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Options & Opportunities for All

# **MDOT SHA's Application for Interstate Access Point Approval (IAPA) August 2022**

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## EXECUTIVE SUMMARY

This is the Maryland Department of Transportation State Highway Administration's (MDOT SHA) Application to the Federal Highway Administration (FHWA) for Interstate Access Point Approval (IAPA).

### A. PROJECT BACKGROUND

MDOT SHA is currently conducting the I-495 & I-270 Managed Lanes Study (MLS) in compliance with the National Environmental Policy Act (NEPA), with FHWA as the lead federal agency and MDOT SHA as the co-lead agency and local project sponsor. The MLS evaluates potential transportation improvements to portions of the I-495 and I-270 corridors in Montgomery and Prince George's Counties, Maryland, and Fairfax County, Virginia. To document the substantial traffic, engineering, and environmental analyses for public review and comment, a Draft Environmental Impact Statement (DEIS), a Supplemental DEIS (SDEIS) and Final EIS (FEIS) have been prepared. The FEIS presents the final analyses completed for the Preferred Alternative, design refinements since the SDEIS, and responses to substantive comments on the DEIS and SDEIS. Chapter 4 of the FEIS provides results from the traffic operational analyses conducted for the 2045 No Build Alternative and Preferred Alternative. It also discusses how the effects of the COVID-19 pandemic are being considered in the traffic analysis, as well as the effects to local roadway networks. This chapter is supported by the Final Traffic Analysis Report in FEIS, **Appendix A**.

The Application for IAPA is requirement to ensure safety, operations, and engineering acceptability on the interstate system. Included in this Application for IAPA is a more detailed assessment of the future mainline and localized operational impacts of the Preferred Alternative.

I-495 and I-270 in Maryland are the two most heavily traveled freeways in the National Capital Region; I-495 is the only circumferential route in the region that provides interregional connections to many radial routes in the region, and I-270 is the only freeway link between I-495 and the fast-growing northwest suburbs in northern Montgomery County and the suburban areas in Frederick County. In addition to heavy commuter traffic demand, I-495 provides connectivity along the East Coast, as it merges with I-95 in Maryland for 25 miles around the east side of Washington DC.

### B. PREFERRED ALTERNATIVE

In January 2021, Alternative 9 was announced as the MDOT SHA Recommended Preferred Alternative based on the results of traffic, engineering, financial, and environmental analyses, as well as public comment. However, after several months of further coordinating with and listening to agencies and stakeholders and reviewing public comments, FHWA and MDOT SHA identified a new Preferred Alternative in the SDEIS: Alternative 9 – Phase 1 South. FHWA and Cooperating Agencies concurred on Alternative 9 – Phase 1 South as the Preferred Alternative in June 2021.

Alternative 9 – Phase 1 South includes the same improvements proposed as part of Alternative 9, two HOT managed lanes in each direction along I-495 and I-270, but within the Phase 1 South limits only. The limits of Phase 1 South are along I-495 from the George Washington Memorial Parkway in Virginia to west of MD 187 in Maryland and along I-270 from I-495 to just north of I-370 and on the I-270 East and West Spurs, as shown in **Figure ES-1**.

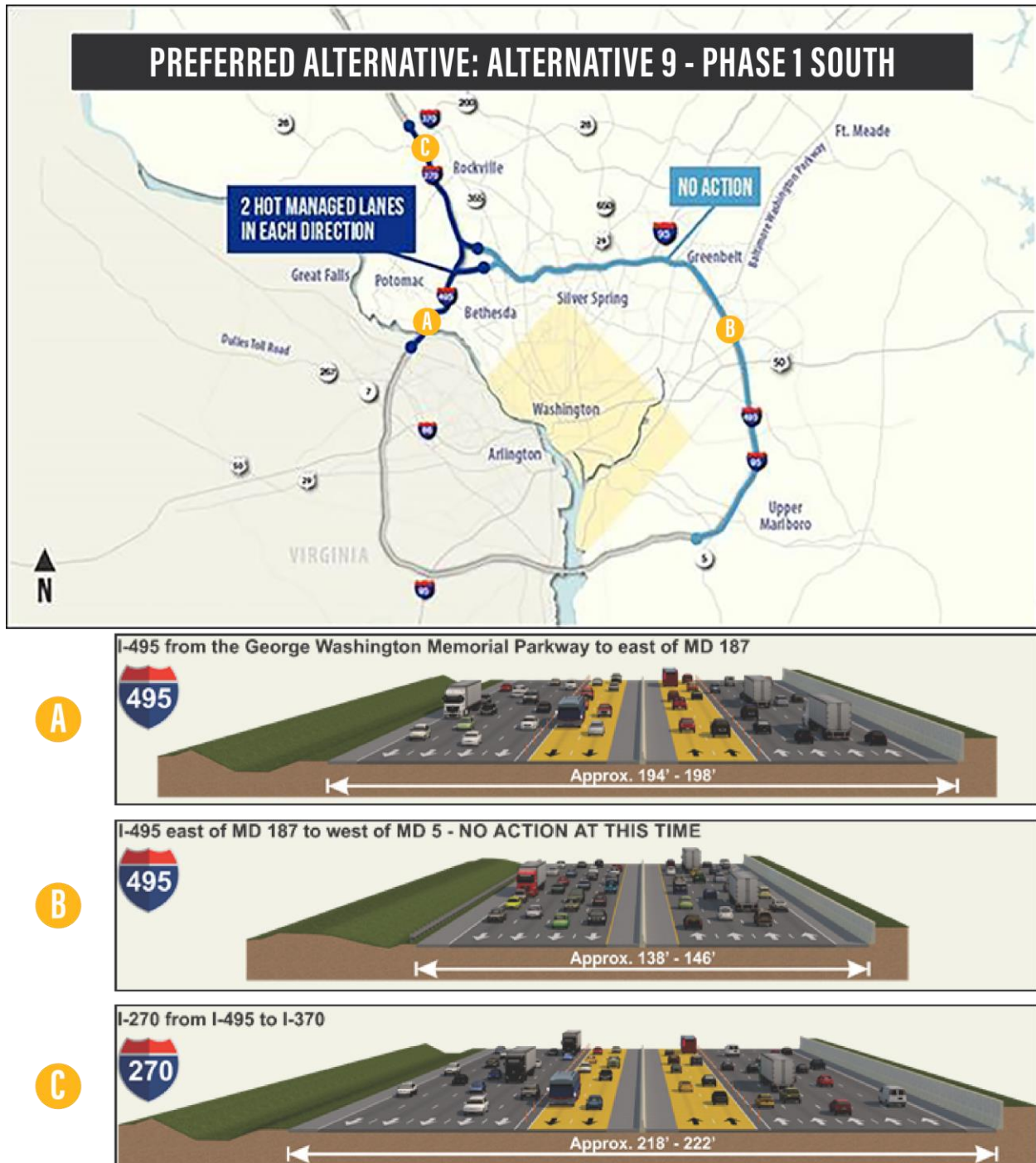
On I-495, the Preferred Alternative consists of adding two new HOT managed lanes in each direction from south of the George Washington Memorial Parkway to west of MD 187. There is no action, or no improvements included at this time on I-495 east of the I-270 East Spur to MD 5. While the Preferred Alternative does not include improvements to the remaining parts of I-495 within the scope of the MLS, improvements on the remainder of the interstate system may still be needed in the future and would advance separately, subject to additional environmental studies, analysis and collaboration with the public, stakeholders, and local agencies.

On I-270, the Preferred Alternative consists of converting the one existing HOV lane in each direction to a HOT managed lane and adding one new HOT managed lane in each direction from I-495 to north of I-370 and on the I-270 East and West Spurs. The existing Collector-Distributor (C-D) lanes from Montrose Road to I-370 would be removed as part of the proposed improvements to address the current imbalanced traffic utilization along the C-D lanes and in response to public comments to keep the improvements within the existing pavement footprint. Potential roadway or transit improvements on I-270 from north of I-370 to I-70 were not included, because that project has a demonstrated need outside of the MLS and is advancing under a separate planning study.

The HOT managed lanes traveling in the same direction as the General Purpose lanes would be separated from the General Purpose lanes by a buffer and flexible delineators as shown in the typical sections of **Figure ES-1**. Transit buses and HOV 3+ vehicles would be permitted to use the managed lanes toll-free.



Figure ES-1: Limits of Preferred Alternative



## C. TRAFFIC OPERATIONAL ANALYSIS FINDINGS

The approved IAPA Framework Document (see **Appendix A**) outlines the understanding between FHWA and MDOT regarding the scope of work of the IAPA, including the study area based on Alternative 9 limits, traffic forecasting and analysis methodology, model calibration, and study assumptions. However, after the document was signed, MDOT SHA aligned the Preferred Alternative to be consistent with the phased delivery approach, which focuses on Phase 1 South. As a result, FHWA and MDOT SHA identified a new Preferred Alternative that includes the same improvements proposed as part of Alternative 9 but is limited to the Phase 1 South limits only (see **Figure ES-1**). The traffic operational analysis findings in this document are based on these new study area limits for Preferred Alternative: Alternative 9 – Phase 1 South.

Operational analysis was performed using VISSIM Version 10.00-9 for freeway analysis. A total of 19 interchanges and 46 miles of freeway were analyzed. For analysis of the adjacent arterials, crossroads, and intersections, Synchro models were developed using Version 10.3. A total of 60 intersections were evaluated for No Build conditions and 67 intersections were evaluated under the Preferred Alternative, as the project will result in a net increase of seven signalized intersections.

The evaluation ensured that the number of lanes provided and the auxiliary lane lengths for merge, diverge, and weave operations were sufficient to handle unconstrained volume (i.e., no interference from bottlenecks outside of the study area) in the design year 2045 at all interchanges impacted within the Preferred Alternative limits; at the project termini locations where the HOT lanes tie back into the General Purpose lanes on I-270 and I-495; and where the proposed HOT lanes in Maryland tie into the proposed HOT lanes system in Virginia. The latest design for the Preferred Alternative presented in the FEIS and this IAPA reflects the modifications required to provide adequate operations on the freeways and freeway junctions, without interference from bottlenecks outside of the study area.

The results of the VISSIM analysis with 2027 conditions, as shown in **Table ES-1**, indicate that with the Preferred Alternative, speeds, densities, and LOS are improved throughout the network. The Preferred Alternative also serves more vehicles in the study area during the full AM and PM peak periods. However, serving significantly more vehicles while experiencing congestion due to external constraints (i.e., bottlenecks outside of the study area that impact operations within the study area), may result in operational repercussions at vulnerable areas within the study area, specifically, travel times along I-495 Inner Loop east of the I-270 West Spur increase during the 8-9 AM hour due to increased throughput and congestion east of the proposed Managed Lanes facility, and slow speeds along I-270 Northbound from 5-6 PM, but comparable to speeds with the No Build condition.

