Chapter VI – Evaluation of Alternatives





Evaluation of Alternatives

Introduction

This chapter presents information relevant to evaluating the I-270/US 15 Multi-Modal Corridor Study alternatives, drawing on information and analyses presented in the previous chapters.

The purpose of this chapter is to highlight the major differences in performance and impacts between the alternatives to support decision making for a locally preferred alternative. The selection of an alternative must be made carefully, balancing the effectiveness of the alternatives' ability to meet the project's transportation needs and other goals against the financial costs and environmental impacts. It is the role of the stakeholders – including residents, businesses, funding agencies, political representatives, civic groups and others – to build consensus finding the right balance of effectiveness, costs and impacts for the Corridor Cities Transitway (CCT) and the I-270/US 15 highway corridor improvements

To facilitate this decision-making process, the chapter is organized to cover the following major categories:

- *Effectiveness* – the extent to which an alternative accomplishes the purposes that the transportation improvements are intended to address
- *Comparative Environmental Effects* – the extent to which each alternative impacts the social, economic, and natural environment
- *Cost and Financial Feasibility* – the extent to which sufficient funding is available or can be developed to support the construction, operation, and maintenance of an alternative
- *Cost-Effectiveness* – the extent to which an alternative provides a level of benefits that is commensurate with its costs (and relative to other alternatives)
- *Equity* – the extent to which each alternative provides fair distribution of costs and benefits across various subgroups in the corridor

Role of the Federal New Starts Criteria

The Section 5309 New Starts program is the Federal Transit Administration's (FTA's) primary program for providing financial support to locally-planned, implemented, and operated fixed guideway transit major capital investments. As discussed in **Chapter V**, it is expected that FTA New Starts funds will be sought if either of the light rail transit (LRT) or bus rapid transit (BRT) alternatives is selected as a transit component of a locally preferred alternative for this project. The federal transportation legislation, Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), requires that proposed New Starts projects be justified based on several project justification criteria, including:

- Mobility improvements
- Environmental benefits
- Operating efficiencies
- Cost-effectiveness
- Transit supportive land use patterns/policies and economic development potential
- The local share of proposed costs and the financial capacity of the community to support them

Table VI-1 indicates how the New Starts Criteria are reflected in the set of measures being analyzed in this chapter to evaluate the CCT transit alternatives and throughout this Alternatives Analysis/Environmental Assessment (AA/EA).

Table VI-1: New Starts Criteria

Mobility Improvements	Discussed in the Effectiveness section, under "Goal 2: Enhance Mobility," as well as under the Equity Considerations sections
Environmental Benefits	Incorporated in various evaluation measures discussed in the Comparative Environmental Effects section
Operating Efficiencies	Operations and Maintenance (O&M) costs and travel time savings are among the measures analyzed in Chapter V, as well as within the discussion of project Cost-Effectiveness in this section
Cost-Effectiveness	FTA's cost-effectiveness calculation is discussed in the Cost-Effectiveness section.
Transit Supportive Land Use Policies and Future Patterns/Economic Development Potential	Land use is discussed at the end of Chapter I and within Chapter IV, and is considered in this chapter in the discussion of "Goal 1: Supporting Orderly Growth"
Local Financial Commitment	Discussed in the financial analysis section included in Chapter V, and summarized in the Financial Feasibility section in this chapter

Alternatives

The alternatives are discussed in **Chapter II** and listed in ***Table VI-2***. There are two components – a highway component and a transit component. The highway component of the build alternatives consists of improvements to I-270 and US 15, including the addition of general-purpose and Express Toll Lanes℠ (ETLs℠) and upgrades to interchanges and ramps. The difference between Alternative 6A/B and Alternative 7A/B is the inclusion in Alternative 7 of an additional ETL on I-270 between MD 121 and north of MD 80. The transit component (LRT or BRT on the CCT) footprint would be the same for both Alternatives 6A and 7A (LRT) and Alternatives 6B and 7B (BRT).

As discussed in **Chapter II**, Alternatives 6.1 No-Build Transit and 6.2 Transit TSM are included for the purposes of establishing a performance baseline to compare against the performance of BRT and LRT on the CCT, in accordance with the FTA guidelines for an Alternatives Analysis, and were not subjected to an environmental evaluation (**Chapter IV**). The AA analysis also includes Alternatives 6A/B and 7A/B.

The LRT and BRT components propose transit service on an exclusive guideway along a reserved corridor (CCT) in Montgomery County that has been preserved for this project in local master plans. LRT would use light rail vehicles on tracks on this alignment and BRT would use rubber-tired transit vehicles on the same alignment.

Table VI-2: Alternatives

ALTERNATIVE	HIGHWAY COMPONENT	TRANSIT COMPONENT
Alternative 1	No-Build	No-Build
Alternative 6.1	Alternative 6	No-Build
Alternative 6.2	Alternative 6	Transit TSM
Alternative 6A	Alternative 6	LRT
Alternative 6B	Alternative 6	BRT
Alternative 7A	Alternative 7	LRT
Alternative 7B	Alternative 7	BRT

Effectiveness

The effectiveness of each alternative is best assessed by first understanding the intended objectives of the project. **Chapter I** presents the project's purpose and need and calls for improvements to be made to the transportation system in the corridor to address the following transportation challenges:

- Growing traffic congestion on I-270 and US 15 throughout the corridor caused by growing population and employment in the region, and the lack of alternative routes for this important commuting and freight corridor
- Limitations on transit services and transit service performance
  - Transit parking lots at Shady Grove Metrorail station, as well as a number of MARC commuter rail stations are operating at capacity
  - MARC service is limited in its service frequency, does not provide "reverse commute" service, and does not serve a number of growth centers within Montgomery County
  - Current bus service operates in mixed traffic, subject to congestion, resulting in slow travel speeds

In order to more effectively evaluate the proposed transportation strategies and alternatives, the original project team, with the input of the I-270/US 15 focus group, developed a list of five goals for this project:

Goal 1: Support Orderly Economic Growth

Support the orderly economic development of the I-270/US 15 Corridor consistent with the existing local government land use plans and the State's Smart Growth Policies.

The transitway components are generally compatible with the local transportation and land use plans for all jurisdictions in the corridor. County and local plans have been developed to support the changes in development and traffic patterns that are expected to result from future growth in a corridor that includes both a transit improvement on the CCT and an expansion of highway capacity on the I-270/US 15 Corridor.

The build alternatives are also compatible with the Maryland Smart Growth Initiative, as explained in **Chapter IV**.

The CCT has been included in Montgomery County's master plans as well as individual sector plans since the 1970s. As such, many of the station areas are targeted for transit supportive growth and development. These include both recent developments, such as King Farm in Rockville, a residential development with the alignment built into the road network; and planned development such as that anticipated for Crown Farm and Metropolitan Grove. With its bikeway component, the CCT improvements are also supported by Montgomery County's *Countywide Bikeways Functional Master Plan*. Some details of the transit plans, particularly the location of the maintenance facility, may not be compatible with all local plans. The *Shady Grove Sector Plan*, for example, recommends that the maintenance facility be located outside of the Shady Grove area, and calls for specific configurations of the Shady Grove station, when station designs have not yet been determined at that level of detail.

Highway improvements to the I-270/US 15 corridor, including roadway widening, are recommended in the master plans of both Montgomery and Frederick Counties. The ETLs are not included in these plans, which call for improvements involving only general purpose or high occupancy vehicle (HOV) lanes. HOV lanes and ETLs are types of managed lanes. Managed lanes include many configurations and/or restrictions to maximize highway facility usage, such as truck-only lanes, ETLs, HOT (high occupancy toll) lanes and HOV lanes among others. The 2002 Draft Environmental Impact Statement (DEIS) examined Alternatives 3A/B and 5A/B/C that included additional HOV lanes and Alternatives 1, 2, and 4A/B that included the existing HOV lanes. The ETLs of Alternatives 6A/B and 7A/B represent an operational change to traffic flow and usage when compared to Alternatives 3A/B and 5A/B/C, and do not represent a change in the number of traffic lanes. Since the concept of ETLs is fairly new, it has not been addressed in Montgomery County master plan updates. However, because the levels of service (LOS) on the corridor's general-purpose lanes would be improved under Alternatives 6A/B and 7A/B, and ETLs are one type of managed lanes like HOVs, the ETLs should not be considered to be in conflict with orderly economic growth outlined in local and county growth plans.

