

5.0 Evaluation of Alternatives

This chapter provides an evaluation of the alternatives presented in Chapter 2 and analyzed in Chapter 3. The intent of this chapter is to provide information to assist the Arlington County Board and the Fairfax County Board of Supervisors in selecting the Locally Preferred Alternative (LPA) for advancement under the Federal Transit Administration (FTA) New Starts/Small Starts program.

As the lead federal agency for the project, FTA is providing oversight of 1) the Alternatives Analysis and project development process; and 2) environmental documentation in compliance with the National Environmental Policy Act of 1969. Both of these functions are important in advancing the Columbia Pike Transit Initiative towards implementation.

5.1 Methodology of Evaluation

The goal of the evaluation is to assess how well each alternative addresses the Columbia Pike Transit Initiative's purpose and needs and goals and objectives. The evaluation is performed using two assessments:

The first assessment evaluates the ability of each alternative to meet the project purpose and need, as described in Chapter 1. This is performed using identified evaluation measures that provide either quantitative or qualitative data on how well each alternative meets the stated need.

The second evaluation is a qualitative assessment of how well an alternative supports the project goals and objectives defined in Chapter 1, relative to the other alternatives.

The final section, Section 5.4, provides a synthesis of the two evaluation assessments, and presents the estimated costs along with risks and benefits associated with each alternative. Each alternative provides certain benefits at varying degrees of investment. The county boards will consider the benefits and risks and weigh the costs of each alternative in order to select the alternative that best satisfies the counties' vision for the corridor and best meets the project purpose and need as well as goals and objectives.

Detailed methodologies for specific topics included in this evaluation can be found in Volume II: Supporting Technical Memoranda.

5.2 Ability to Meet Project Purpose & Need

As described in Chapter 1, the purpose of the Columbia Pike Transit Initiative is to:

- Implement higher-quality and higher-capacity transit service along the corridor in order to provide more capacity;
- Enhance access within the corridor and provide connections to the regional transit network; and
- Support economic development along the corridor.

The needs of the Columbia Pike Transit Initiative include:

- Improve transit capacity and transit mode share;
- Invest in transit service that supports growth and economic development; and
- Improve transit access and regional connectivity to and from Skyline.

The following subsections summarize the results of the qualitative and quantitative measures developed to assess how well each alternative meets the project purpose and need.

5.2.1 Limited Roadway Capacity

Problem: Limited roadway capacity to handle an increase in automobile trips.

Need: Increase transit capacity and improve transit mode share.

The corridor's roadway network is constrained to handle projected population and employment growth. Arlington County's *Master Transportation Plan Streets Element* precludes widening roadways to increase roadway capacity¹, and current transit capacity is limited, given the close headways of buses and levels of current usage. Increasing both transit capacity and the number of persons using transit (increasing transit mode share) would help address and serve the anticipated transit and roadway demand. As shown in Table 5.2-1, the TSM 2 Alternative and Streetcar Build Alternative provide similar, higher levels of transit capacity and transit mode share. The evaluation measures used are described below:

- Total person throughput: projected total number of transit users and automobile passengers at the point of maximum ridership during the peak period at the peak point (peak point is along Columbia Pike between George Mason Drive and Glebe Road).
- Transit capacity per peak period: the total maximum "comfortable standing load" for the Metrobus/Streetcar and ART lines that serve the corridor.
- Transit ridership mode share: projected percentage of travelers using transit (considers all trips to and from areas along the corridor throughout the entire day).
- Total daily transit ridership: projected number of travelers using transit per day.
- Reduction in Vehicle Miles Traveled (VMT): the reduction of the total number of regional VMT during a typical weekday, relative to the No Build Alternative.

¹ Arlington County. (2011). *Arlington County Master Transportation Plan Streets Element*. p. 7.

Table 5.2-1: The need to increase transit capacity and improve transit mode share

Evaluation Measure:	No Build	TSM 1	TSM 2	Streetcar Build
2016 person throughput (at peak-load point) (automobile and transit)	3,101 (37% transit)	3,229 (40% transit)	3,489 (44% transit)	3,524 (45% transit)
2030 person throughput (at peak-load point) (automobile and transit)	3,349 (39% transit)	3,745 (41% transit)	3,795 (46% transit)	3,916 (48% transit)
Transit capacity (peak hour, peak direction)	1,974	2,073	2,654	2,802
2016 transit ridership (total average weekday for Metrobus/ streetcar and ART)	17,800	21,700	25,100	26,200
2030 transit ridership (total average weekday for Metrobus/ streetcar and ART)	20,700	25,000	28,900	30,500
2016 transit mode share (daily total)	11.70%	11.82%	12.01%	12.07%
2030 transit mode share (daily total)	12.91%	13.04%	13.23%	13.31%
2016 Regional Vehicle Miles Traveled (VMT) and savings compared to the No Build Alternative	130M	-5,652	-13,699	-16,323
2030 Regional Vehicle Miles Traveled (VMT) and savings compared to the No Build Alternative	160M	-6,341	-15,208	-18,740