The results of the VISSIM analysis with 2045 conditions, as shown in **Table ES-2**, indicate that with the Preferred Alternative, speeds, densities, and LOS are improved throughout the network. The Preferred Alternative also serves more vehicles in the study area during the full AM and PM peak periods, except for the 6-7 AM hour. Like the 2027 Preferred Alternative conditions, serving significantly more vehicles while experiencing congestion due to external constraints, may result in operational repercussions at vulnerable areas within the study area, specifically, travel times along I-495 Inner Loop east of the I-270 West Spur increase during the 8-9 AM hour due to increased throughput and congestion east of the proposed Managed Lanes facility, and slow speeds along I-270 Northbound from 5-7 PM, but comparable to speeds with the No Build condition from 5-6 PM.



Under 2027 No Build and Preferred Alternative peak period conditions, existing bottlenecks at locations outside of the study area become exacerbated, such as along I-270 Northbound from I-370 to MD 124 and from MD 109 to MD 121, as well as along I-495 Inner Loop from MD 185 to MD 97 and from I-95 to MD 201. The resultant congestion impacts traffic operations within the project limits, including queue spillback onto I-495 and I-270, as shown in **Section 6.4**. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the MLS. Potential mitigation and design considerations are identified in **Chapter 8**.

The results of the Synchro analysis with 2027 conditions and with 2045 conditions indicate that most of the intersections studied are anticipated to operate acceptably under the Preferred Alternative when comparing No Build and Preferred Alternative conditions, and queues are not projected to spillback to the mainline. However, two locations were identified where intersection improvements are proposed to improve safety and/or operations. These intersections are located near new managed lane access ramps and are projected to attract additional traffic that would degrade operations compared to the No Build Alternative if additional improvements were not provided. Therefore, additional turn lanes and signal timing adjustments were included as part of the Preferred Alternative at Wootton Parkway at Seven Locks Road and Gude Drive at Research Boulevard.

Table ES-1: 2027 AM and PM Peak Period Comparisons

| Performance Metric                             | No Build vs. Preferred Alternative Conditions   |
|--|---|
| Network Performance                            | <ul style="list-style-type: none"> <li>AM Peak Period – Preferred Alternative serves 16% more vehicles with no unserved vehicles by end of analysis period, particularly at the I-495 Inner Loop input south of VA 193, which feeds both I-495 and I-270</li> <li>PM Peak Period – Preferred Alternative serves 67% more vehicles with 80% less unserved vehicles at the I-495 Inner Loop input south of VA 193 by end of analysis period</li> </ul>  |
| Lane-Miles of LOS 'D' or better and/or LOS 'F' | <ul style="list-style-type: none"> <li>AM, I-495 Inner Loop: LOS 'D' or better – 58% No Build / 76% Preferred; LOS 'F' – 31% No Build / 22% Preferred</li> <li>AM, I-495 Outer Loop: LOS 'F' – 33% No Build / 3% Preferred</li> <li>AM, I-270 NB: LOS 'D' or better – 98% No Build / 99% Preferred</li> <li>AM, I-270 SB: LOS 'D' or better – 79% No Build / 83% Preferred; LOS 'F' – 11% No Build / 8% Preferred</li> <li>PM, I-495 Inner Loop: LOS 'F' – 80% No Build / 66% Preferred</li> <li>PM, I-495 Outer Loop: LOS 'F' – 25% No Build / 6% Preferred</li> <li>PM, I-270 NB: LOS 'D' or better – 32% No Build / 47% Preferred; LOS 'F' – 59% No Build / 46% Preferred</li> <li>PM, I-270 SB: LOS 'D' or better – 96% No Build / 99% Preferred; LOS 'F' – 4% No Build / 1% Preferred</li> </ul>   |
| Travel Time                                    | <ul style="list-style-type: none"> <li>AM, I-495 Inner Loop – Preferred Alternative improves both GP and HOT travel times between VA 193 and I-270 West Spur</li> <li>AM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT travel times with significant reductions in 8-10 AM hours</li> <li>AM, I-270 SB – Comparable travel time for GP, Preferred Alternative provides improved HOT travel times</li> <li>AM, I-270 NB – Comparable travel times for both GP and HOT</li> <li>PM, I-495 Inner Loop – Preferred Alternative improves both GP and HOT during 3-5 PM hours, with substantial HOT improvement during 5-7 PM hours</li> <li>PM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT, with significant improvements during 5-7 PM hours</li> <li>PM, I-270 SB – Comparable travel times for both GP and HOT</li> <li>PM, I-270 NB – Preferred Alternative improves GP and HOT travel times during 4-6 PM hours, with substantial HOT improvement during 5-6 PM hour</li> </ul> |
| Throughput                                     | <ul style="list-style-type: none"> <li>AM, I-495 Inner Loop &amp; I-270 NB – Preferred Alternative increases throughput by 5% to 13%</li> <li>AM, I-495 Outer Loop &amp; I-270 SB – Preferred Alternative increases throughput by 10% to 12%</li> <li>PM, I-495 Inner Loop &amp; I-270 NB – Preferred Alternative increases throughput by 9% to 18%</li> <li>PM, I-495 Outer Loop &amp; I-270 SB – Preferred Alternative increases throughput by 13% to 18%</li> </ul>  |
| Queuing onto Mainline/Crossroads               | <ul style="list-style-type: none"> <li>AM – Preferred Alternative improves queue spillback at 15 ramps and eliminates queue spillback at all ramps</li> <li>PM – Preferred Alternative improves queue spillback at over 30 ramps</li> </ul>   |

Table ES-2: 2045 AM and PM Peak Period Comparisons

| Performance Metric                             | No Build vs. Preferred Alternative Conditions   |
|--|---|
| Network Performance                            | <ul style="list-style-type: none"> <li>AM Peak Period – Preferred Alternative serves 10% more vehicles with no unserved vehicles by end of analysis period, particularly at the I-495 Inner Loop input south of VA 193, which feeds both I-495 and I-270</li> <li>PM Peak Period – Preferred Alternative serves 55% more vehicles with 80% less unserved vehicles at the I-495 Inner Loop input south of VA 193 by end of analysis period</li> </ul>  |
| Lane-Miles of LOS 'D' or better and/or LOS 'F' | <ul style="list-style-type: none"> <li>AM, I-495 Inner Loop: LOS 'D' or better – 52% No Build / 62% Preferred</li> <li>AM, I-495 Outer Loop: LOS 'F' – 42% No Build / 3% Preferred</li> <li>AM, I-270 NB: LOS 'D' or better – 98% No Build / 99% Preferred</li> <li>AM, I-270 SB: LOS 'D' or better – 73% No Build / 81% Preferred; LOS 'F' – 15% No Build / 9% Preferred</li> <li>PM, I-495 Inner Loop: LOS 'F' – 87% No Build / 75% Preferred</li> <li>PM, I-495 Outer Loop: LOS 'F' – 46% No Build / 6% Preferred</li> <li>PM, I-270 NB: LOS 'D' or better – 34% No Build / 44% Preferred; LOS 'F' – 58% No Build / 50% Preferred</li> <li>PM, I-270 SB: LOS 'D' or better – 94% No Build / 99% Preferred; LOS 'F' – 5% No Build / 1% Preferred</li> </ul>   |
| Travel Time                                    | <ul style="list-style-type: none"> <li>AM, I-495 Inner Loop – Preferred Alternative improves both GP and HOT travel times between VA 193 and I-270 West Spur</li> <li>AM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT travel times with significant improvement in 8-10 AM hours</li> <li>AM, I-270 SB – Comparable travel time for GP, Preferred Alternative provides improved HOT travel times</li> <li>AM, I-270 NB – Comparable travel times for both GP and HOT</li> <li>PM, I-495 Inner Loop – Comparable travel times from 3-5 PM and savings from 5-7 PM for GP; Preferred Alternative improves HOT travel times for all PM hours with greatest savings during 5-7 PM hours</li> <li>PM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT with significant improvement in 5-7 PM hours</li> <li>PM, I-270 SB – Comparable travel times for both GP and HOT</li> <li>PM, I-270 NB – Comparable travel times for GP during 3-6 PM hours; Preferred Alternative improves HOT travel times for all PM hours with greatest savings during 5-7 PM hours</li> </ul> |
| Throughput                                     | <ul style="list-style-type: none"> <li>AM, I-495 Inner Loop &amp; I-270 NB – Preferred Alternative increases throughput by 11% to 19%</li> <li>AM, I-495 Outer Loop &amp; I-270 SB – Preferred Alternative increases throughput by 11% to 19%</li> <li>PM, I-495 Inner Loop &amp; I-270 NB – Preferred Alternative increases throughput by 14% to 27%</li> <li>PM, I-495 Outer Loop &amp; I-270 SB – Preferred Alternative increases throughput by 9% to 20%</li> </ul>   |
| Queuing onto Mainline/Crossroads               | <ul style="list-style-type: none"> <li>AM – Preferred Alternative improves queue spillback at over 15 ramps and eliminates queue spillback at most ramps</li> <li>PM – Preferred Alternative improves queue spillback at over 25 ramps</li> </ul>   |

## **D. SAFETY ANALYSIS FINDINGS**

The safety evaluation conducted as part of this Application for IAPA included a thorough review of existing crash data and crash patterns for all freeways, ramps, intersections, and crossroads; an evaluation of crash rates and the identification of high crash locations within the study area; a qualitative assessment of how key design elements from the Preferred Alternative would be expected to influence safety and affect high crash locations within the study area; and a quantitative analysis that focuses on the relative comparison results from predictive crash analysis under the No Build Alternative and the Preferred Alternative. This multifaceted evaluation was used to develop engineering solutions to incorporate into the Preferred Alternative to reduce congested-related crashes, consistent with the Purpose and Need of the MLS, and improve existing or potentially future high crash locations to enhance safety performance. Safety was not explicitly identified in the Purpose and Need of the MLS; however, the mobility and operational improvements associated with the Preferred Alternative are expected to reduce the potential for crashes attributed to congested roadway conditions. Specifically, the Preferred Alternative is expected to reduce congestion on the interstates and local roadways networks within the study limits, providing more reliable travel times for all users, including emergency responders.

