Street and Eisenhower Avenue to the intersection of Beauregard Street and Arlington Mill Drive in the a.m. peak period. It is computed using the transportation operations model as described in the *Transportation Effects Technical Memorandum*. Under the TSM and Build Alternatives for 2035, it is assumed that intersection signal timing improvements are in place which generally assists in sustaining speeds near 2015 levels.

Bicycles and Pedestrians

The bicycles and pedestrians category considers the presence of new or improved facilities in the study corridor. It is expressed in terms of the percent of the study corridor with new or improved facilities.

Bicycle performance measures the presence of new bicycle paths and dedicated lanes provided by the project (TSM and Build Alternatives) in relation to the transitway corridor length between the Van Dorn Metrorail station and the Alexandria/Arlington boundary. Pedestrian performance measures the presence of new or improved sidewalks provided by the project (TSM and Build Alternatives) in relation to the transitway corridor length between the Van Dorn Metrorail station and the Alexandria/Arlington boundary. For the Build Alternative, bicycle paths and sidewalks are generally provided anywhere the roadway width is changed as a result of providing dedicated transit lanes.

Capacity

Capacity is a measure of the number of people that can be carried through the study corridor. It is expressed in terms of person throughput, i.e., the total persons that can be carried by transit and vehicles through the corridor.

Person throughput is measured on Beauregard Street between Sanger Avenue and the Mark Center for a one hour period based on transit headways and capacity and automobile operations and occupancy.

3.4. Land Use and Economic Development Evaluation

The land use and economic development category measures the compatibility of the proposed transitway with planned land use and the economic benefit of the transitway.

Table 4 summarizes the results of the evaluation of alternatives in this category.

Table 4: Land Use and Economic Development Criteria Evaluation Measures Summary

Category	Evaluation Measures	2015			2035			Score		
		No Build	TSM	Build	No Build	TSM	Build	No Build	TSM	Build
Land Use	Supports planned development	N/A			0.05	0.50	1.00	**0.1**	**0.5**	**1.0**
Economic Benefit	Permits new development (million square feet)	N/A			4.77	4.77	10.23	**0.5**	**0.5**	**1.0**
	Average percentage of income spent on transportation	N/A			9%	9%	8%	**0.9**	**0.9**	**1.0**
	Pace of New Development in Beauregard Small Area (years to hit development cap)	N/A			14	13	7	**0.5**	**0.5**	**1.0**
Average Land Use and Economic Development Score								**0.5**	**0.6**	**1.0**

The land use and economic development category is based on two evaluation factors – land use and economic benefit:

Land Use

The land use criteria measures compatibility of the proposed transitway with planned land use.

<u>Supports Planned Development</u>

This criterion accounts for the degree to which transit in the corridor supports the types and levels of development laid out in the Beauregard Small Area Plan and Landmark/Van Dorn Corridor Plan. It is

expressed in terms of a percentage of the overall planned growth that could occur if the plans are fully implemented.

Measurement of the "supports planned development" criterion is qualitative, and is described in the *Development Potential Technical Memorandum*. The No Build Alternative will not fully support either small area plan, but is projected to have 5% linear growth in development levels between 2015 and 2035. The TSM Alternative is projected to support growth in the Beauregard Small Area, but not Landmark/Van Dorn. The Build Alternative is projected to support development projects associated with Small Area Plans throughout the corridor.

Economic Benefit

The economic benefit criteria measure economic benefit of the transitway corridor in terms of overall development and retail development.

Level of New Development Permitted

The level of new development permitted criterion is a measure of the amount of potential development forecast that can be attributed to the presence of high-quality transit in the corridor. It is expressed in millions of square feet of development forecast to occur within one-half mile of the transitway corridor. The No Build Alternative measures the amount permitted based on current zoning, whereas the TSM and Build Alternatives measure the development called for in the Beauregard Small Area Plan and the Landmark/Van Dorn Corridor Plan. The calculation is described in the *Development Potential Technical Memorandum*.

Estimated Annual Percentage of Income Spent on Transportation

The estimated savings in commuting and housing cost were calculated based on an analysis of Census block groups in the study area. The calculation used existing median incomes obtained from the American Community Survey and forecasted changes based on expected ridership and other factors consistent with industry practice. Transportation costs were computed using the annual household cost of driving a vehicle combined with the annual household cost of using public transportation. The portion of the study area with Alexandria was considered for this analysis. More detail can be found in the *Development Potential Technical Memorandum.*

Potential to Increase Pace of Development

The potential to increase pace of retail development criteria considers the value of additional retail development that can be attributed to the presence of high-quality transit in the corridor. It is measured in terms of the years that it would take, based on growth projections, to hit the cap of development that was placed on Beauregard Small Area. This cap would be removed upon implementation of the West End transitway in accordance with the Beauregard Small Area Plan. Measurement of the potential to increase pace of development is described in the *Development Potential Technical Memorandum*.

