3 TRANSPORTATION AND TRAFFIC

3.1 Introduction

As noted in **Chapter 1**, any proposed action resulting from the Managed Lanes Study (Study) must accommodate existing traffic and long-term traffic growth on I-495 and I-270. In order to properly evaluate how each of the Build Alternatives would address these traffic challenges, it is important to understand the current and projected traffic demands on the transportation network along the study corridors and the surrounding area. This chapter summarizes the Study's traffic analysis methodology and presents an overview of the results from the traffic operational analyses conducted for each of the Build Alternatives and Alternative 5 (for comparison purposes). For additional details, refer to the *Traffic Analysis Technical Report* (**Appendix C**).

The information presented in this chapter was used to help evaluate the Screened and Build Alternatives. Traffic data and findings developed as part of this Study were also used as inputs in the air quality and noise analyses. For additional details on air and noise analyses, refer to **Chapter 4, Section 4.8,** and **Section 4.9**, the *Air Quality Technical Report* (**Appendix I**), and the *Noise Technical Report* (**Appendix J**).

3.1.1 Traffic Analysis Data Collection and Modeling Methodology

To establish baseline conditions, traffic volume and speed data was collected throughout the study corridors. Recent traffic count data was obtained from MDOT SHA's Internet Traffic Monitoring System (I-TMS) and used to determine average daily traffic (ADT) volumes and peak period traffic demands throughout the study corridors for the baseline year of 2017. Hourly speed data along the study corridors was collected from probe data from the Regional Integrated Transportation Information System (RITIS) platform developed by the University of Maryland's Center for Advanced Transportation Technology (CATT) lab. The traffic volume data was input into a VISSIM traffic simulation model and the model was calibrated to match existing speed data within MDOT SHA thresholds. This calibrated model of existing conditions was used as a baseline for future modeling.

MDOT SHA summarizes statewide congestion trends in its annual Maryland State Highway Mobility Report[1]. Congestion patterns within the study corridors were reviewed based on the data from this report, including key parameters of Travel Time Index (TTI) and Planning Time Index (PTI) to identify the poorest performing segments within the study corridors and the most unreliable segments in need of improvements. The volume, speed, and congestion data were used to assist in identifying elements of the Study's Purpose and Need.

Detailed traffic operational analyses were performed for each of the Build Alternatives to evaluate their ability to meet the Study's Purpose and Need in the design year of 2040. The evaluation methodology included a three-step process:

1. First, a regional forecasting model was developed for each of the Build Alternatives. using the Metropolitan Washington Council of Governments Travel Demand Model (MWCOG model), which is the model typically used by MDOT SHA and other transportation agencies to evaluate projects in the Washington, DC metro area. MDOT SHA used the MWCOG model Version 2.3.71, which was a model specifically developed by MWCOG for modeling this Study's alternatives. The prior version of the model, Version 2.3.70 (November 2017), was the most recently adopted model used in the regional air quality conformity analysis, when the traffic modeling for the Study was initiated. Model Version 2.3.71 used for this study included

[1] The latest published version at the time the DEIS was prepared was the *2018 Maryland State Highway Mobility Report*.

revisions to Version 2.3.70 developed by MWCOG to better represent dynamically-priced lanes, but otherwise includes the same base data.

2. Next, the outputs from the MWCOG model were used to develop traffic volume projections for the design year of 2040 for each roadway segment and ramp movement within the study limits for each of the Screened Alternatives during the peak periods. For Alternative 9M, which is a hybrid of Alternative 5 and Alternative 9 that was not one of the original Screened Alternatives, the forecasts were developed using the results from Alternative 5 and Alternative 9 as a base. For additional details, refer to the document titled "Alternative 9 Modified Preliminary Evaluation Memorandum" included in *Appendix B* of the *Alternatives Technical Report* (**Appendix B**).
3. Finally, traffic simulation models for each of the Build Alternatives were developed using VISSIM software to determine the projected operational performance in several key metrics during the AM peak period (6:00 AM to 10:00 AM) and the PM peak period (3:00 PM to 7:00 PM). The metrics were selected to evaluate the effectiveness of each of the Build Alternatives to efficiently move people through the region and to provide benefits to the transportation system.

3.1.2 Traffic Analysis Area

The traffic analysis area for the Study extended beyond the study limits to capture upstream and downstream effects. The VISSIM simulation models prepared for the Study were extended to the following limits (as shown in **Figure 3-1**):

- I-495 from VA 193 in Virginia across the American Legion Bridge and through the state of Maryland around to the Woodrow Wilson Bridge
- I-270 from the I-70 ramp merges to I-495, including the East and West Spurs