Over the three-year crash study period, approximately 4,700 crashes occurred within the study area; 73% of the crashes along the freeways were rear end and sideswipe collisions that occurred during congested roadway conditions. The three-year crash history shows that 50 to 60% of the crashes occurring within the study area occurred during peak periods of congestion. As demonstrated through the operational analysis of this Application, the Preferred Alternative reduces congestion levels during peak periods to address the needs of the system and accommodate existing traffic and long-term traffic growth on I-270 and I-495. By reducing the extent and duration that the freeways and local roadways operate under congestion, unstable flow, and stop-and-go conditions, it can be anticipated that the Preferred Alternative will reduce the potential for congestion-related crashes, such as rear-end and sideswipe crashes occurring during peak periods.

All study interchanges were qualitatively assessed for the Preferred Alternative's impact on safety performance of the interstate facility and local roadway network. High crash locations were identified based on historical crash data for the freeway segments, ramps, and intersections along the crossroads – and those locations were reviewed to identify crash clusters, trends, and contributing factors as well as to assess the safety impacts associated with the Preferred Alternative. In addition, the predictive crash analysis methodologies outlined in the Highway Safety Manual (HSM) were used to provide a quantitative-based analysis on how the Preferred Alternative would potentially impact safety performance in the future. While the predictive method cannot be used to predict the actual safety performance of the Preferred Alternative due to limitations of the HSM methodologies, the results of the predictive analysis can be used for relative comparison purposes. The relative comparison results were reviewed in conjunction with the proposed Preferred Alternative design to identify and address locations where concerns were observed by the safety analysis.

As a result of the safety analysis effort, the Preferred Alternative was developed and refined through an iterative process in support of the project. Furthermore, the Preferred Alternative will replace aging structures, provide new pavement, and include improved geometrics, which are likely to result in safety improvements. The removal of the C-D lanes along I-270 minimizes the project footprint and associated

impacts while also eliminating conflict points at the slip ramps, though there is some tradeoff expected with additional merging and weaving in the General Purpose lanes. While the project will include tighter cross sections through small areas to avoid impacts to critical resources, introduce new signalized intersections along some crossroads, and include additional merge and diverge access points along the freeway at certain locations, safety improvement and mitigation considerations have been identified and will continue to be evaluated through the future design efforts. Areas where safety considerations should continue to be evaluated through the ongoing and future design efforts are identified in **Chapter 8**. Overall, the safety assessment demonstrates the Preferred Alternative should not have a significant adverse impact on the safety of the study corridors.

## **E. FHWA POLICY REQUIREMENTS**

FHWA Policy on Access to the Interstate System, published on May 22, 2017, addresses the two considerations and requirements defined in the memorandum as follows:

- Consideration and Requirement 1: Operational and safety analysis
- Consideration and Requirement 2: Connects to a public road and provides for all movements and is designed to meet or exceed current standards

### **Consideration and Requirement 1: Operational and Safety Analysis**

*An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

Traffic operational and safety analyses are documented in **Chapters 6 and 7**, respectively. The operational study area limits consist of the Phase 1 South limits shown in **Figure 1-1**, the adjacent freeway segments and interchanges along I-495 and I-270, as well as the adjacent signalized intersections along the 13 crossroads. The methodology used to develop traffic forecasts for the project is summarized in **Chapter 5**. VISSIM microsimulation software was used for the evaluation of traffic operations for the project. Safety analysis using historical crash data and HSM methodologies were used for the evaluation of safety. The traffic analysis demonstrates that the “the proposed change in access does not have a significant adverse impact on the safety and operation of the interstate facility or on the local street network based on both the current and planned future traffic projections.”

The operational analysis includes both the Preferred Alternative and No Build conditions for 2027 opening and 2045 design years, documented in **Chapter 6**. All proposed merge and diverge junctions associated with the Preferred Alternative, proposed at-grade exchange ramps along I-270 West Spur, new HOT lane ramps, and the truncation areas where the HOT lanes end and tie into the General Purpose lanes were evaluated. In addition, the proposed interchange modifications at MD 190 (where General Purpose loop ramps will be replaced with directional ramps) and I-270 at MD 189 (where the existing SPUI will be replaced with a DDI) as well as all the proposed HOT lane ramp connections onto the crossroads were evaluated and assessed to determine their operation and safety impacts. With the Preferred Alternative, there are significant operational benefits to the system. In addition to increased throughput there is a significant decrease in the lane mileage of failing freeway segments. While congestion will still be present during the PM peak period on I-270 Northbound and the I-495 Inner Loop in the design year of 2045 due to downstream bottlenecks outside of the Preferred Alternative limits, in most cases, the Preferred Alternative will also increase speeds and reduce travel times and delays compared to the No Build Alternative.

Existing crash data was summarized, high crash locations were identified, and both a qualitative assessment and predictive safety analysis were performed to document the anticipated safety impacts of the Preferred Alternative in **Chapter 7**. By reducing the extent and duration that the freeways and local roadways operate under congestion, unstable flow, and stop-and-go conditions, it can be anticipated that the Preferred Alternative will reduce the potential for congestion-related crashes, such as rear-end and sideswipe crashes occurring during peak periods. As a result of the safety analysis effort, the Preferred Alternative was developed and refined through an iterative process in support of the project. Furthermore, the Preferred Alternative will replace aging structures, provide new pavement, and include improved geometrics, which will likely result in safety improvements. The removal of the C-D lanes along I-270 minimizes the project footprint and associated impacts while also eliminating conflict points at the slip ramps, though there is some tradeoff expected with additional merging and weaving in the General Purpose lanes. While the project will include tighter cross sections through small areas to avoid impacts to critical resources, introduce new signalized intersections along some crossroads, and include additional merge and diverge access points along the freeway at certain locations, safety improvement and mitigation considerations have been identified and will continue to be evaluated through the future design efforts. Areas where safety and operational considerations should continue to be evaluated and monitored through the ongoing and future design efforts are identified in **Chapter 8**. Overall, the safety assessment demonstrates the Preferred Alternative should not have a significant adverse impact on the safety of the study corridors.

A conceptual signing plan depicting all major guide signs was prepared and is detailed in **Section 4.3** and included in **Appendix F**.

#### **Consideration and Requirement 2: Connects to Public Road and Provides for All Movements**

*The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing*



*movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.*

The Preferred Alternative will provide additional new access at existing interchanges to serve traffic to/from the HOT managed lanes, as shown in **Table 3-1**. New access locations would include two new interchanges where access does not currently exist: on I-270 at Wootton Parkway and Gude Drive. A new interchange would be constructed at the existing Wootton Parkway overpass to provide direct access to and from the I-270 HOT managed lanes only. A new interchange would also be constructed at Gude Drive to provide direct access to and from the I-270 HOT managed lanes only. Additionally, direct access to the northbound HOT managed lanes and from the southbound HOT managed lanes on the I-270 West Spur would be provided at Westlake Terrace by repurposing the existing HOV entrance and exit ramps. The existing intersection at Westlake Terrace would be converted to a four-leg intersection with new exit and entrance ramps to/from the south to provide direct access for all directions on the HOT managed lanes. Per Consideration and Requirement 2, less than “full interchanges” are allowed for managed lanes or park and ride lots. There are no existing or proposed interchange access to serve park and ride lots. Wootton Parkway, Gude Drive, and Westlake Terrace are less than full interchanges but have proposed HOT managed lanes access. All existing traffic movements that are currently accommodated along I-270 and I-495 within the limits of the Preferred Alternative will continue to be accommodated.

All elements of the project will be designed in accordance with AASHTO and MDOT SHA standards to the extent practical. Design criteria are identified in **Section 4.1** and **Appendix D**. The Design Exceptions under consideration for the Preferred Alternative are shown in **Table 4-1**.

## 1 INTRODUCTION

This is the Maryland Department of Transportation State Highway Administration's (MDOT SHA) Application to the Federal Highway Administration (FHWA) for Interstate Access Point Approval (IAPA).

MDOT SHA is currently conducting the I-495 & I-270 Managed Lanes Study (MLS). The Study is evaluating potential transportation improvements to portions of the I-495 and I-270 corridors in Montgomery and Prince George's Counties, Maryland, and Fairfax County, Virginia. Alternatives considered were those that address roadway congestion within the specific Study scope of 48 miles from I-495 from south of the George Washington Memorial Parkway in Fairfax County, Virginia, including improvements to the American Legion Bridge over the Potomac River, to west of MD 5, and along I-270 from I-495 to north of I-370, including the East and West I-270 Spurs. The Preferred Alternative (PA) included reduced limits from the initial alternatives that were evaluated. The I-495 & I-270 Managed Lanes Study Preferred Alternative (**Figure 1-1**) limits would extend along 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, I-270 from its interchange with I-495 to north of I-370 and the I-270 East Spur from MD 187 to I-270.

The Notice of Intent to Initiate NEPA Study occurred in Spring 2018. The Draft Environmental Impact Statement (DEIS) was published for public comment in July 2020<sup>1</sup>. The Supplemental Draft Environmental Impact Statement (SDEIS) was completed in October 2021<sup>2</sup>. The Final Environmental Impact Statement (FEIS) was completed in June 2022.

### 1.1 REPORT PURPOSE

MDOT SHA developed this Application for IAPA for the I-495 & I-270 Managed Lanes Study that documents information necessary to allow MDOT SHA to make informed decisions and to be acceptable to FHWA for safety, operations, and engineering. The Application for IAPA is reflective of the future design year of 2045, interim year (2027) analysis for the opening year, revisions to the limits of the managed lanes, and revisions to the proposed managed lanes access points.

The Application for IAPA of the MLS documents the information necessary to allow FHWA to make an informed decision regarding the potential impacts of a change in access.

