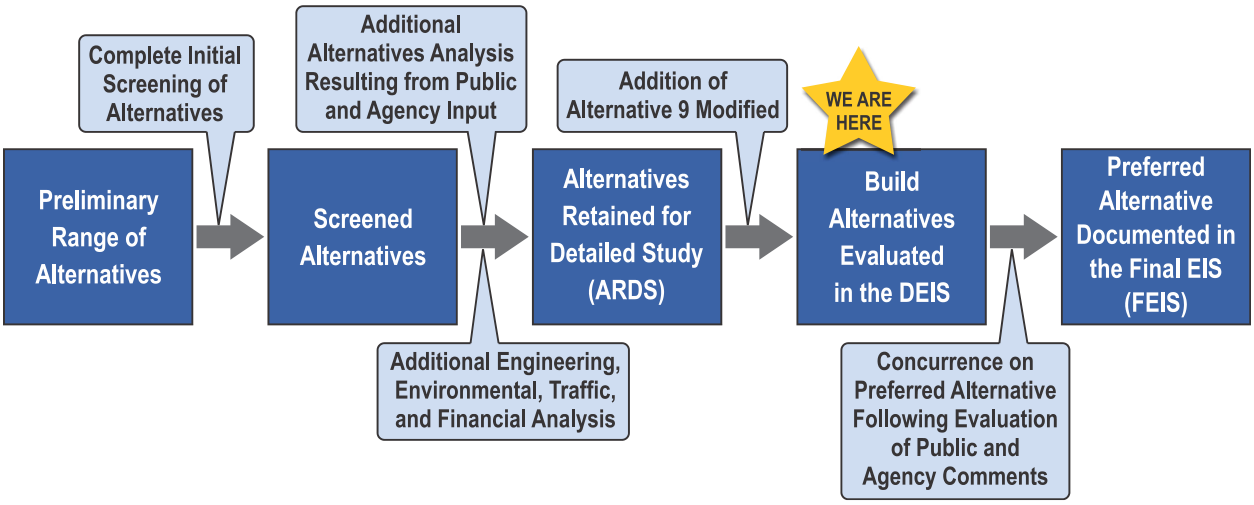
# 2 ALTERNATIVES DEVELOPMENT

## 2.1 Overview of Alternatives Development Process

Preparation of an environmental impact statement (EIS) under the National Environmental Policy Act (NEPA) involves identification of a reasonable range of alternatives to carry out the proposed federal action. The Maryland Department of Transportation State Highway Administration (MDOT SHA) analyzed a broad scope of initial alternatives to create a list of alternatives being carried forward for more detailed analysis in the Draft EIS (DEIS). A reasonable range of alternatives are those that meet the Study's Purpose and Need (refer to **Chapter 1** of this DEIS); and include those that are practical or feasible from the technical and economic standpoints and using common sense (Council on Environmental Quality [CEQ], 40 Questions, Response to Question 2a).[1]

The alternatives development and screening is following a five-step process that narrows the Preliminary Range of Alternatives under consideration down to the Preferred Alternative (**Figure 2-1**). The first four steps are presented in this DEIS; the last step will be documented in the Final EIS. As the level of design and analysis detail increased, the number of alternatives being considered decreased. To accommodate this large Study with numerous preliminary alternatives and substantial public and agency interest, the interim step of identifying Screened Alternatives was included in the alternatives screening process. Following the Screened Alternatives and additional analysis, the Alternatives Retained for Detailed Study (ARDS) were selected. After the ARDS were concurred upon, one additional alternative was evaluated and is included in the DEIS. Aside from the No Build Alternative, the alternatives retained for evaluation in this DEIS are referred to as the Build Alternatives.

**Figure 2-1: Alternatives Screening Process**




A range of 15 Preliminary Alternatives was identified from previous studies and planning documents, input from the public, and federal, state, and local regulatory agencies during the NEPA scoping process. The

[1] Council on Environmental Quality (CEQ), Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act regulations (CEQ, 1986) https://www.energy.gov/nepa/downloads/forty-most-asked-questions-concerning-ceqs-national-environmental-policy-act

Screening of the Preliminary Range of Alternatives was completed by applying screening criteria related to the Study's Purpose and Need to each alternative (refer to **Section 2.2**). A general, qualitative assessment of these criteria was made using readily available information. An alternative was dropped from further consideration only if the available information demonstrated it clearly did not meet the Study's Purpose and Need. Screened Alternatives were identified as those that met the screening criteria or required additional analysis to determine their ability to meet the Purpose and Need. The initial screening of alternatives is documented in *Chapter 4 of the Alternatives Technical Report* (**Appendix B**).

In February 2019, the Screened Alternatives were presented to the public through the website via written documentation and a video. Additional engineering, traffic, financial, and environmental analyses were completed, and used to determine the reasonableness of the Screened Alternatives to be carried forward as the ARDS. The Recommended ARDS included all of the seven Screened Alternatives. They were presented at Spring 2019 Public Workshops and were then further analyzed. At that point, the Federal Highway Administration (FHWA) and MDOT SHA determined that Alternative 5 was not a reasonable alternative because of its deficiencies in addressing existing traffic and long-term traffic growth and trip reliability, as well as concerns with the alternative's financial viability. Consequently, it was determined that Alternative 5 did not meet the Study's Purpose and Need and would not be one of the ARDS. Alternative 5 is included in the comparison of impacts in **Chapters 3** and **4** of this DEIS but is not one of the ARDS or Build Alternatives. The No Build Alternative also does not meet the Study's Purpose and Need but was retained for comparison with the other alternatives in accordance with CEQ's NEPA regulations.

Following the Spring 2019 Public Workshops and agency meetings, several Cooperating and Participating agencies requested that MDOT SHA evaluate an alternative that would provide an alternate route for travelers to use MD 200 (Intercounty Connector) instead of the top side of I-495 between I-270 and I-95 to avoid or reduce impacts to significant, regulated resources and residential relocations. This new alternative (the MD 200 Diversion Alternative) was developed and analyzed with input from the agencies. After evaluation, it was determined that the MD 200 Alternative would not address the Study's Purpose and Need of accommodating long-term traffic growth, enhancing trip reliability or improving the movement of goods and services. A summary of the MD 200 Diversion Alternative analysis is included in **Section 2.5.3** of this chapter and documented in *Chapter 6, Section 4 of the Alternatives Technical Report* (**Appendix B**).

The results of the screening of alternatives and the rationale for the identification of the ARDS are summarized in **Sections 2.5** and **2.6** of this chapter and documented in *Chapter 6* of the *Alternatives Technical Report* (**Appendix B**). Following the cooperating agencies' concurrence[2] on the ARDS, MDOT SHA and FHWA evaluated another additional alternative, called Alternative 9 Modified (Alternative 9M), in response to public and agency input. Alternative 9M consists of a blend of Alternatives 5 and 9 with the primary difference on the top side of I-495 between I-270 and I-95 being the addition of one managed lane per direction instead of two managed lanes. Alternative 9M was evaluated and determined to be a reasonable alternative, and thus is included as a Build Alternative in this DEIS. A summary of the Alternative 9M analysis is included in **Section 2.6.4** of this chapter and is documented in *Chapter 6, Section 5 of the Alternatives Technical Report* (**Appendix B**).

[2] NCPC abstained from concurring on the ARDS; M-NCPPC did not concur on the ARDS.

This DEIS presents the additional analysis and comparison of impacts between the Build Alternatives (Alternatives 8, 9, 9M, 10, 13B, 13C) and the No Build Alternative in **Chapters 3** and **4**, plus Alternative 5 for comparison purposes.

## 2.2 Screening Criteria

The screening of the Preliminary Range of Alternatives involved application of 15 metrics using a "high, medium, low" or "yes and no" approach, which is further defined for each criterion in this section. The evaluation of the Screened Alternatives assessed each alternative under six major elements related to the Study's Purpose and Need including preliminary engineering, traffic, financial viability, and environmental impacts. The screening criteria for the Screened Alternatives were the same used for the initial screening, but were refined by additional data to further differentiate between an alternative's ability to meet the Study's Purpose and Need. A summary of the screening criteria is presented in this section based on how it was defined in the initial screening step for the Screened Alternatives and then refined for the ARDS. Refer to *Chapter 4, Section 3* and *Chapter 6, Section 1 of the Alternatives Technical Report* (**Appendix B**) for the details on these screening criteria.

### 2.2.1 Engineering Considerations

**a. Existing Traffic and Long-Term Traffic Growth**

***Initial Screening Criterion:*** This criterion evaluated whether the alternative addressed existing traffic and long-term traffic growth. A response of "high" indicated the alternative relieved existing and long-term traffic congestion by reducing average travel times and volume-to-capacity (V/C) ratios throughout the study area during all peak hours in the existing and future design years (2017 and 2040). During the initial screening stage, preliminary traffic analyses were performed using available traffic data (including traffic count volumes and existing speeds) and planning-level tools, such as Highway Capacity Software (HCS), to evaluate alternatives, when applicable. In some cases, the preliminary traffic analyses were sufficient to determine that an alternative would not effectively address existing traffic and long-term traffic growth. These alternatives were given a response of "low." However, for other alternatives, additional analysis was needed to determine the projected impacts on existing traffic and long-term traffic growth including development of traffic forecasts and traffic simulation models to evaluate additional metrics, as described in the next section.

***Refined Screening Criterion for ARDS:*** This screening criterion was refined because additional analysis was completed to further determine an alternative's ability to meet the Study's Purpose and Need. Three metrics were identified for this refined screening criterion based on the traffic analysis: 1) system-wide delay, 2) corridor travel times and speeds, and 3) density and level of service[3] (LOS). This additional traffic analysis included projecting future traffic volumes for a four-hour AM peak period (6:00 AM to 10:00 AM) and PM peak period (3:00 PM to 7:00 PM) in the design year of 2040 using the Metropolitan Washington Council of Governments (MWCOG) regional forecasting model and followed by a VISSIM traffic flow simulation model.

[3] Level of Service (LOS) is a letter grade assigned to a section of roadway that measures the quality of traffic flow, ranging from LOS A to LOS F. LOS A represents optimal, free-flow conditions, while LOS F represents failing conditions where demand exceeds capacity.

**b. Trip Reliability**

***Initial Screening Criterion:*** The Planning Time Index (PTI) was used to evaluate whether an alternative enhanced trip reliability. PTI reflects the 95th percentile travel time for a section of roadway and represents the total time motorists should allow to ensure they arrive at their destination on-time. Travelers need more dependable and predictable travel times to ensure trip reliability. For example, a commuter would like to know that their six-mile commute from Point A to Point B along I-495 would routinely take the same amount of time regardless of the day of the week or time of day of the trip. Many factors cause variability in travel time, such as incidents, weather, surges in demand due to special events, time of year, and capacity reductions due to work zones, which makes it difficult for users to predict future trip reliability. However, trip reliability can be enhanced by providing additional capacity and/or managing demand on the system. A response of "high" indicates a more predictable travel time is provided by that alternative.

***Refined Screening Criterion for ARDS:*** This screening criterion was refined because additional analysis was completed to further determine an alternative's ability to meet the Study's Purpose and Need. Non-recurring events that affect PTI, such as incidents, weather, increased demand for special events, and reduced capacity due to work zones, make it difficult to predict future travel times and calculate a future PTI value. Although PTI cannot be calculated directly for future travel times, a similar metric known as Travel Time Index (TTI), a metric used to quantify congestion levels, was used as a proxy to help quantify the future reliability of the network. TTI is defined as the average (50th percentile) travel time on a segment of freeway/expressway for a particular hour compared to the travel time of the same trip during free-flow or uncongested conditions. The higher the TTI, the longer the travel times. Most roadway segments that have a high TTI value also experience high PTI values because they are more likely to be impacted by minor incidents. Roadways with lower TTI values have some reserve capacity to absorb the disruption caused by non-recurring congestion and are typically more reliable.

**c. Additional Roadway Travel Choice**

***Initial Screening Criterion:*** This criterion was used to assess whether the alternative provided an additional roadway travel choice, other than the current congested general purpose (GP) lanes, while retaining the existing GP lanes. A "yes" indicated the alternative would provide travelers with an option for a less congested trip through a roadway management strategy. A "no" indicated the alternative would not provide roadway travelers with an option for a less congested trip.

***Refined Screening Criterion for ARDS:*** The detailed analysis did not change the yes/no response to this screening criterion. A "yes" response indicated an alternative's ability to meet this need.

**d. Ease of Usage for Travelers**

***Initial Screening Criterion:*** Ease of usage for travelers was indicated by factors such as safety, enforcement, signing, and decision points/access. This criterion evaluated whether implementation of the alternative would likely require complex operating configurations that could lead to driver confusion. Alternatives with "high" ease of usage enable efficient and safe operations by allowing one type of lane operation in a lane (e.g. High-Occupancy Toll (HOT) or GP).

***Refined Screening Criterion for ARDS:*** The detailed analysis did not change the high/medium/low response to this screening criterion.

### 2.2.2 Homeland Security

***Initial Screening Criterion:*** Quick, unobstructed roadway access is needed during a homeland security event that causes populations to evacuate. Alternatives with additional capacity and ability to control access would more readily accommodate a population evacuation and improve emergency response. With a response of "yes" or "no", each alternative was assessed considering whether the alternative would provide additional capacity to assist in accommodating population evacuation.

***Refined Screening Criterion for ARDS:*** The detailed analysis did not change the yes/no response to this screening criterion. A "yes" response indicated an alternative's ability to meet this need.

### 2.2.3 Movement of Goods and Services

***Initial Screening Criterion:*** Efficient and reliable highway movements are necessary to accommodate passenger and freight travel and moving goods and services through the region. This criterion indicated whether the alternative would improve reliability for movement of goods and services. With a response of "high, medium, or low," the alternative was evaluated by how well it would enhance the movement of freight, services, and commuting employees by providing a more reliable trip based on the ability of the alternative to enhance trip reliability as described in Section 2.2.1.

***Refined Screening Criterion for ARDS:*** This screening criterion was refined because additional analysis was completed to further determine an alternative's ability to meet the Study's Purpose and Need. This criterion was closely tied to TTI, vehicle throughput, and effects on the local roadway network. For each of the Screened Alternatives, the metric of vehicle throughput was calculated to quantify how efficiently goods and services could be moved through the study corridors. Throughput includes all vehicles traveling in both directions on a roadway including in High-Occupancy Vehicle (HOV) lanes, where provided. Throughput represents the number of vehicles and/or people that pass by a given point in the roadway network in a set amount of time. Throughput quantifies the efficiency of the roadway network in getting people, goods, and services to their destinations. Results were reported for four locations in the study area in terms of percent increase in vehicle throughput for each Screened Alternative compared to the No Build conditions, rounded to the nearest five percent. Higher values indicate more efficient movement of goods and services. Ratings of "high, medium, or low" were given for alternatives based on the anticipated benefit compared to the No Build.

The traffic analysis also included the effect each alternative would have on traffic operations on the surrounding local road network. The projected reduction in delay on the local road network was collected from the MWCOG model. Values were presented in terms of total vehicle hours of delay each day on all arterials in Montgomery County, Maryland; Prince George's County, Maryland; and Washington, DC. Other regions in Maryland and Virginia showed negligible change in the local delay. Lower values are better, representing less delay for local travelers. These numbers were also converted to the percent reduction in delay versus the No Build condition to help compare the relative merit of each of the Screened Alternatives. Higher values are better, reflecting greater benefit.

### 2.2.4 Multimodal Connectivity

***Initial Screening Criterion:*** This criterion determined whether the alternative would enhance connectivity to and between existing transit facilities near the study area. This criterion also considered whether the alternative could enhance access to existing and proposed transit facilities and accommodate reliable,

more efficient transit service through a "high, medium, or low" response. A rating of "high" would both enhance connectivity to and between existing transit facilities near the corridor and provide opportunities for new or modified transit service. A "medium" rating would provide for one or the other and a "low" would minimally or not provide for either.

***Refined Screening Criterion for ARDS:*** The detailed analysis did not change the high, medium, or low response to this screening criterion.

### 2.2.5 Financial Viability

***Initial Screening Criterion:*** Additional capacity and improvements to reduce congestion and enhance reliability must be financially viable. This criterion considered if the alternative would provide a revenue source from pricing options, tolling, or fares through a "yes or no" response.

***Refined Screening Criterion for ARDS:*** Detailed financial analysis results for the Screened Alternatives was not available during the development of the Draft ARDS paper in Spring 2019. Financial viability was originally based on preliminary capital cost estimates[4] and were used as a proxy for overall program costs. In general, the more significant the initial build cost, the higher the long-term operations and maintenance costs that are needed to maintain the infrastructure. However, other data was used as a proxy to allow a comparison of the Screened Alternatives to identify those that would have a greater or lesser likelihood of being financially viable. Potential traffic volume, or annual daily traffic (ADT) in the managed lanes[5], where provided, could roughly equate to revenue. The higher the traffic volume or ADT that is in the managed lanes, the more travelers that would be paying tolls, and therefore, the greater the potential revenue. Following this approach, alternatives with more managed lanes would result in higher revenue and those with only toll users (Express Toll Lanes) would have higher revenue than those with a mix of tolled and non-tolled users (High-Occupancy Toll Lanes).

In June 2019, additional financial analyses were completed for all the ARDS to assess the potential of each alternative to be financially viable. This analysis considered the preliminary capital costs, initial revenue projections, and preliminary operations and maintenance costs. Estimates were developed for net cashflows to the state from delivery as a toll revenue concession (costs and revenues adjusted for inflation and financing modeled based on market precedents for similar transactions) over the course of a 50-year Public-Private Partnership (P3) agreement to indicate the comparative financial viability of each of the recommended ARDS.

### 2.2.6 Environmental

***Initial Screening Criterion:*** While MDOT SHA acknowledged that the Preliminary Range of Alternatives could have had a varying degree of potential environmental impacts, it was not a differentiating factor during the initial screening. The environmental screening criterion used during the initial screening considered whether the Preliminary Alternatives would require additional right-of-way or impact parkland, historic resources, and/or wetlands and waterways, with a "yes" or "no" response. Because the

[4] The preliminary cost estimates were prepared in accordance with the MDOT SHA 2017 *Highway Construction Cost Estimating Manual* at a planning level using the major quantities method of estimation. Where available, quantities for roadway work were obtained with appropriate contingencies added based on the level of uncertainty.

[5] Managed lanes are highway facilities that use strategies, such as lane-use restrictions or congestion pricing, to optimize the number of vehicles that can travel the highway to maintain free-flowing speeds.

alternatives are located along the existing I-495 and I-270 corridors within highly urban and environmentally constrained areas, the answer was "yes" for each alternative aside from the No Build. Therefore, as the main purpose of the initial screening was to determine whether the Preliminary Alternatives met the transportation Purpose and Need, the consideration of the potential for varying degrees of environmental impacts was not a differentiator in whether an alternative should be retained or dismissed.