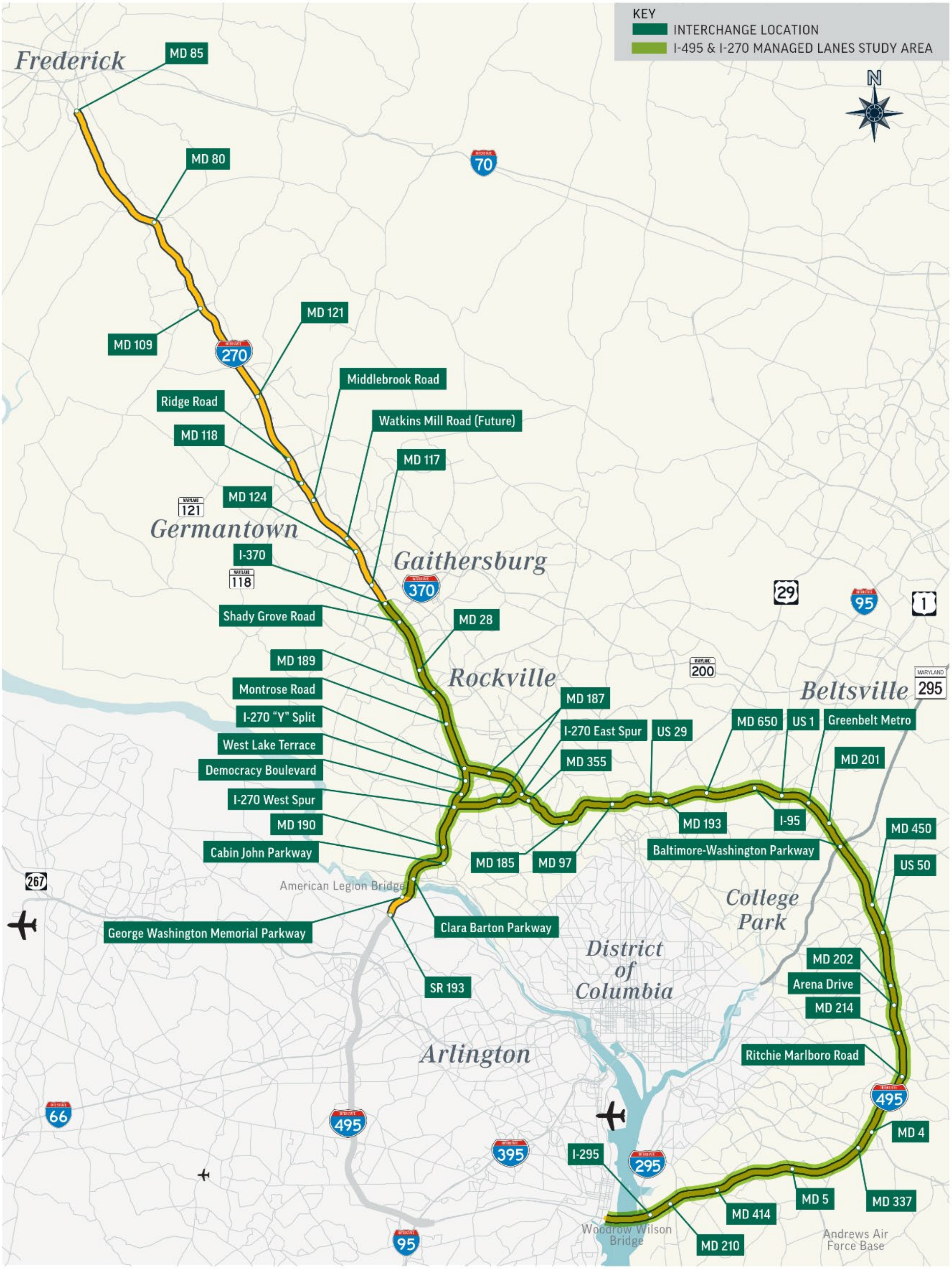
Additionally, the MWCOG model used to develop volume projections for the Study covered the entire National Capital Region of surrounding roadways in 22 jurisdictions, including Montgomery County, Prince George's County, and Frederick County in Maryland, as well as Arlington County and Fairfax County in Virginia, and the District of Columbia.

3.1.3 Traffic Modeling Assumptions

The design year used to evaluate the Build Alternatives in this Draft Environmental Impact Statement (DEIS) is 2040. MDOT SHA assumed a design year of 2040 for all traffic analysis in this document because the latest approved regional forecasting model from MWCOG was for the year 2040 when the Study was initiated. The 2040 forecasts were used to compare alternatives and determine which alternatives would be expected to provide the best operational benefit to meet the Study's Purpose and Need.

In October 2018, a new version of the MWCOG model was approved and released that projected traffic demand out to the year 2045. During development of this DEIS, a sensitivity analysis comparing the 2040 forecasts to the 2045 forecasts was completed and the results are summarized in *Appendix J* of the *Traffic Analysis Technical Report* (**Appendix C**). The sensitivity analysis concluded that the differences in forecast volumes between 2040 and 2045 would be consistent amongst the Build Alternatives, and therefore would not significantly alter the comparison of alternatives presented in this document. The Final EIS (FEIS) will include updated operational analyses for a Preferred Alternative that reflects a design year of 2045 to evaluate how that Alternative would meet the Purpose and Need based on the latest MWCOG model.

Figure 3-1: Limits of VISSIM Model Network and Interchange Locations Included along I-495 and I-270



The traffic projections from the MWCOG model applied traditional forecasting techniques, which do not explicitly account for connected and autonomous vehicles (CAVs). For more information regarding the impact of CAVs on the Study (refer to the *Traffic Analysis Technical Report* (**Appendix C, Section 4.1**)).

The analysis for the design year assumed the completion of several background projects that are included in the region's Constrained Long-Range Plan (CLRP). The impacts of these background projects were assumed as part of the baseline conditions for the design year 2040 No Build condition (Alternative 1), for evaluating all Build Alternatives and Alternative 5 (for comparison purposes). The following roadway projects of regional significance were assumed to be in place in the year 2040 for the purposes of this Study:

- I-270 Innovative Congestion Management (ICM) Improvements
- VDOT I-495 Express Lanes Northern Extension (495 NEXT)
- I-270 at Watkins Mill Road Interchange
- Greenbelt Metro Station Access Improvements

Additionally, the benefits of the following proposed transit projects on the traffic demands for the roadway network within the study corridors are accounted for in the modeling:

- Purple Line Light Rail
- Corridor Cities Transitway (CCT)
- US 29 Bus Rapid Transit (BRT)
- Randolph Road BRT
- North Bethesda Transitway

Were Connected and Automated Vehicles (CAVs) Considered?