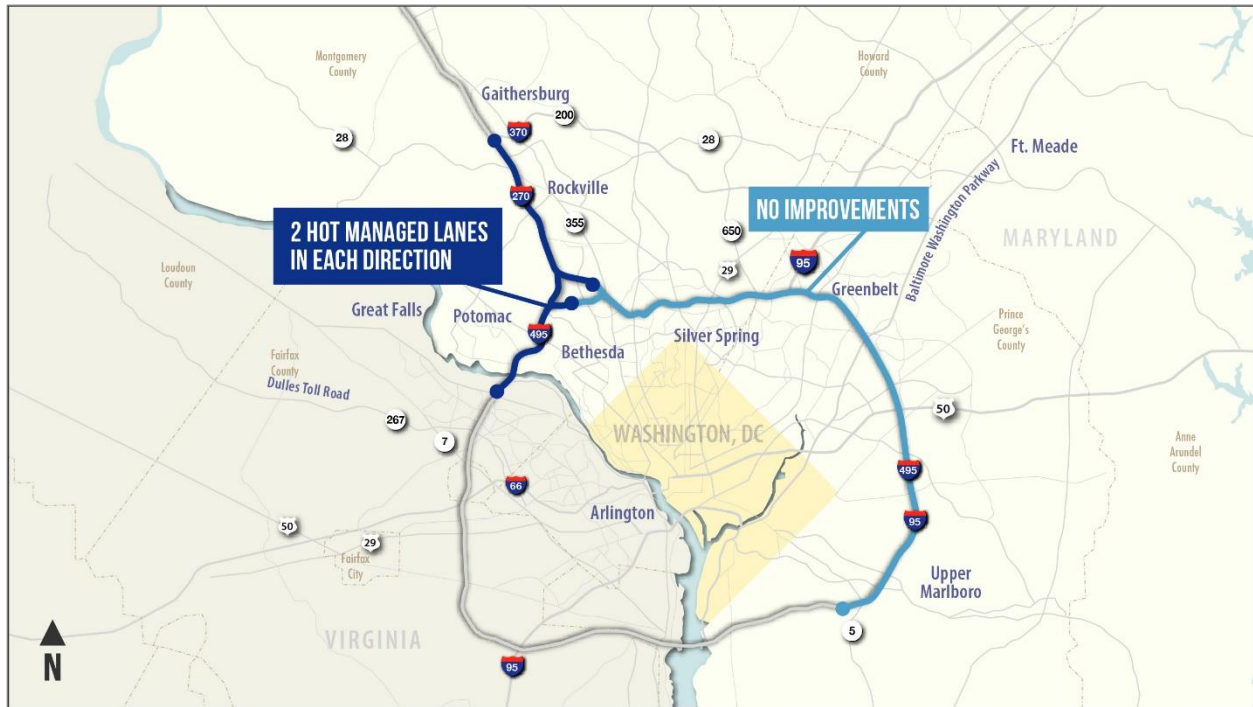
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<sup>1</sup> <https://oplanesmd.com/deis/>

<sup>2</sup> <https://oplanesmd.com/sdeis/>



**Figure 1-1: I-495 and I-270 Managed Lanes Study Corridors – Preferred Alternative**



## 1.2 POLICY POINTS

FHWA's "Policy on Access to the Interstate System" (May 2017) includes two policy points:

1. *An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*
2. *The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23*

*CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.*

This document addresses both policy points. Traffic operational analyses are performed and documented. Details of the scope of the operational analyses are summarized in **Chapter 6**. Existing crash data is summarized and both a qualitative and quantitative safety analysis are performed to document the anticipated safety impacts of the proposed interchange. Details of the scope of the safety analyses are summarized in **Chapter 7**.

The Preferred Alternative maintains all existing traffic movements at all existing interchanges. The Preferred Alternative also adds managed lanes access to multiple interchanges, including two new proposed interchanges that will provide access to the managed lanes only (**Chapter 3**) and the conversion of one interchange (I-270 West Spur at Westlake Terrace) from providing access to HOV lanes to/from the north to providing full access to HOT Managed Lanes, as the HOV lanes currently begin at this interchange and the Preferred Alternative proposes converting the HOV lanes to HOT lanes and providing these lanes both north and south of the interchange. The methodology and assumptions for the operational analyses of these interchanges are summarized in **Chapter 7**. Design exceptions are summarized in **Section 4.2**. A conceptual guide signing plan depicting all major guide signs is summarized in **Section 4.3** and included in **Appendix F**.

This document complies with MDOT SHA's "Interstate Access Point Approval Process for the Maryland Department of Transportation State Highway Administration" (July 2017).

## 2 METHODOLOGY AND ASSUMPTIONS

The approved IAPA Framework Document (see **Appendix A**) outlines the understanding between FHWA and MDOT regarding the scope of work of the IAPA, including the study area, traffic forecasting and analysis methodology, model calibration, and study assumptions. The Framework Document also outlines the FHWA policy points to be utilized and level of detail for each point. This document summarizes the traffic forecasting methodology, the traffic operations methodology, and the safety analysis methodology as outlined in the IAPA Framework Document.

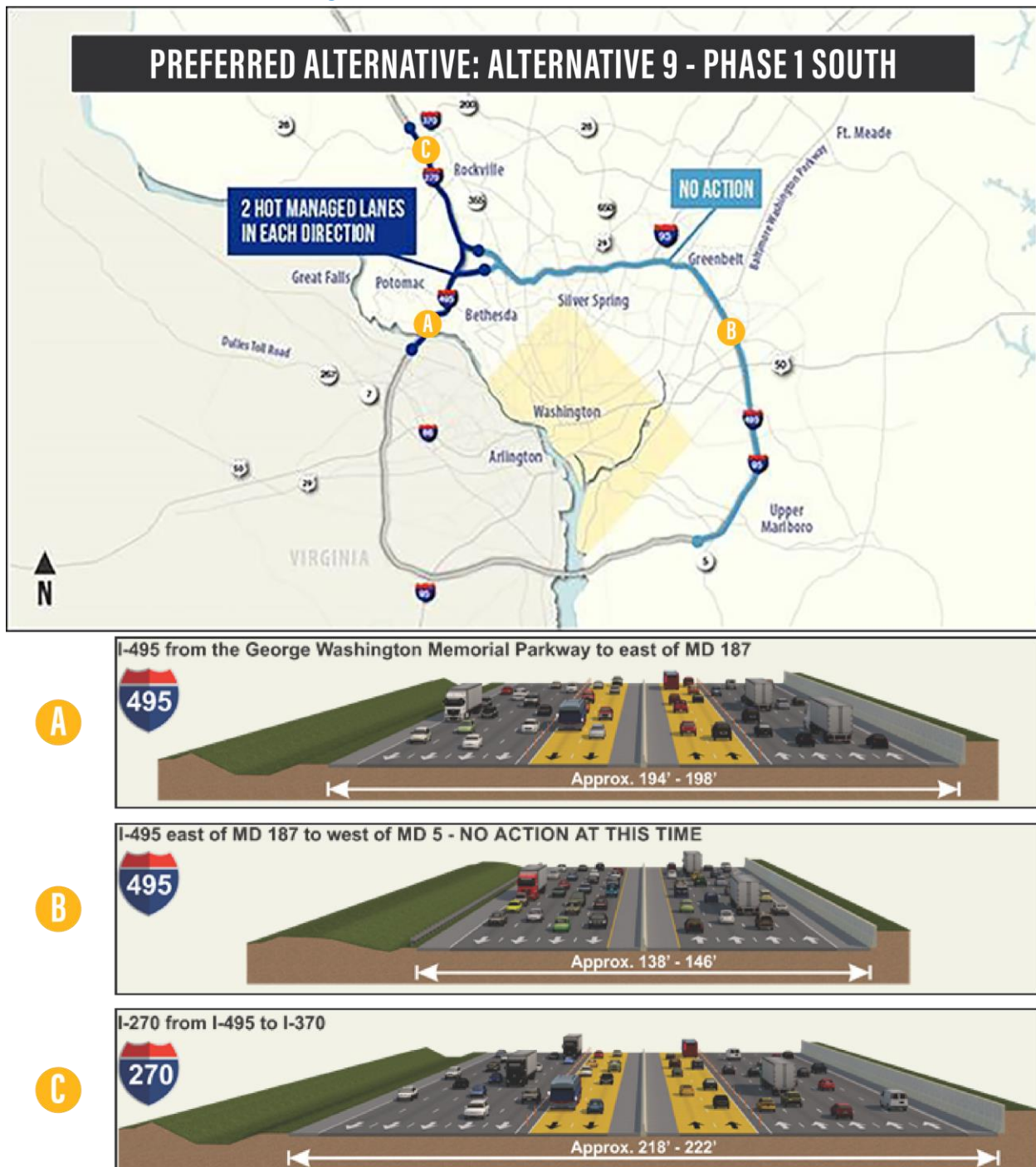
The IAPA Framework Document was agreed upon by both MDOT SHA and FHWA in December 2020 after a series of meetings and reviews. As recommended in the FHWA Interstate System Access Informational Guide, the purpose of the IAPA Framework Document is to engage in early coordination between the State DOT and FHWA to refine the scope of the analysis. This coordination will allow for the project analysis to be performed in a cost-effective manner and provide for a more effective review of the request. In January 2021, Alternative 9, 2-Lane, High-Occupancy Toll Managed Lanes Network was selected as the Preferred Alternative based on the results of traffic, engineering, financial, and environmental analyses, and public comment. Commenters specifically highlighted the need to address improvements to the American Legion Bridge (ALB), a major regional traffic bottleneck, as soon as possible; to minimize property displacement and public parkland impacts; to coordinate with planned managed lane projects in Northern Virginia to provide a seamless regional managed lanes system; and to increase multi-modal transportation options in the Study Area.

MDOT SHA decided to align the Preferred Alternative to be consistent with the previously determined phased delivery and permitting approach, which focuses on Phase 1 South. As a result, FHWA and MDOT SHA identified a new Preferred Alternative: Alternative 9 – Phase 1 South. The Preferred Alternative includes the same improvements proposed as part of Alternative 9 but is limited to the Phase 1 South limits only. The limits of the Preferred Alternative are along I-495 from the George Washington Memorial Parkway to east of MD 187 and along I-270 from I-495 to north of I-370 and on the I-270 East and West Spurs as shown in **Figure 2-1**. The improvements include two new HOT managed lanes in each direction along I-495 and I-270 within the Preferred Alternative limits. There is no action, or no improvements included at this time on I-495 east of the I-270 East Spur to MD 5 (shown in **Figure 2-1**). While the Preferred Alternative does not include improvements to the remaining parts of I-495 within the MLS limits, improvements on the remainder of the interstate system may still be needed in the future. Any such improvements would advance separately and would be subject to additional environmental studies and analysis and collaboration with the public, stakeholders, and agencies.

During the NEPA process, PTV VISSIM AM and PM peak period models were developed with defined geographical limits. The MLS model development began with determining the project limits along I-495, I-270, and associated interchanges. Because initial improvements were considered throughout a similar study area, this previously validated model was used in the IAPA for consistency and time-saving purposes.

**Chapter 6** of this report summarizes VISSIM and Synchro model development and measures of effectiveness; and the safety analysis is summarized in **Chapter 7**.