5.2.2 Insufficient Transit Capacity to Support Growth and Development

Problem: Existing transit service is insufficient to support future growth and development within the corridor.

Need: Invest in transit service that supports growth and economic development.

Potential to increase the transit system capacity:

Based on Metropolitan Washington Council of Governments (MWCOC) estimates, the total population within a quarter-mile of the corridor is expected to grow by approximately 10,000 people by 2030. Similarly, employment along the corridor is expected to grow by approximately 12,000 jobs. Therefore, the corridor needs a transit system that is able to expand and adapt to accommodate future growth by increasing system capacity and service frequency without compromising operational efficiency. On many maturing transit corridors, operational efficiency is compromised as transit service frequency increases, resulting in inconsistent service headways or “bus bunching.” As reflected in both the volume-to-capacity ratio and the potential capacity of the transit fleet in Table 5.2-2, the TSM and Streetcar Build Alternatives are better able to adapt to population and employment growth in the corridor.

The evaluation measures used are described below:

- **Volume-to-capacity ratio:** A ratio of passenger volume over transit line capacity shows how well the corridor transit lines are being utilized in the peak hour and in the peak direction. This indicator is also known as capacity utilization or load factor. Higher values are associated with high levels of utilization. As the ratio approaches a value of 1, vehicles become more crowded, which lowers rider comfort. A volume-to-capacity ratio of 0.8 still reflects a comfortable standing load. However, the assessment averages loadings across the peak hour of travel.
- **Capacity of the transit fleet to expand to adapt to corridor population and employment growth:** As demand for transit grows, and additional transit vehicles are added, the transit system is more prone to inefficiency. This characteristic is expressed in terms of the fleet’s susceptibility to bus bunching. For the purposes of this study, “bunching” occurs when two transit vehicles arrive at a given stop within 30 seconds of each other.

Potential Economic Development Effect:

Unless some investment in higher-quality, higher-capacity transit is made, the projected population and employment growth would not be addressed and would result in increased congestion. This congestion could discourage future development along the corridor. As shown in Table 5.2-2, the TSM Alternatives and Streetcar Build Alternative provide increased transit

capacity, which would help alleviate potential congestion and encourage development along the corridor. The Streetcar Build Alternative has the greatest potential to have a positive economic development effect. The permanent nature of streetcar guideway leads to the increased potential to shape growth and boost the counties' tax base. The evaluation measures used are described below:

- Land Value Premium (existing assets more valuable): Research indicates that people are willing to pay more for properties where transportation access and walkability are improved. The extent of the land value premium is based on the permanence of the transportation investment as well as the size of the mobility benefits associated with each alternative. Alternatives that offer permanent investments (i.e. those that cannot be moved or shifted to another route easily) are more likely to yield land value premiums because there is less risk that the transportation investment and its associated improvements could be moved from the corridor.
- Pace of Development: Due to improved transit access, each alternative could potentially encourage development that is planned for the corridor to occur sooner than it would without transportation investment. In this case the development is not new, but would be generating benefits (and attracting residents, businesses, and employees) earlier than planned. This measure relies on preliminary developer survey and workshop findings identified as part of the Columbia Pike Transit Initiative Return on Investment Study, conducted in spring 2012, to determine the likelihood of each alternative to increase the pace of corridor revitalization.

Economic Effects for Travelers

As summarized in Table 5.2-2, the TSM Alternatives, and to a greater degree, the Streetcar Build Alternative, provide annual travel time savings and travel cost savings. A review of housing and transportation affordability along the project corridor found that the majority of corridor U.S. Census Block Groups are currently within the affordable range, as defined by the Center for Neighborhood Technology (CNT); based on average household income, residents are paying less than 45 percent of their income on housing and transportation costs. As the region continues to grow, congestion levels increase, and housing and transportation expenditures rise, it is likely that the 45 percent threshold would be exceeded in areas along the corridor. This risk highlights the need for continued access to inexpensive public transportation for corridor residents, and the need for Arlington County and Fairfax County to provide adequate affordable housing. The evaluation measures used are described below:

- Value of Annual Travel Time Savings: The operation of the alternatives would improve mobility within the project area relative to the No Build - generating travel time savings for those passengers diverting from current bus routes. The value of the travel time savings is based on the time saved per trip, the percentage of riders diverted

from existing routes, percentage of trips that are work trips, and the average annual wage per hour for the Washington, DC MSA. This measure is shown in dollars.