***Refined Screening Criterion for ARDS:*** In support of the detailed analysis for the Screened Alternatives, existing environmental conditions were further identified through an inventory of readily available public records and resource data, field identifications, and agency consultation. Environmental conditions and a preliminary assessment of impacts that could result from the Screened Alternatives were quantified and documented by resource type including right-of-way and properties, parks and recreation area, historic properties, 100-year floodplains, unique and sensitive areas and habitat, forest canopy, wetlands, waters, and noise receptors.

## 2.3 Regional Transportation Planning

The initial screening of alternatives considered the initiatives and projects outlined in Visualize2045 Plan, the latest financially Constrained Long-Range Plan (CLRP) that was approved by the National Capital Region Transportation Planning Board on October 17, 2018. The Visualize2045 Plan identified Seven Aspirational Initiatives for a Better Future. One of the seven initiatives is "Expand Express Highway Network," which includes congestion-free toll roads, building on an emerging toll road network and new opportunities for transit for express buses to travel in the toll lanes. For more information on this initiative refer to:
http://mwcog.maps.arcgis.com/apps/Cascade/index.html?appid=debc2550777b4cc2bae2364c7712a151

Three specific, financially constrained projects in the Visualize2045 Plan that relate to this Study are:

- CLRP-constrained element ID-1182: I-95/I-495 component of Traffic Relief Plan to include two managed lanes in each direction, between the Baltimore Washington Parkway and the Virginia State Line/Potomac River at the Woodrow Wilson Bridge.

  http://www1.mwcog.org/clrp/projects/clrp-report.asp?PROJECT_ID=1182

- CLRP-constrained element ID-3281: I-95/I-495 component of Traffic Relief Plan to include two managed lanes in each direction, between the Baltimore Washington Parkway and the Virginia State Line/Potomac River at the American Legion Bridge.

  http://www1.mwcog.org/clrp/projects/clrp-report.asp?PROJECT_ID=3281

- CLRP-constrained element ID-1186: I-270 component of Traffic Relief Plan, to include two managed lanes in each direction, between I-495 and I-70/US 40.

  http://www1.mwcog.org/clrp/projects/clrp-report.asp?PROJECT_ID=1186

Whether an alternative was consistent with the Visualize2045 Plan was considered in the initial screening process but was not a determining factor on whether the alternative should be retained or dismissed.

## 2.4 Preliminary Range of Alternatives

The Preliminary Range of Alternatives was identified from previous studies and planning documents, based on proposed engineering improvements, and reflects input received from the public and federal, state, and local regulatory agencies during the NEPA scoping process. The Preliminary Range of

Alternatives included the No Build Alternative as well as alternatives that included elements such as transportation systems management (TSM)[6]/ transportation demand management (TDM),[7] additional general purpose (GP) lanes, High-Occupancy Vehicle (HOV) lanes, priced managed lanes, collector-distributor (C-D) lanes, contraflow lanes, reversible lanes, and transit. Stand-alone transit alternatives considered three transit modes: heavy rail, light rail, and bus. Additionally, options were identified for alternatives that could be applied to either I-495 or I-270 as well as different transit modes. Some of the alternatives have lettered options which reflect whether the options are exclusively applicable to I-495 or I-270 or are related to a specific transit mode. The Preliminary Range of Alternatives were:

- Alternative 1: No Build
- Alternative 2: Transportation Systems Management)/Transportation Demand Management (TSM/TDM)
- Alternative 3: Add one GP Lane in each direction on I-495 and I-270
- Alternative 4: Add one HOV lane in each direction on I-495 and retain existing HOV lane in each direction on I-270
- Alternative 5: Add one priced managed lane in each direction on I-495 and convert one existing HOV lane in each direction to a priced managed lane on I-270
- Alternative 6: Add two GP lanes in each direction on I-495 and I-270
- Alternative 7: Add two HOV lanes in each direction on I-495 and retain one existing HOV lane and add one HOV lane in each direction on I-270
- Alternative 8: Add two priced managed lanes in each direction on I-495 and add one priced managed lane in each direction and retain one existing HOV lane in each direction on I-270
- Alternative 9: Add two priced managed lanes in each direction on I-495 and convert one existing HOV lane to a priced managed lane and add one priced managed lane in each direction on I-270
- Alternative 10: Add two priced managed lanes in each direction on I-495 and on I-270 and retain one existing HOV lane in each direction on I-270 only
- Alternative 11: Physically separate traffic using C-D lanes, adding two GP lanes in each direction on I-495
- Alternative 12A: Convert existing GP lane on I-495 to contraflow lane during peak periods
- Alternative 12B: Convert existing HOV lane on I-270 to contraflow lane during peak periods
- Alternative 13A: Add two priced managed reversible lanes on I-495

**What are Managed Lanes?**

Managed lanes are highway facilities that use strategies, such as lane-use restrictions or congestion pricing, to optimize the number of vehicles that can travel the highway to maintain free-flowing speeds. Managed lanes are designed to improve highway operations and provide the driving public, as well as transit riders, with reduced congestion and improved trip reliability. Managed lanes operate at an acceptable level of service even when the adjacent general purpose lanes are congested because they are managed to control the number of vehicles using the lane to keep them flowing. Managed lanes provide users with a more reliable option to reach their destination(s). Managed Lanes may include but are not limited to: High Occupancy Vehicles (HOV) lanes, High Occupancy Toll (HOT) lanes, Express Toll Lanes (ETL), and bus-only lanes.

[6] TSM are actions that improve the operation and coordination of transportation services and facilities.

[7] TDM is a variety of strategies, techniques, or incentives aimed at providing the most efficient and effective use of existing transportation services and facilities (e.g., rideshare and telecommuting promotion, managed lanes, preferential parking, road pricing, etc.)

- Alternative 13B: Convert existing HOV lanes to two priced managed reversible lanes on I-270
- Alternative 13C: Add two priced managed reversible lanes and retain one existing HOV lane in each direction on I-270
- Alternative 14A: Heavy Rail[8] transit
- Alternative 14B: Light Rail[9] transit
- Alternative 14C: Fixed guideway Bus Rapid Transit (BRT)[10] off alignment of existing roadway
- Alternative 15: Add one dedicated bus lane on I-495 and I-270

Refer to the *Alternatives Technical Report* (**Appendix B, Section 4.4**) for additional details on the Preliminary Range of Alternatives.

## 2.5 Screened Alternatives

Modifications to the Preliminary Range of Alternatives were made in response to public and agency input received during and after the Alternatives Public Workshops held July 17, 18, 24 and 25, 2018. In response to public and agency comments to retain alternatives that maintain the HOV lanes on I-270, MDOT SHA defined priced managed lanes as High-Occupancy Toll (HOT) lanes or Express Toll Lanes (ETLs) and the descriptions of the alternatives were modified accordingly. For alternatives that would retain the existing HOV lanes on I-270, the added priced managed lanes were defined as ETL, where all vehicles in the ETL would be tolled. For alternatives that would involve the conversion of the existing HOV lanes on I-270, the priced managed lanes were defined as HOT lanes. For purposes of the alternatives evaluated in this Study, the existing HOV 2+ lanes on I-270 would be converted to HOT lanes, which could include the following potential operational structure:

**What Managed Lane Strategies Are Being Considered for This Study?**

Throughout the development of the alternatives for the Study, several operational strategies were identified to manage travel demand in the managed lanes. These definitions include:

- **High-Occupancy Toll (HOT) lanes**: High-Occupancy Vehicle (HOV) facilities that allow lower-occupancy vehicles, such as solo drivers, to use the facilities in return for toll payments, which could vary by time of day or level of congestion; may also charge lower-occupancy HOVs.[11]
- **Express Toll Lanes (ETLs)**: dedicated managed lanes within highway rights-of-way that motorists may use by paying a variably priced toll.[12]
- **HOV Lanes**: any preferential lane designated for exclusive use by vehicles with two or more occupants for all or part of a day, including a designated lane on a freeway, other highway or a street, or independent roadway on a separate right-of-way.[13]
- **Reversible Lanes**: facilities in which the direction of traffic flow can be changed at different times of the day to match peak direction of travel, typically inbound in the morning and outbound in the afternoon.

[8] Heavy Rail is a mode of transit service (also called metro, subway, rapid transit, or rapid rail) operating on an electric railway with the capacity for a heavy volume of traffic. It is characterized by high speed and rapid acceleration passenger rail cars operating singly or in multi-car trains on fixed rails.

[9] Light Rail is a mode of transit service (also called streetcar, tramway, or trolley) operating passenger rail cars singly (or in short trains) on fixed rails. Light rail vehicles are typically driven electrically with power being drawn from an overhead electric line via a trolley or a pantograph and driven by an operator on board the vehicle.

[10] Bus Rapid Transit is a high-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms, and enhanced stations.

[11] *National Cooperative Highway Research Program, Research Report 835, Guidelines for Implementing Managed Lanes*. Transportation Research Board. 2016

[12] https://www.fhwa.dot.gov/ipd/tolling_and_pricing/defined/demand_mgmt_tool.aspx

[13] https://ops.fhwa.dot.gov/freewaymgmt/hovguidance/glossary.htm

1. Qualifying or eligible HOVs may use the managed lanes for free under 23 USC 166 authority. The current thinking at the time of the DEIS publication is that vehicles with three or more occupants (HOV 3+) would be eligible for the HOV status.

2. All other lower-occupancy vehicles (two-occupant and single occupant vehicles [SOV]) may be tolled at the full toll rate.

Additional details on the toll regulations are provided in **Section 2.7.5**.

The Preliminary Range of Alternatives were evaluated by applying the screening criteria established from the Study's Purpose and Need, using a general, qualitative assessment (as described in **Section 2.2** of this chapter). As a result of the initial screening, seven alternatives were recommended to be advanced for further detailed analysis and 13 alternatives were dropped from further consideration. The Screened Alternatives retained for further consideration are described in **Section 2.5.1** and the alternatives dropped from further consideration are identified in **Section 2.5.2**. Additional alternatives analysis is presented in **Section 2.5.3**. Refer to *Chapter 4, Section 4 of the Alternatives Technical Report* (**Appendix B**) for additional details on the Screened Alternatives, including typical sections of the alternatives.

### 2.5.1 Alternatives Retained for Further Consideration

Alternatives 1, 5, 8, 9, 10, 13B, and 13C were recommended for further analysis and environmental evaluation as the Screened Alternatives:

- Alternative 1: No Build – Though this alternative does not meet the Study's Purpose and Need, consistent with NEPA requirements, it was carried forward for further evaluation to serve as a base case for comparing the other alternatives
- Alternative 5: One HOT Managed Lane Network
- Alternative 8: Two ETL Managed Lanes Network on I-495 and one ETL and one HOV Lane Network on I-270
- Alternative 9: Two HOT Managed Lanes Network
- Alternative 10: Two ETL Managed Lanes Network on I-495 and I-270 and Retain one HOV Lane on I-270 only
- Alternative 13B: Two HOT Managed Lanes Network on I-495 and two Reversible HOT Managed Lanes Network on I-270
- Alternative 13C: Two ETL Managed Lanes Network on I-495 and two Reversible ETL Managed Lanes Network on I-270, and retain one HOV Lane on I-270 only

Screened Alternatives 8, 10, and 13C would retain the existing HOV lanes on I-270 and Screened Alternatives 5, 9, and 13B would involve the conversion of the existing HOV lanes on I-270 to HOT lanes. Following the additional engineering, traffic, financial and environmental analysis, all seven Screened Alternatives were recommended to be carried forward as the Alternatives Retained for Detailed Study (ARDS).

### 2.5.2 Alternatives Dropped from Further Consideration

Alternatives 2, 3, 4, 6, 7, 11, 12A, 12B, 13A, 14A, 14B, 14C, and 15 were dropped from further consideration during the initial alternatives screening because they did not meet the screening criteria established by the Study's Purpose and Need:

**a. Alternative 2: TSM/TDM**

Alternative 2, the Transportation System Management and Transportation Demand Management (TSM/TDM) alternative would improve the operations of the existing transportation system. Benefits of these types of solutions optimize the existing system, but do not support long-term traffic growth. For example, solutions of this type are currently under construction on I-270, expected to be completed by 2021, to provide traffic operational benefits in the near term. However, detailed modeling of the I-270 improvements also indicated that, as traffic continues to increase, the traffic operations are expected to return to existing levels of congestion by 2040. These types of improvements would not enhance trip reliability, would not provide an additional travel choice, would not accommodate the capacity needed during a Homeland Security event or improve the movement of goods and services, nor would they provide a revenue source. However, elements of the TSM/TDM Alternative will be included in the Build Alternatives as presented in the inset above.

**Will TSM and TDM Elements Be Considered in The Build Alternatives?**

TSM/TDM elements are included in the Build Alternatives for further study. These include:

- Maintaining the adaptive ramp metering being implemented on the interchange entrance ramps along I-270 as part of MDOT SHA's on-going I-270 Innovative Congestion Management project.
- Changes at interchange ramp terminals and intersecting roadways to optimize lane configurations and traffic signal timing to provide adequate traffic flow along the crossroads.
- Enhancements to acceleration and deceleration lanes to meet American Association of State Highway and Transportation Officials (AASHTO) design guidelines.

**b. Alternatives 4 & 7: HOV Lanes**

Alternatives 4 and 7 featured HOV lanes, which are only open to vehicles with a minimum number of occupants. A one- or two-lane HOV network would likely be underutilized due to not having enough HOV-eligible vehicles to fill the lanes, leading to more violators and the need for additional enforcement. The performance of the existing HOV system on I-270 was reviewed to help evaluate the potential advantages and disadvantages of Alternatives 4 and 7. The data showed that the current lanes are not being utilized to their maximum potential to relieve congestion, only about 75 percent of HOV-eligible vehicles use the HOV lane (i.e., a significant portion of HOV-eligible vehicles choose to travel in the GP lanes), and the HOV violation rate is high. Refer to the *Chapter 4, Section 4 of Alternatives Technical Report* (**Appendix B**) for additional details. These alternatives were dropped from further consideration because they would not support long-term traffic growth, would not ensure reliable trips on I-495 and I-270, and would not provide a revenue source. Even if MDOT SHA could fund this construction, it would take one to two decades of fully dedicating its entire statewide budget to deliver these alternatives.

**c. Alternatives 3 & 6: GP Lanes**

GP lanes are the lanes on a freeway that are open to all motor vehicles without tolls. Alternatives 3 and 6 only provided additional GP lanes and were dropped from further consideration. Alternative 3 was dropped because adding one GP lane in each direction would not meet the long-term traffic demand. Adding two GP lanes in each direction, Alternative 6, would not provide a reliable trip because there would

be no ability to manage the long-term demand to ensure it would not exceed the new capacity and result in breakdown conditions. Without the ability to manage the lanes, an additional travel choice would not be provided. Additionally, GP lanes would not provide a revenue source and, similar to HOV lanes, they could not be delivered by MDOT SHA for more than one or two decades.

Additional analysis was completed on Alternative 6 to further evaluate if this alternative would address long-term traffic growth. Regional 2040 forecasts were developed using the MWCOG model and analyzed using VISSIM models, the same methodology that was used to evaluate traffic operations for each of the Screened Alternatives. The results of the Alternative 6 modeling indicated that latent demand, meaning trips from other routes, times and modes, would be expected to fill the GP lanes by 2040, resulting in worse traffic operations than all of the Screened Alternatives in several metrics, including network-wide delay and average travel time. Therefore, Alternative 6 would not address long-term traffic growth, and it remained on the list of alternatives dropped from further consideration following this analysis.

**d. Alternative 11: Collector-Distributor Lanes on I-495**

Alternative 11 consists of physically separating local and long-distance traffic with the use of C-D lanes on I-495 only. The C-D lanes would separate local traffic entering/exiting at the interchanges from the long-distance or express lanes and helps reduce the number of conflicts on the highway. Collector-distributor lanes work well on highways where there is a substantial volume of long-distance trips that could benefit from being separated from local trips. This type of system would not be favorable for the travel along I-495 because it includes a mix of long, medium, and short-distance trips. Additionally, due to the high volume of traffic entering and exiting I-495 at the interchanges and the short distance between many other interchanges, it would likely cause more congestion in the local lanes. Additionally, this type of system on I-495 would require more widening to construct and would not provide an additional travel choice nor a revenue source for the improvement.

**e. Alternatives 12A, 12B & 13A: Contraflow Lanes and Reversible Lanes on I-495**

Alternative 12A included contraflow lanes on I-495, which are access-restricted lanes operating on the opposite side of the median barrier, in the opposite direction of the flow of traffic. They are used to support heavy traffic in the peak direction of travel and are separated from opposing traffic by a movable barrier. Reversible Lanes (Alternative 13A) are designed to change the direction of traffic flow at different times of the day to match the peak direction of travel. These types of alternatives are more effective where there is a significant directional split in traffic. For example, when the majority of traffic is moving in one direction in the morning and in the opposite direction in the afternoon. On I-495, traffic is fairly evenly split by direction and peak period, so contraflow and reversible lanes would not provide additional capacity in the opposite direction of the contraflow or reversible lane, and therefore, Alternatives 12A and 13A would not address long-term traffic growth in both directions simultaneously on I-495. Additionally, these alternatives would not provide the capacity needed during a Homeland Security event, improve freight travel, or provide a revenue source.

Like I-495, contraflow lanes could be added on I-270, but Alternative 12B was dropped from further consideration because adding contraflow lanes on I-270 would mean that one lane would need to be removed in the off-peak direction (for example, removing a lane in the northbound direction during the morning peak period). Consequently, traffic would be required to cross over the highway median, which means that non-HOV users would have to merge into/across the existing HOV lane to enter and exit the

contraflow lane, potentially impacting the operations and enforcement of these lanes approaching the contraflow access points.

Additionally, a movable barrier would be needed to separate opposing traffic and shifting the barriers for more than 10 miles of highway would take hours to complete, thus reducing the roadway capacity during these times. Furthermore, there are significant long-term operational and maintenance expenses associated with a movable barrier system. Therefore, Alternative 12B was dropped from further consideration because it would only provide capacity in one direction, would not provide the capacity needed during a Homeland Security event, would not improve freight travel, and would not include a revenue source for development of the improvements.

Alternative 13A considers adding two priced managed (as either HOT or ETL), reversible lanes on I-495. As noted above, the directional traffic is fairly evenly split on I-495 and there is no clear "off-peak" direction. Therefore, reversible lanes along I-495 would not address long-term traffic growth in the off-peak direction because additional capacity is needed in both directions during the peak periods on I-495. Alternative 13A would provide a reliable trip, but only in the peak direction. Therefore, the direction of traffic that is not benefitting from the reversible lanes would experience the same congestion as the No Build Alternative, and there would be no improvement in trip reliability in that direction.