Figure 2-1: Limits of Preferred Alternative



## 2.1 I-495 DESCRIPTION

I-495 is a 64-mile circular freeway that runs through Maryland and Virginia and around the District of Columbia and includes 42 miles in Maryland. I-495 provides access to several roadways in the Washington, DC area, including:

- I-95, which runs along the east coast of the United States from Maine to Florida,
- I-270, which connects the Washington, DC area to Frederick County and western Maryland,
- US 29 and MD 295 (Baltimore-Washington Parkway), which provide connections from the Washington, DC Maryland suburbs to the Baltimore region,
- US 50, which provides access to Annapolis and the Eastern Shore, and
- MD 5, which provides access to southern Maryland.

For a 25-mile section in Prince George's County from the I-495/I-95 interchange to the Woodrow Wilson Bridge, I-495 runs concurrent with I-95. Local lanes are present along the Inner Loop from I-95 to US 1 and in both directions from north of MD 202 to Arena Drive and from MD 210 to the Woodrow Wilson Bridge. The posted speed limit along I-495 is 55 mph.

## 2.2 I-270 DESCRIPTION

I-270 is a 35-mile freeway (including the I-270 Spur) that runs from I-495 in the southeast to I-70 in the northwest, near Frederick, Maryland. North of I-70, this roadway becomes US 15, which continues north into Pennsylvania. I-270 primarily serves as a commuter route to the Washington, DC area from Frederick County and the communities along the corridor. For two miles north of I-495, I-270 splits into an East Spur and a West Spur. Both directions of I-270 include High Occupancy Vehicle (HOV) and local lanes. The I-270 Southbound HOV lane begins at I-370 and ends at I-495 along the East Spur and south of Democracy Boulevard along the West Spur. The I-270 Northbound HOV lane begins at I-495 along the East Spur and south of Democracy Boulevard along the West Spur and ends at MD 121. The HOV lanes are in service weekdays from 6:00-9:00 AM in the southbound direction and 3:30-6:30 PM in the northbound direction. General traffic may use these lanes at other times. The HOV lanes are designated HOV 2+, meaning two or more people must occupy the vehicle. Motorcycles and emergency vehicles (during an emergency) are also permitted in these lanes. Additionally, plug-in electric and plug-in hybrid electric vehicles registered in Maryland are permitted to drive in the HOV lanes with only one occupant. The local lanes run along I-270 Southbound from north of I-370 to south of Montrose Road, and along I-270 Northbound from south of Montrose Road to north of MD 124. The local lanes are barrier-separated, and the number of lanes vary along the corridor. The HOV lanes are not barrier-separated. The posted speed limit along I-270 is 55 mph from I-495 (both spurs) to MD 121, 65 mph from MD 121 to MD 85, and 55 mph from MD 85 to I-70.

## 2.3 CORRIDOR MODELING LIMITS

While the MLS limits initially extended along I-270 from I-495 to north of I-370 and along I-495 from south of the George Washington Memorial Parkway in Virginia to west of MD 5 in Maryland, all VISSIM modeling efforts were extended to the following limits:

- I-495 from VA 193 in Virginia to the Woodrow Wilson Bridge on the Maryland side
- I-270 from the I-70 ramp merges to I-495, including the East and West Spurs



Extending the modeling to these limits ensures that the model accounts for effects of congestion originating outside the MLS limits that impact the freeway segments within the MLS limits, and that it captures the full extent of congestion both within the MLS limits as well as outside of the MLS limits that impact the area within the MLS limits. Every existing interchange along I-495 and I-270 within these modeling limits was included in the modeling analysis. The interchange that recently opened at I-270 at Watkins Mill Road was included in all future models. The modeled network includes a total of 50 interchanges: 29 along I-495, 18 along I-270, 1 interchange between I-270 and the I-270 Spurs, and 2 interchanges between I-495 and the I-270 Spurs. These limits were maintained after the limits of the MLS were changed to the Preferred Alternative limits to maintain the model calibration.

## 2.4 TRAFFIC DATA COLLECTION

### 2.4.1 Existing Traffic Volumes

Traffic count data was obtained from MDOT SHA's Internet Traffic Monitoring System (ITMS), which is available to the public. This data includes 59 counts from 2015, 97 counts from 2016, and 102 counts from 2017. For the MLS, intersection turning movement counts (TMC) and average daily traffic (ADT) counts were collected at 101 locations along the I-495 and I-270 corridors in 2018 to supplement existing traffic data. TMC data was collected using 24-hour video counts and ADT count data was collected over 48-hour periods at mainline and ramp locations. All counts were conducted during typical weekday conditions (Tuesdays, Wednesdays, and Thursdays while schools were in session).

The use of multiple years of data was necessary due to the vast quantity of data needed throughout the entire Study area (over 350 locations). Volume data along I-270 had previously been normalized as part of the I-270 Innovative Congestion Management (ICM) initiative; therefore, most of the new count data was used to supplement the information that had been collected previously.

For the Application for Interstate Access Point Approval, existing traffic counts were conducted where no count data was available to establish baseline volumes at the adjacent intersections for locations outside the limits of the MLS VISSIM model. This count data was used for analysis of adjacent intersections that were not previously studied during the NEPA process.

Existing traffic volumes were balanced through the study network, including the I-495 and I-270 along with the crossing roadways, so that no volume sinks were present along the access-controlled facilities. Along I-270, volumes were developed separately for the local, express, and HOV lanes where multiple facility types exist. For all roadways, ADT and peak period volumes were developed by direction.

Peak period hourly volumes were adjusted upward at some locations where drops in peak period traffic counts were due to upstream congestion and bottlenecks. This produces a set of peak period traffic volumes that reflect the actual traveler demand and not the resulting network throughput, which was needed so that VISSIM model volume inputs for existing (and future) conditions were adequate to represent actual congestion.

Volume diagrams are included in **Appendix B**.

### 2.4.2 Signal Timings

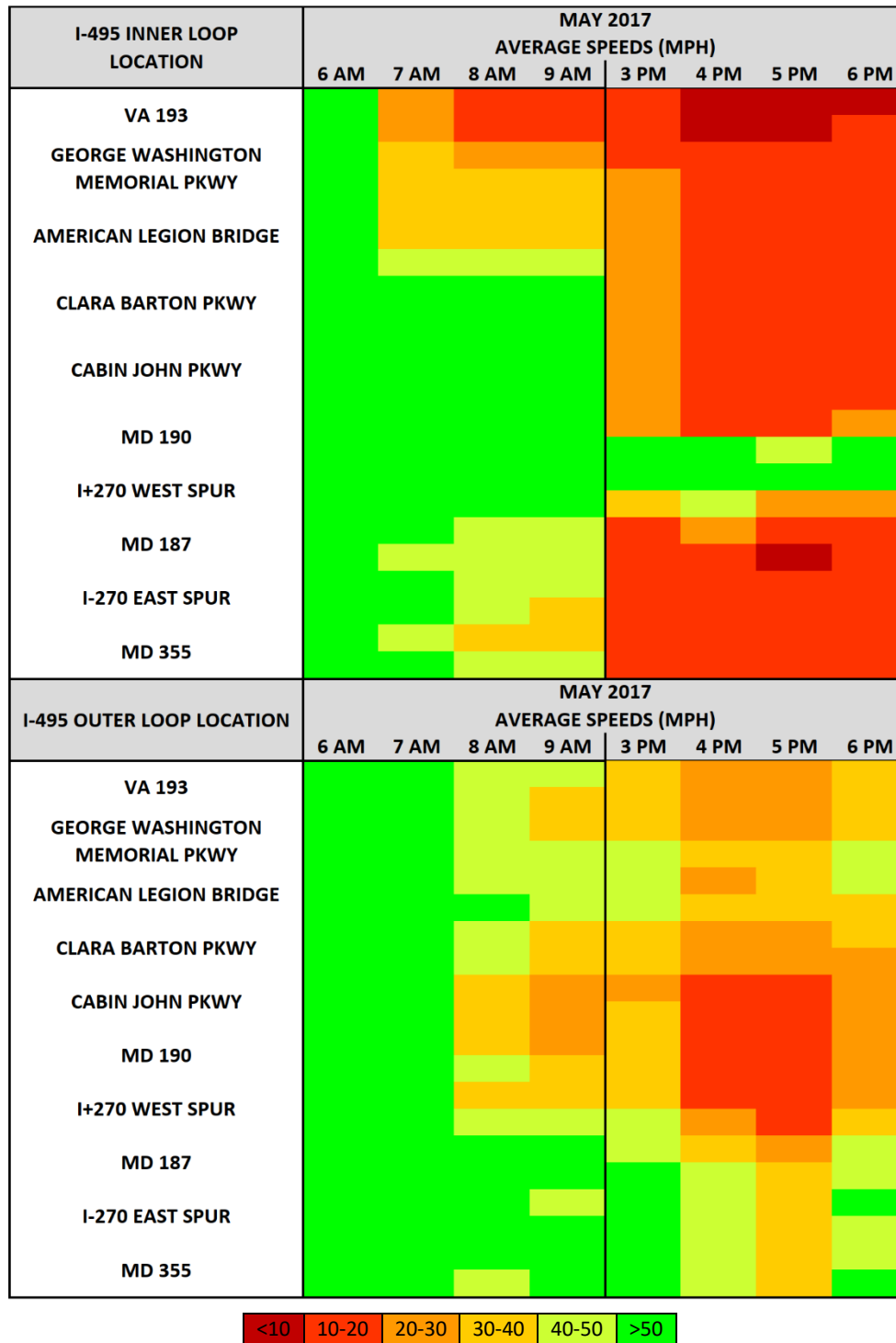
Signal timing data was provided for signalized intersections within the study area to ensure that the Synchro and VISSIM models included accurate existing signal timings and phasing. Timing data was obtained from MDOT SHA's Office of Traffic and Safety (OOTs), Montgomery County Department of Transportation, Prince George's County Department of Public Works and Transportation, the City of Frederick, and the City of Rockville.

### 2.4.3 Existing Travel Times and Speeds

Hourly speed and travel time data along the I-495 and I-270 corridors consist of 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 RITIS platform provides this probe data from INRIX, HERE, TomTom, and NPMRDS for any state-owned facility in Maryland in support of the I-95 Corridor Coalition. The segment-level data is available for any day of the year and any time of the day and provides insight into corridor speeds and bottlenecks. The data for the MLS was pulled and refined to include the month of May 2017 on Tuesdays, Wednesdays, and Thursdays as an appropriate typical time frame with recurring trends, which was then averaged across all days and excluded any atypical outliers. **Figure 2-1 and Figure 2-2** show the average speeds from RITIS along the I-495 and I-270 corridors, respectively, throughout the day to demonstrate the variability of the corridor's average speeds.