The ability to support orderly economic growth should not be a differentiating factor among the build alternatives because all four build alternatives include improvements to the same highway corridor, involve ETLs, and propose transit improvements on the same alignment.

Goal 2: Enhance Mobility

Provide enhanced traveler mobility through the I-270/US 15 Corridor.

Mobility is the ability of individuals to get from one location to another. Private automobiles provide excellent mobility in that they can take the driver virtually anywhere in the study area. However, not everyone is able to drive a car, has access to one, or chooses to travel via private automobile for their trip. Those that drive during peak commuting hours are frequently caught in slow-moving traffic and often face significant parking costs at urban destination centers. Transit serves a number of destinations and is open to a wider range of travelers with limits on mobility options, such as residents with low incomes, those who are elderly or disabled, or the young. When traveling on an exclusive guideway, such as rail tracks or a busway, transit is able in many cases to provide faster travel times than driving.

The transit components of the alternatives serve different, although overlapping, travel markets from the highway improvements, and are therefore discussed separately.

Transit

The ability of an alternative to attract new riders is a good measure of its effectiveness in providing a mobility improvement that works for people. Ridership estimates from the travel demand model analysis are shown in ***Table VI-3***, along with estimates of travel time savings for users, expressed as "annual user benefit hours". Also shown is the number of annual new transit trips projected for each alternative.

LRT is projected to attract 10-15 percent more riders to CCT stations than BRT, making ridership an important differentiator between those transit build alternatives. User benefit hours, which represent the travel time saved by all travelers of the transportation system as compared to Alternative 6-TSM, are about seven percent higher for BRT compared to LRT. The higher ridership for LRT is due in part to the attractiveness of LRT over rubber-tired modes. It is also related to the slightly faster travel speeds.

An important difference between LRT and BRT is related to local bus operations. Alternatives 6A/B and 7A/B incorporate local feeder bus routes that bring passengers from residential areas to CCT stations. With LRT, these feeder bus routes will typically terminate at an LRT station, requiring passengers to transfer. With BRT, the buses can join the guideway to run express on the CCT alignment, eliminating the need for a transfer. The effects of this advantage are reflected in the ridership and user benefit calculations for the BRT alternative.

Because the LRT and BRT use the same alignment, with stations in the same locations, other transit service factors would be identical for the alternatives, including the availability of parking, residential housing and employment located within walking distance of stations.

Overall, therefore, the LRT alternatives (6A and 7A) have a higher effectiveness than the BRT alternatives (6B and 7B) in enhancing mobility – providing greater benefits to riders, and providing a service that is attractive to a greater number of users.

Highway

Level of service for highway improvements provides a good measure to assess the mobility effectiveness for roadway users. The I-270 and US 15 roadways are forecasted to experience traffic congestion under the No-Build Alternative in year 2030 for the southbound AM peak hours, for the I-270 roadway segments north of Father Hurley Boulevard (AM and PM peak directions), and for several US 15 segments (both AM and PM peak directions).

Table VI-3: Ridership, User Benefit Hours, and Annual New Transit Trips

ALTERNATIVE	TOTAL DAILY GUIDEWAY BOARDINGS	ANNUAL USER BENEFIT HOURS (TRAVEL TIME SAVINGS)	ANNUAL NEW TRANSIT TRIPS
Alternative 6A w/LRT	30,000	2,070,000	2,679,600
Alternative 6B w/BRT	26,000	2,220,000	2,864,400
Alternative 7A w/LRT	30,000	2,100,000	2,710,400
Alternative 7B w/BRT	27,000	2,250,000	2,895,200

Note: User Benefit Hours and Annual New Transit Trips are reported as compared to Alternative 6-TSM.

With the proposed highway improvements (Alternatives 6A/B and 7A/B), the Montgomery County I-270 mainline sections of I-270 would show improving conditions during the 2030 AM and PM peak periods. The improvement is due to the ETLs providing relatively congestion-free travel speeds past existing bottlenecks caused by entering/exiting interchange traffic. ETL usage by former general purpose lane vehicles reduces the number of vehicles in the general purpose lanes, thus improving overall operating conditions. In northern Montgomery County (north of MD 121), Alternative 7A/B further improves roadway congestion by offering a second ETL for motorists to choose a reliable travel time versus the potentially congested general purpose lanes.

With the proposed highway improvements (Alternatives 6A/B and 7A/B), the Frederick County mainline sections of I-270 will also show improving conditions during the 2030 AM and PM peak periods. Although the two build alternatives both add highway capacity, they both experience LOS F conditions for all or a portion of highway segments from the Montgomery County line to MD 85. Alternative 7A/B would result in better overall traffic operational conditions due to the additional ETL lane over Alternative 6A/B. The proposed traffic volumes of the two build alternatives are relatively close in their forecasts with Alternative 7A/B having approximately five percent more ADT than Alternative 6A/B but providing approximately 22 percent more vehicle capacity.

The general expectation along US 15 through the City of Frederick is that the build alternative traffic conditions will improve over the No-Build condition and remove all LOS F conditions by the year 2030. Alternative 7A/B will experience no LOS E segments while Alternative 6A/B will experience two LOS E segments (Jefferson Street to US 40/MD 144 and north of Biggs Ford Road). Each of the build alternatives yield similar results along US 15 due to the identical improvements there.

The overall traffic analyses show that I-270 and US 15 will continue to experience congested segments (with the proposed build alternatives) to 2030 and beyond due to the existing and projected growth along the corridor. However, the build alternatives provide congestion relief for segments of I-270 and US 15 as well as for those motorists who choose to travel in the ETLs. In addition, the projected traffic operations would be worse under the No-Build Alternative. A review of the difference in mainline segment miles that operate under LOS F conditions between the build alternatives and the No-Build Alternative, as indicated in ***Table VI-4***, illustrates the congestion relief for the general purpose lanes.

Alternative 6A/B would provide a 13-mile total reduction in mainline segments operating at LOS F (five miles reduction northbound, eight miles reduction southbound). Alternative 7A/B would provide a 30-mile total reduction in mainline segments operating at LOS F (12 miles reduction northbound, 18 miles reduction southbound). Therefore, Alternative 7A/B offers the greatest reduction in LOS F mileage along the corridor when compared to the expected No-Build conditions and offers the best alternative to enhance roadway user mobility within the project study area.

Goal 3: Improve Goods Movement

Facilitate the movement of goods within and through the I-270/US 15 Corridor and improve the delivery of services in support of the regional and local economies.

The build alternatives would enhance goods movement along the I-270/US 15 corridor by improving LOS during peak travel hours on both the ETLs and the general-purpose lanes. Freight and other commercial carriers would be able to use the ETLs and the general-purpose lanes depending on how valuable the time savings is to a particular trip. Due to the improved LOS conditions Alternative 7A/B offers versus Alternative 6A/B, Alternative 7A/B provides the most improvement in traffic operations throughout the I-270 and US 15 roadway corridor.

Goal 4: Preserve the Environment

Deliver transportation services in a manner that preserves, protects, and enhances the quality of life and social, cultural and natural environment in the I-270/US 15 Corridor.

The build alternatives are designed to enhance quality of life and the environment by reducing congestion, increasing mobility, and encouraging the use of more environmentally-friendly forms of transportation (i.e., transit).

The highway and transit alignments were designed to follow existing roadway and transit corridors to reduce impacts to the natural and social fabric of the study area. The transitway is planned to follow an alignment that has been identified for over 30 years, resulting in a relatively low impact on parks, homes and other forms of development for a project of its size.