### f. Alternatives 14A, 14B, 14C, and 15: Transit-Only Alternatives

Transit-only alternatives (Alternatives 14A, 14B, 14C, and 15) which would include heavy rail, light rail, bus rapid transit, and dedicated bus-only managed lanes without additional highway capacity were dropped from further consideration. Transit alone would not meet this Study's Purpose and Need to address the existing and long-term traffic growth in the study corridors. This section explains why the various transit-only alternatives do not meet this Study's Purpose and Need, how transit is currently being considered in the National Capital Region and how it continues to be a key strategy to addressing the region's various transportation needs outside of this Study. The 2002 *Capital Beltway / Purple Line Study* (2002 Study), initiated by MDOT SHA and the Maryland Department of Transportation Maryland Transit Administration (MDOT MTA), concluded "Congestion on the Beltway itself as well as demand on the other transportation facilities is so great that no single highway or transit improvement will provide significant relief to the long-term demand." The 2002 Study recommended that highway and transit alternatives be studied separately because transit operates more efficiently if it serves areas where people live and work. The 2002 Study also concluded that fixed guideway transit was not recommended along the Capital Beltway right-of-way itself. Although a beltway transit corridor would take advantage of existing transportation right-of-way where available, it would not effectively connect activity centers. Adding that people do not live and work "on the Beltway," transit would better serve patrons by more directly connecting activity center locations.

**Alternative 14A: Heavy Rail Transit**

Alternative 14A considers heavy rail transit parallel to the existing I-495 and I-270 right-of-way. Consideration of heavy rail or light rail transit to circle Washington, DC began in the 1990s. The 2002 Study recommended the "inner Purple Line" (inside the Beltway) as the priority transit corridor, rather than within the right-of-way of I-495 or outside the Beltway. The 2002 Study did not recommend a transit mode, but rather recommended that additional detailed transit planning studies be performed. Other segments, between I-270/Rock Spring Technology Park and New Carrollton and between New Carrollton

and Suitland/Branch Avenue, were projected to have lower daily transit demand and were recommended to be implemented at a later time when conditions change, and the corridors are more attractive for improvements to transit service.

Heavy rail was considered in the 2008 *Purple Line Alternatives Analysis/DEIS* but was dropped from further consideration due to prohibitive capital costs; desired operational conditions that could not be met without traversing through communities; not meeting the goal of cost-effective transit alternative that is rapid, reliable, and environmentally friendly; and the availability of other viable alternatives.

Communities along the I-270 corridor are currently served by the Washington Metropolitan Area Transit Authority (WMATA) Metro Red Line and the Maryland Area Regional Commuter (MARC) Brunswick Line. The Red Line Metro alignment follows MD 355 with five stations north of I-495. The Red Line also crosses I-495 at MD 97 with three stations north of I-495. The MARC Brunswick line includes five stations north of I-495 within the study corridors and continues north into West Virginia. The MARC Brunswick Line is generally parallel to MD 355 to the east.

State planned, heavy rail improvements do not include new heavy rail service, but rather focus on maintenance of existing systems and improvements to the capacity of existing heavy rail service. The 2016 CLRP Amendment document was approved by the National Capital Region TPB at the MWCOG in November 2016, and in the list of major transit projects included, "MARC – Increased trip capacity and frequency along all commuter lines, 2029", (page 24). The Visualize2045 and the FY 2019-2024 Transportation Improvement Program (TIP), approved on October 17, 2018, identifies heavy rail maintenance projects in the Financially Constrained plan including track improvements and overhaul and replacement of rolling stock[14]. The MARC Growth and Investment Plan also identified a phased implementation of improvements to the Brunswick Line through 2035, including additional daily seats, and rail service improvements such as reduced headways, expanded service during peak and off-peak periods, extension to northern Virginia, and weekend service.

Heavy rail commuting options currently exist in the I-270 corridor via the WMATA Metro Red Line and the MARC Brunswick Line and current planning documents do not include new heavy rail service. Alternative 14A was dropped from further consideration because it would not address existing and long-term traffic growth, would not provide an additional roadway travel choice, or improve trip reliability along I-495 or I-270.

**Alternative 14B: Light Rail Transit**

While Alternative 14B may enhance trip reliability for existing and future transit commuters, overall, it would not improve trip reliability along I-495 and I-270, would not address existing and long-term traffic growth and would not provide an additional roadway travel choice. Also, the Purple Line light rail is under construction with service anticipated to begin in 2022 and other planned transit studies are already underway in the vicinity of the study corridors. For these reasons, Alternative 14B was dropped from further consideration.

[14] Rolling stock is defined in the Buy America regulations (49 CFR Part 661.3) as: "transit vehicles such as buses, vans, cars, railcars, locomotives, trolley cars and buses, and ferry boats, as well as vehicles used for support services."

The 2002 Study considered both highway and transit; the light rail alignment which was recommended from the Study extends from Bethesda to New Carrollton (the Purple Line). As noted above, the 2002 Study determined both highway improvements and transit were needed. The transit alternative, the Purple Line, moved forward into planning and design and is currently under construction. The FEIS and Draft Section 4(f) Evaluation was signed in 2013 and a Record of Decision (ROD) was issued in 2014. The 16-mile, two-track light rail system is scheduled to begin in operation in 2022. The Purple Line project is addressing the transit demand for a transit alignment inside the Beltway as identified as the transit priority corridor in the 2002 Study.

The transportation analysis completed in support of the Purple Line FEIS used the 2040 MWCOG travel demand model and compared the No Build Alternative with the Purple Line alternative's regional daily vehicle trips. Under the Purple Line Preferred Alternative in 2040, the number of daily vehicle trips would be 16,790 less (0.06 percent) on a regional basis relative to the No Build Alternative.[15]

The Purple Line FEIS and Purple Line Travel Forecasts Results Report also evaluated the impact of transit alternatives on overall automobile usage by presenting the vehicle miles travel (VMT)[16] in the region. In 2040, under the Purple Line Preferred Alternative, 129,828 less vehicle miles (0.07 percent) would be traveled each day in the region versus the 2040 No Build Alternative.[17] The Purple Line is planned to provide additional transportation options connecting activity centers and mobility improvements to the region; however, these improvements may not be evident on the Beltway itself, but on parallel arterials and local streets where trips can be diverted back to major roads.

As previously stated, congestion on I-495 and the demand for other transportation is so great that both transit and roadway improvements are needed to address congestion in the region (2002 Study).

**Alternative 14C: Fixed Guideway Bus Rapid Transit (Off Alignment)**

This alternative considered a fixed guideway BRT along a new alignment separate from existing roadways. Consideration of this alternative was informed in part by the recent analysis concerning a proposed regional network of BRT routes across the region. The Visualize2045 and the FY 2019-2024 TIP identifies several BRT projects in the Financially Constrained plan approved on October 17, 2018.

- Randolph Road BRT: US 29 to MD 355
- North Bethesda BRT: Montgomery Mall Transit Center to White Flint Metrorail Station
- MD 355/Rockville Pike BRT: Bethesda to Clarksburg
- MD 650/New Hampshire Avenue BRT: Colesville Park-and-Ride to Eastern Avenue
- MD 586/Veirs Mill Road BRT: MD 355/Rockville Pike to MD 97/Georgia Avenue

A 2017 study by the National Capital Region TPB, Long-Range Plan Task Force, titled, *An Assessment of Regional Initiatives for the National Capital Region - Draft Technical Report on Phase II of the TPB Long-Range Plan Task Force,* studied a series of regional transportation initiatives compared to the baseline of the CLRP. One of the initiatives studied was a regionwide system of BRT and transitway networks (known

[15] *Purple Line FEIS and Draft Section 4(f) Evaluation* and *Purple Line Travel Forecasts Results Report*, 2013
[16] Vehicles miles traveled (VMT) represents the total miles traveled during all of the vehicle trips in the region, without regard to the number of passengers in a vehicle, Purple Line FEIS, page 3-12.
[17] Purple Line FEIS, page 3-12 and Purple Line Travel Forecasts Results Report, 2013

as *Initiative 4: Regionwide Bus Rapid Transit and Transitways*). This included new BRT facilities in Montgomery and Prince George's Counties in Maryland, Northern Virginia, Washington, DC, and a transitway from Branch Avenue to Waldorf, MD. These lines are in addition to those already in the CLRP.

This study showed that an extensive, regionwide network of BRT and transitway facilities would result in a one percent reduction in average travel times for transit, HOV and SOV commute trips relative to the 2040 CLRP scenario. Daily vehicle hours of delay would be reduced by two percent, and transit commute mode share would increase four percent. Daily VMT and daily VMT per capita would be reduced by less than one percent. The share of passenger miles on reliable modes would increase by six percent.

Given the modest improvements to travel times and vehicle hours of delay expected from an extensive regionwide network of BRT and transitways, dedicated BRT facilities in the proximity of only I-495 and I-270 would not achieve the Study's Purpose and Need as it would not address existing and long-term traffic growth, would not enhance trip reliability along I-495 or I-270, and based on the 2017 previous study mentioned above that concluded a regional network of BRT and transitway facilities would not substantially improve traffic conditions over the No Build, Alternative 14C was dropped from further consideration.

**Alternative 15: Dedicated Bus Managed Lane Network on I-495 and I-270**

This alternative assumed that buses would operate in a managed, dedicated bus lane on I-495 and I-270 between existing park-and-ride facilities and new connections at specified locations. This bus lane would include constructing a new travel lane and retaining the existing GP lanes in each direction. The bus lane could accommodate all bus travel, including express bus service, commuter buses, WMATA local buses, over-the-road coach buses, tourist buses, and inter-city buses.

With this alternative, transit service would be enhanced by the increased roadway capacity along I-495 and I-270 and would experience the same increased speeds and reliable travel as other managed lane users. A dedicated, managed bus lane would result in higher operating speeds than a bus traveling in a GP lane and could operate during peak periods only or all day. However, Alternative 15 does not meet the Study's Purpose and Need as it would not accommodate the existing and projected automobile traffic.

**What Transit Components Are Included in the Build Alternatives?**

Opportunities to accommodate existing and planned multimodal mobility and connectivity are included with each Build Alternative including:

- Allowing free bus usage in the managed lanes to provide an increase in speed of travel, assurance of a reliable trip, and connection to local bus service/systems on arterials that directly connect to activity and economic centers.
- Accommodating direct and indirect connections to existing transit stations and planned Transit-Oriented Development at the Silver Spring Metro/MARC (US 29), Shady Grove Metro (I-370), Twinbrook Metro (Wootton Parkway), Montgomery Mall Transit Center (Westlake Terrace), Medical Center Metro (MD 187 and MD 185), Kensington MARC (MD 185), Greenbelt Metro/MARC (Cherrywood Lane), New Carrollton Metro/MARC/Amtrak (US 50), Largo Town Center (MD 202 and MD 214), and Branch Avenue Metro (MD 5).

A *Managed Lanes Transit Work Group*, with representatives from MDOT SHA, MDOT MTA, FHWA, FTA, WMATA and local transit service providers, meets monthly to explore how managed lanes on I-495 and I-270 will complement and benefit local transit service in Anne Arundel, Frederick, Howard, Montgomery and Prince George's Counties and Washington, DC.

Also, a dedicated bus lane would be underutilized if it is used for buses only leaving unused available capacity in this lane for other vehicles. Under this alternative, fares would be collected, but additional analysis would be needed to determine financial feasibility based on ridership and operations and maintenance costs because typically transit fares are used to cover a portion of the operating costs of the service. Therefore, as a standalone alternative, Alternative 15 was dropped from further consideration. However, as described in the insert, buses would be allowed to use the managed lanes for free under other alternatives and transit components are included in each of the Build Alternatives.

### 2.5.3 Additional Alternatives Analysis

Following the Spring 2019 Public Workshops, additional analysis was completed on the Screened Alternatives and a new alternative, called the MD 200 Diversion Alternative, was considered. Based on the results of this evaluation, MDOT SHA determined that the MD 200 Diversion Alternative did not meet the Study's Purpose and Need. In addition, FHWA and MDOT SHA determined that Alternative 5 did not meet the Study's Purpose and Need. Details for these alternatives and the rationale for not carrying them forward as ARDS are presented below. The remaining Screened Alternatives (8, 9, 10, 13B, and 13C) were retained as ARDS as well as Alternative 1 (No Build) for comparison purposes per NEPA requirements.

#### a. Further Consideration of Alternative 5

Alternative 5 consists of adding one HOT managed lane in each direction on I-495 and converting the one existing HOV lane in each direction to a HOT managed lane on I-270. Based on additional analysis, FHWA and MDOT SHA found that Alternative 5 would fail in certain aspects and in others would perform so poorly in addressing the Study's Purpose and Need that it was not a reasonable or feasible alternative. During the alternatives screening process, Alternative 5 was rated "low" for system-wide delay, TTI in the GP lanes, density, LOS, and vehicle-throughput. In addition, Alternative 5 was determined to not be financially viable. However, Alternative 5 was evaluated to the same level as other ARDS and is included in the DEIS as a useful means of comparison to the Build and No Build Alternatives. As Alternative 5 would have some reduction in environmental impacts, a full comparison addresses agency and public comments to better understand the potential differences between a one-lane and two-lane alternative.

The following summarizes the key findings concerning the inability of Alternative 5 to meet the project Purpose and Need[18]:

**Accommodate Existing and Long-Term Traffic Growth** (Metrics used: system-wide delay, corridor travel times and speeds and density and LOS)

- Alternative 5 would achieve the lowest percentage of improvement to system wide delay compared to the No Build Alternative for the morning peak period and would tie for the lowest afternoon peak period compared to the ARDS.
- Alternative 5 would have the lowest average travel speed in the general purpose lanes compared to the ARDS
- Alternative 5 would have the highest percentage of lane miles failing and operating at a level of service "F" in both peak periods compared to the ARDS.

[18] DEIS Chapters 2 and 3 and Appendices B (*Alternatives Technical Report*) and C (*Traffic Technical Report*)

**Enhance Trip Reliability** (Metric used: TTI)

- Alternative 5 would have the highest number of "heavy congestion" and "severe congestion" corridor segments in the GP lanes for both peak periods compared to all the ARDS.

**Improve the Movement of Goods and Services** (Metrics used: vehicle throughput and effect on local roadway network)

- Alternative 5 is the only alternative that does not demonstrate a significant increase in vehicle throughput during the AM peak period and has minimal increase in throughput at key locations during the PM peak period.
- Alternative 5, would provide no additional throughput on I-495 at MD 5 during the AM peak period compared to the No Build Alternative and would provide the smallest throughput benefit at the other three key locations studied (I-495 at American Legion Bridge, I-495 west of I-95 and I-270 at Montrose Road).
- Alternative 5 would achieve approximately half the benefits compared to the ARDS for effects to local roadway network with a reduction of approximately 3 percent in daily delay versus the No Build Alternative.

Additionally, slow-moving vehicles on a one-lane facility could cause slower speeds for vehicles traveling behind them. In practice, single-lane systems are estimated to perform even worse than VISSIM simulation models indicate, particularly for congestion and reliability metrics, because the models do not capture the impacts of these slow-moving vehicles. Therefore, the traffic results for corridor travel time and speeds, as well as TTI, may slightly overestimate the benefits of a one-lane HOT/ETL, such as Alternative 5, compared to the No Build.

In addition to failing to adequately meet the Study's Purpose and Need, Alternative 5 would not be considered a practicable alternative in the context of the US Army Corps of Engineers' permitting requirements. This conclusion is based on an accumulation of factors including, but not limited to, the minimal likelihood of Alternative 5 being financially viable, the marginal difference in resource impacts between building a one-lane and two-lane facility, and the estimated relative high cost of building a one-lane facility. Specifically, Alternative 5 is not a practicable alternative because:

- It would not likely achieve a return on investment that would attract the private sector interest needed for a P3. The estimated revenue shortfall of Alternative 5 would be the largest of all ARDS because it would provide half of the capacity of the two-lane alternatives and could provide even less capacity because of traffic performance issues. This preliminary assessment of financial viability indicates that Alternative 5 would likely not attract a P3 investor.
- It provides only a marginal benefit for the avoidance of sensitive water resources when compared to the ARDS. The difference in impacts between Alternative 5 and the widest Limit of Disturbance[19] (LOD) Alternatives (9 and 10) is 1.1 acres of wetlands and 2,222 linear feet of stream impacts across the entirety of the 48-mile study limits. Given this marginal difference, the ability to mitigate impacts to water resources would be equal among all Build Alternatives including

[19] A limit of disturbance (LOD) is the proposed boundary within which all construction, construction access, staging, materials storage, grading, clearing, erosion and sediment control, landscaping, drainage, stormwater management, noise barrier replacement/construction, and related activities would occur.

Alternative 5. The potential for avoidance of certain resources would not be anywhere near equivalent to the likely loss of revenue compared to building a two-lane alternative.

- The $7.8 - $8.5 billion estimated construction cost of Alternative 5 represents up to 90 percent of the cost of the two-lane ARDS. The extremely close estimated construction budget results from the one-lane option requiring virtually the same amount of right-of-way and property needed for developing the expanded roadway as with two-lane alternatives. In the context of a project with such a large expected private sector investment, the incremental difference in overall cost would not prove economical. For a potential fractional cost savings, Alternative 5 only provides half of the capacity and reduces the likelihood of a project of this magnitude being financially viable.

For all these reasons, Alternative 5 would not adequately address the project Purpose and Need and does not qualify as a reasonable and a practicable alternative. It was not carried forward for further study in the DEIS, but is included for impact comparison purposes only, as appropriate.

**b. Consideration of the MD 200 Diversion Alternative**

Following the Spring 2019 Public Workshops and agency meetings, a few Cooperating and Participating Agencies requested that MDOT SHA evaluate an alternative that would encourage travelers to use MD 200 (Intercounty Connector) instead of the top side of I-495 between I-270 and I-95 to avoid or reduce impacts to significant, regulated resources and residential relocations in this area. In compliance with Section 4(f) of the US Department of Transportation Act of 1966, the alternative was also evaluated to determine if it could be a feasible and prudent alternative that would provide the least overall harm to park resources along the top side of I-495 including: Rock Creek Stream Valley Park, Sligo Creek Stream Valley Park, Northwest Branch Stream Valley Park, and other smaller parks (Refer to *Chapter 5* and *Appendix F*, *Draft Section 4(f) Evaluation*).