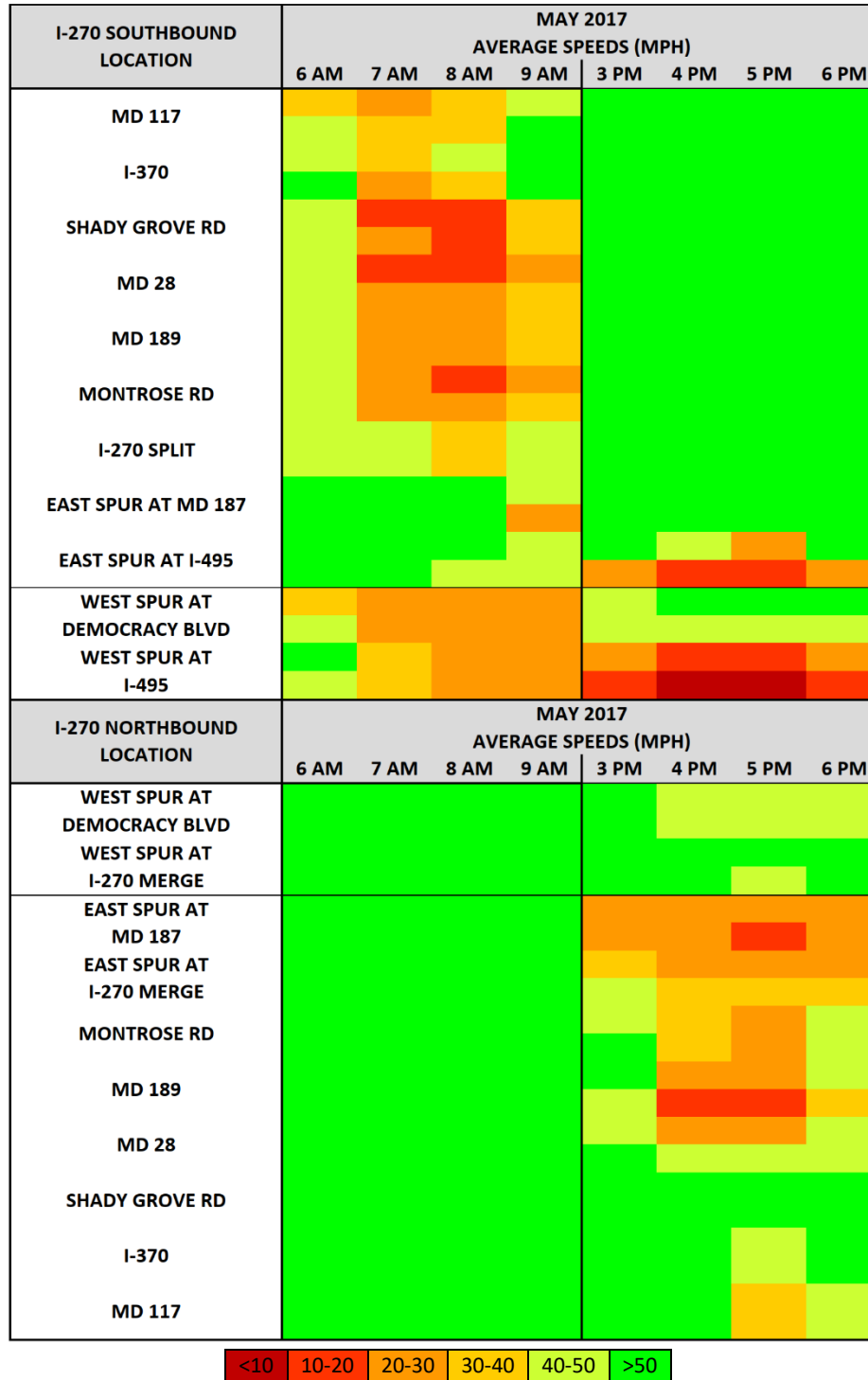
Due to the heavy traffic volumes and insufficient roadway capacity, recurring congestion is prevalent throughout the MLS corridors under existing conditions. On the I-495 Inner Loop, most roadway segments are operating with slower speeds less than 20 mph during the entire PM peak period whereas average speeds are less than 40 mph on the I-495 Outer Loop with much slower speeds (i.e., less than 20mph) from the I-270 West Spur through the Cabin John interchange area. Average speeds during the peak hours drop below 30 mph on I-270 Southbound in the morning and on I-270 Northbound in the afternoon with slower speeds (i.e., less than 20mph), particularly between Shady Grove Road and Montrose Road, due to downstream bottleneck spillback in both peak periods.

**Figure 2-1: I-495 2017 Existing AM/PM Peak Period Average Speeds from RITIS**





**Figure 2-2: I-270 2017 Existing AM/PM Peak Period Average Speeds from RITIS**



#### 2.4.4 Field Observations

Field observations were conducted during the peak periods along the adjacent crossroads. Observations included queue measurements, speed measurements, signal timing verification, and lane distribution, in addition to other observations specific to the location. Existing roadway conditions during the peak periods were verified against Google Maps' typical traffic conditions.

### 2.5 ANALYSIS YEARS AND BACKGROUND PROJECTS

The opening year for the Preferred Alternative is anticipated to be 2027, and the design year is 2045. Traffic analysis was performed for No Build and Preferred Alternative within the Preferred Alternative limits for the years 2027 and 2045.

The analysis for the 2027 and 2045 analysis years assumed completion of several background projects included in the Washington region's Visualize 2045 – Financially Constrained Long-Range Plan (CLRP), adopted by the Metropolitan Washington Council of Governments (MWCOC) – Transportation Planning Board (TPB) in 2018. The impacts of these background projects were assumed as part of the baseline conditions for the design year 2045 No Build Alternative and for 2045 Preferred Alternative. The 2027 and 2045 analysis years assume completion of the following projects that are proposed or under construction in the area:

- **Within Preferred Alternative Limits**
  - **I-270 Innovative Congestion Management (ICM) Improvements<sup>3</sup>:** a Progressive Design-Build project to construct improvements along I-270 between I-70 and I-495, including the East and West Spurs. The project includes fourteen roadway improvements that increase capacity and vehicle throughput and address safety concerns and bottlenecks. The project also includes innovative technologies and techniques, including adaptive ramp metering and active traffic management strategies. Construction of the ICM improvements is ongoing and is expected to be completed by the end of 2022. The proposed improvements of the I-270 ICM initiative are shown in **Figure 2-3**.
- **Within Modeling Area Outside Preferred Alternative Limits**
  - **I-270 at Watkins Mill Road Interchange<sup>4</sup>:** a new interchange along I-270 at Watkins Mill Road, located north of the interchange at MD 124. This interchange opened to traffic in June 2020.
  - **Greenbelt Metro Station Access Improvements:** an MDOT SHA proposed project to convert the existing partial interchange between I-495 and the Greenbelt Metro Station into a full movement interchange. This project is currently in the planning stage. Forecasts for this project have been updated in this study to reflect the latest planning efforts. The plans for these improvements are shown in **Figure 2-4**.

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<sup>3</sup> <https://mdot-sha-i270-i70-to-i495-inno-cong-mgmt-mo0695172-maryland.hub.arcgis.com/>

<sup>4</sup> <https://mdot-sha-i270-watkins-mill-intrc-mo3515172r-maryland.hub.arcgis.com/>

- o **VDOT I-495 Express Lanes Northern Extension (NEXT) Study<sup>5</sup>:** VDOT completed this study on a proposed extension of the I-495 Express Lanes from the I-495 at Dulles Toll Road interchange to the American Legion Bridge. The study began in April 2018 and the Finding of No Significant Impact (FONSI) was completed in June 2021. FHWA approved the Interchange Justification Report (IJR) in January 2022. Construction began in March 2022 and is expected to be completed by 2026. A map of the VDOT NEXT study area is shown in **Figure 2-5**.
- o **MD 97 Montgomery Hills Project<sup>6</sup>:** an MDOT SHA-proposed project to improve pedestrian and bicycle connectivity and mobility as well as vehicular operations. This project includes the removal of the loop ramp from I-495 Inner Loop to MD 97 Northbound and conversion of this movement to a signalized left-turn movement, and the installation of a traffic signal at the intersection of MD 97 at Flora Lane south of I-495. This project is currently in the design phase. The plans for this improvement are shown in **Figure 2-6**.
- o **MD 185 Salt Barn<sup>7</sup>:** an MDOT SHA project completed in 2020 to build a Salt Barn along the ramp from I-495 Outer Loop to MD 185. This project includes a modification of the intersection of MD 185 at I-495 Outer Loop Ramps to create a connection from the off-ramp to the on-ramp through the signal to serve vehicles exiting the Salt Barn.

## 2.6 ANALYSIS SCENARIOS

The following scenarios were evaluated for the weekday AM and PM peak periods:

- **Existing Conditions (Year 2017)**
- **No Build Conditions (Year 2027 and Year 2045):** This scenario includes VDOT NEXT, and all projects included in the Washington region's CLRP that are planned to be constructed by 2027 and 2045, including those listed above.
- **Preferred Alternative Conditions (Year 2027 and 2045):** This scenario includes the No Build improvements plus the Preferred Alternative and assumes No Build conditions outside the Preferred Alternative limits.

Lane diagrams for the Preferred Alternative are included in **Appendix C**.

## 2.7 ANALYSIS PERIODS

Based on a review of hourly traffic volumes collected for the MLS, the identified peak periods for the VISSIM microsimulation analysis are 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM. For the Synchro analysis of the adjacent intersections, the peak hours are reported, which include 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM, the hours when speeds are the lowest.