Yes, CAVs are an important consideration for all future transportation projects. However, there are currently many unknowns regarding how CAVs will affect traffic:

- Adding CAVs to the traffic stream will likely increase capacity, but the magnitude of the increase is unclear at this time.
- The benefits of more vehicles per lane may be offset by an increased demand in auto trips. This could include trips by people that cannot afford a car but would pay for "mobility as a service" or "deadhead" trips – autonomous vehicles with no passengers traveling empty to their next stop.
- CAVs could impact land use policy by encouraging growth further from urban areas.

Due to these unknowns, it is prudent to use traditional forecasting techniques for current studies, while being cognizant of potential CAV impacts in the future.

Managed lanes work well with CAVs. The managed lanes provide physical separation, new pavement, and clear delineation, which gives CAVs the opportunity to connect with each other, form platoons, and maximize efficiency by operating in a more controlled environment.

Potential roadway or transit improvements on I-270 from north of I-370 to I-70 were not included as part of this Study, as alternatives are currently being developed as part of a separate I-270 Pre-NEPA effort (https://495-270-p3.com/i270-environmental/).

Each of the Build Alternatives studied as part of the traffic analysis for this DEIS included managed lanes. The managed lanes were assumed to be buffer-separated with a physical delineation from the adjacent general purpose (GP) lanes, with access provided via direct connections at key locations. The direct access locations have evolved throughout the Study based on input from the stakeholders and design modifications to avoid or minimize impacts to sensitive resources, while still meeting Purpose and Need (refer to **Chapter 2, Section 2.7.1**).

The operational analysis results presented in this DEIS assume direct access would be provided at the following locations:

- Twelve (12) Interchanges on I-495:
  - George Washington Memorial Parkway
  - Cabin John Parkway / MD 190
  - I-270 West Spur
  - MD 187
  - I-270 East Spur
  - US 29
  - I-95
  - Cherrywood Lane
  - Baltimore-Washington Parkway
  - US 50
  - Ritchie Marlboro Road
  - MD 5
- Four (4) Interchanges on I-270:
  - Westlake Terrace (to and from the north only)
  - Montrose Road
  - Gude Drive (to and from the south only)
  - I-370
- One (1) Set of At-Grade Slip Ramps: North of Clara Barton Parkway

The current design for each of the Build Alternatives (shown in **Appendix D**) include some modifications to the direct access locations and additional direct access locations that were selected after the operational analyses were completed. The latest set of direct access locations, listed in **Chapter 2, Table 2-4** used to determine the limit of disturbance (LOD) for the environmental evaluation in this DEIS. All changes to direct access locations during the Study were applied consistently across all Build Alternatives. Therefore, any changes to direct access assumptions would not result in a relative change in overall operational benefits when comparing alternatives. However, operational analysis of the Preferred Alternative will be updated in the FEIS to reflect the latest direct access assumptions for consistency.

The final toll policies and toll rate ranges for the proposed managed lanes have not yet been determined, but they will be defined following Maryland's legal requirements and include public hearings as described in **Chapter 2, Section 2.7.5**. The managed lanes would operate under a dynamic tolling approach where the toll rates would change in response to real-time variations in traffic conditions. For the purposes of the analysis in the DEIS, the volume in the managed lanes would be set to maintain a minimum average operating speed of at least 45 mph and not exceed 1,600 to 1,700 vehicles per hour per lane in the highest demand section of the managed lanes. The remaining portion of demand for each freeway section would be in the GP lanes. For planning purposes only, the dynamically priced toll rates were retained from the initial MWCOG model runs, as shown in the *Traffic Analysis Technical Report* (**Appendix C**). The dynamic toll rates used by MWCOG for travel demand modeling were developed as "per mile" rates based on an iterative process for each alternative and ranged from $0.20 to $1.36 per mile (in 2016 dollars). The iterative process was designed to estimate appropriate toll values to control the volume of traffic using the managed lanes through a combination of volume to capacity ratios and maintaining a minimum operating speed at or near free-flow conditions. The toll rates produced as part of this MWCOG modeling process were developed by MWCOG staff. MDOT SHA did not perform this step for traffic forecasting and traffic analysis purposes, because the estimated toll values for future-year networks were provided by MWCOG when the model was transmitted to MDOT SHA.

3.2 Existing Conditions

The study limits include many of the most heavily traveled, most congested, and most unreliable roadway segments in Maryland[2]. According to the *2018 Maryland State Highway Mobility Report*, the top three

[2] Segments as defined by *2018 Maryland State Highway Mobility Report*

highest volume roadway sections in Maryland based on average daily traffic (ADT) are contained within the study limits. These locations include I-270 from the I-270 Split to MD 117, I-495 from the I-270 East Spur to I-95, and I-495 from the Virginia State Line to the I-270 West Spur. **Table 3-1** shows the existing (year 2017) ADT for each segment within the study area, which reflects total traffic in both directions.

Table 3-1: Existing Average Daily Traffic (ADT)

Corridor	Segment	Existing Volumes (2017)
I-270 (both directions)	I-370 to MD 28	226,000
	MD 28 to I-270 Spur	259,000
I-495 (both directions)	at American Legion Bridge	243,000
	MD 190 to I-270 Spur	253,000
	Between I-270 Spurs	119,000
	MD 355 to I-95	235,000
	I-95 to US 50	230,000
	US 50 to MD 214	235,000
	MD 214 to MD 4	221,000
	MD 4 to MD 5	198,000

Due to the heavy traffic volumes and insufficient roadway capacity, recurring congestion is prevalent throughout the study corridors under existing conditions. Average speeds during the peak hours drop below 20 mph on I-270 southbound in the morning and on I-270 northbound during the afternoon. On I-495, average speeds are less than 10 mph along the Outer Loop between I-95 and MD 193 during the morning rush hour and approaching the American Legion Bridge during the afternoon peak period. On the I-495 Inner Loop, the average speed from Virginia 193 across the American Legion Bridge through the top side of I-495, and east of I-95 to the MD 214 interchange (a distance of 29 miles) is less than 25 mph throughout the afternoon peak period, with several segments operating at less than 10 mph.