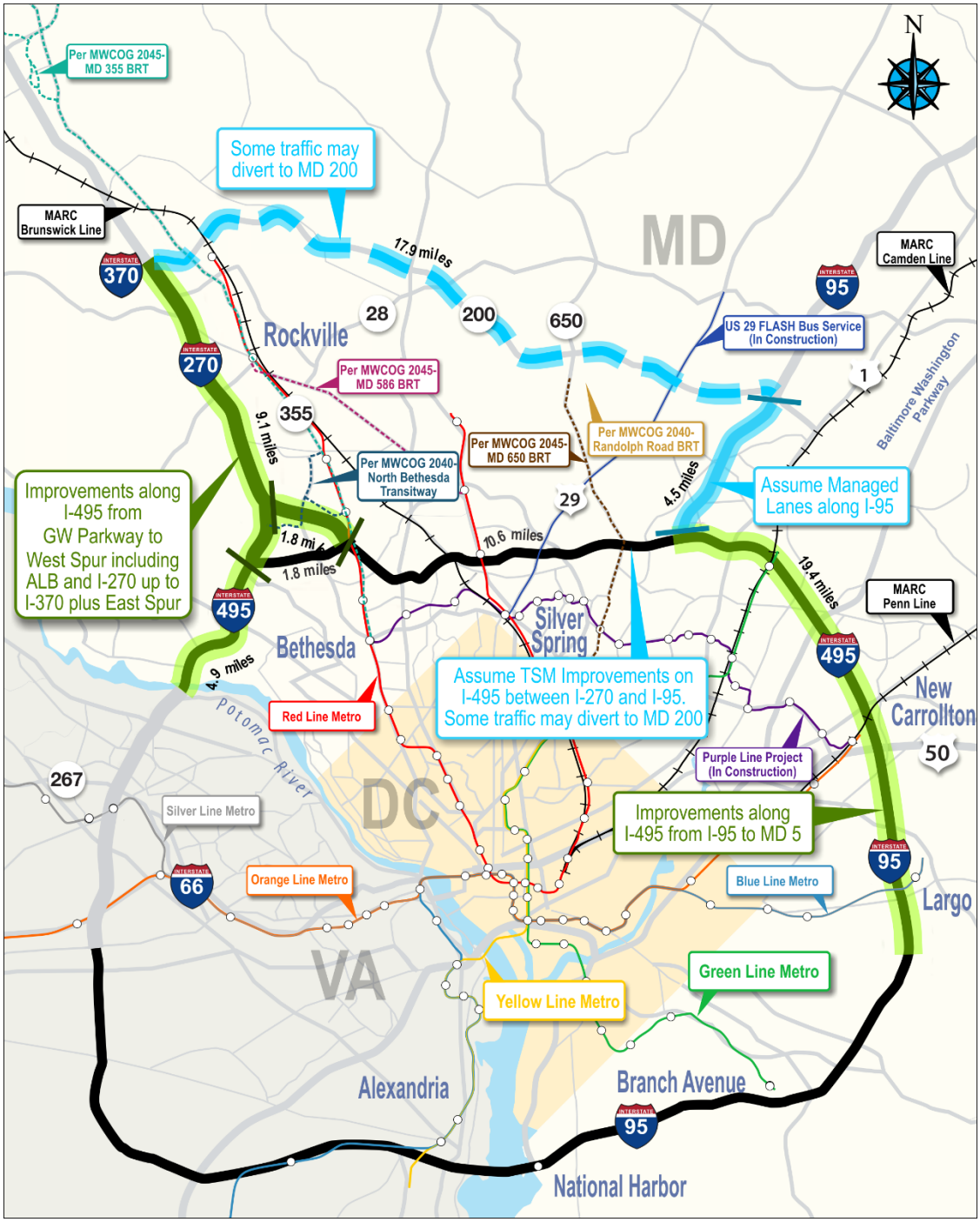
The purpose of this analysis was to evaluate the MD 200 Diversion Alternative to the same level of detail as the Screened Alternatives to determine if it would meet the Purpose and Need of the Study, and thus be considered a reasonable alternative to be carried forward for detailed study in the DEIS.

As shown in **Figure 2-2**, the MD 200 Diversion Alternative would include the following elements:

- No widening or capacity improvements along I-495 between the I-270 West Spur and I-95.
- Consideration of TSM/TDM improvements along I-495 between the I-270 East Spur and I-95.
- Two HOT managed lanes[20] added in each direction on I-495 between the study limits south of George Washington Memorial Parkway and the I-270 West Spur, including the American Legion Bridge. (Similar to Alternative 9)
- Conversion of the one existing HOV lane in each direction to a HOT managed lane on I-270 and the West Spur, and the addition of one HOT managed lane in each direction on I-270, resulting in a two-lane managed lanes network. (Similar to Alternative 9)
- Two HOT managed lanes[20] added in each direction on I-495 between I-95 and the study limits west of MD 5. (Similar to Alternative 9)
- Two managed lanes added in each direction on I-95 between MD 200 and I-495.

[20] For the purposes of the traffic, environmental or financial analysis, the tolling operation whether HOT lanes or ETLs, would not be a differentiating factor.

**Figure 2-2: MD 200 Diversion Alternative**




Note: The proposed BRT Lines on the map were included in the 2045 MWCOG model. The traffic analysis in support of the MD 200 Diversion Alternative and ARDS was based on the 2040 MWCOG model.

There are several diversion routes that occur in this alternative. Southbound traffic on I-95, coming from north of MD 200, that is destined for points west and south of the I-495 and I-270 West Spur interchange would use MD 200 and I-270 instead of I-95 and I-495. The same diversion route could occur in the opposite direction heading from Virginia to points north of I-95. This diversion route would be 10.1 miles

longer than using I-495. Westbound traffic on I-495, coming from points east of the I-95 and I-495 interchange that is destined for points south of the I-495 and I-270 West Spur interchange would use I-95, MD 200, and I-270 instead of the top side of I-495. The same full diversion route could occur in the opposite direction heading from Virginia to points east of I-95. This full diversion would be 19.1 miles longer than using I-495.

In the near term, the premise of this alternative has merit due to the currently available capacity on MD 200, a Maryland Transportation Authority (MDTA) facility. As such, MDOT SHA is working with MDTA to encourage through traffic from points north on I-95 that is destined for the American Legion Bridge or beyond (and the reverse movement) to utilize MD 200 to take advantage of the near term spare capacity and potentially provide some relief to the top side of I-495. In an attempt to divert some of this traffic, MDOT SHA has proposed to MDTA to provide travel times for I-495 and MD 200 through the use of the existing dynamic messaging signs as in the sample shown in **Figure 2-3**. If the travel times show the trip is shorter on MD 200 and the toll is amenable to travelers, then they may choose to divert to MD 200.

**Figure 2-3: Sample Travel Times on Dynamic Message Sign**


However, in addressing the Study's Purpose and Need, the MD 200 Diversion Alternative must also accommodate long-term traffic growth, enhance trip reliability, and improve the movement of goods and services. In the design year of 2040, the traffic analysis results indicated that the MD 200 Diversion Alternative would perform worse than most of the Screened Alternatives in many metrics used to evaluate the reasonableness of the alternatives. The following summarizes the results of these metrics:

- For **system-wide delay**, along I-495 and I-270, the alternative would perform the worst of all Screened Alternatives and would only save 3 to 7 percent in delay compared to the No Build Alternative (with 20 to 35 percent reduction in delay for the Screened Alternatives.
- For **corridor travel time and speed**, the alternative would have the lowest average speed compared to the Screened Alternatives. Additionally, there would be a 15 percent decrease in speed along the I-495 Inner Loop during the morning peak period compared to the No Build, and the HOT lanes on the I-495 Inner Loop would not achieve the federally-mandated average speed of 45 miles per hour for HOT lanes.

- For **density and LOS**, the alternative would have the highest number of lane miles operating at LOS F and the highest percentage of failing lane-miles amongst the Screened Alternatives.
- For **travel time index (TTI),** the average TTI on the GP lanes within the study area would be 1.6, which is the second worst of the Screened Alternatives. Two segments of the I-495 Inner Loop would be projected to have TTI values that exceed 2.0 during the PM peak period and therefore would be considered "severe" congestion based on MDOT SHA criteria.
- For **vehicle throughput**, the alternative would have similar average throughput to Alternative 5, which was not advanced as an ARDS. Additionally, the top side of I-495 would perform worse than the No Build Alternative in the morning peak period and would have approximately half of the throughput benefit of the retained alternatives across the American Legion Bridge (15 percent with the MD 200 Diversion Alternative compared to 35 percent in the PM peak under Alternatives 9 and 10).
- For the **effect on the local roadway network**, the MD 200 Diversion Alternative would be projected to reduce delay on north-south arterials due to the additional proposed widening along I-95, particularly in Prince George's County. However, it would reduce the benefit on east-west arterials in Montgomery County and the District of Columbia compared to the Screened Alternatives.

Regarding environmental impacts, the MD 200 Diversion Alternative would include the No Build Alternative on the topside of I-495. Therefore, it would avoid environmental resources and property relocations within this area. However, it would include improvements to I-95, which would add to the overall potential environmental impacts for this alternative. While the MD 200 Diversion Alternative would avoid the use of important resources along the topside of I-495, it would still impact significant environmental resources in other areas and would not address the significant congestion issues, despite the cost of approximately $7.2 to $7.9 billion (**Table 2-1**).

For financial viability, the MD 200 Diversion Alternative would require a subsidy of public funding, which means that even with the toll revenues, the State would have to pay approximately $310 million.

Overall, the operational analyses show that a continuous, unbroken network of managed lanes along I-495 is necessary to meet the Study's Purpose and Need (specifically accommodating long-term traffic growth and enhancing trip reliability) and for the project to be financially viable. The section of I-495 between the I-270 East Spur and I-95 carries the second highest ADT volume in Maryland and the Outer Loop from I-95 to US 29 was ranked the #1 most congested freeway section in Maryland during the AM peak. In addition, the section of I-495 Inner Loop from the I-270 East Spur to MD 97 was ranked the third most congested freeway section in Maryland during the PM peak on an average weekday in 2017. Finally, the top three most unreliable freeway segments in Maryland during the AM peak are all located on the I-495 Outer Loop between I-95 and MD 193 and during the PM peak, the I-495 Inner Loop at MD 355 ranks as the sixth most unreliable freeway segment in Maryland.

## Table 2-1: PRELIMINARY Effects Comparison of the Screened Alternatives (JUNE 2019 IMPACTS) and the MD 200 Diversion Alternative[1]

| | Resource[2,3] | Alternative 1 No Build | Alternative 5[4] | Alternative 8 | Alternative 9 | Alternative 10 | Alternative 13B | Alternative 13C | MD 200 Diversion Alt[4] |
|---|---|---|---|---|---|---|---|---|---|
| Environmental[5] | Number of Parks | 0 | 46 | 47 | 47 | 47 | 47 | 47 | 35 |
| | Potential Use of Section 4(f) Properties[6] {Potential Use of Historic BW Parkway in acres} | 0 | 170 {63} | 176 {63} | 176 {63} | 177 {63} | 175 {63} | 177 {63} | 136 {63} |
| | Number of Known Previously Recorded National Register Historic Properties | 0 | 20 | 21 | 21 | 21 | 21 | 21 | 12 |
| | 100-Year Floodplain (acres) | 0 | 123 | 127 | 127 | 128 | 127 | 127 | 80 |
| | Unique and Sensitive Areas (acres) | 0 | 404 | 414 | 414 | 417 | 414 | 416 | 405 |
| | Sensitive Species Project Review Area (acres) | 0 | 150 | 153 | 153 | 153 | 153 | 153 | 271 |
| | Forest canopy (acres) | 0 | 1,452 | 1,507 | 1,507 | 1,519 | 1,507 | 1,514 | 1,258 |
| | Wetlands of Special State Concern (acres) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Wetlands – Field Reviewed (acres) | 0 | 18 | 19 | 19 | 19 | 19 | 19 | 18 |
| | Waters of the US (linear feet) | 0 | 147,468 | 150,049 | 150,049 | 150,658 | 150,074 | 150,285 | 121,097 |
| | Tier II Catchments (acres) | 0 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| | Noise Receptors Impacted[7] | 0 | 3,661 | 4,470 | 4,470 | 4,581 | 4,411 | 4,461 | Not Avail |
| Engineering[5] | Total Right-of-way Required (acres) | 0 | 301 | 335 | 335 | 344 | 335 | 341 | 273 |
| | Number of Properties Directly Affected | 0 | 1,222 | 1,445 | 1,445 | 1,485 | 1,446 | 1,462 | 1,076 |
| | Number of Residential Displacements | 0 | 25 | 34 | 34 | 34 | 34 | 34 | 0 |
| | Number of Business Displacements | 0 | 4 | 4 | 4 | 4 | 4 | 4 | 1 |
| | Width of Pavement on I-495 (feet) | 138–146 | 170–174 | 194–198 | 194–198 | 194–198 | 194–198 | 194–198 | 194–198 |
| | Width of Pavement on I-270 (feet) | 228–256 | 194–198 | 218–222 | 218–222 | 242–248 | 202–206 | 226–230 | 218–222 |
| | Width of Pavement on I-95 (feet) | 144 | N/A | N/A | N/A | N/A | N/A | N/A | 196 |
| | Capital Costs (billions) | N/A | $7.7 – $8.6 | $8.7 – $9.6 | $8.7 – $9.6 | $9.0 – $10.0 | $8.6 – $9.5 | $8.9 – $9.9 | $7.2 - $7.9 |

**Notes:** [1] Preliminary impacts represented in this table assume total impacts; temporary and permanent impacts will be differentiated in the FEIS.

[2] Annual Average Hours of Savings per Commuter is included as a comparison item in the *Alternatives Technical Report* (**Appendix B**, Table 6-14 and Table 6-17). It was removed from this table in the DEIS because it was not a metric used in assessing the Screened Alternatives.

[3] All of the alternatives follow the existing highways; therefore, the quantity of impacts is similar.

[4] MDOT SHA and FHWA determined Alternative 5 and the MD 200 Diversion Alternative are not reasonable alternatives and were not advanced as ARDS.

[5] Detailed analyses, including further avoidance, minimization and private sector incentives, will be prioritized to reduce the property and environmental impacts.

[6] Potential Use of Section 4(f) Properties includes total acres of potential impacts to parks and known historic properties and did not reflect additional avoidance and minimizations efforts coordinated with the resource agencies after the preparation of this table.

[7] Noise receptors are noise-sensitive land uses which include residences, schools, places of worship, and parks, among others. Noise analysis along the I-95 portion of the MD 200 Diversion Alternative was not completed.

FHWA and MDOT SHA would not retain an alternative (MD 200 Diversion Alternative) for detailed study that would not address the worst traffic deficiencies in Maryland, nor meet the Study's Purpose and Need. Based on the results, the MD 200 Diversion Alternative was not carried forward for detailed study as it does not meet the Study's Purpose and Need. Refer to the MD 200 Diversion Alternative Analysis Results Paper as *Appendix A* to the *Alternatives Technical Report* (**Appendix B**) for additional details.

## 2.6 Alternatives Retained and Evaluated in this Document

After applying the refined screening criteria based on additional engineering, traffic, financial, and environmental analysis, all the Screened Alternatives except Alternative 5 met the Study's Purpose and Need. The No Build Alternative does not meet the Study's Purpose and Need but is retained for comparison with other alternatives in accordance with the regulations for implementing NEPA (40 CFR §1502.14(d)). The remaining alternatives (Alternatives 1, 8, 9, 10, 13B, and 13C) were concurred upon by the Cooperating Agencies[21] as the ARDS. Following this concurrence step, MDOT SHA and FHWA evaluated another additional alternative, called Alternative 9M, in response to public and agency comments. Alternative 9M was evaluated and determined to be a reasonable alternative, and thus is included in addition to the ARDS for further evaluation in this DEIS.

Excluding the No Build Alternative, the five ARDS (8, 9, 10, 13B, and 13C) and Alternative 9M are referred to as the Build Alternatives. These six Build Alternatives and the No Build Alternative are evaluated in this DEIS (**Table 2-2**). Each discussion of the Build Alternatives and the No Build Alternative includes a description of the alternative and typical section. Refer to *Chapter 6, Sections 3* and *5* of the *Alternatives Technical Report* (**Appendix B**) for additional details. The traffic operational analysis is presented in **Chapter 3** of this DEIS. The environmental analysis of the Build Alternatives is presented in **Chapter 4**. Alternative 5 is included in this DEIS for comparison purposes only.

**Table 2-2: Alternatives Evaluated in the DEIS**

| Alternative | Description |
|---|---|
| **Alternative 1** | No Build |
| **Alternative 8** | Two-Lane, ETL Managed Lanes Network on I-495 and One-Lane ETL Managed Lane and One-Lane HOV Lane on I-270 |
| **Alternative 9** | Two-Lane, HOT Managed Lanes Network on both I-495 and I-270 |
| **Alternative 9M** | Two-Lane, HOT Managed Lanes Network on west and east side of I-495 and on I-270; One-Lane HOT Lane on top side of I-495 |
| **Alternative 10** | Two-Lane, ETL Managed Lanes Network on I-495 and I-270 plus One-Lane HOV Lane on I-270 only |
| **Alternative 13B** | Two-Lane, HOT Managed Lanes Network on I-495; HOT Managed, Reversible Lane Network on I-270 |
| **Alternative 13C** | Two-Lane, ETL Managed Lanes Network on I-495, ETL Managed, Reversible Lane Network and One-Lane HOV Lane on I-270 |

[21] NCPC abstained from concurring on the ARDS; M-NCPPC did not concur on the ARDS.

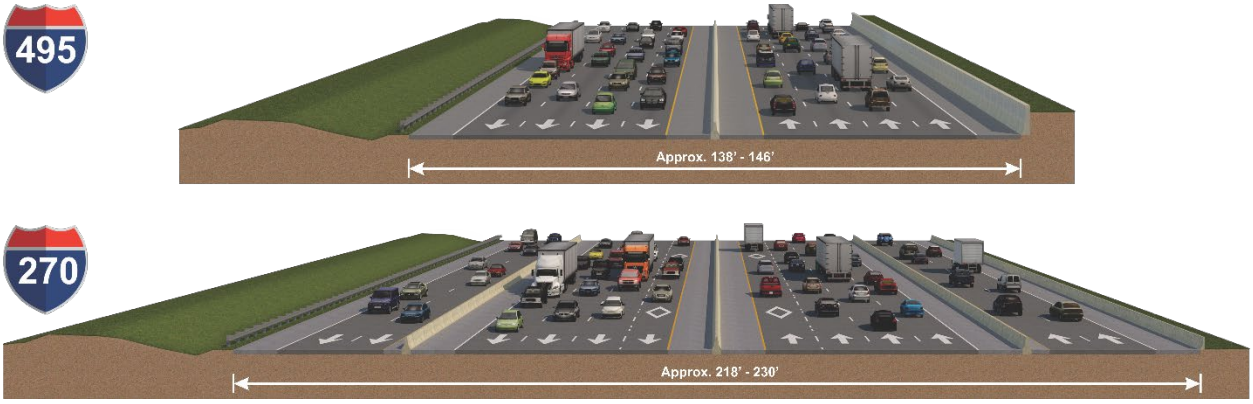
### 2.6.1 Alternative 1

The No Build Alternative, often called the base case, includes all other projects in Visualize2045 adopted by the MWCOG, TPB in 2018, except improvements considered under this Study (**Figure 2-4**). The No Build Alternative includes other projects programmed in the CLRP. Specifically, the CLRP reflects the extension of the I-495 express lanes in Virginia from the Dulles Toll Road interchange to the American Legion Bridge. The No Build Alternative also includes the I-270 Innovative Congestion Management Contract Project, which is providing a series of projects to improve mobility and safety at key points along I-270 targeted to reduce congestion at key bottlenecks along the corridor. All improvements are being implemented within the existing roadway right-of-way and are anticipated to be completed by 2021. While these improvements will improve mobility and safety, they will not address the long-term capacity need for the I-270 corridor.