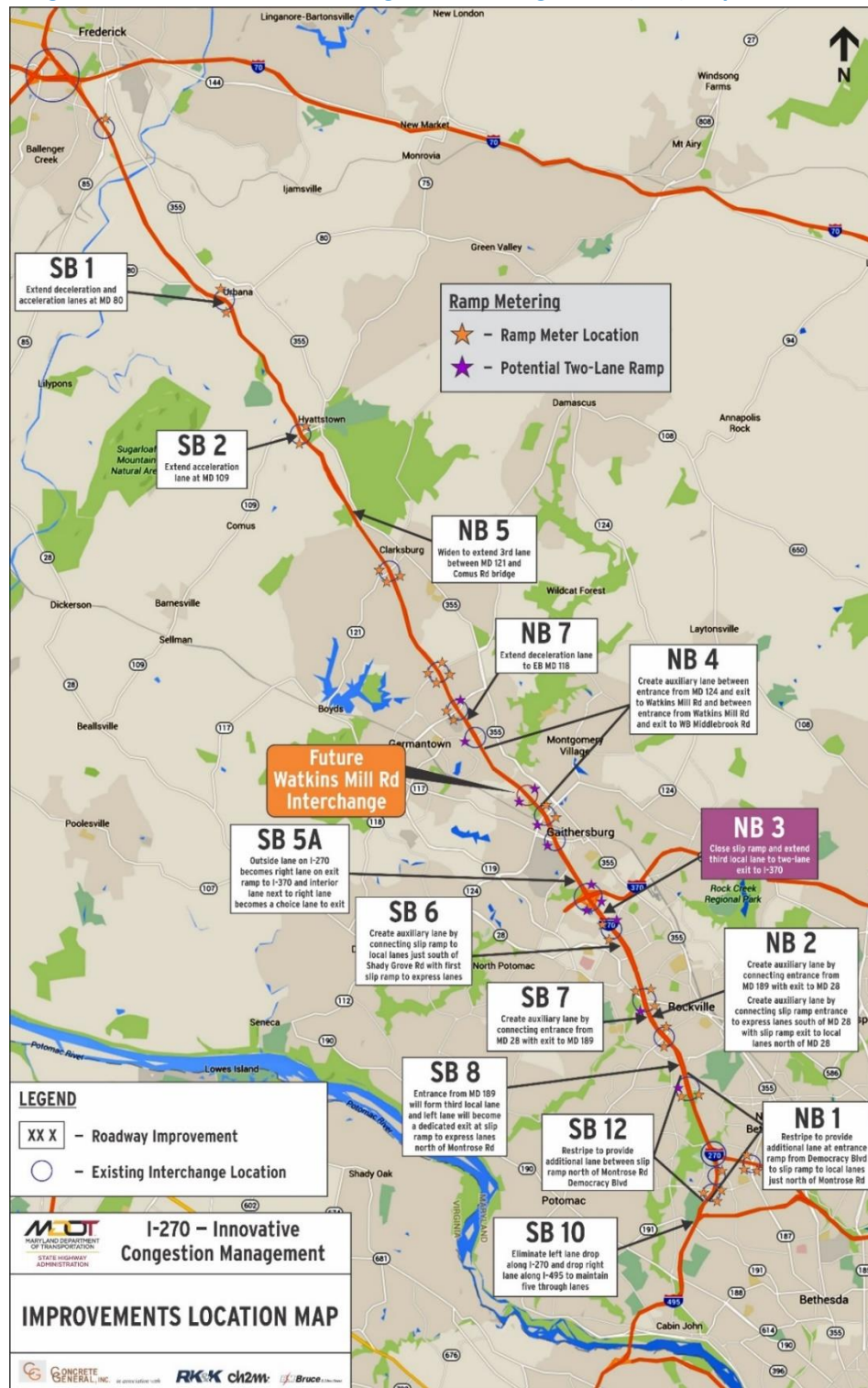
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<sup>5</sup> <http://www.495northernextension.org/>

<sup>6</sup> <https://mdot-sha-md97-md390-to-md192-mo2242115-maryland.hub.arcgis.com/>

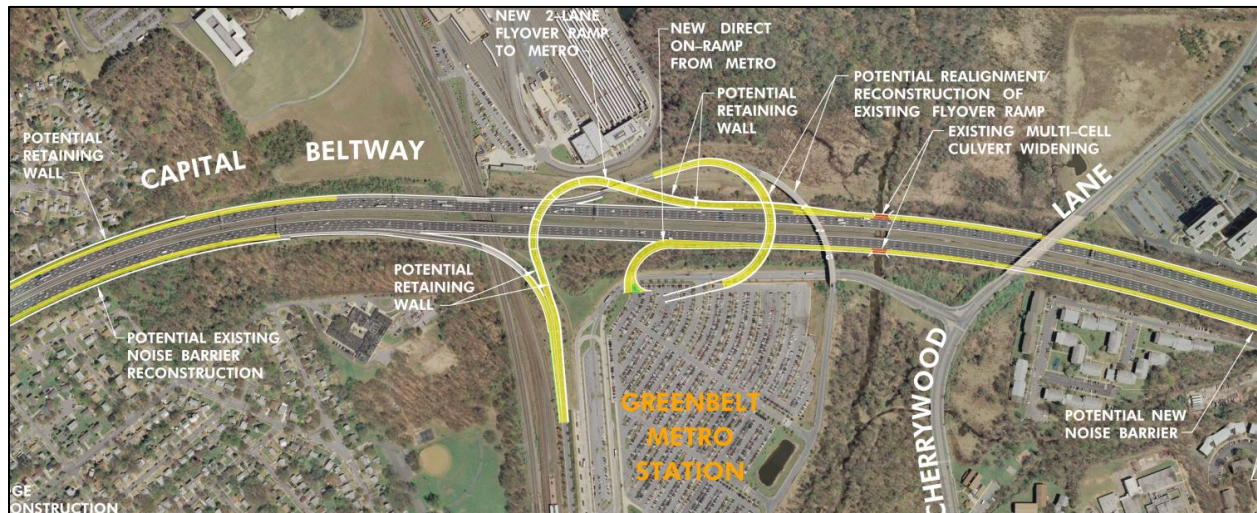
<sup>7</sup> <https://mdot-sha-md185-salt-barn-replacement-mo5245115-maryland.hub.arcgis.com/>

**Figure 2-3: I-270 Innovative Congestion Management (ICM) Improvements**

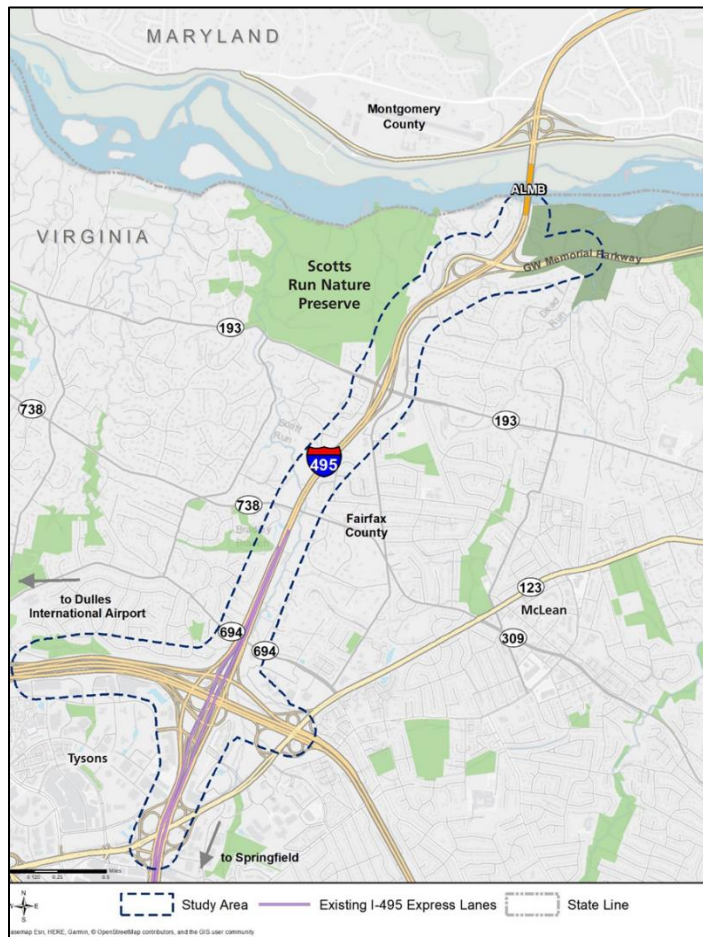




**Figure 2-4: Greenbelt Metro Station Access Improvements**



**Figure 2-5: VDOT NEXT Study Area**



**Figure 2-6: MD 97 Montgomery Hills Project**



### 3 SELECTION OF PREFERRED ALTERNATIVE

The alternatives development process involves developing conceptual alternatives that address the Purpose and Need of the project. Public agency coordination is then conducted to receive input on the conceptual alternatives. Seven alternatives were evaluated and compared in the technical reports supporting the DEIS. The DEIS evaluated the No Build Alternative (Alternative 1) and six Build Alternatives (Alternatives 5, 8, 9, 10, 13B and 13C). Additionally, Alternative 9M and the MD 200 Diversion Alternatives were considered. Identification of the Preferred Alternative was documented in the NEPA process.

In January 2021, Alternative 9 was announced as the MDOT SHA Recommended Preferred Alternative based on the results of traffic, engineering, financial, and environmental analyses, as well as public comment. However, after several months of further coordinating with and listening to agencies and stakeholders and reviewing public comments FHWA and MDOT SHA identified a new Preferred Alternative in the SDEIS: Alternative 9 – Phase 1 South. FHWA and Cooperating Agencies concurred on Alternative 9 – Phase 1 South as the Preferred Alternative in June 2021.

Alternative 9 – Phase 1 South includes the same improvements proposed as part of Alternative 9, two HOT managed lanes in each direction along I-495 and I-270, but within the Phase 1 South limits only. The limits of Phase 1 South are along I-495 from the George Washington Memorial Parkway in Virginia to west of MD 187 in Maryland and along I-270 from I-495 to just north of I-370 and on the I-270 East and West Spurs, as shown in **Figure 1-1**.

On I-495, the Preferred Alternative consists of adding two, new HOT managed lanes in each direction from south of the George Washington Memorial Parkway to west of MD 187. There is no action, or no improvements included at this time on I-495 east of the I-270 East Spur to MD 5. While the Preferred Alternative does not include improvements to the remaining parts of I-495 within the scope of the MLS, improvements on the remainder of the interstate system may still be needed in the future and would advance separately, subject to additional environmental studies, analysis and collaboration with the public, stakeholders, and local agencies.

On I-270, the Preferred Alternative consists of converting the one existing HOV lane in each direction to a HOT managed lane and adding one new HOT managed lane in each direction on I-270 from I-495 to north of I-370 and on the I-270 East and West Spurs. Potential roadway or transit improvements on I-270 from north of I-370 to I-70 were not included, because that project has a demonstrated need outside of the MLS and is advancing under a separate planning study.