One of the primary measures of congestion on freeways is the Travel Time Index (TTI), which is defined as the ratio of the average (50th percentile) travel time during a particular hour to the travel time during free-flow or uncongested conditions. MDOT SHA defines "congestion" as any roadway segment with a TTI value greater than 1.15, while "severe congestion" is reached when TTI values exceed 2.0. On I-495, the average TTI (in both directions) exceeds 1.15 for 10 hours of the day each weekday (6:00 AM to 10:00 AM and 2:00 PM to 8:00 PM). During those 10 hours, severe congestion (TTI greater than 2.0) is also experienced in at least one segment of I-495. On I-270, the average TTI exceeds 1.15 for more than 7 hours each weekday (6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM). During eight hours each weekday, at least one segment on I-270 experiences severe congestion (TTI greater than 2.0).

The study corridors also include many unreliable segments due to instability and non-recurring congestion caused by incidents, weather, and lane reductions from crashes and work zones. Roadway users have certain expectations of predictability of travel time when they make their trip. When there is a lot of variability in travel time on a given corridor, the highway system is considered unreliable. Trip reliability impacts automobiles, trucks, and buses, and it is critical for transit and freight operations. The measure that MDOT SHA uses to evaluate trip reliability is the Planning Time Index (PTI). PTI is calculated as the ratio of the 95th percentile travel time for a section of roadway compared to the free-flow travel time. Roadway segments with a PTI of less than 1.5 are considered reliable, while segments with a PTI value between 1.5 and 2.5 are considered moderately unreliable, and segments with a PTI value greater than 2.5 are considered highly unreliable.

According to the *2018 Maryland State Highway Mobility Report*, the top three most unreliable segments in Maryland during the AM peak period are all located within the Study limits: I-495 Outer Loop at MD 650, I-495 Outer Loop from MD 650 to MD 193, and I-495 Outer Loop from I-95 to the Prince George's County Line. Additionally, the most unreliable segment in Maryland during the PM peak period is also within the Study limits: I-270 Southbound from the I-270 Split to Democracy Boulevard.

3.3 Future Traffic Conditions and Alternatives Analysis

Traffic volumes throughout the study corridors are projected to continue to grow over the next 20 to 25 years due to expected increases in population and employment in the Washington, DC metropolitan region. **Table 3-2** shows the projected design year 2040 ADT for each segment along I-495 and I-270 within the study limits under the No Build condition, as well as the percent increase in daily traffic volumes. Despite many segments already operating at or near capacity, daily traffic volumes on I-270 and I-495 are projected to increase by 7 to 17 percent between now and the design year 2040 under the No Build condition.

Table 3-2: 2040 No Build Average Daily Traffic (ADT)

Corridor	Segment	Existing (2017)	No Build (2040)	Percent Increase
I-270	I-370 to MD 28	226,000	265,000	17%
	MD 28 to I-270 Spur	259,000	299,000	15%
I-495	at American Legion Bridge	243,000	277,000	14%
	MD 190 to I-270 Spur	253,000	282,000	11%
	Between I-270 Spurs	119,000	127,000	7%
	MD 355 to I-95	235,000	252,000	7%
	I-95 to US 50	230,000	245,000	7%
	US 50 to MD 214	235,000	252,000	7%
	MD 214 to MD 4	221,000	244,000	10%
	MD 4 to MD 5	198,000	218,000	10%

For future traffic conditions, each of the Build Alternatives (and Alternative 5 for comparison purposes) was evaluated and compared to the No Build condition for several key operational metrics, including speed, delay, travel time, level of service, throughput, and the effect on the local network. The results were obtained from the MWCOG model and the VISSIM traffic simulation models and are summarized in the following sections. Additional details are provided in the *Traffic Analysis Technical Report* (**Appendix C**). **Table 3-3** shows the projected design year 2040 ADT for each segment along I-495 and I-270 within the study limits for each of the Build Alternatives and Alternative 5 (for comparison purposes). Build Alternatives that add capacity to I-270 and I-495 would be projected to see an increase in daily traffic volumes served compared to the No Build Alternative.

Table 3-3: 2040 Build Average Daily Traffic (ADT)

Corridor	Segment	Alternative						
		5[1]	8	9	9M	10	13B	13C
I-270	I-370 to MD 28	255,000	279,000	268,000	260,000	283,000	264,000	281,000
	MD 28 to I-270 Spur	286,000	319,000	302,000	288,000	325,000	292,000	320,000
I-495	at American Legion Bridge	298,000	314,000	311,000	300,000	317,000	311,000	313,000
	MD 190 to I-270 Spur	297,000	331,000	321,000	310,000	331,000	316,000	330,000
	Between I-270 Spurs	127,000	145,000	138,000	131,000	145,000	136,000	147,000
	MD 355 to I-95	285,000	309,000	308,000	291,000	308,000	307,000	306,000
	I-95 to US 50	257,000	262,000	268,000	263,000	268,000	262,000	259,000
	US 50 to MD 214	269,000	282,000	286,000	282,000	286,000	281,000	281,000
	MD 214 to MD 4	263,000	275,000	287,000	282,000	287,000	275,000	274,000
	MD 4 to MD 5	233,000	238,000	240,000	239,000	240,000	237,000	237,000

Note: [1] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

3.3.1 Speed

The metric of average speed was calculated from the traffic simulation model output. **Table 3-4** shows the average speed for each of the Build Alternatives and Alternative 5 (for comparison purposes) in the general purpose (GP) lanes of I-495 and I-270 compared to the No Build Alternative during the peak periods in the design year of 2040.