As **Chapter IV** indicates, each of the build alternatives would have some impacts on the environment. However, the No-Build Transit (6.1) and Transit TSM (6.2) Alternatives have impacts as well, including increased congestion and air pollution and reduced travel opportunities in the study area, reduced potential for economic development, and reduced opportunities for use of the trails that are proposed adjacent to the transitway. ***Table VI-11*** summarizes the principal environmental differences among the build alternatives.

It is the role of stakeholders, including residents, businesses, project sponsors, local governments and politicians, to decide if the benefits of the build alternatives outweigh the resulting environmental impacts.

Because the build alternatives are similar and have identical footprints, there is little to differentiate them in terms of environmental benefits. A comparison of specific impacts is provided on the following pages.

Table VI-4: I-270/US 15 Level of Service Improvements

	ALTERNATIVE 1 2030 NO-BUILD	ALTERNATIVES 6A/B	ALTERNATIVES 7A/B
Year 2030 Mainline Segment Mileage of LOS F Conditions*			
I-270/US 15 Northbound (PM Peak Hour)	20	15.8	11.6
I-270/US 15 Southbound (AM Peak Hour)	23.2	15.5	5.7
Total Mileage of LOS F Segments	**43.2**	**31.3**	**17.3**
Year 2030 Mileage Reduction of LOS F Segments from Alternatives 1 (No-Build) and 2 (TSM/TDM)			
I-270/US 15 Northbound (PM Peak Hour)	N/A	4.2	8.4
I-270/US 15 Southbound (AM Peak Hour)	N/A	7.7	17.5
Total Mileage Reduction of LOS F Segments	**N/A**	**11.9**	**25.9**

**I-270/US 15 Corridor within project limits is approximately 32.1 miles. The northbound and southbound lanes account for a total length of 64.2 miles.*

Goal 5: Optimize Public Investment

Provide a transportation system in the I-270/US 15 Corridor that makes optimal use of the existing transportation infrastructure, while making cost-effective investments in facilities and services that support other project goals.

Each of the build alternatives would increase the efficient use of the transportation system by reducing travel times and encouraging the use of transit.

CCT and Bikeway Investment

The existing CCT corridor represents a major community investment in transportation infrastructure. The land within the corridor, parts of which would have been developed for residential and/or other use, has instead been set aside for decades. Converting it from its largely-unused current condition to an exclusive transitway and bicycle/pedestrian path would allow Montgomery County to maximize the value of this asset to the community.

Both the LRT and BRT alternatives would provide a high level of transit service that would enable travelers to save time by avoiding congestion during peak hours. Each of the transit build alternatives would also provide a bikeway adjacent to the transitway. Because of the cost differential, however, the BRT alternatives rank much higher than the LRT alternatives in terms of value provided per dollar. As explained in the section on Cost-Effectiveness, the capital costs of the LRT ($777.5 million) are estimated to be 73 percent higher than the cost of implementing BRT ($449.9 million). Operating costs for the LRT alternatives are about five percent higher than BRT, which includes the cost of operating feeder and other background bus services. Because the connectivity benefits of the bikeway are the same under each build alternative, and benefits of BRT and LRT are similar (for example, the travel time savings for LRT is only four percent higher than for BRT), the relative benefit per dollar of the BRT alternatives (Alternatives 6B and 7B) is higher than that of the more expensive LRT alternatives (Alternatives 6A and 7A).

Highway Investment

The proposed Alternatives 6A/B and 7A/B highway improvements are identical in the amount of roadway to be installed and right-of-way needed; the differences are a result of the operational configuration of the ETLs. From near the MD 121 interchange to north of MD 80, the two highway alternatives differ in the number of ETLs operating. Alternative 6A/B has one ETL per direction and Alternative 7A/B has two ETLs per direction. As a result, the proposed cost for each alternative is similar with an estimated total project cost of $3.9 billion. This cost would be higher if the facility were to be built on new alignment with the same configuration of the existing plus proposed lanes and interchanges, especially the cost to purchase new right-of-way. The overall project cost will continue to be evaluated if a build alternative is selected for implementation.

Alternatives 6A/B and 7A/B will encourage further carpooling and transit usage in the corridor by providing connections to intermodal transfer facilities. The ETLs will provide a reliable travel time from just north of MD 80 southward to Rockville (south of I-370), the Shady Grove Metrorail station and eastward towards eastern Montgomery County and Prince George's County (via the Intercounty Connector tolled roadway). A carpool vehicle on the ETLs would not only experience reduced travel time but also the occupants would share commute costs (tolls, fuel and parking charges), reduce the number of peak period vehicles using the highway, lower the amount of highway congestion on the general purpose lanes, and lower the amount of highway infrastructure needed to address all of the general purpose lane congestion. The ETLs, with their potential for higher carpooling usage, would be able to transport a higher number of people than other lane types.

Development Impacts

In addition to mobility benefits, the public stands to gain from the development opportunities presented by the project. The development benefits arising from the build alternatives include increasing the value of existing development as well as enhancing development opportunities, particularly near stations. The No-Build Transit (6.1) and Transit TSM (6.2) Alternatives, in contrast, are expected to have a dampening effect on development in the corridor due to the increasing traffic congestion.

The enhanced development value of the build alternatives is expected to result both from improved accessibility and from the public investment in local urban design (such as station design). Some properties may lose value, particularly those that would be adjacent to a new highway or transitway, which would be subjected to noise or visual impacts, or might lose part of their yards. Other properties, particularly those within walking distance to station areas, may gain in value.

The economic effects discussion in **Chapter IV** of this document indicates that the study area generally can expect land values to increase near existing or proposed transit stations, especially for employment centers and light commercial and industrial centers. These positive impacts are expected to be similar for both of the LRT and BRT alternatives, with a slight advantage for the LRT alternatives. LRT may provide a higher perception of permanence among developers than rubber-tired transit modes, and may therefore have an advantage in attracting developers to capitalize on the accessibility improvements provided at station areas. In addition, LRT would create more new jobs (roughly 3,800 average annual new jobs during project construction with LRT compared to 3,400 under the BRT alternatives).

Considering the highway component, the accessibility analysis has shown that increasing the capacity of I-270 and US 15 will likely serve to facilitate further economic and land development in the project area. Areas in and around the City of Frederick and on the urban fringe in northern Montgomery County are most likely to experience increased residential and retail land development pressure as a result of project accessibility improvements. The ETLs, by improving capacity on the crucial link between these areas and the employment centers in Montgomery County, would serve to facilitate additional land development on the urban periphery if current trends continue. A comparison between the ETL alternatives shows that Alternatives 7A and 7B tend to increase accessibility and development potential better than Alternatives 6A and 6B, although the differences between them are slight.

Considering both the highway and transit components, Alternative 7A, the combination of LRT and two ETLs each direction between MD 121 and north of MD 80, has the greatest potential development impact. This is due to Alternative 7A having the largest accessibility benefit for the highway improvements combined with LRT generating a greater potential for transit-oriented development (TOD) along the CCT alignment than BRT due to perceptions of alignment and station permanence. While Alternative 7B improves overall accessibility more than Alternative 7A, BRT's accessibility advantage results primarily from users being able to make a one-seat ride directly to their destinations. This caveat of BRT's accessibility benefits means BRT may primarily serve to enhance access to existing or planned residential and employment developments rather than providing stimulation for creating new TOD that is possible with LRT.

Comparative Environmental Effects

Detailed information on the environmental impacts of each alternative is presented in **Chapter IV**, and a summary of the impacts of Alternatives 6A/B and 7A/B is presented in ***Table S-2***. Alternatives 6A/B and 7A/B would be constructed primarily along existing transportation corridors; therefore, impacts are generally small for a project of this size. In addition, Alternatives 6A/B and 7A/B have identical limits of disturbance (physical footprints), limiting the impact differences between the alternatives. A brief discussion of the differences in impacts between alternatives is presented here. ***Table VI-11*** also presents differences in environmental impacts between the alternatives.