- Value of Annual Travel Cost Savings: The operation of the alternatives would improve mobility within the project area relative to the No Build - generating travel cost savings for travelers diverting from autos to transit. The value of the travel cost savings is based on the number of new riders, average length of the previous auto trip, average auto operating cost per mile, and the cost of the new transit trip. This measure is shown in dollars.
- Location Efficiency: The operation of the alternatives would contribute to the ability to maintain housing and transportation affordability within the project corridor. The CNT calculates the affordability index as the combined neighborhood housing and transportation costs divided by average neighborhood income. (Volume II, Chapter 6 provides greater detail on location efficiency.)

Table 5.2-2: The need to invest in transit service that supports growth and economic development

Evaluation Measure:	No Build	TSM 1	TSM 2	Streetcar Build
2016 transit volume to capacity ratio (average weekday ridership, peak hour, peak direction)	0.61	0.66	0.65	0.62
2030 transit volume to capacity ratio (average weekday ridership, peak hour, peak direction)	0.67	0.72	0.73	0.74
Capacity of the transit fleet to expand to adapt to corridor population and employment growth	Greatest levels of bus bunching/inefficiency (19-25% buses bunched in 2016; 18-28% buses bunched in 2030).	<ul style="list-style-type: none"> Ability to expand fleet in the future. Greater levels of bus bunching/inefficiency (23-29% of buses bunched in 2016; 20-26% of buses bunched in 2030). 	<ul style="list-style-type: none"> Ability to expand fleet in the future. Reduced bus bunching/inefficiency (16-24% of buses bunched in 2016; 14-21% of buses bunched in 2030). 	<ul style="list-style-type: none"> Ability to expand fleet in the future. Reduced bus bunching/inefficiency (14-21% of transit vehicles bunched in 2016; 17-22% of transit vehicles bunched in 2030).
Land Value Premium (Existing assets more valuable)	Negligible impacts on property values adjacent to right-of-way.	Negligible impacts on property values adjacent to right-of-way.	Slight impacts on property values adjacent to right-of-way.	4% increase in property values adjacent to right-of-way.
Pace of Development	No Effect.	No Effect.	Some potential to increase pace of development.	More potential to increase pace of development.
Value of Annual Travel Time Savings	No travel time savings.	\$2.2M	\$4.5M	\$5.1M
Value of Annual Travel Cost Savings	No travel cost savings.	Annual travel cost savings for 2030 identified (\$0.3M).	Annual travel cost savings for 2030 identified (\$0.7M).	Annual travel cost savings identified for 2030 (\$0.9M).
Location Efficiency	Housing and transportation costs likely to increase without travel time or travel cost savings.	Housing costs likely to increase for reasons independent of transportation investment; travel cost savings for 2030 (\$0.3M) identified to offset housing cost.	Housing costs likely to increase for reasons independent of transportation investment; annual travel cost savings for 2030 (\$0.7M) identified to offset housing cost.	Housing costs likely to increase with overall increase in property values due to alternative, but impact mitigated by housing policies; travel cost savings for 2030 (\$0.9M) identified to offset housing cost.

5.2.3 Improve Transit Access to Skyline

Problem: Skyline, a regional center of office, commercial, and residential activity, is poorly connected to the regional transit network.

Need: Improve transit access and regional connectivity to and from Skyline.

In order to improve mobility and transit service for existing riders and to attract new riders to the system, efficient and accessible transit during peak and off-peak periods must be available. Retail and employment centers within the corridor must also be well served. One area that is particularly underserved by transit within the corridor is Skyline. The Skyline area contains a high concentration of residents, employees, and visitors who would benefit from a more direct route to the Pentagon/Pentagon City area and a more convenient connection to the regional Metrorail system. As reflected in Table 5.2-3, the TSM and Streetcar Build Alternatives provide the greatest transit service frequency to and from Skyline. Additionally, the proposed Jefferson Street Transit Center, which would provide a park-and-ride and bus transfer facility under the TSM 2 Alternative and Streetcar Build Alternative, would further improve transit connectivity and access.