Table 3-4: 2040 Average Speed

Alternative	Average Speed[1] (General Purpose Lanes)
Alternative 1 (No Build)	25 mph
Alternative 5[2]	36 mph
Alternative 8	39 mph
Alternative 9	41 mph
Alternative 9M	38 mph
Alternative 10	40 mph
Alternative 13B	40 mph
Alternative 13C	39 mph

Notes: [1] Reflects weighted average speed on I-270 and I-495 during peak hours; [2] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

Any managed lanes would provide average speeds of at least 45 mph for all Build Alternatives in the simulation model due to the tolling assumptions described in **Section 3.1.3**. However, average speed performance in the GP lanes along I-495 and I-270 during the peak periods would vary between the Alternatives. For this metric, Alternative 9 would perform the best with an average speed of 41 mph in the GP lanes, while Alternative 9M would perform the worst of the Build Alternatives with an average speed of 38 mph in the GP lanes.

Detailed corridor travel speed results by peak hour and direction for the general purpose lanes and the managed lanes are provided in **Table 3-5**. Additional details are provided in the *Traffic Analysis Technical Report* (**Appendix C**).

Table 3-5: 2040 Corridor Travel Speed Results from VISSIM Model

Peak Period	Corridor	Travel Lanes	Alternative 1	5[1]	8	9	9M	10	13B	13C
AM Peak	I-495 Outer Loop from MD 5 to George Washington Memorial Parkway	General Purpose	23	31	36	37	35	37	33	32
		HOT/Express Toll Lane	N/A	62	62	62	62	62	62	62
	I-495 Inner Loop from George Washington Memorial Parkway to MD 5	General Purpose	34	38	40	41	39	40	41	41
		HOT/Express Toll Lane	N/A	54	54	54	54	52	54	50
	I-270 Northbound from I-495 to I-370	General Purpose	63	61	61	61	61	61	61	61
		HOT/Express Toll Lane	N/A	63	63	63	64	64	N/A	N/A
	I-270 Southbound from I-370 to I-495	General Purpose	38	37	41	50	47	32	51	25
		HOT/Express Toll Lane	N/A	61	58	59	59	60	61	60
PM Peak	I-495 Outer Loop from MD 5 to George Washington Memorial Parkway	General Purpose	19	46	52	52	51	49	52	50
		HOT/Express Toll Lane	N/A	62	62	62	62	61	62	62
	I-495 Inner Loop from George Washington Memorial Parkway to MD 5	General Purpose	15	26	25	29	25	38	31	37
		HOT/Express Toll Lane	N/A	62	52	55	62	47	55	55
	I-270 Northbound from I-495 to I-370	General Purpose	53	39	51	44	41	35	43	45
		HOT/Express Toll Lane	N/A	53	56	50	51	61	40	58
	I-270 Southbound from I-370 to I-495	General Purpose	50	15	27	41	18	42	21	40
		HOT/Express Toll Lane	N/A	63	60	63	63	64	N/A	N/A

Note: [1] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

3.3.2 Delay

System-wide delay was calculated to determine the average amount of time each vehicle in the traffic simulation model was delayed while trying to reach its destination. Delay can be caused by slow travel due to congestion or vehicles yielding the right-of-way at stop-controlled or signalized intersections. **Table 3-6** shows the projected average delay per vehicle in the network under each Alternative during the 2040 AM peak period and the 2040 PM peak period.

Table 3-6: 2040 System-Wide Delay

Alternative	Average Delay (min/vehicle)		Percent Improvement vs. No Build	
	AM Peak	PM Peak	AM Peak	PM Peak
Alternative 1 (No Build)	8.8	11.8	N/A	N/A
Alternative 5[1]	7.0	9.2	20%	22%
Alternative 8	6.7	7.9	23%	33%
Alternative 9	5.8	7.9	34%	33%
Alternative 9M	6.1	8.2	30%	30%
Alternative 10	5.7	7.7	35%	34%
Alternative 13B	6.4	9.2	27%	22%
Alternative 13C	6.5	7.7	26%	34%

Note: [1] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

The results indicated that all the Build Alternatives studied would be expected to reduce delay compared to the No Build Alternative by at least 22 percent. For this metric, Alternative 10 would perform the best, resulting in the lowest amount of delay per vehicle during the AM peak period and tied with Alternative 13C for the lowest amount of delay per vehicle during the PM peak period. When averaging the percent for the AM and PM peaks, Alternative 13B would perform the worst of the Build Alternatives.

3.3.3 Travel Time

Travel time index (TTI) was calculated for each segment of I-495 and I-270 based on the outputs from the traffic simulation model. TTI quantifies the average travel time and congestion levels during the peak periods. TTI also serves as a proxy for the Planning Time Index (PTI), which is used to estimate reliability, because there is a strong correlation between PTI and TTI. Roadways with a lower TTI have some reserve capacity to absorb the disruption caused by non-recurring congestion (and generally have a lower PTI), while roadways with high TTI values are more likely to be impacted by minor incidents (and generally have a higher PTI). **Table 3-7** shows the weighted average TTI values in the GP lanes for each Build Alternative and Alternative 5 (for comparison purposes) in the design year 2040.