As discussed in **Chapter IV**, potential impacts of the alternatives are based on preliminary engineering and field investigations and will change during continued planning and final design. As an example, between 26 and 35 potential residential displacements in the Fox Chapel neighborhood near Middlebrook Road, identified in the 2002 DEIS, would be eliminated based on the Maryland State Highway Administration's (SHA's) proposed typical section reduction and the use of retaining walls. SHA presented the mitigation plan to the public on August 25, 2003. The Fox

Chapel neighborhood mitigation plan is included in Alternatives 6A/B and 7A/B. Minimization and mitigation measures will continue to be developed to reduce impacts to resources.

The location for the transit O&M facility has not been decided. As described in **Chapter II**, there are five locations currently under review. Three are being evaluated for either LRT or BRT use. One site is being evaluated for BRT operation only, and another is appropriate only for LRT operation. The impacts resulting from the selection of a maintenance site are discussed separately in many sections below to assist with decision-making.

Land Use and Zoning

Some county and municipal master plans and zoning have been updated to take into account changes to the alternatives since the 2002 Draft Environmental Impact Statement (DEIS), although some plans have not. The Montgomery County Master Plan calls for HOV lanes rather than ETLs and the Clarksburg Master Plan limits the maximum I-270 widening to six total lanes. In addition, local land use plans and zoning have been updated to accommodate, and in some cases maximize, the potential development impacts that are likely to result from the proposed highway and transitway improvements.

With no difference in the right-of-way to be used by the highway and transitway improvements, and the alternative use of ETLs rather than HOV lanes as the managed lane type, there is no differential between the build alternatives with regard to conforming to local land use and zoning.

Displacements

Estimated displacements, summarized in ***Table VI-5***, are the same for Alternatives 6A/B and 7A/B because the physical footprints are identical. The residential and business displacements are presented in detail in **Chapter IV** in ***Table IV-11*** and ***Table IV-12***. They are given as ranges because the location has not been chosen for an O&M site. Retaining walls can be used in many areas to avoid or reduce the number of homes and businesses that need to be relocated. Minimization of proposed shoulder widths and modifications of the proposed MD 117 direct access ramps would also reduce the number of displacements required for the highway improvements.

Displacements related to the transit components vary depending on the site selected for an O&M facility (***Table VI-6***).

Neighborhoods and Social Environment

Other than the impact from displacements discussed above, the impacts of the alternatives on neighborhoods and social cohesiveness are expected to be minimal, with little difference between alternatives. This is a result of the fact that the highway and transit components are being built along existing corridors, which are on the periphery of existing neighborhoods.

Parkland and Other Community Facilities and Services

Park impacts for the build alternatives are discussed in detail in **Chapter IV**. Potential impacts include loss of acreage and loss of buffer landscapes adjacent to the highway and transitway. An alignment shift through the Monocacy National Battlefield has limited the impacts to the west side of I-270 only, avoiding impacts to the more historically important sites east of the highway. There is no difference in parkland impacts between the alternatives. None of the proposed transit O&M facilities would result in parkland impacts.

Economic Environment and Development Potential

Alternatives 6A/B and 7A/B would enhance the economic development potential in the study area by improving accessibility. The development benefits would be similar for all build alternatives, as the proposed interchange locations, bikeway alignment, and transit stations are the same. Slight differences would occur in the level and location of development benefits.

Table VI-5: Displacements Summary

LOCATION	MAXIMUM DISPLACEMENTS *without minimization*	MINIMIZED DISPLACEMENTS *with minimized shoulders and/or retaining walls*[1]
Total Highway Residential Displacements	251 residences	9 – 74 residences
Total Transitway Residential Displacements	5 - 9 residences[2]	5 - 9 residences[2]
Highway and Transit Displacements in Montgomery County	240 - 244 residences	12 – 83 residences
Highway and Transit Displacements in Frederick County	16 residences	0 - 1 residence
Total Highway and Transitway Residential Displacements	256 - 260 residences	12 – 83 residences
Total Highway Business Displacements	10 -11 businesses	2 - 4 businesses
Total Transitway Business Displacements	3 - 32 businesses[2]	
Total Highway and Transitway Business Displacements	13 - 43 businesses[2]	5 - 36 businesses[2]

[1]Preliminary impacts are based on both a 25-foot and a 10-foot buffer beyond the proposed cut/fill line or the proposed retaining wall respectively, as well as an assessment of minimum/maximum structure displacements for townhouse units.

*[2]There is a range of potential displacements since only one or possibly none of the O&M sites listed in **Table VI-6** will be chosen.*

Table VI-6: O&M Facility Displacements

LOCATION	O&M SITE APPROPRIATE FOR LRT OR BRT	RESIDENTIAL DISPLACEMENTS	BUSINESS DISPLACEMENTS
Shady Grove Site 1D – South of Redland Road	LRT and BRT	None	29*
Shady Grove Site 6 – Crabbs Branch Way	BRT only	None	None
Metropolitan Grove Site 4/5 – PEPCO Transmission Lines	LRT only	4 residences	None
Metropolitan Grove Site 6 – Police Vehicle Impound Lot	LRT and BRT	None	2 businesses: the Police Forensics Lab and the Montgomery County Police Vehicle Impound Lot
Communications Satellite, Inc. (COMSAT) Area Site 5 – Observation Drive	LRT and BRT	1 farmhouse (with outbuildings)	None

**Displaced businesses are located in a strip mall and include multiple shops and restaurants, a storage facility, and several vehicle and machine maintenance shops.*

Transit

LRT may have a somewhat higher economic development benefit than BRT for the following reasons:

1. LRT may be perceived by its patrons as a more attractive mode, with a better ride quality, faster boarding and alighting, and a slightly faster travel time than BRT.
2. The LRT alternatives show ridership up to 10-15 percent higher than the BRT alternatives, which could enhance TOD potential.
3. The LRT alternatives could provide a higher number of annual construction jobs than the BRT alternatives (3,800 average annual new jobs during project construction with LRT vs. 3,400 with BRT).

Highway

The highway components are likely to have slightly differing development effects. Both Alternatives 6A/B and 7A/B would make travel along I-270 and US 15 faster and thus reduce commute times to employment centers in southern Montgomery County. Reduced commute times will tend to encourage continued land development on the urban periphery, including in northern and western Frederick County, and eastern West Virginia. To the extent that Alternative 7A/B would reduce travel times to a greater degree than Alternative 6A/B, Alternative 7A/B would generate somewhat larger increases in consumer, retail, and job accessibility within the corridor, and would also be more likely to encourage development in areas further away from the urban periphery.

Historic Resources

There is no difference between the alternatives with respect to cultural resources. Ten historic properties were identified within the area of potential effect for Alternatives 6A/B and 7A/B. The build alternatives were found to have an adverse effect on eight of these resources and no adverse effect on two properties. The highway and/or transitway would require right-of-way from seven properties, and noise impacts will affect four resources. No identified archaeological sites will be impacted by the project with the possible exception of unknown sites that may exist in the Monocacy National Battlefield.

Natural Environment

There is no difference between Alternatives 6A/B and 7A/B with respect to natural environmental impacts.

The impacts of the O&M Facilities sites on natural resources vary depending on the location of the O&M facility selected, as well as the layout of the facility's components. The lowest level of impact would occur at Shady Grove Site 1D, which is largely on developed land. The greatest level of impact to natural resources would occur at Metropolitan Grove Site 4/5, which is primarily wooded, with a few clearings around homes.

Hazardous Materials/Waste Sites

No severely contaminated sites were identified in the corridor. Eighteen sites were found to have documented or suspected modest contamination. Additional investigation is recommended to determine the presence of hazardous materials prior to the selection of a preferred alternative. Because of the identical footprint of the build alternatives, the differences between alternatives would arise only in the selection of the transit O&M site.