The CLRP also includes transit improvement projects including the Purple Line, improvements to MARC, and the construction of a BRT network. The MDOT MTA and Montgomery County have BRT studies underway to provide additional travel choices and relieve congestion on the adjacent roadway networks.

Routine maintenance and safety improvements along I-495 and I-270 are included in the No Build Alternative. However, it does not include new capacity improvements to I-495 and I-270. Alternative 1 does not meet the Study's Purpose and Need and is only retained for the purposes of comparison with the Build Alternatives in accordance with the regulations for implementing NEPA (40 CFR §1502.14(d)).

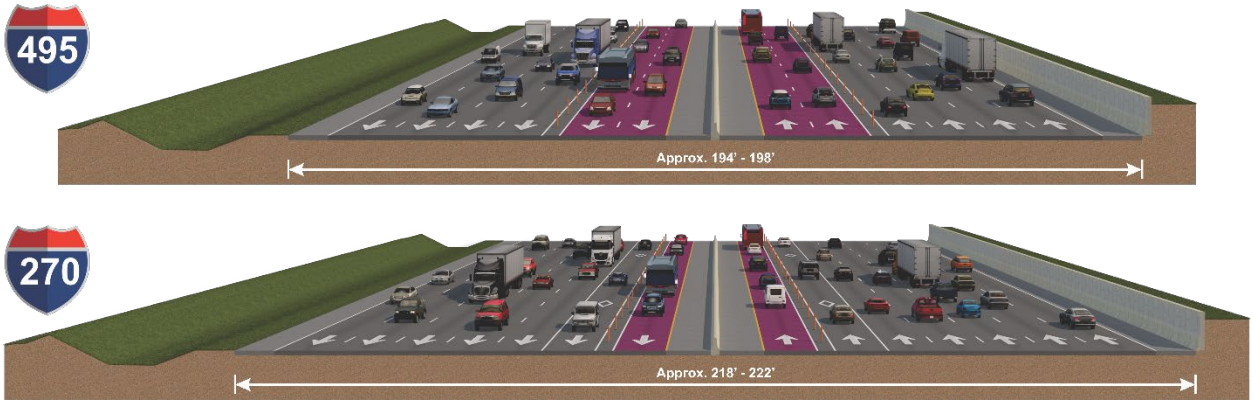
**Figure 2-4: Alternative 1 (No Build) Typical Sections**




### 2.6.2 Alternative 8

Alternative 8 consists of adding two ETL managed lanes in each direction on I-495, retaining one existing HOV lane in each direction on I-270 and the I-270 East and West Spurs, and adding one ETL managed lane in each direction on I-270 and the I-270 East and West Spurs (**Figure 2-5**). The managed lanes would be separated from the GP and HOV lanes using pylons (i.e., flexible delineators or tubular markers) placed within a four-foot buffer. Transit buses would be permitted to use the managed lanes for free.

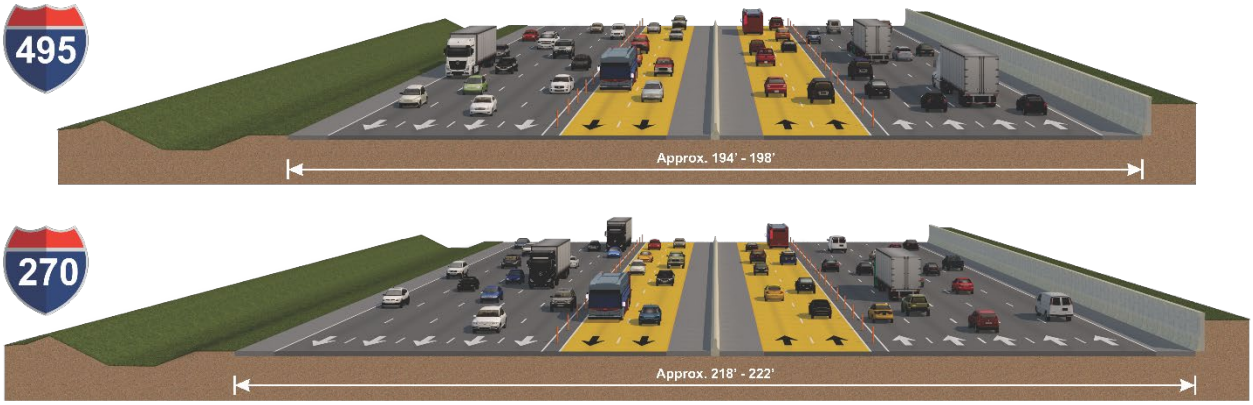
Figure 2-5: Alternative 8 Typical Sections




### 2.6.3 Alternative 9

Alternative 9 consists of adding two HOT managed lanes in each direction on I-495, converting the one existing HOV lane in each direction to a HOT managed lane on I-270 and the I-270 East and West Spurs, and adding one HOT managed lane in each direction on I-270 and the I-270 East and West Spurs, resulting in a two-lane, managed lanes network on both highways (**Figure 2-6**). The managed lanes would be separated from the GP lanes using pylons placed within a four-foot buffer. Transit buses would be permitted to use the managed lanes for free.

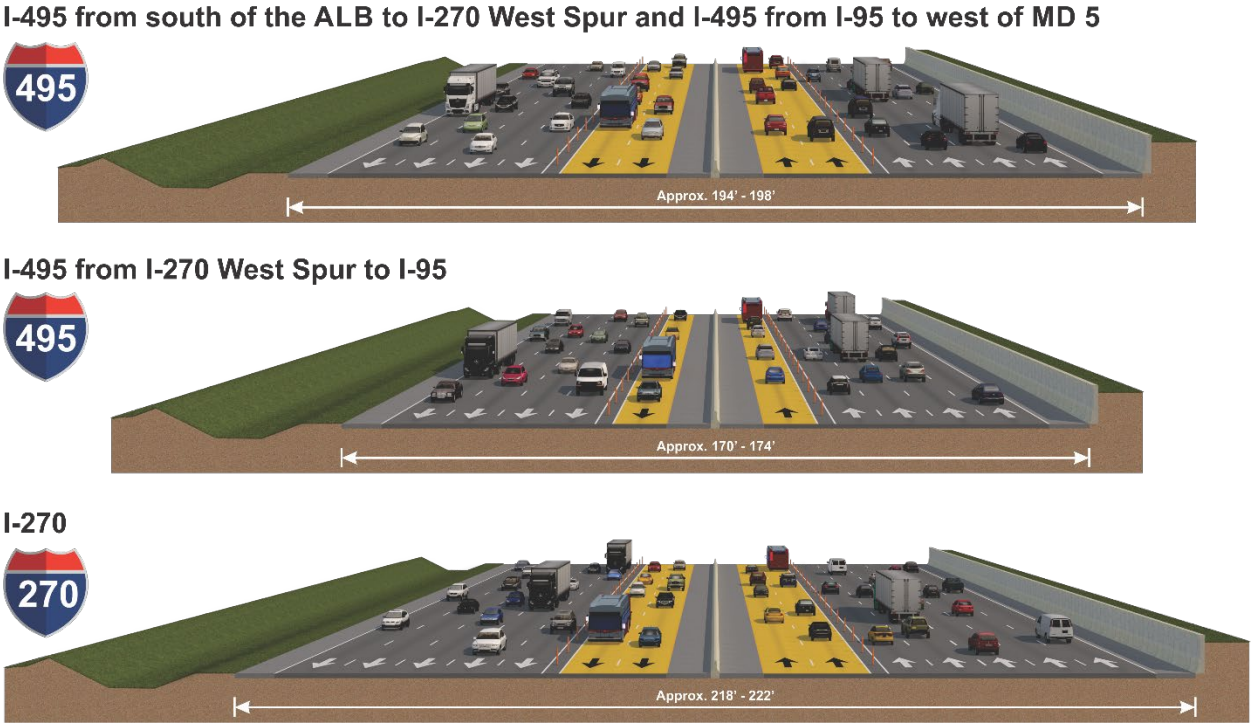
Figure 2-6: Alternative 9 Typical Sections




### 2.6.4 Alternative 9M

MDOT SHA and FHWA evaluated an additional alternative for the Study called Alternative 9M in response to public and agency comments. Alternative 9M would consist of a blend of Alternative 5 and Alternative 9 in an effort to avoid or reduce impacts to sensitive environmental resources and property relocations on the top side of I-495. An evaluation was completed to determine if the alternative, which includes a reduction of lanes on the top side of I-495, would sufficiently meet the Study's Purpose and Need. The results of the evaluation indicate that Alternative 9M meets the Study's Purpose and Need, and therefore is included as a reasonable alternative in this DEIS. Alternative 9M, shown in **Figure 2-7** and **Figure 2-8**, would consist of the following:

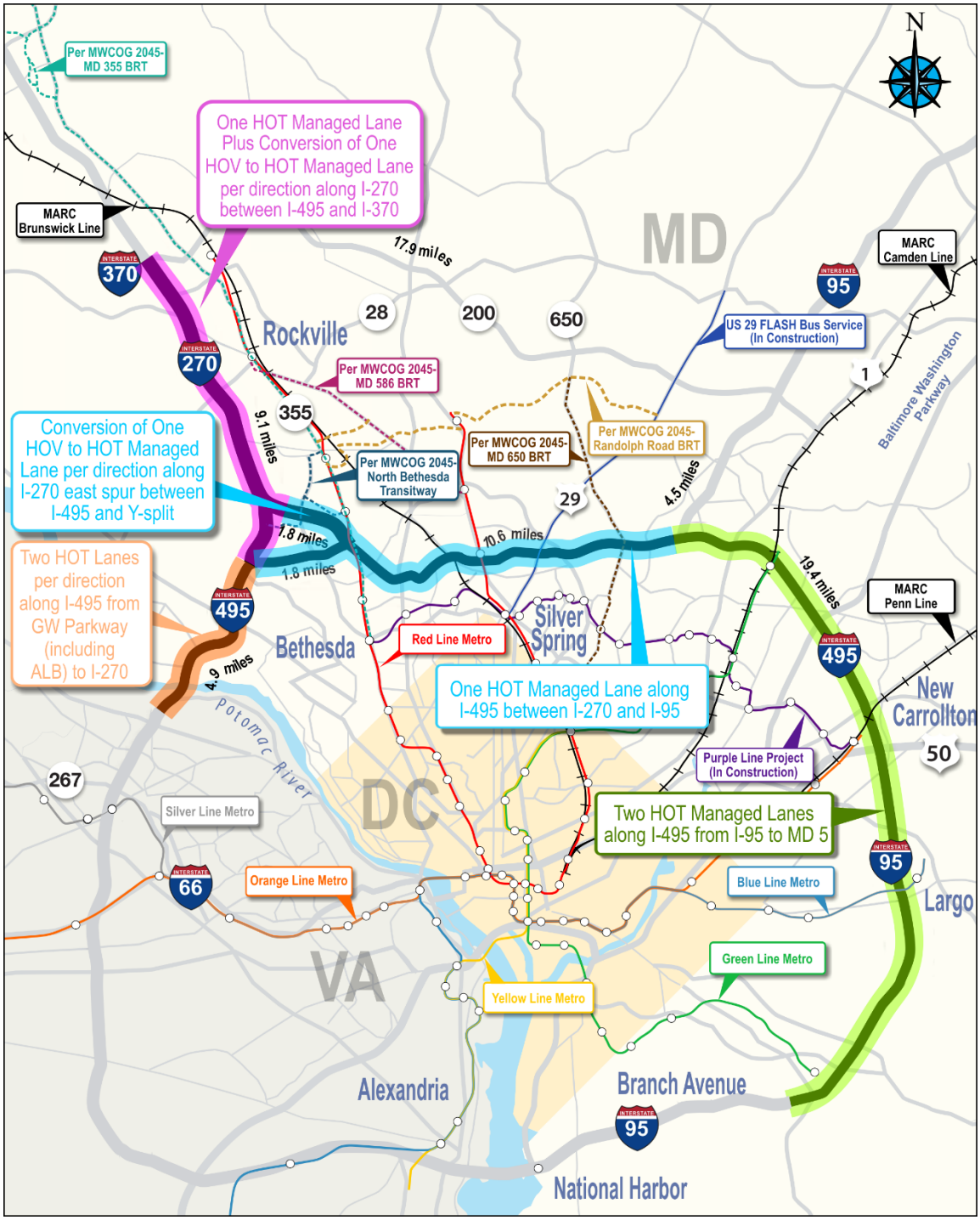
**Figure 2-7: Alternative 9M Typical Sections**




- Addition of two HOT managed lanes added in each direction on I-495 on the west side between the study limits south of the George Washington Memorial Parkway and the I-270 West Spur, including the American Legion Bridge. (Similar to Alternative 9, shown in orange on **Figure 2-8**).
- Conversion of the one existing HOV lane in each direction to a HOT managed lane on I-270 and the I-270 West Spur, and the addition of one HOT managed lane in each direction on I-270 and the I-270 West Spur, resulting in a two-lane managed lanes network. (Similar to Alternative 9, shown in purple on **Figure 2-8**).
- Conversion of the one existing HOV lane in each direction to a HOT managed lane on the I-270 East Spur. (Similar to Alternative 5, shown in blue on **Figure 2-8**).
- Addition of one HOT managed lane in each direction on I-495 between the I-270 West Spur and I-95. (Similar to Alternative 5, shown in blue on **Figure 2-8**).
- Addition of two HOT managed lanes added in each direction on I-495 on the east side between I-95 and the study limits west of MD 5. (Similar to Alternative 9, shown in green on **Figure 2-8**).

The build elements, including managed lane access locations and interchange improvements, would be the same as they were for Alternatives 5 and 9, where the typical section is consistent with each of those alternatives, and transit buses would be permitted to use the managed lanes for free; however, the managed lanes would need to transition from one to two lanes in each direction and vice versa. These transitions are described below and are shown in *Chapter 6, Section 5* of the *Alternatives Technical Report* (**Appendix B**).

**Figure 2-8: Alternative 9 Modified**




- At the I-270 West Spur interchange, one northbound managed lane would continue along I-495 to the east and two northbound managed lanes would continue north on the I-270 West Spur. Two southbound managed lanes would come from the I-270 West Spur to join one southbound managed lane from I-495.

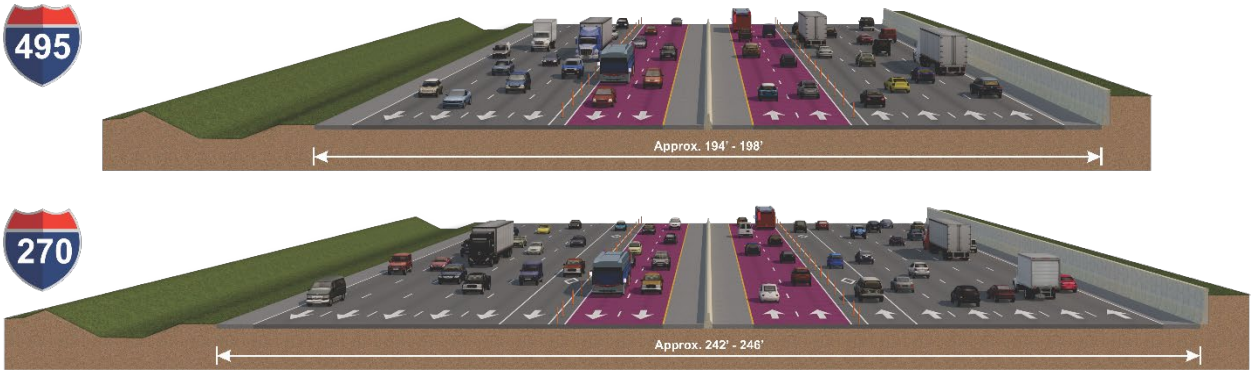
- At the I-270 Y-split, one northbound managed lane would come from the East Spur to join two northbound managed lanes from the West Spur. The three southbound managed lanes on I-270 would split so that one managed lane would go to the East Spur and two would go to the West Spur.
- At the I-95 interchange on I-495, the southbound I-95 managed lane ramp would join with one eastbound managed lane from I-495 to the west and would continue eastbound as two managed lanes. The two westbound managed lanes on I-495 east of the interchange would split so that one lane would exit to I-95 northbound and one managed lane would continue westbound on I-495.

Refer to *Appendix B* to the *Alternatives Technical Report* (**Appendix B**) for a summary of the Alternative 9M analysis and results.

### 2.6.5 Alternative 10

Alternative 10 consists of adding two ETL managed lanes in each direction on I-495, retaining one existing HOV lane per direction on I-270 and the I-270 East and West Spurs, and adding two ETL managed lanes in each direction on I-270 and the I-270 East and West Spurs (**Figure 2-9**). The managed lanes would be separated from the GP and HOV lanes using pylons placed within a four-foot buffer. Transit buses would be permitted to use the managed lanes for free.

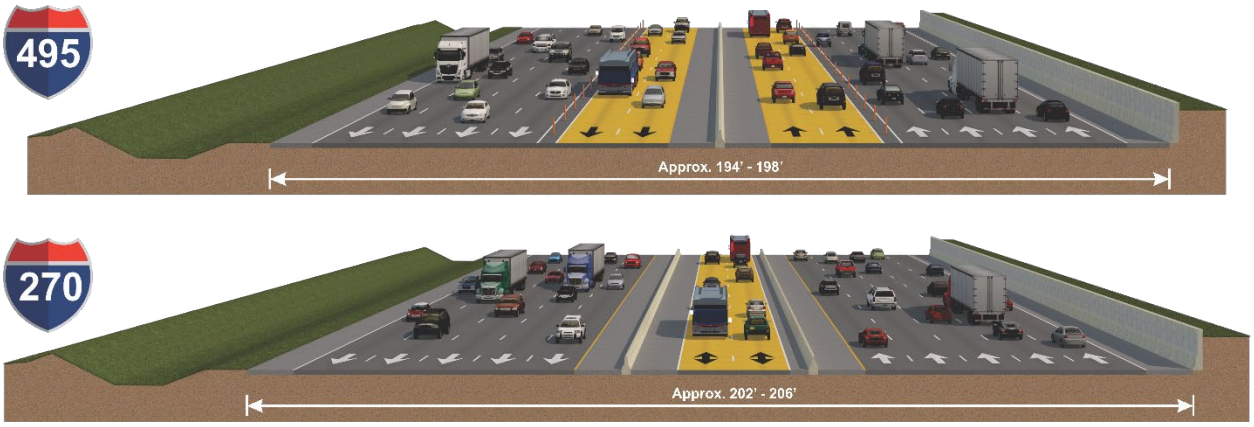
**Figure 2-9: Alternative 10 Typical Sections**




### 2.6.6 Alternative 13B

Alternative 13B would provide a two-lane, HOT managed lanes network on I-495 similar to Alternative 9. This alternative would also convert the existing HOV lanes on I-270 and the I-270 East and West Spurs to two HOT managed reversible lanes while maintaining the existing GP lanes (**Figure 2-10**). The managed lanes on I-495 would be separated from the GP lanes using pylons placed within a four-foot buffer and the managed reversible lanes on I-270 would be separated from the GP lanes using concrete barriers. Transit buses would be permitted to use the managed lanes for free.