Under the No Build Alternative, due to inconvenient and infrequent transit service connections between Skyline and Columbia Pike, total ridership estimates for the Skyline area are low. However, with improved service under the TSM 1 Alternative, and even more so under the TSM 2 and Streetcar Build Alternatives, ridership estimates to and from the Skyline area increase. Providing this “missing link” to the regional transit system for residents and workers in Skyline would have a profound effect on transit usage, as evident in the peak period weekday ridership projections to and from Skyline. As reflected in Table 5.2-3, the Streetcar Build Alternative provides the best travel time from Skyline to Pentagon City. The evaluation measures used are described below:

- Intra-corridor Trips: frequency of transit service that serves Skyline to Pentagon or Pentagon City (vehicles per hour, peak period).
- Additional facilities to improve transit connectivity and access: number of current or planned intermodal transfer centers within the corridor.
- Corridor Travel Time: the travel time of a transit vehicle running on lines 16G and 16H in the peak period and in the peak direction from Jefferson Street to Pentagon City.
- Ridership: the transit ridership calculated for the peak period (6:00-9:00am), during a typical weekday to and from Skyline.

Table 5.2-3: The need to improve connection from Skyline to the regional transit network

Evaluation Measure:	No Build	TSM 1	TSM 2	Streetcar Build
Intra-corridor Trips: Frequency of transit service that serves Skyline to Pentagon or Pentagon City (peak period vehicles per hour)	8	14	14	14
Additional facilities to improve transit connectivity and access	None	None	Jefferson Street Transit Center	Jefferson Street Transit Center
2016 Corridor Travel Time: Jefferson Street to Pentagon City (am peak period)	29 min.	26 min.	23 min.	23 min.
2030 Corridor Travel Time: Jefferson Street to Pentagon City (am peak period)	30 min.	28 min.	25 min.	23 min.
Peak period, weekday ridership: To Skyline (trip attraction)	17	447	877	931
Peak period, weekday ridership: From Skyline (trip production)	231	217	784	785

5.3 Ability to Support Project Goals and Objectives

At the onset of this project, goals and objectives were established to help guide development of the alternatives. The goals and objectives were created through extensive public and stakeholder involvement and reflect the underlying locally adopted land use and transportation plans and policies of both counties. The goals and objectives represent the combined vision of policy-makers, stakeholders, and members of the community.

The following subsections summarize the results of a qualitative evaluation of how well each of the alternatives supports the project goals and objectives.

5.3.1 GOAL 1: Improve Mobility for Corridor Residents, Employees, Customers, and Visitors.

Mobility is improved by increasing transit system capacity and accessibility, improving transit service, and providing high-quality intra-corridor trips. Through increased mobility, all travelers, including the transit-dependent, are better served.

Objective 1- Provide additional transportation capacity to meet current and future travel demand: Relative to the other alternatives, the TSM 2 and Streetcar Build Alternatives provide the greatest increases in transit system capacity. The TSM 1 Alternative somewhat increases transit capacity, while the No Build Alternative does not increase capacity of the existing transit service.

Objective 2- Provide more transportation choices: All alternatives provide more transportation choices for residents and visitors of the corridor by promoting alternative transportation modes, including pedestrian, bicycle, and transit facilities. The TSM and Streetcar Build Alternatives provide more transportation choices than the No Build Alternative due to increased service frequency throughout the day and improved transit service to Skyline.

Objective 3- Provide high-quality service for local trips along the corridor: The TSM 2 and Streetcar Build Alternatives provide higher-quality transit than the No Build and TSM 1 Alternatives, due to the enhanced station stops along the full alignment and features that increase transit efficiency and improve corridor travel time, including off-board vehicle fare collection, multi-door boarding, and low-floor vehicles. However, the streetcars provide a higher-quality ride and increase rider comfort due to the smooth acceleration and deceleration of the electric propulsion and the ease and convenience of boarding and alighting from the wide doors and larger lower floor areas. The Streetcar Build Alternative best meets the objective of providing higher-quality and higher-capacity transit service along the corridor.

Objective 4- Address the transportation needs of transit-dependent populations in the corridor: All alternatives support the needs of the transit-dependent populations by providing safe transit service. However, the TSM and Streetcar Build Alternatives better serve the needs of the transit-

dependent populations in the corridor by increasing service frequency throughout the day and providing additional service to the Skyline area. The TSM 2 and Streetcar Build Alternatives better address the needs of the transit dependent by providing more passenger amenities, greater improvements in corridor travel time, and the greatest service reliability (as measured by bus bunching).