Air Quality

The air quality analysis used data from the travel demand model to estimate the total emissions produced under the No-Build and under each of the build alternatives. The regional impact of Alternatives 6A/B and 7A/B was predicted to cause changes to regional pollutant levels ranging from an increase of 1.1% to a reduction of -0.3% (see **Chapter IV**, ***Table IV-28***). Based on these changes, the project alternatives are predicted to have a minimal effect on regional pollutant levels, with Alternatives 6A/B performing slightly better than Alternatives 7A/B.

Table IV-28 shows that in 2015 Alternatives 7A and 7B were found to encourage a higher level of vehicle use, resulting in higher levels of emissions of carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), and volatile organic compounds (VOC) compared to Alternatives 6A and 6B. In 2030, Alternatives 7A and 7B were found to have higher levels of PM, and lower levels of CO and NO_x compared to Alternatives 6A and 6B. Differences in 2030 VOC levels between the No-Build, Alternative 6A/B and Alternative 7A/B are not considered significant.

The air quality analysis described in **Chapter IV** determined that the build alternatives meet all the project level $PM_{2.5}$ conformity requirements, and that the project will not cause or contribute to a new violation of the $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS). The project area is classified as an attainment area for PM_{10}.

Similarly, no violations of the one-hour and eight-hour CO levels were predicted.

The project build alternatives may result in increased exposure to mobile source air toxics (MSAT) emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

Noise and Vibration

The two LRT alternatives, Alternatives 6A and 7A have higher noise impacts than the BRT alternatives, with little overall difference between the two highway alternatives. Vibration levels were not found to cause impacts for either the LRT or BRT alternatives.

Chapter IV describes the noise abatement criteria utilized in the impact analysis, which define whether a change in noise levels represents no impact, or a moderate or severe impact.

Transit

Twenty-five noise monitoring sites were analyzed for impacts of the LRT or BRT on the CCT alignment. Following FTA criteria, LRT was found to have moderate noise impacts at four locations. BRT was found to result in no noise impacts at any of the 25 locations.

Of the five locations that were considered for locating a transit O&M facility, three locations are found to be potentially sensitive to noise from activities that would occur there due to the proximity of residences: on Redland Boulevard near the Shady Grove Redland Road site; and along Wicker Place and Game Preserve Road, both near the PEPCO Transmission Lines site. While the existing noise levels at these three locations are high enough that the transit yard would not cause a noise impact, the nighttime yard activities might require mitigation. It is recommended that noise-producing activities at the O&M site be limited to daylight hours.

Highway

The results for the two highway components varied by location, but were very similar overall.

Alternative 6A/B was found to impact 40 of the 55 highway sites studied, including 28 residential areas and 12 non-residential areas including parks, one hotel, a cemetery and two museums. Of these, six sites were projected to experience noise level increases of 10 decibels or more.

Alternative 7A/B was found to impact 39 of the 55 highway sites studied, including 27 residential areas and the same 12 non-residential areas impacted by Alternative 6A/B. Of these 39 impacted sites, seven sites were projected to experience noise level increases of 10 decibels or more.

Energy

The energy analysis detailed in **Chapter IV** looks at two components of energy use: the energy required to construct the project alignment, and the change in energy usage relating to daily vehicular travel in the region.

In terms of energy used for project construction, the Alternatives 6A and 7A use less energy for construction.

Each of the build alternatives has less than a one percent effect on regional transportation energy consumption. Alternative 7 will encourage more vehicle miles traveled (VMT), resulting in higher energy usage than Alternative 6. Alternative 6B causes the lowest increase in energy usage for regional transportation. BRT appears to use less energy in its daily operations (443 BTUs) than LRT, which would use 479 BTUs to operate LRT and its associated feeder bus service daily. Alternative 6B is therefore predicted to have the smallest relative increase in transportation energy of all the build alternatives.

Visual and Aesthetic Quality

The project will introduce new elements into the visual landscape such as an electrified transit railway (LRT), additional buses, additional lanes, structures, park and ride lots, noise walls and transit stations. Where possible, these elements will be designed to be compatible and integrated with the environmental context of their locations. As discussed in the 2002 DEIS and **Chapter IV**, the extent of the visual impacts of these new elements will depend on the existing visual character of each specific area, as well as surrounding land uses.

Transit

In general, the BRT alternatives will have less of a visual impact than the LRT alternatives. Most elements introduced by the transit improvements will be the same for BRT and LRT, including stations, park and ride lots, and elevated sections of transitway. The LRT option would introduce more elements to the landscape than the BRT options, largely due to the overhead catenary system and supporting aerial structures that would be present along the transitway.

Highway

In most cases, the highway improvements are proposed in areas where there is already significant existing infrastructure. There will be little overall difference between the visual impact of the highway alternatives.

Indirect and Cumulative Effects (ICE) Analysis

The LRT and BRT alternatives, as noted above, will have similar development impacts, largely concentrated in station areas, and it is possible that Alternative 7A/B will encourage more development on the urban periphery than Alternative 6A/B. Residential and commercial development produces secondary impacts by placing additional demands or development pressures on parklands, cultural resources, water resources, terrestrial habitat, and farmlands.

The ICE Analysis *(Indirect and Cumulative Effects Analysis Technical Report,* SHA, March 2009) for Alternatives 6A/B and 7A/B agreed with the conclusions of the 2002 Secondary and Cumulative Effects Analysis (SCEA) for Alternatives 3A/B, 4A/B and 5A/B/C that "… in select locations the region would experience future development beyond that planned for Montgomery and Frederick counties." According to the analysis, this additional development would occur "… regardless of the alternate, including the No-Build." As explained in **Chapter IV.L**, there are no indications that the conclusion of the 2002 SCEA has changed, and the ICE Analysis completed in 2009 supports this conclusion.

Cost and Financial Feasibility

There are two types of costs associated with the build alternatives – capital costs and O&M costs. Capital costs include one-time costs spent on right-of-way and infrastructure construction, as well as costs spent on items, such as rail cars or buses, that will last many years. The highway capital costs consist of right-of-way, construction of the roadway (labor and materials), and installation of signs and safety barriers, as well as planning and design services. Transit capital costs also include right-of-way, roadway or track installation, and planning and design services as well as the purchase of LRT and BRT vehicles, signaling and power systems, station and maintenance facility construction, and other elements.

In contrast, O&M covers ongoing cost items, such as labor expenses for bus drivers, transit system managers, and roadway/transitway and vehicle maintenance crews. Materials costs are also part of O&M expenses and include electricity to power LRT vehicles and signal systems, diesel or other fuels for buses, lubricants for oil changes, tires, etc.

Table VI-7: Estimated Capital Costs (in millions of 2007 dollars)

ALTERNATIVE	HIGHWAY*	TRANSIT	TOTAL
Alternative 6A - LRT	$3,879	$777.5	$4,656.5
Alternative 6B - BRT	$3,879	$449.9	$4,328.9
Alternative 7A - LRT	$3,879	$777.5	$4,656.5
Alternative 7B - BRT	$3,879	$449.9	$4,328.9

**Highway cost estimates are identical for Alternatives 6 and 7, as they have identical footprints and an equal amount of paving. Costs represent a "snapshot" in time for comparison. Project costs are subject to change based on world and local financial markets.*

Capital Costs

As ***Table VI-7*** shows, the CCT LRT transit mode option is approximately 73 percent more expensive than the BRT option in terms of capital costs. This is due primarily to the need for continuous track, power, and signal systems for LRT.

The estimated cost is the same for both highway Alternatives 6A/B and 7A/B, as they have require an identical amount of land and paving. Each of the alternatives includes the same highway and ETL access points and interchange improvements. As a result, the capital costs are the same. In terms of capital expenditures, Alternatives 6A and 7A with the LRT option are more costly than Alternatives 6B and 7B with the BRT option.