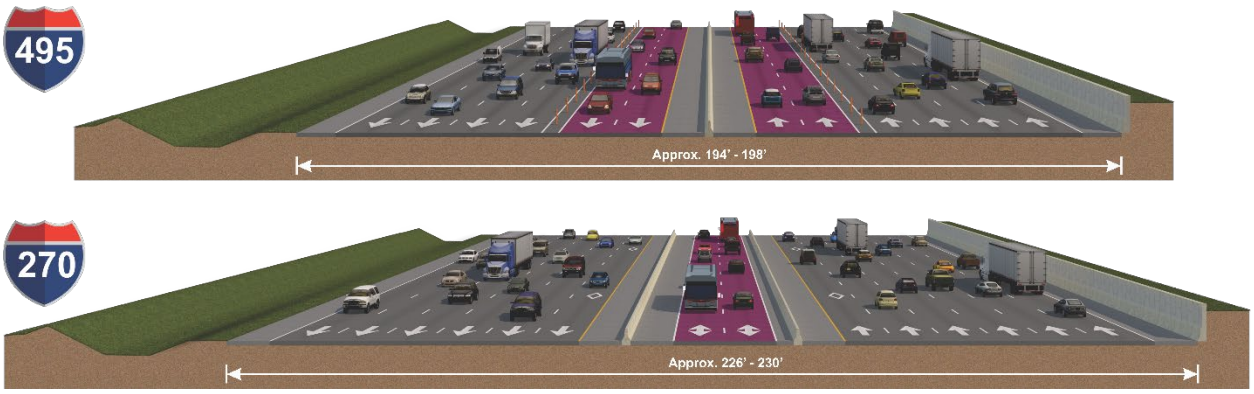
Figure 2-10: Alternative 13B Typical Sections




## 2.6.7 Alternative 13C

Alternative 13C would provide a two-lane, ETL managed lanes network on I-495 similar to Alternatives 8 and 10 (**Figure 2-11**). It would also retain the existing HOV lanes in both directions and add two ETL managed, reversible lanes on I-270 and the I-270 East and West Spurs. The managed lanes on I-495 would be separated from the GP lanes using pylons placed within a four-foot buffer and the managed reversible lanes on I-270 would be separated from the GP and HOV lanes using concrete barriers. Transit buses would be permitted to use the managed lanes for free.

Figure 2-11: Alternative 13C Typical Sections




The comparison of the impacts for the No Build Alternative, Build Alternatives, and Alternative 5 (for comparison purposes) is presented in **Table 2-3**.

## Table 2-3: Summary of Effects Comparison of the Build Alternatives[1]

| | Resource | Alternative 1 No Build | Alt 5[2] | Alt 8 | Alt 9 | Alt 9M | Alt 10 | Alt 13B | Alt 13C |
|---|---|---|---|---|---|---|---|---|---|
| Environmental | Total Potential Impacts to Section 4(f) Properties including park and historic properties (acres) | 0 | 141.7 | 146.8 | 146.8 | 144.7 | 149.0 | 145.5 | 146.7 |
| | Number of Historic Properties with Adverse Effect[3] [Adverse effect cannot be determined[4]] | 0 | 13[7] | 13[7] | 13[7] | 13[7} | 13[7] | 13[7] | 13[7] |
| | 100-Year Floodplain (acres) | 0 | 114.3 | 119.5 | 119.5 | 116.5 | 120.0 | 119.5 | 119.9 |
| | Unique and Sensitive Areas (acres) | 0 | 395.3 | 408.2 | 408.2 | 401.8 | 410.8 | 406.7 | 408.6 |
| | Sensitive Species Project Review Area (acres) | 0 | 151.7 | 155.0 | 155.0 | 153.7 | 155.0 | 155.0 | 155.0 |
| | Forest canopy (acres) | 0 | 1,434 | 1,497 | 1,497 | 1,477 | 1,515 | 1,489 | 1,503 |
| | Wetlands of Special State Concern | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Wetlands – Field Reviewed (acres) | 0 | 15.4 | 16.3 | 16.3 | 16.1 | 16.5 | 16.3 | 16.5 |
| | Wetland 25-foot buffer (acres) | 0 | 51.2 | 53.1 | 53.1 | 52.7 | 53.6 | 53.1 | 53.5 |
| | Waters of the US (linear feet) | 0 | 153,702 | 155,922 | 155,922 | 155,229 | 156,984 | 155,822 | 156,632 |
| | Tier II Catchments (acres) | 0 | 55.2 | 55.3 | 55.3 | 55.3 | 55.3 | 55.3 | 55.3 |
| | Noise Receptors[5] Impacted | 0 | 3,661 | 4,470 | 4,470 | 4,249 | 4,581 | 4,411 | 4,461 |
| Traffic | System-Wide Delay Savings vs. No Build (AM/PM)[6] | 0 | 20%/22% | 23%/33% | 34%/33% | 30%/30% | 35%/34% | 27%/22% | 26%/34% |
| Engineering | Total Right-of-way Required[7] (acres) | 0 | 284.9 | 323.5 | 323.5 | 313.4 | 337.3 | 318.9 | 329.3 |
| | Number of Properties Directly Affected | 0 | 1,240 | 1,475 | 1,475 | 1,392 | 1,518 | 1,447 | 1,479 |
| | Number of Residential Relocations | 0 | 25 | 34 | 34 | 25 | 34 | 34 | 34 |
| | Number of Business Relocations | 0 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Width of Pavement on I-495 (feet) | 138–146 | 170–174 | 194–198 | 194–198 | 170- 198 | 194–198 | 194–198 | 194–198 |
| | Width of Pavement on I-270 (feet) | 228–256 | 194–198 | 218–222 | 218–222 | 218-222 | 242–248 | 202–206 | 226–230 |
| | Capital Cost Range [Construction & ROW] (billions) | N/A | $7.8–$8.5 | $8.7 – $9.6 | $8.7 – $9.6 | $8.5 - $9.4 | $9.0 – $10.0 | $8.7 - $9.6 | $8.8 - $9.7 |

Notes: [1] Preliminary impacts represented in this table assume total impacts; permanent and temporary impacts will be distinguished in the FEIS.

[2] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

[3] Refer to Chapter 4, Section 4.7 and Appendix G, Volume 1 for additional details on the effects to historic properties.

[4] Based on current design information, effects cannot be fully determined on these seven historic properties. MDOT SHA will evaluate these properties further as design advances.

[5] Noise receptors are noise-sensitive land uses which include residences, schools, places of worship, and parks, among other uses. Note that these numbers include receptors that do not have an existing noise wall as well as receptors that have an existing noise wall which is expected to be replaced.

[6] Previous versions of this table used a similar metric of Annual Average Hours of Savings per Commuter. System-Wide Delay Savings better reflects benefits to all road users.

[7] The right-of-way is based on state records research and filled in with county right-of-way, as necessary. With the Section 4(f) properties, some boundaries vary based on the presence of easements and differences in the size and location of historic and park boundaries.

## 2.7 Common Elements Among the Build Alternatives

The Build Alternatives have many elements that are the same or similar among them. These elements are described in detail in this section including, Interchanges and Managed Lanes Access; Stormwater Management Considerations; Construction and Short-term Effects; Limits of Disturbance; Tolling; Transit-Related Elements; Pedestrian and Bicycle Considerations; and Construction Phasing.

### 2.7.1 Interchanges and Managed Lanes Access

There are 34 existing interchanges within the study limits. For each Build Alternative, all interchanges would be modified as needed to accommodate the mainline widening of I-495 and I-270. The concurrent-flow managed lanes would be separated from the GP lanes by a buffer and delineators and reversible managed lanes would be separated from the GP lanes by concrete barriers as shown in the typical section figures for the Build Alternatives (**Figure 2-5** through **Figure 2-7** and **Figure 2-9** through **Figure 2-11**). Access to/from the managed lanes would be provided via direct access ramps at select existing interchanges (**Figure 2-12**), direct access ramps at two new interchanges, at-grade auxiliary lanes where ingress to the managed lanes from the GP lanes or egress from the managed lanes to the GP lanes would be provided (**Figure 2-13**), and at the end points of the Study. The specific number of lanes and ramp configurations at the I-495 and I-270 interface interchanges and the I-270 Y-split are shown for each Build Alternative in *Chapter 5, Section 3* of the *Alternatives Technical Report* (**Appendix B**).

**Figure 2-12: Example Direct Access Interchange**

The preliminary direct access locations were identified using the following considerations:

- Providing system-to-system connections between major interstates and freeways (e.g., I-495/I-95, I-495/I-270 spurs, I-495/US 50)
- Providing access at interchanges with high traffic demand (e.g., US 29, MD 5)

- Providing access throughout the study area for reasonable access to the managed lanes (e.g., MD 187, Ritchie Marlboro Road)
- Providing access in consideration of land use and at major transit facilities (e.g., Cherrywood Lane at Greenbelt Metro, Pennsy Drive at New Carrollton Metro)
- Potential community, property, and environmental impacts resulting from providing access.

**Figure 2-13: Example At-Grade Access Slip Ramp Configuration**

In total, access to and from the managed lanes is proposed at 27 locations (19 existing interchanges, three new interchanges, and five at-grade locations), as well as at the start of the system along the I-495 inner loop west of MD 5 and southbound I-270 north of I-370. The proposed interchange locations in need of modifications to accommodate the widened mainline and managed lane access locations are listed in **Table 2-4** and shown in **Figure 2-14** and would be the same for all of the Build Alternatives. Refer to *Chapter 5, Section 3* of the *Alternatives Technical Report* (**Appendix B**) for additional details.

**Table 2-4: Proposed Interchange Modifications and Managed Lanes Access Locations[22]**

| Location | Modification |
|---|---|
| Interface with Virginia I-495 HOT Lanes north of Clara Barton Parkway (see location 'G' on **Figure 2-14**) | • Exchange ramps between Virginia and Maryland managed lanes |
| I-495/George Washington Memorial Parkway Interchange (see location 'F' on **Figure 2-14**) | • Managed lanes direct access to managed lanes in Maryland<br>• Adjusted interchange ramps to accommodate widened mainline |

[22] The proposed managed lanes access points are based on preliminary traffic and revenue analyses and agencies' input. The locations may change based on public and agencies' comments on the DEIS and as more detailed analyses are completed, and the Interstate Access Point Approval request is reviewed by FHWA.

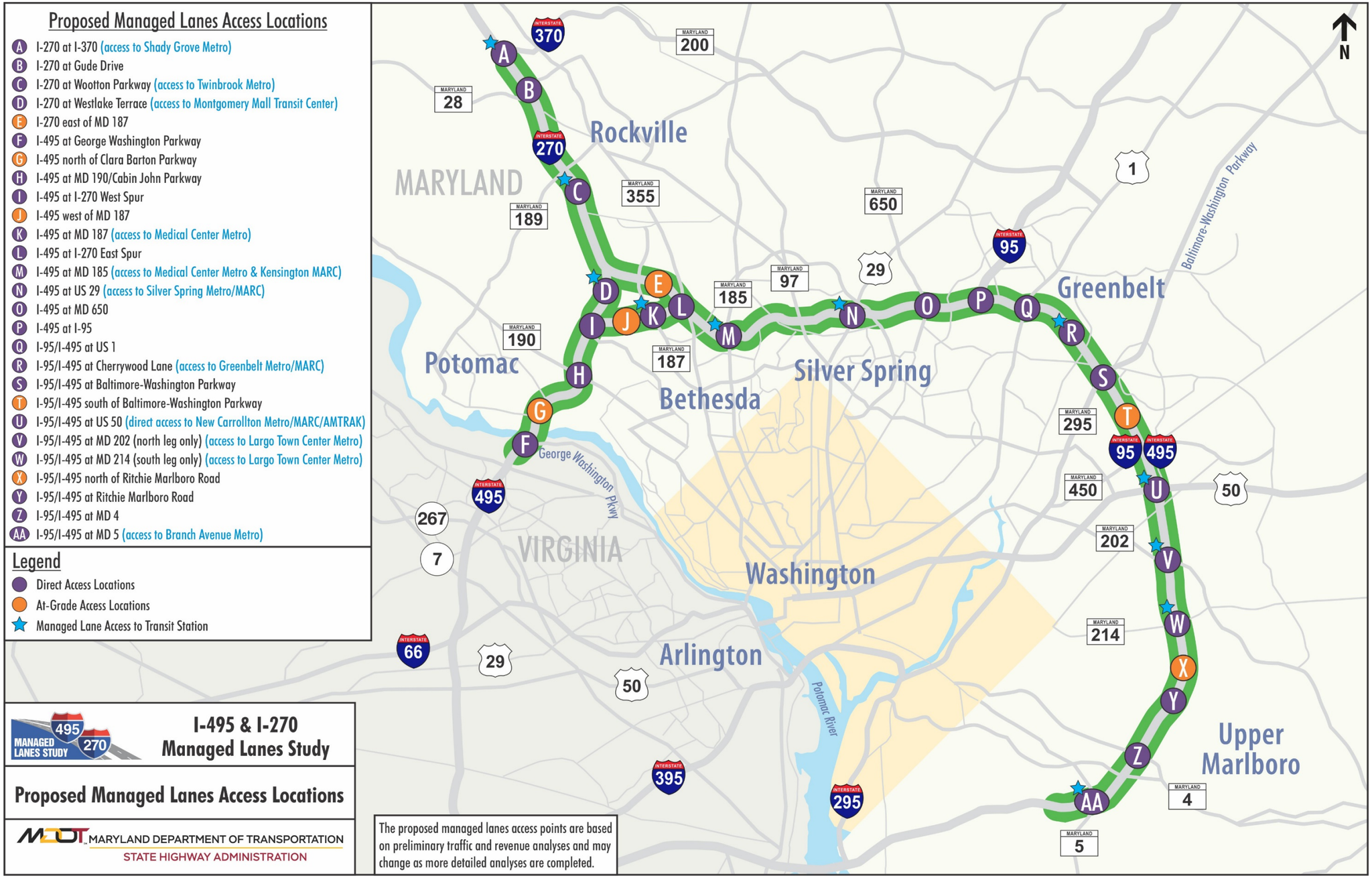
| Location | Modification |
|---|---|
| I-495/MD 190/Cabin John Parkway Interchange (see location 'H' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-495/I-270 West Spur Interchange (see location 'I' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Reconstructed interchange to accommodate managed lanes |
| At-grade auxiliary lanes along I-495 between I-270 West Spur and MD 187[23] (see location 'J' on **Figure 2-14**) | • Managed lanes at-grade access |
| I-495/MD 187 Interchange (see location 'K' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Reconfigured interchange ramps to accommodate widened mainline |
| I-495/I-270 East Spur/MD 355 Interchange (see location 'L' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Reconstructed interchange to accommodate managed lanes |
| I-495/MD 185 Interchange[23] (see location 'M' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-495/MD 97 Interchange | • Reconfigured interchange to accommodate widened mainline |
| I-495/US 29 Interchange (see location 'N' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Reconfigured interchange ramps to accommodate widened mainline |
| I-495/MD 193 Interchange | • Reconfigured interchange to accommodate widened mainline |
| I-495/MD 650 Interchange[23] (see location 'O' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Reconfigured interchange to accommodate widened mainline |
| I-495/ I-95 Interchange (see location 'P' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-495/US 1 Interchange[23] (see location 'Q' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-495/Greenbelt Metro Interchange | • Adjusted interchange ramps to accommodate widened mainline<br>• Added ramps to provide full interchange |
| I-495/Cherrywood Lane Interchange *(new interchange)* (see location 'R' on **Figure 2-14**) | • New interchange for managed lanes direct access only |
| I-495/MD 201 Interchange | • Adjusted interchange ramps to accommodate widened mainline |
| I-495/Baltimore-Washington Parkway Interchange (see location 'S' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| At-grade slip ramps along I-495 between the Baltimore-Washington Parkway and MD 450[23] (see location 'T' on **Figure 2-14**) | • Managed lanes at-grade access |
| I-495/MD 450 Interchange | • Adjusted interchange ramps to accommodate I-495 widened mainline |
| I-495/US 50 Interchange (see location 'U' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-495/MD 202 Interchange[23] (see location 'V' on **Figure 2-14**) | • Managed lanes direct access interchange to/from north only<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-495/Arena Drive Interchange | • Adjusted interchange ramps to accommodate widened mainline |

[23] These locations were not included in the initial identification of proposed managed lane access points and therefore was not included in the traffic, noise, and air quality analyses for the DEIS. The traffic, noise, and air quality analyses will be updated for the FEIS to include this access point.

| Location | Modification |
|---|---|
| I-495/MD 214 Interchange[23] (see location 'W' on **Figure 2-14**) | • Managed lanes direct access interchange to/from south only<br>• Adjusted interchange ramps to accommodate widened mainline |
| At-grade slip ramps along I-495 between MD 214 and Ritchie Marlboro Road[23] (see location 'X' on **Figure 2-14**) | • Managed lanes at-grade access |
| I-495/Ritchie Marlboro Interchange (see location 'Y' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-495/MD 4 Interchange[23] (see location 'Z' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Reconfigured interchange ramps to accommodate widened mainline |
| I-495/MD 337/Suitland Road Interchange | • Adjusted interchange ramps to accommodate widened mainline |
| I-495/MD 5 Interchange (see location 'AA' on **Figure 2-14**) | • Managed lanes direct access interchange<br>• Adjusted interchange ramps to accommodate widened mainline |
| I-270 West Spur/Democracy Boulevard Interchange | • Adjusted interchange ramps to accommodate widened mainline |
| I-270 West Spur/Westlake Terrace Interchange (see location 'D' on **Figure 2-14**) | • Repurposed existing HOV only ramps to/from north to managed lanes direct access ramps<br>• Added managed lanes direct access ramps to/from south |
| I-270 Y-Split Interchange | • Reconstructed interchange to accommodate managed lanes |
| I-270/Montrose Road Interchange[24] | • Adjusted interchange ramps to accommodate widened mainline |
| I-270/Wootton Parkway Interchange *(new interchange)*[23] (see location 'C' on **Figure 2-14**) | • New interchange for managed lanes direct access only |
| I-270/MD 189 Interchange | • Adjusted interchange ramps to accommodate widened mainline |
| I-270/MD 28 Interchange | • Adjusted interchange ramps to accommodate widened mainline |
| I-270/Gude Drive Interchange *(new interchange)* (see location 'B' on **Figure 2-14**) | • New interchange for managed lanes direct access only |
| I-270/Shady Grove Road Interchange | • Adjusted interchange ramps to accommodate widened mainline |
| I-270/I-370 Interchange (see location 'A' on **Figure 2-14**) | • Managed lanes direct access interchange (to/from south only)<br>• Adjusted interchange ramps to accommodate widened mainline |
| At-grade auxiliary lanes along I-270 East Spur north of I-495 [23] (see location 'E' on **Figure 2-14**) | • Managed lanes at-grade access |
| I-270 East Spur/MD 187/Rockledge Drive Interchange | • Adjusted interchange ramps to accommodate widened mainline |

[24] This location was included as a direct access interchange in the initial identification of proposed managed lane access points and was included in the traffic, noise, and air quality analyses for the DEIS. The traffic, noise, and air quality analyses will be updated for the FEIS to reflect changes in access point locations.