5.3.2 GOAL 2: Contribute to and Serve as a Catalyst for Economic Development.

Both Arlington County and Fairfax County have adopted policies and plans that encourage economic development along the corridor, such as Fairfax County's redevelopment plan for Baileys Crossroads and Arlington County's Columbia Pike Initiative and form-based code implementation. These plans have provided the necessary zoning codes and land use plans to encourage higher-density redevelopment, first floor retail/commercial development, and development of public spaces that enliven streets and create a "sense of place" for residents and visitors. To support both Arlington and Fairfax Counties' vision of an easily navigable, walkable community with vibrant retail spaces, the corridor must be easily accessible and served by transit. In general, a transit service that improves mobility by increasing accessibility and service for intra-corridor trips, and providing high-quality service, can support and encourage economic development.

Objective 1- Support continued population and employment growth in the corridor: To support the increase in population and employment growth, transit service along the corridor must be able to accommodate an increase in ridership and provide reliable transit service. Because Arlington County's plans preclude adding additional travel lanes for automobiles, and existing transit service already operates at high frequency, Arlington County and Fairfax County must address the potential future demand with additional transit capacity. Both the TSM 2 Alternative and the Streetcar Build Alternative support continued population and employment growth in the corridor by providing significant increases in transit capacity. The TSM 1 Alternative somewhat supports this goal by slightly increasing transit capacity. The No Build Alternative does not increase current transit capacity. An enhanced transit service can provide the transit capacity and service needed to support the types of development densities envisioned in the local plans.

Objective 2- Support County economic development initiatives: To support County economic development initiatives, the transit service must improve mobility and enhance access. Relative to existing conditions and to the No Build Alternative, the TSM and Streetcar Build Alternatives better improve mobility by providing increased transit capacity, improving travel time, and increasing travel frequency. Because developers see rail as more permanent, and are thus more likely to invest in an area with rail, the Streetcar Build

Alternative could support economic development initiatives to a greater degree than the other alternatives.²

Objective 3- Maximize local economic impact of transportation investments: The Streetcar Build Alternative supports the objective to “maximize local economic impact of transportation investments.” The Streetcar Build Alternative would have a more pronounced effect on the local economy than the other alternatives, by increasing property values along the corridor, which could provide greater opportunities to shape future growth and development (Section 3.6 provides more information on economic development). This increase in property values would increase the tax bases for both Arlington County and Fairfax County, which would translate into an increase in annual property tax revenues received by each county.

5.3.3 GOAL 3: Enhance Livability and Long-Term Economic and Environmental Sustainability of the Corridor.

Providing communities with high-quality transit investments that connect people to desired destinations is vital to enhancing livability and supporting environmental sustainability. By improving mobility through increasing transit frequency and improving transit service, households at a range of income levels have better access to transit. With improved accessibility and convenience, more people will choose to ride transit rather than drive to reach their destinations along the corridor, which would reduce single-occupancy vehicle trips and VMT.

Objective 1- Support lifestyle choices for environmentally sustainable communities: All alternatives support lifestyle choices for environmentally sustainable communities by providing transit service for short, intra-corridor, local trips and for connecting to the regional transit network. The TSM and Streetcar Build Alternatives better support lifestyle choices for environmentally sustainable communities by providing enhanced transit service, increasing off-peak service frequency, and improving transit service to Skyline. Service enhancements contribute to a community environment where residents and visitors can access local and regional services and activities without a private automobile. The TSM and Streetcar Build Alternatives reduce regional VMT (See Section 3.1 for results). The TSM 2 and Streetcar Build Alternatives provide the greatest annual travel cost savings for 2030, which would reduce household transportation costs and support livability in the corridor.

Objective 2- Support long-term private investment in transit-friendly development: The Streetcar Build Alternative would best support long-term private investment in transit-friendly development due to the permanence of

² AECOM, *District of Columbia Transit Improvements Alternatives Analysis Return on Investment Report*, DDOT, May 2005. Interview results indicated that BRT improvements were not enough to entice additional development. The developers preferred the fixed assets associated with the streetcar system.

in-street tracks. Developers recognize that bus routes can change, while in-street rail tracks are permanent.³

Objective 3- Minimize adverse environmental impacts of transportation investments: In developing each alternative, planners have worked to minimize adverse impacts on the environment. However, due to the capital investment required for the Streetcar Build Alternative, including the construction of the O&M facility, additional stops, track work, traction power substations, and regrading of Jefferson Street, the Streetcar Build Alternative would have a greater effect on the built and natural environment than the other alternatives. While the Streetcar Build Alternative would result in some environmental impacts, none of the impacts identified would result in severe or adverse effects that could not be mitigated. Associated impacts for each alternative are described in detail in Chapter 3 and in Volume II.