Estimated O&M costs for the transit components of the alternatives are shown in ***Table VI-8***. Both transit alternatives involve new high quality transit service along an exclusive guideway that separates the transit service, either LRT or BRT, from other forms of transportation between the Shady Grove Metrorail Station and COMSAT, and include adjustments to the background bus service.

LRT is about five percent more expensive in terms of operating costs when compared to BRT. While LRT operation along the CCT alignment is about 50 percent more expensive than BRT operation, LRT provides substantial savings in the feeder bus service. Feeder bus routes that continue along the transitway in the BRT alternative simply terminate at a CCT station under the LRT alternatives.

Highway O&M costs include minor repairs and routine paving, snow removal, mowing and other maintenance. These costs would be similar for the two highway alternatives, and are minor in comparison to transit O&M costs.

Financial Feasibility

In general, the lower the cost of a project, the easier it is to fund. The CCT transit improvements have been included in the current financially-constrained Long-Range Transportation Plan (CLRP) for the National

Table VI-8: Annual Estimated Transit O&M Costs*

ALTERNATIVE	MAINLINE TRANSIT SERVICE	BACKGROUND BUS SERVICES	TOTAL
LRT	$26,985,700	$1,143,400	$28,129,000
BRT	$17,907,850	$8,950,950	$26,859,000

**Costs are expressed in terms of cost increases above the Alternative 6.1 No-Build Transit.*

Capital Region as a planning project. The highway improvements with widening and HOV – where HOV is one form of managed lanes under consideration – are also included in the CLRP as a planning project. In the fall of 2007, the Governor and Maryland General Assembly committed an additional $80 million to the CCT in a legislative package of new revenues to be collected from Maryland residents and dedicated to transportation as well as the Maryland General Fund. This funding will be appropriated through the 2009-2014 Consolidated Transportation Program (CTP) to be enacted during the 2009 General Assembly session.

Highway and transit projects traditionally have different funding sources and have different funding needs and opportunities.

Transit

As discussed in **Chapter V**, the capital cost and annual operating cost subsidy for the CCT would be funded from a package of federal, state, county and possibly private sources. It is expected that at least 50 percent of the capital funding will be sought from the federal New Starts funding with the remainder of capital costs being contributed by the State of Maryland as well as other federal, county and private sources.

FTA's New Starts funding program is the principal source of federal funding for major transit projects. There is a limited amount of funding available nationally, and most projects therefore receive no more than 50 percent of the project's capital costs from New Starts. A number of other federal programs have the potential to provide some funding for enhancement, and associated components of a CCT locally preferred alternative (LPA) and will be explored further once the LPA is selected.

Beyond state and federal funds, the remainder of the funding would come from county and possible private-sector sources. It is expected that Montgomery County would provide capital funds for construction of the CCT in addition to right-of-way contributions, easements, and ancillary roadway and trail facilities.

The private sector is also a potential source of funding, especially in areas that are undergoing land development changes or expected to in the future. The Maryland Department of Transportation (MDOT), Washington Metropolitan Area Transit Authority (WMATA), and Montgomery County have recent experience in both joint development and value capture mechanisms, which will be explored for this project.

Operations & Maintenance Funding for Transit

The MTA is anticipated to operate the CCT service. As is the case for existing MTA services, that portion of the annual O&M and associated costs not covered by fare revenues, i.e., the operating subsidy, would be funded by the Maryland Transportation Trust Fund (TTF). As part of the State-level revenue enhancement for capital funding, other sources and mechanisms for providing the operating subsidy may be considered, including possible county contributions.

Highway

Funding for the highway components of Alternatives 6A/B and 7A/B would come from two potential sources: the TTF and toll revenues collected from the I-270 ETLs through the Maryland Transportation Authority. At this time, there are no projections on funding values from these two sources. In addition, the Metropolitan Washington Council of Governments (MWCOG) 2007 CLRP and the CTP lists the I-270/US 15 Multi-Modal Corridor Study project for planning funds only with no funding allocated towards design, right-of-way acquisition and construction. If a selected build alternative is determined as the LPA, MDOT and SHA would determine the best financial method to fund the following project development phases.

Cost-Effectiveness

Transit Cost-Effectiveness

Cost-effectiveness is a measure of the long-term benefits of the proposed project compared to the capital and operating costs of the project. Assessments of cost-effectiveness can vary depending on how an alternative's benefits are valued. In terms of easily-quantified criteria, such as riders per dollar or travel time savings per dollar, the BRT alternative is more cost-effective. LRT and BRT provide similar levels of benefit, and have similar levels of O&M cost requirements, in both cases with LRT slightly higher than BRT. However, the substantially lower BRT construction cost makes the BRT mode option rank higher in terms of overall cost-effectiveness.

FTA Cost-Effectiveness Assessment

The FTA requires the use of a specific formula for calculating cost-effectiveness. This formula is used to provide a uniform basis for comparing projects in different metropolitan areas, thereby assisting FTA in making funding decisions for its New Starts program.

In its evaluation of the cost-effectiveness of a proposed project, FTA considers the incremental cost per hour of transportation system user benefits in the forecast year. Transportation system user benefits reflect the improvements in regional mobility caused by the implementation of the proposed project as measured by the changes in travel time to users of the regional transportation system. The cost-effectiveness measure is calculated by first estimating the incremental "base-year" annualized capital and operating costs of the project (over a lower cost "baseline" of transit service), and then dividing these costs by the projected user benefits.

The result of this calculation is a measure of project cost per hour of projected user (i.e., travel-time) benefits expected to be achieved if the project is added to the regional transit system. Proposed projects with a lower cost per hour of projected travel-time benefits are evaluated as more cost-effective than those with a higher cost per hour of projected travel-time benefits (*FY 2009 New Starts and Small Starts Evaluation and Rating Process*; July 2007).

Table VI-9 presents the thresholds FTA will use in FY 2009 for assigning a *High, Medium-High, Medium, Medium-Low* or *Low* cost-effectiveness rating for each proposed project. FTA publishes updates to these breakpoints annually to reflect the impact of inflation.

FTA assigns a weight of 50 percent each to the cost-effectiveness and land use criteria in order to establish a summary project justification rating. Therefore, cost-effectiveness is a highly important measure in obtaining an acceptable rating along the path toward securing federal New Starts funding.

Table VI-10 summarizes the cost-effectiveness calculations for the CCT alternatives. As shown, each of the build alternatives is compared to Alternative 6.2 TSM. With this comparison, the FTA is determining whether the costs of a fixed guideway system are worth the investment. The table shows that the two BRT alternatives would meet the FTA threshold, and would be acceptable to proceed into preliminary engineering, where more detailed study would be conducted on the alignments and costs.

Table VI-9: FTA FY 2009 Cost-Effectiveness Breakpoints

COST-EFFECTIVENESS RATING	BREAKPOINT
High	$11.99 and under
Medium-High	$12.00 - $15.49
Medium	$15.50-$23.99
Medium-low	$24.00-$29.99
Low	$30.00 and over

Highway Cost-Effectiveness

The capital cost for Alternatives 6A/B and 7A/B are identical since the roadway paving is the same; therefore, the differences in cost-effectiveness between the two alternatives are founded in their operational performance. Alternatives 6A/B have one ETL from MD 121 to north of MD 80 while Alternatives 7A/B have two ETLs for the same segment. South of MD 121 both alternatives have two ETLs. The ETL toll rate has not been determined but the I-270 ETLs (not the I-270 general purpose lanes) are proposed as a 24-hour toll facility like the Intercounty Connector. The ETL toll rate is also planned to be dynamically set based on the level of I-270 general purpose lane traffic congestion. As the I-270 general purpose lane traffic congestion worsens, the I-270 ETL toll rate would increase. This scenario makes it difficult to determine which of Alternatives 6A/B or 7A/B would be the most cost effective to implement.

From the traffic operations/LOS viewpoint, Alternatives 7A/B would provide the most traffic congestion improvement. Out of a total 64 miles of I-270 peak direction highway segments, Alternatives 7A/B would provide 30 miles of peak direction LOS F improvement while Alternatives 6A/B would provide 13 miles of peak direction LOS F improvement.