Figure 2-14: Proposed Managed Lanes Access Locations



### 2.7.2 Stormwater Management Consideration

#### a. Introduction

A planning-level, conceptual identification of stormwater management (SWM) needs was considered throughout the study corridor when establishing the LODs. The Maryland *Stormwater Management Act of 2007* emphasizes Environmental Site Design (ESD)[25] and consideration of SWM early in the planning stage of a project to better balance transportation needs, right-of-way considerations, and the requirements of the SWM Act of 2007.

The study corridors are extremely developed with numerous natural, cultural, and socioeconomic resources. The existing roadways are generally an open section (i.e., no curb or barrier) with the majority of the cross slopes superelevated. The density of development adjacent to the study corridors, combined with numerous sensitive areas, complicate finding suitable SWM site locations. However, SHA MDOT will assure SWM water quality requirements and treatment will be provided to the maximum extent practicable at on-site locations and, as required under the SWM Act, will improve current conditions.

#### b. Methodology and Assumptions

The 2000 Maryland Stormwater Design Manual (Rev. May 2009) requires all projects to provide Water Quality Volume (WQv), Channel Protection Volume (Cpv), Recharge Volume (Rev), and Overbank Protection Volume or Quantity management (Qp). In addition, the project will need to meet the county requirements within their jurisdiction limits. Montgomery County requires a Qp of 10-year management and Prince George's County requires a Qp of 100-year management. All new impervious area and a minimum of 50 percent of reconstructed impervious area will require treatment. Reconstructed impervious area is defined as existing impervious area that is removed, exposing bare earth, before being repaved or repurposed. In order to calculate both the total new and reconstructed impervious area, the study corridor was divided into sections including the mainline through the interchanges and the mainline between the interchanges. Existing study points (where water leaves the state right-of-way) were identified in each section and field investigated to determine existing conditions. SWM requirements or impervious area requiring treatment were determined for each Build Alternative and preliminary SWM facility locations were identified. An evaluation of potential water quality loss and major culvert crossings was also conducted.

For this analysis, the new impervious area was quantified by assuming all shoulders and 25 percent of the existing lanes would need to be reconstructed. For each Build Alternative, there would be locations where the existing pavement could be removed and a SWM credit considered when an existing interchange was reconfigured that resulted in a ramp removal or relocation. Pavement removal along the mainline was only considered for SWM credit if the width of removal was greater than 10 feet. Some of the areas of potential pavement removal are shown on the *Environmental Resource Mapping* in **Appendix D** (e.g., at the I-495 interchange at US 29 on map 70 of Appendix D).

[25] Title 4, Subtitle 201.1(B) of the Stormwater Management Act of 2007 defines ESD as "...using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources." Under this definition, ESD includes: optimizing conservation of natural features (e.g., drainage patterns, soil, vegetation); minimizing impervious surfaces (e.g., pavement, concrete channels, roofs); slowing down runoff to maintain discharge timing and to increase infiltration and evapotranspiration; or using other nonstructural practices or innovative technologies approved by the Maryland Department of Environment (MDE).

### c. Major Culvert Crossings

All major culverts, defined as culverts 36 inches in diameter or greater with a drainage area greater than 25 acres, were identified and analyzed to determine if the existing culvert crossings needed additional capacity in the proposed conditions. Major culverts were identified by desktop analysis using the MDOT SHA large and small structure database, LiDAR topographic data and one-foot contours, the MDOT SHA National Pollutant Discharge Elimination System (NPDES) database, and the study point field evaluations for this Study.

If an existing culvert crossing needed additional capacity in the proposed conditions, then an auxiliary culvert was proposed to increase the capacity of the culvert crossing. Two sizes of auxiliary culverts were proposed: 48-inch and 60-inch. It was assumed that the auxiliary pipes could be installed using trenchless technologies (installing the culvert underground without disturbing the existing road) so as not to disrupt traffic traveling on the existing road. Existing culverts were extended so that the proposed outfall structure could be tied into the proposed grading limits for each Build Alternative.

### d. Assumed Stormwater Management Provided by Build Alternative

Five types of SWM facilities were identified in the analysis for this Study: quantity ponds, ESD ponds, swales, quantity vaults, and water quality vaults. The proposed, preliminary large surface SWM features are shown on the *Environmental Resource Mapping* (**Appendix D**).

The quantity requirements for each Build Alternative must be met for each drainage section. The ESD requirements must be maximized; however, any deficit within a given drainage segment could be met utilizing compensatory stormwater management within the same watershed as defined by the MDOT SHA Sediment and Stormwater Guidelines and Procedures (SSGP), Section 5.5. Compensatory stormwater management is anticipated to be provided primarily through the use of a project-specific Water Quality Bank which is to be developed through a variety of means including but not limited to the transfer of excess water quality credits from other MDOT programs (e.g. the TMDL program), through offsite stormwater retrofitting or by other means for stormwater pavement removal or generation of water quality credits as provided in applicable sections of the SSGP. **Table 2-5** summarizes the required quantity, provided quantity, ESD surface areas for each Build Alternative and Alternative 5 (for comparison purposes), and the resulting compensatory stormwater management mitigation requirement.

**Table 2-5: Stormwater Management per Build Alternative**

| Build Alternative | Required Quantity surface area (ac) | Provided Quantity surface area (ac) | Required ESD surface area (ac) | Provided ESD surface area (ac) | Impervious Area Requiring Offsite Treatment (ac) |
|---|---|---|---|---|---|
| **5[1]** | 70 | 74 | 245 | 173 | 181 |
| **8/9** | 96 | 101 | 301 | 153 | 372 |
| **9M** | 89 | 94 | 288 | 160 | 321 |
| **10[2]** | 105 | 108 | 319 | 145 | 434 |
| **13B[2]** | 91 | 96 | 288 | 152 | 342 |
| **13C[2]** | 98 | 102 | 305 | 148 | 392 |

Notes: [1] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.
[2] Alternatives 10, 13B and 13C differ only along the I-270 section. The I-495 section is the same for Alternatives 8, 9, 10, 13B, and 13C. Offsite requirements are based on the engineering design as of January 2020.

Due to the large amount of impervious area requiring treatment for each Build Alternative and existing site constraints, ESD could not be met for the Build Alternatives within the study area. Consequently, compensatory stormwater management treatment may be required to offset the ESD deficit, as shown in **Table 2-5**. It is important to consider that the methodology used to determine the conceptual SWM requirements for the Study was based on surface area requirements and was developed to support overall costs and determine right-of-way needs. Several innovative SWM technologies exist that were not considered for this Study. Utilizing these innovative technologies could prove beneficial in reducing the amount of compensatory stormwater management needed to meet the SWM requirements for the Build Alternatives. A detailed SWM analysis will be performed for the Selected Alternative during final design to determine required and provided stormwater management volumes. This more detailed analysis could result in reduced compensatory stormwater management requirements.

### 2.7.3 Construction and Short-term Effects

Any of the Build Alternatives will require extensive construction work within a heavily developed area constrained by existing development and environmental resources. A detailed analysis was completed to assess constructability requirements in the context of existing constraints and to identify appropriate adjustments to the LODs and cost estimates. Incorporation of the results of this constructability analysis allows for a fuller picture of potential project effects. An overview of the analysis is provided below.

#### a. Constructability Considerations

The constructability analysis was based on assumptions and conceptual ideas about construction phasing, methodology, and general sequence of how the work may proceed. These include:

- Construction sequencing to construct the proposed work in a manner that limits the total number of phases and accommodates reasonable and feasible construction methods.
- Maintenance of traffic to maintain the existing number of mainline travel lanes during peak periods, maintain traffic on cross roads, and maintain existing interchange ramp movements. Temporary off-peak lane closures were assumed.
- Construction access and staging to ensure that the LOD allows for storage of construction equipment and materials and construction access to/from the site.
- The ability of regional construction suppliers and contractors to meet the scheduled demand for resources given the scope of this project and the many other large concurrent projects proposed within the region.

#### b. Elements Included in the Constructability Analysis

The constructability analysis included potential approaches to complete the proposed work, including:

- Mainline widening to accommodate the managed lanes.
- Interchange reconstruction to accommodate mainline widening and direct access for the managed lanes, including new or reconstructed bridges and ramp structures within the existing interchange areas.
- Mainline bridges and overpass reconstruction to accommodate the widened mainline.
- Work at challenging locations such as reconstruction of the American Legion Bridge and the bridges over the C&O Canal and Clara Barton Parkway; widening adjacent to Thomas Branch, Rock Creek, and Southwest Branch; and reconstruction of the bridges over Northwest Branch. The

constructability analysis included coordination with the regulatory agencies at the properties or resources under their jurisdiction. This included National Park Service, Maryland-National Capital Park and Planning Commission, United States Army Corps of Engineers, Maryland Department of the Environment, and Maryland Department of Natural Resources.

- Minimization of impacts at residential and commercial properties, Section 4(f) and Section 106 resources, and at all wetlands and waters to the greatest extent practicable.
- Drainage outfall stabilization and cross culvert reconstruction to accommodate roadway drainage, including MD Code 378[26] compliance.
- Minimization of railroad and WMATA Metro line impacts.
- Avoidance and minimization of utility impacts where feasible and accommodation of utility relocations where impacts may be unavoidable.
- Retaining wall construction approaches in cut and fill sections.

The LODs of the Build Alternatives account for areas needed for construction. The assumed areas for construction staging, materials storage, and access needs at specific locations are identified on the *Environmental Resource Mapping* (**Appendix D**). The quantified impacts presented in this DEIS are assumed for the purpose of this analysis to be permanent or long-term effects. As design is advanced on the Preferred Alternative, the long-term effects will be refined and short-term, construction related effects will be quantified and documented in the FEIS. Short-term, construction related work would include construction staging, material and equipment storage, construction easements, and other areas needed to support the construction, but not part of the long-term improvements.

### 2.7.4 Limits of Disturbance

A limit of disturbance (LOD)is the proposed boundary within which all construction, construction access, staging, materials storage, grading, clearing, erosion and sediment control, landscaping, drainage, stormwater management, noise barrier replacement/construction, and related activities would occur. The LOD for each alternative was determined from the proposed roadway typical sections, interchange configuration, and roadside design elements. The LODs were used to calculate the impacts of the Build Alternatives. The LODs for all the Build Alternatives include the following elements:

- On-site stormwater management, including swales, ponds and large facilities along the roadside and within interchanges
- Profile adjustments and roadway shifts for roads that cross over I-495 and I-270 due to mainline widening
- Area assumed for noise barriers
- Area assumed for reconstruction of I-495 and I-270 mainline and interchange ramp bridges over water and roadways
- Full replacement of the American Legion Bridge as further confirmed by the "Capital Beltway

**Is the Replacement of the American Legion Bridge Part of the Managed Lanes Study?**
Yes, all Build Alternatives include the full replacement of the American Legion Bridge with a new, wider bridge on existing alignment (not widening of the existing bridge). The existing bridge is nearly 60 years old and would need to be replaced regardless of this Study. The new bridge would be constructed in phases to maintain the same number of existing lanes at all times, and therefore the new bridge will be replaced in the same existing location.

[26] Plans must be submitted to the local Soil Conservation District for approval and prepared in accordance with MD 378: USDA Natural Resources Conservative Service Maryland Pond Code 378, January 2000.

Accord" announced in November 2019 by Governor Hogan of Maryland and Governor Northam of Virginia[27]
- Area assumed for utility relocations
- Area for interchange ramp relocation, reconfiguration, and tie-ins due to mainline widening
- Avoidance and impact minimization of adjacent land uses such as: streams, wetlands, historic properties, parks, and private properties
- Direct access ramps and at-grade auxiliary lanes for access to the managed lanes.

Refer to *Chapter 5, Section 2* of the *Alternatives Technical Report* (**Appendix B**) for additional details.

### 2.7.5 Tolling

All Build Alternatives include tolling through either HOT lanes or ETLs. This section describes the federal regulations that allow tolling of the interstate; a description of the toll rate ranges and how they would be set; information on toll collection methods and the associated physical impacts; and an explanation of dynamic tolling.

#### a. Federal Legislation

Tolling on federal-aid Highways including interstates is generally prohibited Under Title 23 of the US Code; however; there are two statutes (Title 23 USC Section 129 and Title 23 USC Section 166) that allow for tolling.

- **Title 23, Section 129** provides broad authority for states to implement tolling on Federal-aid highways in conjunction with new construction or other improvements to those highways or interstates, provided the number of toll-free lanes is not reduced and that the State DOT ensures compliance with certain federal requirements governing the use of toll receipts.

  Under this regulation, the Build Alternatives that include the addition of ETLs (Alternatives 8, 10, and 13C) fall within the parameters that would allow implementation of tolls on those new lanes along I-495 and I-270. In these Build Alternatives, the existing HOV lanes along I-270 would continue to operate as free HOV lanes. MDTA would determine the toll pricing structure for the ETLs (see **Section 2.7.5b**).

- **Title 23, Section 166** also grants authority for states to either convert existing HOV lanes or construct new HOV lanes and implement tolling under a HOT Lane approach. In the HOT lanes, vehicles that meet the state-defined minimum number of occupants qualify as HOV-eligible (or qualifying HOVs) and could travel in the HOT lanes for free. In this Study, three or more occupants in a vehicle would qualify as an HOV-eligible vehicle. Available capacity in those lanes that is not used by the HOV-eligible vehicles could be used by vehicles with a lower occupancy level, e.g. vehicles with two occupants or SOV; these vehicles would pay a toll for the ability to use the available capacity. MDTA would determine the toll pricing structure for vehicles subject to a toll.

  Under this statute, the Build Alternatives that include HOT lanes (Alternatives 9, 9M, and 13B) would fall within the parameters that would allow implementation of HOT lanes along I-495 and

[27] http://www.mdot.maryland.gov/News/Releases2019/2019_November_12_Capital_Beltway_Accord_Release.html

conversion of HOV to HOT on I-270, if the definition of MDOT SHA's HOT lanes does not include a toll for defined HOV-eligible vehicles.

Additionally, Section 166 authorizing HOV/HOT conversions requires that certain performance metrics are met such as maintenance of a minimum average travel speed of 45 miles per hour in those lanes consistent with MDOT's goal of improving the flow of traffic through the corridor.

All of the Build Alternatives would include dynamic tolling for the managed lanes (HOT or ETL) for the full length of the Study. It is anticipated that the lanes would be designed, built, and operated by a Developer through a P3 over a yet-to-be-determined period of time. However, the MDOT SHA would continue to own the GP and managed lanes on I-495 and I-270 and ensure the highway meets their intended transportation function.

Tolling the newly constructed managed lanes is the only viable option for funding these congestion management improvements. However, even with tolling, the state lacks the available debt capacity and capital funding necessary to deliver improvements of this magnitude. As such, following a competitive solicitation process, the selected P3 Phase Developer will leverage the anticipated toll funds through a carefully structured project debt and equity approach that will optimize the funding availability to provide the much-needed traffic relief; repave roads and replace bridges; and operate and maintain the managed lanes during the term of the Developer's Agreement.

**b. Toll Rate Ranges**

The toll rate ranges will be set as required by the Code of Maryland Regulations (COMAR) 11.07.05 – Public Notice of Toll Schedule Revisions, including public input. The toll rate range would include an upper limit on the toll rate per mile. At the time of the DEIS publication, it is anticipated that the toll rate range setting process and public hearings could occur in 2021. The following steps summarize the process:

- A traffic and revenue study will be completed to develop a recommended range of toll rates to manage the traffic and ensure the facilities can meet the necessary traffic performance requirements. It is anticipated the toll rate range would be broad enough to suffice for many years.
- The recommended toll rate range will be presented to the MDTA Board Members for review and approval to be released for public comment.
- MDTA will hold a 60-day public comment period that will include public hearings in each county affected by the toll rates.
- The public comments will be summarized for the MDTA Board Members, which could include proposed revisions to the toll rate range.
- The MDTA Board Members will approve the toll rate range that would be used in the managed lanes.
- If the toll rate range is approved through this State-legislated public process by the time the FEIS or ROD are published, the approved toll rate range will be included.
- Once the managed lanes are opened, the toll rates will be adjusted dynamically within the approved MDTA toll rate range to ensure the traffic and lane performance requirements are achieved and comply with operational requirements defined in the Developer Agreement, such as minimum average operating speeds.

- If the toll rate range needs to be modified to maintain the traffic performance requirements, the same process listed above would be followed.