Table 3-7: 2040 Travel Time Index (TTI)

Alternative	Weighted Average TTI[1] (GP Lanes)
Alternative 1 (No Build)	2.28
Alternative 5[2]	1.69
Alternative 8	1.54
Alternative 9	1.40
Alternative 9M	1.58
Alternative 10	1.36
Alternative 13B	1.46
Alternative 13C	1.44

Notes: [1] Reflects weighted average TTI on I-270 and I-495 during peak hours; [2] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

Under the No Build Alternative, the weighted average TTI along I-270 and I-495 during the peak hours is greater than 2.0, which indicates severe congestion per MDOT SHA's thresholds described in **Section 3.2**. All the Build Alternatives studied would be expected to improve the TTI in the GP lanes to below the severe congestion threshold. Additionally, the managed lanes in all of the Build Alternatives would have TTI values in the uncongested range (TTI less than 1.15). For this metric, Alternative 10 would perform the best with an average TTI of 1.36 in the GP lanes, while Alternative 9M would perform the worst of the Build Alternatives with an average TTI of 1.58 in the GP lanes. TTI values broken down by segment are provided in **Table 3-8** and have been color coded based on MDOT SHA's definition of uncongested conditions, moderate congestion, heavy congestion, and severe congestion. Additional details are presented in the *Traffic Analysis Technical Report* (**Appendix C, Section 5.6**).

Table 3-8: 2040 Travel Time Index (TTI) Results for General Purpose Lanes from VISSIM Model

Peak Period	Corridor	Alternative							
		1	5[1]	8	9	9M	10	13B	13C
AM Peak	I-495 Inner Loop from Virginia 193 to I-270	2.1	1.6	1.6	1.3	1.4	1.3	1.8	1.6
	I-495 Outer Loop from I-270 to Virginia 193	1.2	1.7	1.3	1.7	1.7	1.7	1.7	1.6
	I-495 Inner Loop from I-270 to I-95	1.0	1.5	1.2	1.3	1.5	1.2	1.2	1.2
	I-495 Outer Loop from I-95 to I-270	4.3	1.6	1.5	1.6	1.5	1.3	2.1	1.8
	I-495 Inner Loop from I-95 to MD 5	1.8	1.5	1.5	1.4	1.4	1.5	1.3	1.4
	I-495 Outer Loop from MD 5 to I-95	1.5	1.2	1.0	1.0	1.2	1.0	1.0	1.0
	I-270 Northbound from I-495 to I-370	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	I-270 Southbound from I-370 to I-495	1.5	1.5	1.4	1.1	1.2	1.7	1.1	2.2
PM Peak	I-495 Inner Loop from Virginia 193 to I-270	5.5	2.7	4.5	2.6	2.6	1.2	1.6	1.6
	I-495 Outer Loop from I-270 to Virginia 193	2.4	1.4	1.0	1.0	1.0	1.0	1.0	1.0
	I-495 Inner Loop from I-270 to I-95	5.0	3.2	2.5	2.6	3.1	2.4	2.4	2.6
	I-495 Outer Loop from I-95 to I-270	2.7	1.2	1.1	1.1	1.1	1.4	1.1	1.3
	I-495 Inner Loop from I-95 to MD 5	1.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	I-495 Outer Loop from MD 5 to I-95	2.5	1.2	1.0	1.0	1.1	1.0	1.0	1.0
	I-270 Northbound from I-495 to I-370	1.0	1.4	1.1	1.3	1.3	1.6	1.3	1.2
	I-270 Southbound from I-370 to I-495	1.1	3.7	2.0	1.3	3.1	1.3	2.6	1.4

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] MDOT SHA defines various levels of congestion based on TTI: Uncongested (green) – TTI ≤ 1.15; Moderate Congestion (yellow) – 1.15 < TTI ≤ 1.3; Heavy Congestion (orange) – 1.3 < TTI < 2.0; Severe Congestion (red) – TTI ≥ 2. [3] This table summarizes TTI in the GP lanes. All HOT/Express Toll Lanes would have TTI values in the uncongested range (TTI less than 1.15).

3.3.4 Level of Service

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. For freeway segments, the *Highway Capacity Manual* assigns LOS grades based on density. Urban freeway segments reach failing (LOS F) conditions when the density exceeds 45 passenger cars per mile per lane (pc/mi/ln). The percentage of lane-miles projected to operate at LOS F during the peak periods in the design year of 2040 was calculated from the traffic simulation model output for each Alternative. The results are shown in **Table 3-9**.

Table 3-9: 2040 Percent of Lane-Miles Operating at LOS F

Alternative	Percent of Lane-Miles Operating at LOS F		
	AM Peak	PM Peak	Average
Alternative 1 (No Build)	28%	53%	41%
Alternative 5[1]	21%	20%	20%
Alternative 8	14%	14%	14%
Alternative 9	12%	12%	12%
Alternative 9M	15%	15%	15%
Alternative 10	15%	14%	14%
Alternative 13B	14%	12%	13%
Alternative 13C	18%	12%	15%

Note: [1] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

The results indicated that each of the Build Alternatives is effective at reducing the number of failing segments within the study corridors, but that some LOS F segments would remain in the GP lanes on I-495 and I-270 under all Build Alternatives. For this metric, Alternative 9 would perform the best, with only 12 percent of the lane-miles projected to operate at LOS F during both the AM peak period and the PM peak period in 2040. Alternatives 9M and 13C would perform the worst of the Build Alternatives, with an average of 15 percent of the freeway lane-miles operating at LOS F during the peak periods.