Table VI-10: Cost-Effectiveness

	ALTERNATIVE 6.2 TRANSIT TSM	ALTERNATIVE 6A	ALTERNATIVE 6B	ALTERNATIVE 7A	ALTERNATIVE 7B
Capital Costs[1]	$86,860,000	$777,530,000	$449,920,000	$777,530,000	$449,920,000
Equivalent Annual Capital Costs[1,2]	$7,440,700	$62,202,400	$36,443,500	$62,202,400	$36,443,500
Equivalent Annual Capital Costs[1] above Alternative 6.2		$54,761,700	$29,002,800	$54,761,700	$29,002,800
Net Change in Operating Costs[1]	$14,793,000	$28,129,000	$26,859,000	$28,129,000	$26,859,000
Operating Costs above Alternative 6.2[1]		$13,336,000	$12,066,000	$13,336,000	$12,066,000
Daily User Benefit Hours	6,300	13,200	13,700	13,300	13,800
Benefit Hours above Alternative 6.2		6,900	7,400	7,000	7,500
Annual Benefit Hours		2,070,000	2,220,000	2,100,000	2,250,000
Annual New Transit Trips		2,679,600	2,864,400	2,710,400	2,895,200
Annual Cost per New Rider Above Alternative 6.2		$26.54	$14.34	$26.24	$14.18
Cost-Effectiveness		$32.90	$18.50	$32.43	$18.25

[1]All costs are given in $million (2007 dollars)
[2]These are the one-time capital costs expressed as an annualized stream of payments over 20 years, much as the value of a mortgage can be expressed in terms of annual payments.
Costs represent a "snapshot" in time for comparison. Project costs are subject to change based on world and local financial markets.

Equity Considerations

Service Equity

Transit

The I-270/US 15 Multi-Modal Corridor transit improvements will support economic development and improved access throughout the corridor. The project will provide substantial travel benefits to residents of the project area and beyond, including minority, low-income and elderly populations. Low-income individuals, who can be the most transit-dependent, will especially benefit from greater accessibility to jobs, services and shopping opportunities. This improved accessibility will be evenly distributed to communities within and surrounding the project area. These benefits will accrue not only from the proposed CCT transitway service, but also from the enhanced connectivity it will provide to existing bus services and to Metrorail, which provides transit service throughout Washington, DC and its suburbs.

The build alternatives will provide Washington, DC residents, a substantial portion of whom are low-income and transit-dependent, the opportunity to commute to jobs in the I-270/US 15 Corridor. Further, the build alternatives will provide more convenient transit services for project area residents to access the services, shopping and recreational opportunities within the project area as well as in Washington, DC.

Key employment centers in the corridor include Washington, DC, Bethesda, Rockville, Gaithersburg, Germantown, and Clarksburg. (Clarksburg, while much smaller in employment than the other areas listed, has long-range plans to accommodate over 10,000 dwelling units and enough commercial/industrial space for 20,000 employees). The build alternatives will reduce travel times to these areas and will benefit low-income and transit-dependent workers by widening the geographic area for employment opportunities that are accessible in relatively the same amount of travel time. The build alternatives will provide a higher benefit for the transit-dependent than Alternative 6-TSM because of the improved travel times. The build alternatives focus accessibility along the CCT alignment, where existing and proposed businesses are located, and considerably improve transit connections to those businesses.

In addition to job access benefits, the build alternatives will shorten travel times, increasing consumers' accessibility to project area and region-wide services, shopping, and recreational activities. As a result, consumers will benefit from greater availability of attractive shopping opportunities and lower prices from competing businesses within the project corridor.

The BRT alternatives will also have an advantage over the LRT alternatives for the transit-dependent in that there is a greater chance for a one-seat ride. While individuals with access to a car might use kiss and ride or park and ride to access the CCT, transit-dependent riders are more likely to arrive at a CCT station by bus. BRT allows these local feeder buses to enter the system and continue along the transitway as express buses. In the LRT alternatives, all passengers arriving by bus would have to alight from the bus and transfer to a train.

Highway

As with the transit components, the accessibility and development benefits of the highway components will be evenly distributed throughout the corridor. Benefits such as growth in jobs, residential development, commercial development, and growth in land values will also be well-distributed. There should be no difference in the distribution of transportation benefits between Alternative 6A/B and Alternative 7A/B.

Due to the cost of tolls, the benefit of the ETLs will likely not be as great for the low-income drivers. Drivers who are less able to pay for tolls will still benefit from the build alternatives, however, because of the improved LOS predicted on the general-purpose lanes.

Financial Equity

Financial equity relates to the sources of capital and operating funds for the project and is a function of how the sources of those funds correlate to the beneficiaries of the project and to various income groups. There is no difference between the build alternatives with respect to financial equity.

The construction of the ETL lanes will be partially financed through ETL tolls; however, to a large extent the construction of the build alternatives will be financed by sources other than users, predominantly by state and federal funds. Transit users will pay transit fares to use the transit services, but those funds are typically used to cover part of the operating costs. Some local funding from Montgomery County and Frederick County are likely to be provided; the source and allocation of county funds are unknown at this time. State funds will come from the State TTF. The trust fund consists of general taxes, fees, charges and operating revenues of MDOT paid by residents statewide. This is the funding source for most statewide transportation projects. Because of this broad-based mix of tax sources, no one group will be bearing a disproportionate financial burden as a result of the financial plan for the proposed I-270/US 15 Multi-Modal Corridor improvements.

It is anticipated the selected alternative will compete with other transportation improvement projects in the Washington, DC region and throughout Maryland for existing federal and state funding allocations. If existing revenue sources are not sufficient, additional revenue sources may need to be provided by local, state, or even private sources as discussed in **Chapter V**. These may include locally-enacted or increased gasoline, sales or property taxes, although these sources have not been widely supported in the past. The taxes are often enacted within the area expected to benefit from the transportation improvements through congestion relief or improved access to public transit, which serves to offset the regressive nature of the levy(ies).

Environmental Justice

Chapter IV of this document describes impacts to low-income and minority communities in the study area. With the exception of displacements, few impacts were found to have a disproportionate impact on areas with low-income and/or minority populations. Project benefits were likewise well-distributed, with highway benefits accruing to all residents, and three transit stations (East Gaither, West Gaither, and Metropolitan Grove) located within EJ areas (block groups that met the EJ threshold).

Residential displacements were found to be disproportionately high in communities within census block groups that met the 50 percent threshold for minority populations, such as the Foxcroft II apartments in Frederick, and the Brighton West and London Derry communities in Montgomery County along I-270 south of MD 117. This impact is the same under each of the build alternatives.

O&M Facilities Sites

None of the transit O&M sites would have environmental justice impacts. None are located in census block groups that meet the 15.4 percent poverty threshold for Montgomery County, and only one site (Crabbs Branch Way) is in a block group that meets the county's 50 percent minority threshold.

The Crabbs Branch Way site (Shady Grove Site 6) is located in a census block group with 54 percent minority residents. The site is adjacent to a residential area that could potentially be an EJ neighborhood. There are no displacements associated with this undeveloped site; therefore, the selection of this site would not physically impact any minority communities.

Development Impacts

Beyond the direct impacts of displacements discussed above, EJ areas in the corridor may also be affected by the indirect impacts of the enhanced economic development encouraged by the alternatives. While the build alternatives will improve access to employment, shopping, educational, recreational, and other opportunities for all residents, including minority and low income residents, these benefits can result in increased land values and gentrification. Increased land values are a benefit for current land owners who are willing to relocate, or who are able to take advantage of their wealth. However, it can be a burden for renters and for low-income homeowners who will have to pay higher property taxes. This effect will also impact neighborhood businesses or institutions that may be forced to close or relocate when commercial property values increase. Loss of community businesses and residents can harm community cohesiveness.