4. ALTERNATIVES EVALUATION SUMMARY

The overall scores for the three categories of measures were aggregated and a summary score developed. Equal weight was given to each category. The aggregated scores and are shown in **Figure 1**. The detailed scoring can be found in **Appendix 1**. The summary represents a representative average of the alternatives' performance between 2015 and 2035 and takes into account both routes to the Pentagon.

Figure 1: Alternatives Evaluation Scoring Summary

The Build Alternative scores the highest for all three evaluation factors – transit, transportation, and land use and economic development. The Build Alternative scores high in transit because it has the highest forecast ridership, provides the best regional transit connectivity, the shortest transit travel time, is the most reliable, and best utilizes bus capacity. The Build Alternative includes significant improvement to bicycle and pedestrian facilities. While it has minimal effect on vehicular travel time in the corridor, the Build Alternative would have some negative impact to intersection operations in the corridor, particularly on cross-street movements. The Build Alternative provides the most person throughput capacity in the corridor. The Build Alternative best supports planned development, a mix of uses, permits the most new development, and has the highest potential to increase the pace of retail development.

The TSM Alternative scores well in a number of categories, especially transit. It provides comparable coverage to residents, jobs, and transit-dependent populations as the Build Alternative. It also

provides strong forecast ridership, regional transit connectivity, and transit travel time. However, the TSM Alternative is not as reliable and does not use transit capacity as efficiently as the Build Alternative. The TSM Alternative minimally impacts vehicular travel time in the corridor, but it does not improve bicycle or pedestrian conditions. In terms of land use and economic development, the TSM Alternative is generally equivalent to or slightly better than the No Build Alternative, but falls short of the benefits generated by the Build Alternative.

The No Build Alternative has the lowest total score. The No Build Alternative scores lower than the other alternatives for transit coverage, travel time, reliability, and utilization. It has the lowest impacts to traffic operations in the corridor; however the difference between the No Build and Build Alternative in terms of travel time is less than a minute of additional delay. The No Build Alternative does not improve bicycle or pedestrian conditions. The score for the land use and economic development factor reflects a relatively strong existing mix of uses and the development potential of existing zoning, but the No Build Alternative does not provide additional transportation capacity to support the Beauregard Small Area Plan or the Landmark/Van Dorn Corridor Plan.

Appendix 1: Scoring Summary Matrix

Evaluation Criteria			Raw Score 2015			Possible Score	Raw Score 2035			Possible Score	Normalized			
			No Build	TSM	Build	Max or Min	No Build	TSM	Build	Max or Min	No Build	TSM	Build	Scoring Comments
TRANSIT	Ridership	Ridership (average weekday bus riders in the West End corridor)	26,433	30,159	31,668	31,668	32,404	39,147	41,030	41,030	0.81	0.95	1.00	
	Coverage	Residents within stop/station walkshed	11,712	28,200	28,200	28,200	17,345	39,000	39,000	39,000	0.43	1.00	1.00	
		Jobs within stop/station walkshed	10,146	17,300	17,300	17,300	16,360	27,300	27,300	27,300	0.59	1.00	1.00	
		Transit-dependent households within stop/station walkshed	695	1,831	1,831	1,831	1,132	2,727	2,727	2,727	0.40	1.00	1.00	
	Transit Connectivity	Connectivity between corridor and regional activity centers (transit travel time in minutes)	71	62	58	58	69	63	58	58	0.83	0.92	1.00	
	Transit Operations	Speed (corridor transit travel time in minutes)	51.1	36.49	31.71	31.71	53.70	37.51	32.08	32	0.61	0.86	1.00	Scoring is updated such that the lowest travel time has the highest score.
		Reliability (variation from scheduled headway in minutes)	2.7	2.70	2.40	2.4	3.0	2.90	2.30	2.3	0.83	0.84	1.00	Scoring is updated such that the most reliable alternative has the highest score.
		Capacity Utilization (persons per bus at peak loading point)	24	43	52	52	26	48	50	50	0.49	0.90	1.00	
	TRANSIT AVERAGE										0.6	0.9	1.0	
OTHER TRANSPORTATION	Traffic Operations	Intersection performance (total seconds of delay)	745	888	925	745	818	910	1,042	818	1.00	0.87	0.80	Scoring is updated such that the lowest intersection delay has the highest score
		Vehicular travel time (minutes)	15.7	16.0	16.5	16	15.9	16.1	16.5	16	1.00	0.98	0.96	Scoring is updated such that the lowest travel time has the highest score.
	Bicycles and Pedestrians	New/improved sidewalks (percent of corridor)	0%	0%	49%	49%	0%	0%	49%	49%	0.00	0.00	1.00	
		New bicycle path (percent of corridor)	0%	0%	39%	39%	0%	0%	39%	39%	0.00	0.00	1.00	
	Capacity	Person throughput (persons per hour)	2,354	2,612	2,837	2,837	2,611	2,715	2,940	2,940	0.86	0.92	1.00	
	TRANSPORTATION AVERAGE										0.6	0.6	1.0	
LAND USE AND ECONOMIC DEVELOPMENT	Land Use	Supports planned development	N/A				5%	50%	100%	100%	0.05	0.50	1.00	
		Permits new development (million square feet)					4,766,420	4,766,420	10,228,389	10,228,389	0.47	0.47	1.00	
	Economic Benefit	Average percentage of income spent on transportation					9%	9%	8%	0.08	0.86	0.86	1.00	Scoring is updated such that the lowest percentage has the highest score.
		Pace of New Development in Beauregard Small Area (years to hit development cap)					14	13	7	7.00	0.50	0.54	1.00	Scoring is updated such that the lowest time to reach the cap has the highest score.
	LAND USE/ECON. DEVEL. AVERAGE										0.5	0.6	1.0	
	TOTAL										1.7	2.1	3.0	