Objective 4- Serve households at a range of income levels: All alternatives provide service to households at a range of income levels and assume the same fare structure. However, the TSM 2 and Streetcar Build Alternative offer the greatest travel cost savings due to the improved travel time. Given the predicted increase in housing costs for the region, travel cost savings can help support livability and affordability along the corridor.

Objective 5 Promote pedestrian and bicycle focused communities: In their policies, plans, and projects, Arlington County and Fairfax County are working to create and sustain communities where people can choose to walk or bike. All alternatives would include additional bicycle facilities near and along the corridor and provide an enhanced pedestrian environment (through the Multimodal Project). However, the Streetcar Build Alternative best promotes pedestrian- and bicycle-focused communities by being most consistent with Arlington County’s land use plans that envision Columbia Pike as a “main street” pedestrian environment. Arlington County’s vision for Columbia Pike is predicated on an enhanced transit service that helps foster a multi-modal environment.

5.3.4 Goal 4: Support Development of an Integrated Regional Multimodal Transportation System.

The corridor connects and serves several concentrations of residential, retail, and business activity. All alternatives support an integrated, regional, multimodal transportation system by providing transit service along the corridor that links and provides connections to the regional Metrorail system.

Objective 1- Provide enhanced connections to intermodal centers: The TSM 2 Alternative and the Streetcar Build Alternative enhance connections to intermodal centers by providing significant improvements in travel time from Jefferson Street to Pentagon City and the Pentagon City Metrorail station. Furthermore, the TSM Alternatives and the Streetcar Build Alternative provide

³ IBID.

increased transit service to and from Skyline, a regional activity center that is currently underserved. In addition, the TSM and Streetcar Build Alternatives extend weekend and late night service hours to match Metrorail service. The TSM 2 and Streetcar Build Alternatives provide for higher levels of transit ridership and increase transit mode share along and within the corridor, as compared with the No Build Alternative and the TSM 1 Alternative.

Objective 2- Provide improved service to regional activity centers: The TSM and Streetcar Build Alternatives provide the greatest improvement in service to regional activity centers, such as Skyline and Pentagon City. This is mainly due to increased service frequency throughout the day and improved travel time.

Objective 3- Increase transit ridership and mode share: Because the TSM 2 and Streetcar Build Alternative provide greater levels of passenger convenience and travel time savings, both alternatives increase transit ridership and mode share more than the TSM 1 and No Build Alternatives.

5.3.5 Goal 5: Provide a Safe Environment for all Modes of Travel

This goal represents the desire of both Arlington County and Fairfax County to continue providing a safe environment for vehicles, bicycles, transit vehicles and pedestrians. Each alternative supports the goal and the following objectives:

Objective 1- Enhance personal security for travelers in the corridor: All alternatives enhance personal security for travelers in the corridor. All Super Stops along Columbia Pike are designed in consideration of personal safety of transit riders. Stops are well lit, positioned to maximize visibility, and use transparent glass. Emergency phones are available at each stop, with operations staff always available to field calls.

Objective 2- Provide safe operations for travelers in the corridor: All alternatives provide the appropriate measures for safe operations for travelers in the corridor. To enhance safety for cyclists, the No Build Alternative includes plans for a continuous bike facility parallel and along the corridor. Section 3.15 provides more information regarding the characteristics of each alternative to provide safe operations for motorists, pedestrians, and cyclists.

Objective 3- Provide a safe environment for transportation operations staff and employees: Both Arlington County and Fairfax County will ensure a safe environment for transportation operations staff and employees under all alternatives. If the Streetcar Build Alternative is selected as the Locally Preferred Alternative, the Virginia Department of Rail and Public Transportation (DRPT) will oversee the safety and security of the system and will follow all guidelines under *49 CFR Part 659: Rail Fixed Guideway Systems; Safety Oversight*.

5.4 Evaluation Synthesis

As described earlier in this chapter, the purpose of this document is to provide appropriate information for the public and decision-makers to consider the advantages and disadvantages, as well as the trade-offs for each alternative as they prepare to select an LPA.