3.3.5 Throughput

The metric of vehicle throughput was calculated from the traffic simulation model output to quantify how efficiently goods, services, and people could be moved through the study corridors under each Alternative. Throughput represents the number of vehicles that pass by a given point in the roadway network in a set amount of time. Four key locations were chosen for evaluating throughput during the peak periods: I-495 crossing the American Legion Bridge, I-495 west of I-95, I-495 at MD 5, and I-270 at Montrose Road. These locations cover the four main segments of the study area, separated by major freeway junctions (I-495 at I-95 and I-495 at I-270) and are therefore representative of the entire study area. **Table 3-10** summarizes the average vehicle-throughput at the four key locations for the No Build Alternative, each of the Build Alternatives, and Alternative 5 (for comparison purposes) in terms of vehicles per hour. The values include traffic traveling in both directions and account for vehicles traveling in both the GP lanes and the managed lanes.

Table 3-10: 2040 Vehicle Throughput

Alternative	Average Vehicle Throughput at Four Key Locations[1] (veh/hr)
Alternative 1 (No Build)	15,500
Alternative 5[2]	17,000
Alternative 8	18,800
Alternative 9	19,100
Alternative 9M	17,900
Alternative 10	19,700
Alternative 13B	18,300
Alternative 13C	19,300

Notes: [1] Evaluation locations include I-495 at American Legion Bridge, I-495 west of I-95, I-495 at MD 5, and I-270 at Montrose Road; [2] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

Under No Build conditions, the number of vehicles (and people) that can travel through the system during the peak period is constrained by congestion. Each of the Build Alternatives results in increased throughput compared to the No Build Alternative. This translates into increased efficiency of the roadway network in getting people, goods, and services to their destinations. Additional benefits of increased throughput on the highway include reduced peak spreading (i.e., less congestion in the off-peak hours) and reduced burden on the surrounding roadway network. For this metric, Alternative 10 would perform the best by serving an average of 19,700 vehicles/hour during the peak periods at four key locations. Alternative 9M would perform the worst of the Build Alternatives, serving 17,900 vehicles/hour.

Table 3-11 provides additional detail by showing the vehicle throughput results generated from the VISSIM outputs at each key location. Results are reported in terms of vehicles per hour and percent increase in vehicle-throughput for each Build Alternative compared to the No Build Alternative, rounded to the nearest five percent. For additional information, refer to the *Traffic Analysis Technical Report* (**Appendix C, Section 5.8**).

3.3.6 Local Network

While the focus of the Study is to provide benefits to travelers using I-495 and I-270, the proposed action would also have impacts on the surrounding local roadway network[3]. This impact was quantified by using the results of the MWCOG regional model output for each Build Alternative and Alternative 5 (for comparison purposes) to calculate the total vehicle hours of delay on all arterials in Montgomery County, Maryland; Prince George's County, Maryland; and the District of Columbia. It should be noted that other regions in Maryland and Virginia showed negligible changes in local delay as a result of the project. **Table 3-12** shows the relative change in total delay on the local network for each of the Build Alternatives compared to the No Build Alternative.

The results indicated that all of the Build Alternatives would be projected to result in a net reduction in delay on the surrounding arterials by drawing traffic off the local network, despite some localized increases in arterial traffic near the managed lane access interchanges. For this metric, Alternative 9 would perform the best with a 7.0 percent delay savings on the local roadway network compared to the No Build

[3] For the purposes of this Study, the local roadway network includes minor and principal arterials, but not roadways that are classified as expressways, freeways, or interstate.

Alternative. Alternative 9M would perform the worst of the Build Alternatives, providing less benefit to the local network compared to the other Build Alternatives (5.9 percent delay savings).

Table 3-11: 2040 Vehicle Throughput Results from VISSIM Model

Metric	Peak Period	Location	Alternative							
			1	5[1]	8	9	9M	10	13B	13C
Vehicle-Throughput (veh/hr)	AM Peak	I-495 at American Legion Bridge	17,405	20,113	22,240	22,343	21,368	22,770	21,788	22,442
		I-495 west of I-95	13,910	15,977	18,994	19,189	17,307	19,052	19,000	19,679
		I-495 at MD 5	12,606	12,789	15,640	14,002	13,630	14,145	14,525	15,258
		I-270 at Montrose Rd	17,087	17,985	20,951	18,975	18,586	21,374	18,310	19,675
	PM Peak	I-495 at American Legion Bridge	15,421	18,776	18,817	20,906	19,681	20,801	20,035	20,288
		I-495 west of I-95	15,420	19,101	21,524	21,312	19,763	21,489	20,170	21,474
		I-495 at MD 5	13,916	15,132	13,868	15,715	15,647	15,725	15,652	15,853
		I-270 at Montrose Rd	17,972	16,098	18,540	20,156	16,848	22,305	16,946	19,989
Percent Change in Vehicle-Throughput vs. 2040 No Build	AM Peak	I-495 at American Legion Bridge	N/A	15%	30%	30%	25%	30%	25%	30%
		I-495 west of I-95	N/A	15%	35%	40%	25%	35%	35%	40%
		I-495 at MD 5	N/A	0%	25%	10%	10%	10%	15%	20%
		I-270 at Montrose Rd	N/A	5%	25%	10%	10%	25%	5%	15%
	PM Peak	I-495 at American Legion Bridge	N/A	20%	20%	35%	30%	35%	30%	30%
		I-495 west of I-95	N/A	25%	40%	40%	30%	40%	30%	40%
		I-495 at MD 5	N/A	10%	< 0%	15%	10%	15%	10%	15%
		I-270 at Montrose Rd	N/A	< 0%	5%	10%	< 0%	25%	< 0%	10%