This DEIS does not include a recommendation for the toll rate ranges to be set for users of the managed lanes. Additionally, it is not intended that the FEIS or ROD would stipulate or affect the managed lanes toll rate ranges, as that process is part of COMAR described above. Regardless, it is appropriate for the purposes of this Study to make assumptions about potential toll rates to moderate the traffic and evaluate the financial viability of the Build Alternatives. The toll rates would be established to achieve the following goals:

- Manage traffic demand and congestion on the I-270 and I-495
- Ensure a minimum average operating speed of 45 miles per hour (mph) within the overall managed lanes system
- Ensure maximum volumes are not exceeded in the managed lanes

For planning purposes only and to meet these goals, this Study determined the estimated opening year (2025) average weekday toll rates per mile (in 2020 dollars) per alternative for all time periods for passenger cars paying the electronic toll collection (ETC) class and payment type. The analysis split an average weekday into 13 time periods. Commercial vehicles were considered in the analysis at proportionally higher toll rates relative to their number of axles. It was assumed that ETC would include E-ZPass transponder and video toll collection. Driver sensitivity to different toll rates was estimated by considering several factors including potential travel times on the managed lanes and general purpose lanes, driver's value of time, and travel time reliability. These average daily toll rates were calculated by dividing the total passenger car ETC revenue for all time periods by the total passenger car ETC vehicle miles traveled for all time periods[28]:

- Alternative 8: $0.70/mile
- Alternative 9: $0.69/mile
- Alternative 9M: $0.77/mile
- Alternative 10: $0.68/mile
- Alternative 13B: $0.73/mile
- Alternative 13C: $0.71/mile

As described above, the toll rate ranges will ultimately be set by the MDTA Board after public review and comment; however, it is not anticipated that the environmental and community impacts would be substantially different once this toll rate range is approved because the modeling process for estimating potential planning-level toll rates is similar to the modeling process to support analysis of toll rate ranges that will be presented to MDTA for consideration by the Board.

### c. Toll Collection and Toll Impacts

The tolls would be collected electronically in the managed lanes at highway speeds, with no toll plazas, no toll booths, and no cash payments for all Build Alternatives. Typical methods for electronic toll collection include E-ZPass transponders and video tolling, which are currently utilized on MD 200 and the

[28] Although Alternative 5 was not determined to be a reasonable alternative, the average daily toll rate of $0.97/mile is included in the DEIS for comparison purposes only.

I-95 ETLs north of Baltimore. Video toll collection would allow a vehicle to use the managed lanes without a transponder and receive a Notice of Toll Due in the mail from the MDTA.

A switchable E-ZPass Flex transponder would be required for HOVs in Build Alternatives with HOT lanes. An HOV-eligible user could then use the additional switchable feature to make declarations regarding their HOV status and travel toll-free if they meet the occupancy requirements. The current thinking at the time of the DEIS publication is that vehicles with three or more occupants (HOV 3+) would be eligible for HOV status.

The Virginia Express Lanes on I-495 would merge directly into the Maryland managed lanes and vice versa, and the system operating rules are being determined in collaboration with the Virginia Department of Transportation (VDOT) and FHWA. Based on coordination with VDOT, it is unlikely that the business rules between the VDOT and MDOT managed lane systems will be the same. Exchange ramps are being proposed near the state line to facilitate vehicles entering and exiting the managed lanes between the systems.

While the managed lanes would not include toll plazas or toll barriers, variable message toll signing would be installed to advise motorists of the toll pricing required to manage the traffic. The variable message toll signing will generally be installed within the proposed right-of-way; however, determination of final locations would be completed during final design. Tolls were considered when addressing environmental justice and community impacts. Refer to **Chapter 4, Section 21** of this DEIS for additional details.

#### d. Dynamic Tolling

Once the managed lanes are opened, the toll rates will be adjusted dynamically within the approved toll rate range. They would operate under a dynamic tolling approach where the toll rates would change in response to real-time variations in traffic conditions such as travel speeds, traffic density and traffic volumes. There will be minimum traffic performance requirements associated with these variables, such as maintaining a minimum average operating speed of 45 mph on the managed lanes. The traffic performance requirements would be incorporated into a tolling algorithm and would help to set the toll rates within the approved toll rate range to manage the congestion in the managed lanes. During congested times of the day, the toll rates could change every five to 15 minutes depending on the traffic and algorithm parameters being measured. Through this approach, traffic flow would be managed, congestion would be reduced, and a minimum average operating speed of 45 mph would be maintained in the managed lanes.

The benefits of effective congestion management are:

- Reliable travel times and minimum average operating speeds for persons using the managed lanes (motorists and users of public transit on the facility)
- Improved travel times for persons using the GP lanes adjacent to the managed lanes
- Minimized start-and-stop driving conditions in a congested environment which could result in reduced crash rates
- Minimization of environmental and social impacts associated with congestion

### 2.7.6 Transit-Related Elements

The Study is addressing transit-related elements by providing access/connectivity and enhancing mobility for transit vehicles and passengers. Additionally, MDOT SHA's I-495 & I-270 P3 Program Office will address the State BPW conditions for regional transit service improvements as described below and has prepared the Transit Service Coordination Report as the initial product from the I-495 & I-270 Managed Lanes Transit Work Group to assist affected counties and transit providers in prioritizing capital and operating investments.

**a. Enhanced Transit Mobility and Connectivity**

A key element of this Study's Purpose and Need includes enhancing existing and planned multimodal mobility and connectivity. In furtherance of this key consideration and to address public and agency comments received to-date, MDOT SHA has identified opportunities to enhance transit mobility and connectivity within the Build Alternatives. These include the following elements:

- Allowing bus transit usage of the managed lanes for free to provide an increase in speed of travel, assurance of a reliable trip, and connection to local bus service/systems on arterials that directly connect to activity and economic centers.
- Accommodating direct and indirect connections from the proposed managed lanes to existing transit stations and planned Transit Oriented Development at the Shady Grove Metro (I-370), Twinbrook Metro (Wootton Parkway), Montgomery Mall Transit Center (Westlake Terrace), Medical Center Metro (MD 187 and MD 185), Kensington MARC (MD 185), Silver Spring Metro and MARC (US 29), Greenbelt Metro and MARC (Cherrywood Lane), New Carrollton Metro, MARC, and Amtrak (US 50), Largo Town Center Metro (MD 202 and MD 214), and Branch Avenue Metro (MD 5).

**Will Transit Riders Benefit from Managed Lanes?**

Yes, transit riders and transit service will experience the following benefits:

- Buses and transit riders using these highways will have reduced travel times because buses can use the Managed Lanes.
- Enhanced transit mobility and connectivity to existing and planned transit facilities.
- Improved highway system will provide less-congested and more reliable routes for bus service.
- Direct and indirect access to existing transit stations and transit-oriented developments will be included at Greenbelt, New Carrollton, Branch Avenue, Silver Spring, and Shady Grove Metro stations, among others.
- Provides opportunities for planned or modified bus service to connect to underserved suburban to suburban transit markets.
- Provides opportunities for new express bus service in National Capital Region, such as between Bethesda and Tysons.

MDOT SHA is also committed to working with WMATA to consider the results of the Washington Area Bus Transformation Study. A Strategy and Action Plan[29] was developed in December 2019 and outlines 26 recommendations with a clear approach to implementing the recommendations. While the planning phase of the Bus Transformation Study is complete, initial results of a public survey[30] conducted between September and November 2018 identified several barriers to bus ridership, including:

- Doesn't come frequently enough
- Too slow

[29] https://bustransformationproject.com/wp-content/uploads/2019/12/Action-Plan-2019-12-06-SECURE.pdf?x27033

[30] https://bustransformationproject.com/resources/public-survey-results/

- Doesn't go where I need to go
- No direct service/I would have to transfer
- Doesn't run at the hours I need to use it
- Doesn't reliably get me to my destination on time.

The opportunity to use the proposed managed lanes, for any of the Build Alternatives, could address some or all of these identified barriers.

**b. State BPW & Regional Transit Services**

On June 5, 2019, the BPW took its first action with respect to the use of a P3 for delivery of the project. Subsequently, on January 8, 2020, the BPW approved an Amendment to the initial approval, which states:

*"The Reporting Agencies (MDOT SHA) will develop memoranda of understanding with the affected Counties defining regional transit service improvements to be provided as part of the P3 Agreements. Terms of the agreements will be provided to the BPW concurrently with the P3 Agreements. Furthermore, the Reporting Agencies will develop the transit service improvements collaboratively with the affected Counties.*

*Specific transit investment will be provided as part of the P3 agreements. This will ensure these regional transit service improvements are provided at defined and predictable times. By including the regional transit service improvements in the P3 agreements, the affected Counties will be guaranteed the transit service improvements. This approach will fully honor the BPW request from June 5, 2019. The memoranda of understanding between MDOT and the affected Counties defining transit service improvements to be developed as part of the P3 Agreements will be provided to the BPW as part of the request for approval of the P3 Agreements to clearly show that the Reporting Agencies have complied with this BPW condition."*

**c. Transit Work Group and Transit Service Coordination Report**

The MDOT Secretary convened the I-495 & I-270 Managed Lanes Transit Work Group in May 2019 to seek input on existing transit services and help identify feasible opportunities for transit to use the managed lanes. Eight meetings were held with transit and planning representatives who were both directly and indirectly affected by the P3 Program, including Montgomery, Prince George's, Frederick, Howard, Anne Arundel and Charles counties, as well as MDOT MTA commuter bus and MARC and WMATA, MDOT Secretary's Office of Planning and Capital Programming, MDOT SHA, FHWA, Federal Transit Administration (FTA) and the MWCOG.

The Transit Service Coordination Report is the result of coordination between MDOT, local governments, and the transit providers through the I-495 & I-270 Managed Lanes Transit Work Group. The purpose of the report was to inform the development of the I-495 & I-270 P3 Program and assist the affected counties and transit providers in prioritizing capital and operating investments. The report was made available to the public in June 2020 on the P3 Program website (https://495-270-p3.com/transit-benefits/) and it summarizes the following work efforts:

- Analyzing existing and potential transit markets
- Suggesting short-term review of existing transit services to maximize benefits
- Identifying where long-term transit service options may be feasible

- Identifying key managed lane access points beneficial to transit
- Analyzing existing and potential carpool and vanpool markets and strategies
- Documenting Maryland's investment in transit throughout the service corridor

The report is being used to inform affected counties and transit providers about the significant transit opportunities offered by managed lanes such as strategies to maximize the benefits of reliability and speed; provide a basis for the evaluation and prioritization of future capital and operating needs in the service area; and initiate discussions about ways to incorporate regional transit services into the P3 Program. The options considered were broad, and in many cases a significant investment would be needed to implement them. Further discussion will be held to establish priorities, identify and develop specific regional transit service improvements to be considered as part of the memorandum of understandings, and determine appropriate long-term funding strategies.

### 2.7.7 Pedestrian and Bicycle Considerations

Existing sidewalks, shared use paths, bikeable shoulders, and bikeways impacted by the proposed improvements and widening would be replaced in kind. Many such facilities exist along cross roads or as separate facilities that cross over or under I-495 and I-270. Coordination with the local agencies having jurisdiction over these facilities, including identification of master planned facilities for potential inclusion in the concept design for this Study, is ongoing. As part of the "Capital Beltway Accord"[27], the new American Legion Bridge would include new pedestrian and bicycle access to connect trails on both side of the Potomac River. The proposed improvements are anticipated to include a shared use path along the south side of the American Legion Bridge with a potential connection to the C&O Canal, pending further discussions with the National Park Service. The path could connect to the planned Fairfax County trail system and the Montgomery County Master Plan system. Additional new facilities or upgrades may be provided along the corridor in accordance with MDOT SHA or local agency design requirements as further coordination efforts occur.

### 2.7.8 Construction Phasing

This Study is the first element of the broader I-495 & I-270 P3 Program. The alternatives that are described in this chapter of the DEIS are focused on addressing the transportation needs within the 48-mile study limits only.

Due to the magnitude of the Study, MDOT SHA intends to construct the improvements in phases, if a Build Alternative is selected. Per the State Board of Public Works (BPW) and as further defined in MDOT SHA's February 7, 2020 Request for Qualifications (RFQ), Phase 1 of the P3 Program would include selection of a developer for improvements to I-495 from the vicinity of the George Washington Memorial Parkway in Virginia, across and including the American Legion Bridge, to its interchange with I-270 at the West Spur and I-270 from its interchange with I-495 to its interchange with I-70. The length of I-270 from I-370 to I-70, which would be advanced through a separate, independent NEPA study. In the event that HOT or ETL managed lanes are not part of the Preferred Alternative in the Study FEIS or the Selected Alternative in the ROD, the solicitation for Phase 1 will not proceed.

Under a P3 agreement, Phase 1 would be developed and delivered by a Phase Developer that will be selected based on the competitive solicitation process initiated by the RFQ. The southern portion of Phase 1 from I-495 in the vicinity of the George Washington Memorial Parkway to I-270 and I-270 from I-495 to

I-370 shall be developed and delivered first. An environmental decision document under the NEPA will be approved before final design and construction will commence on any portion of Phase 1. This is in addition to any future BPW approvals necessary.

The Phase 1 P3 Agreement would govern the Predevelopment Work for Phase 1 including, but not limited to, items such as preliminary engineering design to reduce impacts and reduce risks; sequencing and scheduling for Phase 1 sections; preparing congestion pricing scenarios; and evaluating debt financing arrangements. The final design and engineering would be completed after the Phase 1 P3 Agreement is approved by the BPW and after the ROD.

Additional improvements will proceed as expeditiously as possible through subsequent P3 solicitation(s).

## 2.8 Financial Viability

The financial analysis completed for all the Build Alternatives to assess the potential of each to be financially self-sufficient was updated in January 2020. This analysis considered multiple factors including: preliminary capital costs (a high and low range of ±5 percent of the base cost), initial revenue projections, preliminary operations and maintenance costs, and the likely methods for how construction phases would be financed. The key input of interest rates considered a high and low range of ±0.50 percent from the base assumptions. The estimated results for each Build Alternative are summarized below[31] and in **Table 2-6**.

- Alternative 8 cashflow estimates indicate a more positive financial self-sufficient position (requiring no public subsidy) than several other Build Alternatives. Results for the baseline scenario indicated positive excess cashflows of approximately $833 million. Under a lower construction price and lower interest rate scenario, the positive cashflows would be estimated at $2,627 million. Conversely, a higher construction cost and higher interest rate scenario would result in a negative cashflow estimate where the state may be required to provide a subsidy of approximately $584 million.
- Alternative 9 cashflow estimates indicate that it would be the most likely to be financially self-sufficient. In the baseline scenario, positive excess cashflows would be approximately $960 million. Under a lower construction price and lower interest rate scenario, the positive cashflows would be estimated at $2,762 million. Conversely, a higher construction cost and higher interest rate scenario would result in a negative cashflow estimate where the State may be required to provide a subsidy of approximately $482 million (lowest of the potential subsidies estimated from the financial analysis).
- Alternative 9M cashflow estimates would be less likely to be financially self-sufficient than Alternatives 8, 9, and 10 with lower overall revenue potential. In the base case scenario, positive excess cashflows would be approximately $459 million. Under a lower construction price and lower interest rate scenario, the positive excess cashflows would be estimated at $2,190 million, compared to the result for a higher construction price and higher interest rate scenario which

[31] Although Alternative 5 was not determined to be a reasonable alternative, the cashflow estimates are included in the DEIS for comparison purposes. Alternative 5 cashflows would be less likely to be financially self-sufficient than Alternatives 8, 9, 10, and 13C. Results for the baseline scenario indicated positive excess cashflows of approximately $226 million. Under a lower construction price and lower interest rate scenario, the positive cashflows would be estimated at $1,799 million. Conversely, a higher construction cost and higher interest rate scenario would result in a negative cashflow estimate where the state may be required to provide a subsidy of approximately $907 million.

indicate negative cashflows where the State may be required to provide a subsidy of approximately $827 million.

- Alternative 10 cashflow estimates indicate a more positive financial self-sufficient position requiring no public subsidy than several other Build Alternatives. Results for the baseline scenario indicated positive excess cashflows of approximately $866 million. Under a lower construction price and lower interest rate scenario, the positive cashflows would be estimated at $2,711 million. Conversely, a higher construction cost and higher interest rate scenario would result in a negative cashflow estimate where the state may be required to provide a subsidy of approximately $604 million.
- Alternative 13B cashflow estimates indicate that it would be the least likely to be financially self-sufficient among the Build Alternatives. Results for the baseline scenario indicated positive excess cashflows of approximately $196 million. Under a lower construction price and lower interest rate scenario, the positive cashflows would be estimated at $1,907 million. Conversely, a higher construction cost and higher interest rate scenario would result in a negative cashflow estimate where the state may be required to provide a subsidy of approximately $1,088.
- Alternative 13C cashflow estimates would be less likely to be financially self-sufficient than Alternatives 8, 9, and 10. In the base case scenario, positive excess cashflows would be approximately $328 million. Under a lower construction price and lower interest rate scenario, the positive excess cashflows would be estimated at $2,065 million, compared to the result for a higher construction price and higher interest rate scenario which indicate negative cashflows where the State may be required to provide a subsidy of approximately $998 million.

If a state subsidy is required, it would typically be paid to the developer at the beginning of the contract, whereas if positive excess cashflows are anticipated, they could be paid to the State at the beginning of the contract and/or as revenue sharing payments to the State during the operation of the facility.

**Table 2-6: Estimated Cashflows for Build Alternatives**

| Build Alternative | Cash Flow (in millions) | | |
|---|---|---|---|
| | Low Capital Cost & Low Interest Rate | Mid Capital Cost & Mid Interest Rate | High Capital Cost & High Interest Rate |
| **Alternative 8** | $2,627 | $833 | - $584 |
| **Alternative 9** | $2,762 | $960 | - $482 |
| **Alternative 9M** | $2,190 | $459 | - $827 |
| **Alternative 10** | $2,711 | $866 | - $604 |
| **Alternative 13B** | $1,907 | $196 | - $1,088 |
| **Alternative 13C** | $2,065 | $328 | - $998 |

Notes:

1. The results summarized in this table must be considered in the context presented in DEIS Section 2.8 Financial Viability.
2. The analysis is preliminary because the value of numerous input assumptions used to compute the financial viability of the Build Alternatives could change. A consistent methodology was used to estimate the revenue and consistent financial assumptions were used for all Build Alternatives summarized herein.
3. This analysis considered multiple factors including estimates of: preliminary capital costs (a high and low range of ±5 percent of the base cost), initial revenue projections, preliminary operations and maintenance costs, and the likely methods for how construction phases would be financed.
4. The key input of interest rates considered a high and low range of ±0.50 percent from the base assumptions.
5. Refer to *Chapter 6, Section 2.3* of the *Alternatives Technical Report* (**Appendix B**) for additional information.

The financial analysis is preliminary because the value of numerous input assumptions used to compute the financial viability of the Build Alternatives could change. Key input factors include capital costs, operations and maintenance costs, revenue forecasts, and financing assumptions. However, if any of the inputs change, it is anticipated that the result of the financial analyses would change in a consistent direction for all Build Alternatives. For example, capital costs for all alternatives would generally go up or down proportionally since the same baseline assumptions were used to develop the capital costs. Similarly, a consistent methodology was used to estimate the revenue and consistent financial assumptions were used for all Build Alternatives. Therefore, any changes in the inputs (i.e., interest rates) would be expected to result in a similar comparative difference between the alternatives. The conclusion is that the financial analysis results would likely indicate that Alternative 9 would be the most financially viable. Refer to *Chapter 6, Section 2.3* of the *Alternatives Technical Report* (**Appendix B**) for additional information.