Section 5.4.1 summarizes the results of the two assessments: the ability to meet the project purpose and need, and the ability to meet the project goals and objectives.

Estimated costs of each alternative are summarized in Section 5.4.2. Anticipated risks and benefits associated with implementing a higher-quality, higher-capacity transit service are discussed in Sections 5.4.3 and 5.4.4.

5.4.1 Purpose and Need; Goals and Objectives

Tables 5.4-1 and 5.4-2 summarize the results of the two evaluations: the ability to meet the project purpose and need, and the ability to meet the project goals and objectives.

Table 5.4-1: Evaluation Synthesis: Project Needs

Project Needs	Measures	No Build	TSM 1	TSM 2	Streetcar Build
Increase transit capacity and improve transit mode share	<ul style="list-style-type: none"> Transit system capacity Person throughput (2016 and 2030) Transit ridership (2016, 2030) Transit mode share Regional VMTreduction 				
Invest in transit service that supports growth and economic development	<ul style="list-style-type: none"> Travel time savings Travel cost savings Premium property values (increase) Permanence of investment (ability to attract investment) 				
Improve connectivity and transit service to and from Skyline	<ul style="list-style-type: none"> Intra-corridor trips: frequency of transit service that serves Skyline to Pentagon or Pentagon City Additional facilities to improve transit connectivity and access Corridor travel time (peak period, weekday ridership: to Skyline (trip production)) 				

Rating Legend:

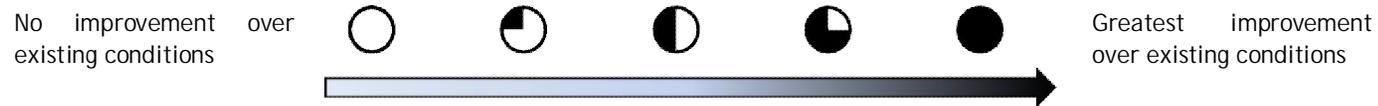
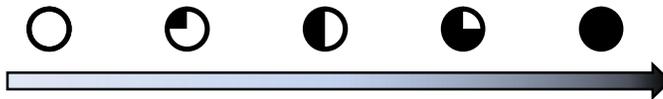


Table 5.4-2: Evaluation Synthesis: Project Goals

Project Goals	Objectives	No Build	TSM 1	TSM 2	Streetcar Build
Improve mobility for corridor residents, employees, customers and visitors.	<ul style="list-style-type: none"> • Provide additional transportation capacity to meet current and future travel demand. • Provide more transportation choices. • Provide high-quality service for inter-and intra-corridor trips. • Address the transportation needs of the transit-dependent populations in the corridor. 				
Contribute to and serve as a catalyst for economic development.	<ul style="list-style-type: none"> • Support continued population and employment growth in the corridor. • Support county economic development initiatives. • Maximize local economic impact of transportation investments. 				
Enhance livability and long-term economic and environmental sustainability of the corridor.	<ul style="list-style-type: none"> • Support lifestyle choices for environmentally sustainable communities. • Support long-term private investment in transit-friendly development. • Minimize adverse environmental impacts of transportation investments. • Serve households at a range of income levels. • Promote pedestrian and bicycle focused communities. 				
Support development of an integrated regional multimodal transportation system.	<ul style="list-style-type: none"> • Provide enhanced connections to intermodal centers. • Provide improved service to regional activity centers. • Increase transit ridership and mode share. 				
Provide a safe environment for all modes of travel.	<ul style="list-style-type: none"> • Enhance personal security for travelers in the corridor. • Provide safe operations for travelers in the corridor. • Provide a safe environment for transportation operations staff and employees. 				

Rating Legend:

Marginally Satisfies Goals and Objectives



Fully Satisfies Goals and Objectives

5.4.2 Estimated Costs

Capital Costs: The projects included in the No Build Alternative are investments in transportation infrastructure along Columbia Pike that set the stage for higher-quality, higher-capacity transit improvements.

The TSM 1 Alternative includes additional standard buses for deployment along the corridor. The TSM 2 Alternative includes a new fleet of articulated buses and an assumed share in construction of a maintenance facility that accommodates the larger bus vehicles. The Streetcar Build Alternative, with its in-street guideway, modern streetcar vehicles and supporting facilities, is the most costly to construct. Estimated Streetcar Build Alternative capital costs vary according to the three different Western Terminus Design Options.