Note: [1] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

Table 3-12: 2040 Effect on the Local Network

Alternative	Percent Reduction Local Network Delay vs. No Build[1]
Alternative 1 (No Build)	N/A
Alternative 5[2]	3.7%
Alternative 8	6.6%
Alternative 9	7.0%
Alternative 9M	5.9%
Alternative 10	6.5%
Alternative 13B	6.8%
Alternative 13C	6.4%

Notes: [1] *Based on total daily vehicle-hours of delay from 2040 MWCOG model for arterials in Montgomery County, Prince George's County, and the District of Columbia-*; [2] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

Table 3-13 provides additional detail by showing the total vehicle hours of delay and percent reduction compared to the 2040 No Build Alternative for Montgomery County, Prince George's County, and the District of Columbia individually. For additional information, refer to the *Traffic Analysis Technical Report* (**Appendix C, Section 5.9**).

Table 3-13: 2040 Local Network Results from MWCOG Model

Metric	Alternative							
	1	5[1]	8	9	9M	10	13B	13C
Daily Delay (vehicle-hours) for All Arterials in Montgomery County	247,462	241,601	233,725	231,608	234,681	233,139	233,448	234,352
Percent Reduction vs. No Build (Montgomery County)	N/A	2.4%	5.6%	6.4%	5.2%	5.8%	5.7%	5.3%
Daily Delay (vehicle-hours) for All Arterials in Prince George's County	171,265	163,660	158,725	158,606	159,709	158,831	158,798	158,505
Percent Reduction vs. No Build (Prince George's County)	N/A	4.4%	7.3%	7.4%	6.7%	7.3%	7.3%	7.5%
Daily Delay (vehicle-hours) for All Arterials in District of Columbia (DC)	178,074	169,630	165,184	164,571	167,262	165,931	163,978	165,851
Percent Reduction vs. No Build (District of Columbia)	N/A	4.7%	7.2%	7.6%	6.1%	6.8%	7.9%	6.9%
Total Daily Delay (vehicle-hours) for All Arterials in Montgomery County, Prince George's County, and District of Columbia (DC)	596,801	574,891	557,634	554,785	561,652	557,901	556,224	558,708
Percent Reduction vs. No Build (Total)	N/A	3.7%	6.6%	7.0%	5.9%	6.5%	6.8%	6.4%

Note: [1] MDOT SHA and FHWA determined Alternative 5 is not a reasonable alternative, but it is included in the DEIS for comparison purposes only.

3.3.7 Summary

The following summarizes the results of the design year 2040 traffic operational evaluation for each Build Alternative and Alternative 5 presented in this section.

1. **Alternative 1 (No Build)** would not address any of the significant operational issues experienced under existing conditions, and it would not be able to accommodate long-term traffic growth, resulting in slow travel speeds, significant delays, long travel times, and an unreliable network.

2. **Alternative 5** was determined to not be a reasonable alternative, as it does not meet the Study's Purpose and Need due to deficiencies in addressing the existing traffic and long-term traffic growth and trip reliability. However, the results for Alternative 5 have been included in this DEIS for comparison purposes only. Refer to the *Alternatives Technical Report* (**Appendix B**) for more information.
3. **Alternative 8**, **Alternative 13B**, and **Alternative 13C** would all outperform the No Build Alternative in every metric. However, these alternatives would not rank first in any of the operational metrics studied and would therefore only be expected to provide moderate benefits.

4. **Alternative 9M** was not originally included as a Build Alternative, but it has been evaluated to the same level of detail as the ARDS. This alternative was studied as a blend of Alternative 5 and Alternative 9. Refer to **Chapter 2, Section 2.6.4** and the *Alternatives Technical Report* (**Appendix B**) for more information. Alternative 9M would outperform Alternative 1 in every metric, but it would not rank first in any of the operational metrics studied, similar to Alternative 8, Alternative 13B, and Alternative 13C.

5. **Alternative 9** and **Alternative 10** would consistently perform well in all the operational metrics studied, and each Alternative ranked first in three of the six key metrics. Alternative 9 would perform the best in terms of average speed, LOS, and effect on the local network. Alternative 10 would perform the best in terms of delay, travel time index, and throughput. These two alternatives would be expected to provide the best operational benefits to the I-495 and I-270 Managed Lanes Study area and the surrounding transportation network.

3.4 Next Steps

The information presented in this chapter reflects the traffic analysis conducted during the DEIS stage of the Study to establish baseline conditions and evaluate the range of Build Alternatives. As noted above, the future analysis assumed a design year of 2040 and included the original preliminary set of proposed direct access locations for the managed lanes. Several updates are anticipated as the Study progresses, and the FEIS will include the following:

- Traffic forecasts for the Preferred Alternative will be performed to reflect year 2045 conditions.
- Traffic forecasts will be updated to continue to ensure the managed lanes would maintain an average speed of at least 45 mph if any toll policy changes from the analysis assumptions in the DEIS occur from Maryland's statutory requirements for tolling.
- Traffic models for the Preferred Alternative will be updated to include the latest set of proposed direct access locations following continued coordination with stakeholders.
- Traffic models will be updated to reflect any design changes implemented as part of the ongoing efforts to avoid or minimize impacts to sensitive resources while ensuring acceptable traffic operations would be achieved in the design year.

Additionally, MDOT SHA will continue to work with FHWA to evaluate operations and safety at all interchanges and project termini as part of the Interstate Access Point Approval (IAPA) process. This evaluation will utilize the 2045 design year and will focus on the Preferred Alternative.