Alternative 7A/B should enhance land values, particularly in Frederick County where travel times to employment centers in southern Montgomery County will be reduced more so than under Alternative 6A/B. The transit improvements will primarily benefit Montgomery County, particularly in the vicinity of transit stations. Because the LRT component is believed to have slightly higher development benefits than BRT, the LRT alternatives should have a somewhat larger impact on station areas, including those located in minority and low-income neighborhoods.

Alternative 7A/B may, therefore, have a slightly larger impact on EJ areas in both counties. This includes positive benefits, such as enhanced access to jobs and other destinations, and higher job creation resulting from the higher construction costs of Alternative 7A. Negative impacts, such as the somewhat higher gentrification pressures that may be put on historically low-income or minority communities, would also accrue with Alternative 7A/B.

Key Differentiators

Ease of transportation, particularly reducing the amount of time spent commuting, is a major factor in a community's quality of life. Major improvements of all types often have environmental impacts, and it is the job of the public, political leaders and other stakeholders to decide if the benefits of a project justify both the financial costs and the project impacts to the natural and social environment.

Because the footprint of Alternatives 6A/B and 7A/B is the same, environmental impacts are identical for some resources (wetlands, floodplains, forests), and of a similar degree for others (noise, air quality). This leaves effectiveness and cost as the key differentiators. Alternative costs, as well as other criteria where there are notable differences between the build alternatives, are shown in ***Table VI-11***. Where differences are not

Table VI-11: Evaluation Matrix[1]

CRITERION	ALTERNATIVE 6A LRT 1 ETL[2]	ALTERNATIVE 6B BRT 1 ETL[2]	ALTERNATIVE 7A LRT 2 ETLs[2]	ALTERNATIVE 7B BRT 2 ETLs[2]
Ridership (Daily Guideway Boardings)	30,000	26,000	30,000	27,000
Annual Rider Benefit Hours	2,070,000	2,220,000	2,100,000	2,250,000
Annual New Transit Trips	2,679,600	2,864,400	2,710,400	2,895,200
Cost per Rider Benefit Hour	$32.90	$18.50	$32.43	$18.25
2030 LOS on ETLs	LOS C/D	LOS C/D	LOS C/D	LOS C/D
2030 LOS F conditions on general-purpose lanes (64 total direction miles)	30.2	30.2	13.4	13.4
Daily VMT (regional)	40,950,909	40,950,909	41,020,351	41,020,351
Daily Average Speed (regional)	22.2	22.0	22.4	22.4
Operating Cost				
Transit ($2007)	$28.1M	$26.9M	$28.1M	$26.9M
Highway	n/a	n/a	n/a	n/a
Capital Cost				
Transit ($2007)	$777.5M	$449.9M	$777.5M	$449.9M
Highway	$3,879M	$3,879M	$3,879M	$3,879M
Total	$4,656.5M	$4,328.7M	$4,656.5M	$4,328.7M
Visual Impacts	2nd	1st	2nd	1st
Air Quality	1st	1st	2nd	2nd
CO[3]	0.50%	0.50%	0.50%	0.50%
NO_x[3]	0.40%	0.40%	0.30%	0.30%
PM_{10}[3]	1.00%	1.00%	1.10%	1.10%
$PM_{2.5}$[3]	1.00%	1.00%	1.10%	1.10%
VOC[3]	-0.30%	-0.30%	0.10%	0.10%
Economic Development Potential	2nd	4th	1st	3rd
Potential for Increased Housing Costs	3rd	1st	4th	2nd
Energy				
Construction Energy	1st	2nd	1st	2nd
Transportation Energy				
Construction-phase Impacts on Neighborhoods	2nd	1st	2nd	1st

[1]Criteria that are not easily quantifiable are ranked. Those ranked 1st have the best performance (highest effectiveness or lowest impact). Does not include O&M facility, if one is chosen.
[2]Refers to the number of ETLs between MD 121 and north of MD 80.
[3] These percentages represent the change in regional transportation emissions compared to the No-Build.
M = million

quantifiable, a ranking is used to show which alternative or alternatives ranks best (highest effectiveness or lowest impact).

Consistency with Local Planning Documents and Public Input

Relevant to Purpose and Need Goal 1 – Support Orderly Economic Growth

There is no difference among the alternatives with respect to planning documents. Local planning documents have called for a rapid transit system to be built along the CCT corridor for decades, and each of the build alternatives provides that. Current plans also assume that the I-270/US 15 Corridor will be widened and account for the development that is likely to result from these improvements.

While the local planning documents recommended additional general-purpose or HOV lanes for highway improvements, the new ETLs proposed with Alternatives 6A/B and 7A/B will likely have similar effects on development and may encourage higher transit usage. ETLs are a newer type of managed lanes that have not been incorporated into many master plan updates.

Transportation Effectiveness

Relevant to Purpose and Need Goal 2 – Enhance Mobility, and to Purpose and Need Goal 3 – Improve Goods Movement

With an additional ETL lane north of MD 121, Alternative 7A/B will provide a better level of service on both the ETL and general purpose lanes compared to Alternative 6A/B. LRT attracts ten to 15 percent more riders, has slightly faster travel times, and provides seven percent more travel time savings benefits than BRT. Alternative 7A should therefore be considered as having the highest performance in terms of transportation benefits.

Environmental Impacts

Relevant to Purpose and Need Goal 4 – Preserve the Environment

Each build alternative has an identical physical footprint. The selection of an O&M facility location will vary, as some are LRT or BRT-only locations. Most environmental resource impacts are identical, except in the areas of air quality, energy usage, visual and construction-phase impacts on neighborhoods. These differences are very slight among alternatives. Measureable differences are anticipated for the following:

- **Visual** impacts differ in that the entire LRT alignment will have poles, catenary wires, and other features that are not included in the BRT alternatives. Alternatives 6B and 7B therefore rank highest in this area – having less visual impact.
- **Economic Development Potential** is higher for the LRT alternatives compared to the BRT alternatives, and for Alternative 7A/B compared to Alternative 6A/B. Alternative 7A therefore ranks highest in this area. Economic impact differences among the build alternatives may have secondary effects as well, as described in the equity section.
- **Equity –** The BRT alternatives may provide a better level of service to the transit-dependent, as transit trips made under BRT are more likely to be one-seat rides, while LRT trips are more likely to require transfers. Economic development impacts, mentioned above, may also have secondary effects resulting in gentrification pressures on traditionally low-income or minority communities. The stronger the economic development impact, the stronger the development pressures, meaning that Alternative 6B would be likely to have the least harmful impact.

With each alternative ranking best in at least one of the above criteria, the relative performance of the build alternatives in terms of environmental impacts is not quantifiable, and must be decided by stakeholders.

Costs/Cost-Effectiveness/Financial Feasibility

Relevant to Purpose and Need Goal 5 – Optimize Public Investment

Alternatives 6B and 7B are the least costly of the build alternatives. These alternatives would therefore be easiest to find funding for, although all alternatives are financially feasible given current state and federal funding resources, private funding opportunities resulting from the projected economic development, and the availability of toll revenues from the ETLs.

Selecting the most cost-effective alternative is not as clear. Looking only at the FTA cost-effectiveness measure, which calculates the cost of transit riders' travel time savings benefits above Alternative 6.2 TSM, it is clear that Alternatives 6B and 7B (BRT transit mode) rate substantially higher than Alternatives 6A and 7A (LRT transit mode) due to the latter's substantially higher capital cost. Alternative 7B rates slightly higher than Alternative 6B due to the additional benefit hours that Alternative 7B provides to transit users.

However, there are other issues that will be considered important by the residents, business owners, and workers of the area, as well as by the funding agencies, planning departments, and other stakeholders. These issues include the effectiveness of the alternatives to provide development opportunities, job opportunities, and a balanced and equitable transportation system. The selection of a preferred alternative must be made with these considerations in mind, as well as each alternative's cost and environmental impacts.