Estimated capital costs for the alternatives are as follows:

- TSM 1: \$4M (2011); \$5M (2015).
- TSM 2: \$47M (2011); \$53M (2015).
- Streetcar Build: \$214 to \$231M (2011); \$242 to \$261M (2015).

Operations & Maintenance Costs: The No Build Alternative, equivalent to the existing levels of service along the corridor, would cost approximately \$16.7 million to operate in 2016. Estimated annual operations and maintenance costs for the other alternatives are as follows:

- TSM 1: \$23.3M (2016); \$35.2 (2030).
- TSM 2: \$22.5M (2016); \$34.1M (2030).
- Streetcar Build: \$22.5 to \$29.6M (2016); \$34.1 to \$44.8M (2030).

Cost differences between the No Build and TSM 1 Alternatives are due to additional service provided throughout the average weekday and on weekends. Service levels between the TSM 1 and TSM 2 Alternatives are comparable; improved corridor travel times for the TSM 2 Alternative yield O&M cost savings as compared with the TSM 1 Alternative. The Streetcar Build Alternative provides the same frequency and span of service as the TSM alternatives. Unit O&M costs for streetcar systems tend to be incrementally higher than O&M costs for bus systems. The range in estimated O&M costs for the Streetcar Build Alternative relate to different hourly unit costs derived from peer U.S. streetcar and LRT systems.

5.4.3 Risks

For each alternative, there are risks to successful implementation. Chapter 3 details risks in the form of potential effects across the range of environmental categories, and related to construction activities. Chapter 4 details risks related to financing and operation of the transit system alternatives. The discussion below highlights some of the potential risks related to implementation of the alternatives.

No Build and TSM 1: There are no known implementation risks associated with these alternatives.

TSM 2: The TSM 2 Alternative would replace standard buses with articulated buses on Metrobus 16G and 16H routes; however, there are no maintenance facilities in Northern Virginia capable of servicing articulated buses. Construction of the planned WMATA Cinder Bed Road Maintenance Facility, capable of servicing articulated buses, is currently on hold pending resolution of a legal dispute. If the TSM 2 Alternative were selected as the LPA, the project could incur the cost of building a new facility capable of servicing articulated buses.

The TSM 2 Alternative also assumes off-vehicle fare collection and WMATA as the service provider. However, WMATA does not plan to introduce off-vehicle fare collection for Metrobus service before the project implementation year, 2017. Consequently, introduction of off-vehicle fare collection, the main contributor to the travel time improvement, would not be feasible without a change in WMATA policy.

Streetcar Build Alternative: Arlington County and Fairfax County are jointly implementing the Columbia Pike Transit Initiative. County staff and officials have worked closely together during the planning phase, but will need to resolve project sponsorship, governance, and operations organization issues which could lead to delays in implementation.

5.4.4 Benefits

For each alternative, there are benefits associated with long-term operation. Chapter 3 details mobility and economic benefits, which are also summarized above in Tables 5.4-1 and 5.4-2. An ongoing Return on Investment study⁴ documents input from local property owners and developers related to anticipated corridor-specific economic development benefits. The discussion below summarizes some of the potential benefits related to long-term operation of the alternatives.

No Build: The No Build Alternative includes infrastructure investment, including Super Stops, that will support transit service improvements into the future.

TSM 1: As compared with the No Build Alternative, the TSM 1 Alternative provides more frequent service during weekdays and weekends. The TSM 1 alternative is limited in its potential to add transit capacity in response to ridership demand.

TSM 2: Like the TSM 1 Alternative, the TSM 2 Alternative provides more frequent service during weekdays and weekends. With the TSM 2 Alternative, the counties could add passenger capacity in response to increasing ridership with little increase in operating costs by replacing standard buses with articulated buses.

⁴ Columbia Pike Transit Initiative: Return on Investment Study (Draft), AECOM for Arlington County and Fairfax County, May 2012.

Streetcar Build: A streetcar system would be the most amenable to accommodating growth in ridership. Like the TSM Alternatives, the Streetcar Build Alternative provides more frequent service during weekdays and weekends. As a fixed guideway system, the Streetcar Build Alternative could add significant passenger capacity with little increase in operating costs by replacing buses with higher-capacity streetcar vehicles. In the future, capacity could be increased further—again with little increase in operating costs—through the use of multiple-car consists.

Because of its capacity to accommodate growth, and because of the permanent nature of its guideway and facilities, the Streetcar Build Alternative would exert the greatest long-term leverage to create and sustain walkable, mixed-use, mixed-income neighborhoods.