WEST END TRANSITWAY

Alternatives Analysis – Appendix E

CITY COUNCIL RESOLUTION

APPROVED

MARCH 29, 2016

ALEXANDRIA ACCELERATED

RESOLUTION NO. 2715

RESOLUTION OF RE-CONCURENCE FOR THE WEST END TRANSITWAY LOCALLY PREFERRED ALTERNATIVE (LPA) APPROVED BY CITY COUNCIL ON NOVEMBER 17, 2012.

WHEREAS, the City Council of Alexandria adopted the Locally Preferred Alternative (LPA) for the West End Transitway on November 17, 2012; and

WHEREAS, the adopted LPA is defined as Bus Rapid Transit (BRT) in dedicated lanes where practicable between the Van Dorn Metro and the Pentagon; and

WHEREAS, the Alternatives Analysis (AA) further analyzed the LPA and Environmental Documentation, a requirement of the National Environmental Policy Act (NEPA), included in this effort have incorporated technical and policy guidance from multiple City Council approved plans including the Comprehensive Transportation Master Plan (2008), Landmark/Van Dorn Corridor Plan (2009), Complete Streets Policy (2011), Transitway Corridor Feasibility Study (2012), and Beauregard Small Area Plan (2012); and

WHEREAS, this effort has refined the LPA (also referred to as the Build Alternative) through additional Conceptual Engineering; and

WHEREAS, this effort has considered the key issues which were requested to be brought to resolution during a subsequent planning effort: 1) LPA maintains access to Northern Virginia Community College (NVCC) from North Beauregard Street with stations at Fillmore Avenue and Braddock Road and includes significant pedestrian safety improvements at each station; 2) No action is required at this time regarding potential conversion of the West End Transitway from BRT to streetcar.

WHEREAS, the AA and environmental documentation effort has involved significant coordination with and incorporated guidance from local, regional, state, and federal officials; and

WHEREAS, the AA and environmental documentation effort has substantively sought, vetted, and incorporated feedback from public and local stakeholders; and

WHEREAS, the AA and Environmental Documentation effort and Transitway corridor planning effort proposes a net increase in the number of trees and tree canopy along the corridor, and in particular, along sections proposed for dedicated transit lanes; and

WHEREAS, the AA and environmental documentation effort has received and incorporated specific input from the City Council established Policy Advisory Group (PAG); and

WHEREAS, the AA and environmental documentation effort has evaluated and provided acceptable concepts addressing specific areas of concern such as: bicycle and pedestrian facilities, safety, property impacts, parking impacts, stormwater impacts, operational feasibility, engineering feasibility, plan and policy compliance; and

WHEREAS, on December 3, 2015 the Policy Advisory Group voted to recommend that the City advance the refined LPA (also referred to as the Build Alternative) forward toward operation through project development which includes completion of the project Environmental Document, commitment of funding, and completion of work activity including design, engineering, phasing, permitting, financial planning, bidding, and construction leading to the initiation of service; and

WHEREAS, on February 17, 2016 the Transportation Commission held a public hearing and moved to endorse the proposal for the West End Transitway, including the recommendations of the Policy Advisory Group, in support of advancement to the design phase.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF ALEXANDRIA, VIRGINIA

That the City Council of Alexandria, Virginia:

1. Accepts the recommendations of the Policy Advisory Group and Transportation Commission.
2. Re-concurs the November 17, 2012 action identifying the Locally Preferred Alternative (LPA) for the West End Transitway as Bus Rapid Transit in dedicated lanes where practicable between Van Dorn Metro and the Pentagon.

Adopted: March 29, 2016

ALLISON SILBERBERG MAYOR

ATTEST:

Jacqueline M. Henderson, MMC City Clerk