The existing collector-distributor (C-D) lanes along I-270 from Montrose Road to I-370 would be removed as part of the proposed improvements to address the current imbalanced traffic utilization along the C-D lanes and in response to public comments to keep the improvements within the existing pavement footprint. The removal of the Collector-Distributor lanes eliminates conflict points at the slip ramps and helps to balance volumes evenly across the General Purpose lanes, which improves traffic flow. However, there is some tradeoff as this change causes additional merging and weaving in the General Purpose lanes, which can negatively impact operations. Removal of the Collector-Distributor lanes was evaluated as part of the operational and safety analysis. The area north of I-370 is outside the limits of this study and may be considered as part of a separate study.



The HOT managed lanes traveling in the same direction as the General Purpose lanes would be separated from the General Purpose lanes by a buffer and flexible delineator as shown in the typical sections of **Figure 3-1**. Transit buses and HOV 3+ vehicles would be permitted to use the managed lanes toll-free.

Access to and from the HOT managed lanes is proposed via direct access ramps at select existing interchanges; direct access ramps at two new interchanges; exchange ramps between Virginia and Maryland where ingress to the Maryland HOT managed lanes from the General Purpose lanes along the Inner Loop and egress from the Maryland HOT managed lanes to the General Purpose lanes along the Outer Loop would be provided; exchange ramps providing ingress to and egress from the HOT managed lanes in both directions along the I-270 West Spur; and at the limits of the build improvements for the Preferred Alternative where the proposed HOT managed lanes would tie into existing conditions. Direct access locations were identified based on several consideration, including:

- Providing system-to-system connections between major interstates and freeways (e.g., I-495/I-270 West Spur, I-270/I-370)
- Providing access at interchanges with high traffic demand (e.g., MD 190)
- Providing access throughout the study area (e.g., Gude Drive, Wootton Parkway)
- Providing access in consideration of land use and at major transit facilities (e.g., Westlake Terrace at Westfield Montgomery Mall Transit Center)
- Potential community, property, and environmental impacts resulting from providing access.

Virginia's 495 Express Lanes Northern Extension (495 NEXT) project proposes to extend the existing Express Lanes on I-495 in Virginia by approximately three miles from the I-495 and Dulles Toll Road interchange to the vicinity of the American Legion Bridge (ALB). MDOT's Preferred Alternative will overlap and tie-in with VDOT's 495 NEXT improvements on I-495 at the George Washington Memorial Parkway interchange. MDOT has coordinated closely with the Virginia Department of Transportation (VDOT) to refine the preliminary design concept to consolidate and provide compatible movements at the interchange. As documented in the 495 NEXT Interchange Justification Report (IJR), Fairfax County Board of Supervisors endorsed the 495 NEXT project.

Additionally, MDOT SHA's ongoing I-270 Innovative Congestion Management (ICM) project is providing a series of improvements to address mobility and safety at key points along I-270 targeted to reduce congestion at bottlenecks along the corridor in the short-term. Elements of the ICM that will be maintained within the Preferred Alternative limits include ramp metering; the additional auxiliary lane added in both directions along the I-270 West Spur and I-270 mainline up to Montrose Road; and auxiliary lanes in both directions along I-270 between the MD 189 and MD 28 interchanges.

Study interchanges and changes in access are summarized in **Table 3-1** and **Figure 3-2**. There are 19 total interchanges within the IAPA influence area – this includes four interchanges that are the next adjacent interchange outside the limits of the Preferred Alternative (I-270 at MD 117, I-495 at VA 193, I-495 at MD 187, and I-495 at MD 355/I-270 East Spur). Access to the HOT managed lane facility is proposed at 9 interchanges, which includes two locations where no access (General Purpose or managed) between the freeway and crossroad is currently provided. Additionally, the reconfiguration of the interchange at I-495 at MD 190/Cabin John Parkway will include the removal of the weave segment between the ramp from MD 190 to I-495 Outer Loop General Purpose Lanes/Cabin John Parkway and the ramp from I-495 Outer



Loop General Purpose Lanes to Cabin John Parkway; this interchange reconfiguration will also remove the redundant movement from I-495 Outer Loop General Purpose Lanes onto these ramps to return to I-495 Outer Loop General Purpose Lanes. Lastly, new at-grade slip ramp merges and diverges are proposed along I-495 and I-270 West Spur and East Spur where the HOT managed lanes within the median tie into the General Purpose lanes along the freeway:

- I-270 West Spur north of I-495: addition of at-grade exchange ramps from northbound General Purpose Lanes to HOT Lanes and HOT Lanes to General Purpose Lanes, and southbound HOT Lanes to General Purpose Lanes and General Purpose Lanes to HOT Lanes between I-495 and the I-270 Y-Split
- I-270 East Spur east of MD 187: addition of at-grade exchange ramps from HOT Lanes to General Purpose Lanes southbound and General Purpose Lanes to HOT Lanes northbound
- I-495 west of MD 187: addition of at-grade exchange ramps from HOT Lanes to General Purpose Lanes along the Inner Loop and General Purpose Lanes to HOT Lanes along the Outer Loop

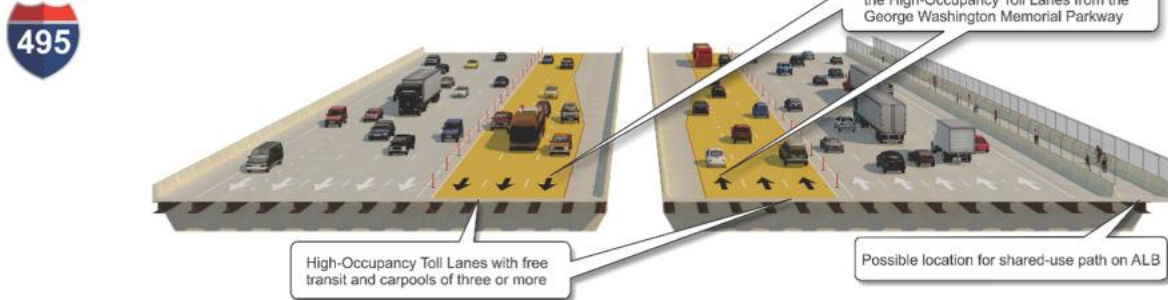
Once this alternative was selected, further refinement and analysis was conducted for this alternative. All analysis in this document is based on this Preferred Alternative and the No Build condition.

**Figure 3-1: Preferred Alternative Typical Sections (HOT Managed Lanes Shown in Yellow)**

I-495 from the George Washington Memorial Parkway to east of MD 187



I-495: American Legion Bridge (Looking north towards Maryland)



I-495 east of MD 187 to west of MD 5 - NO ACTION AT THIS TIME



I-270 from I-495 to I-370



**Table 3-1: Study Interchanges and HOT Managed Lane Access Locations under the Preferred Alternative**

| Interchange/Access Location Description                     | Proposed HOT Managed Lanes Access  | Proposed General Purpose Lanes Access  |
|---|--|--|
| I-270 at MD 117 (next adjacent interchange)                 | None   | No change  |
| I-270 at I-370  | To/from south via I-270 (slip ramps) and I-370   | Adjust interchange ramps to accommodate widened mainline   |
| I-270 at Shady Grove Road                                   | None   | Adjust interchange ramps to accommodate widened mainline   |
| I-270 at Gude Drive (new interchange)                       | Full   | No change (no General Purpose Lanes access provided)   |
| I-270 at MD 28  | None   | Adjust interchange ramps to accommodate widened mainline   |
| I-270 at MD 189   | None   | Reconfigure interchange ramps to diverging diamond to accommodate widened mainline   |
| I-270 at Wootton Parkway (new interchange)                  | Full   | No change (no General Purpose Lanes access provided)   |
| I-270 at Montrose Road                                      | None   | Adjust interchange ramps to accommodate widened mainline   |
| I-270 at I-270 West Spur (Y-Split)                          | Direct access between I-270 HOT Lanes and I-270 West Spur HOT Lanes                                      | Reconstruct interchange to accommodate HOT Lanes   |
| I-270 West Spur at Westlake Terrace                         | Full   | Existing ramps to/from HOV lanes to/from the North repurpose to HOT lanes; add HOT Lanes direct access ramps to/from south |
| I-270 West Spur at Democracy Boulevard                      | None   | Adjust interchange ramps to accommodate widened mainline   |
| I-270 West Spur north of I-495                              | At-grade ramps NB and SB from HOT Lanes to General Purpose Lanes and General Purpose Lanes to HOT Lanes  | No change  |
| I-270 East Spur at Rockledge Drive / MD 187                 | None   | Adjust interchange ramps to accommodate widened mainline   |
| I-270 East Spur east of MD 187                              | At-grade ramps from HOT Lanes to General Purpose Lanes SB and from General Purpose Lanes to HOT Lanes NB | No change  |
| I-270 East Spur at I-495/MD 355 (next adjacent interchange) | None   | No change  |

Note: The rows shaded in blue indicate interchanges with HOT managed lanes access. The rows shaded in green indicate non-interchange at-grade slip ramp locations with access to/from the HOT managed lanes.

**Table 3-1: Study Interchanges and HOT Managed Lane Access Locations under the Preferred Alternative (Continued)**

| Interchange/Access Location Description        | Proposed HOT Managed Lanes Access   | Proposed General Purpose Lanes Access   |
|--|---|---|
| I-495 at VA 193<br>(next adjacent interchange) | None  | No change   |
| I-495 at George Washington Memorial Parkway    | To/from north (ramps to/from south to be completed by others), includes exchange ramp OL from Maryland HOT Lanes to Virginia General Purpose Lanes and exchange ramp IL from Virginia General Purpose Lanes to Maryland HOT Lanes | Adjust interchange ramps to accommodate widened mainline  |
| I-495 at Clara Barton Parkway                  | None  | Adjust interchange ramps to accommodate widened mainline  |
| I-495 at MD 190 / Cabin John Parkway           | Full  | Replace all three loop ramps with directional ramps at signalized intersections along MD 190; remove weave segment including redundant movement from OL General Purpose Lanes to return to OL General Purpose Lanes |
| I-495 at I-270 West Spur                       | Direct access between I-495 HOT Lanes and I-270 West Spur HOT Lanes   | Reconstruct interchange to accommodate HOT Lanes  |
| I-495 west of MD 187                           | At-grade ramps from HOT Lanes to General Purpose Lanes EB and from General Purpose Lanes to HOT Lanes WB  | No change   |
| I-495 at MD 187<br>(next adjacent interchange) | None  | No change   |

Note: The rows shaded in blue indicate interchanges with HOT managed lanes access. The rows shaded in green indicate non-interchange at-grade slip ramp locations with access to/from the HOT managed lanes.



Figure 3-2: Study Interchanges and HOT Managed Lane Access Locations under the Preferred Alternative

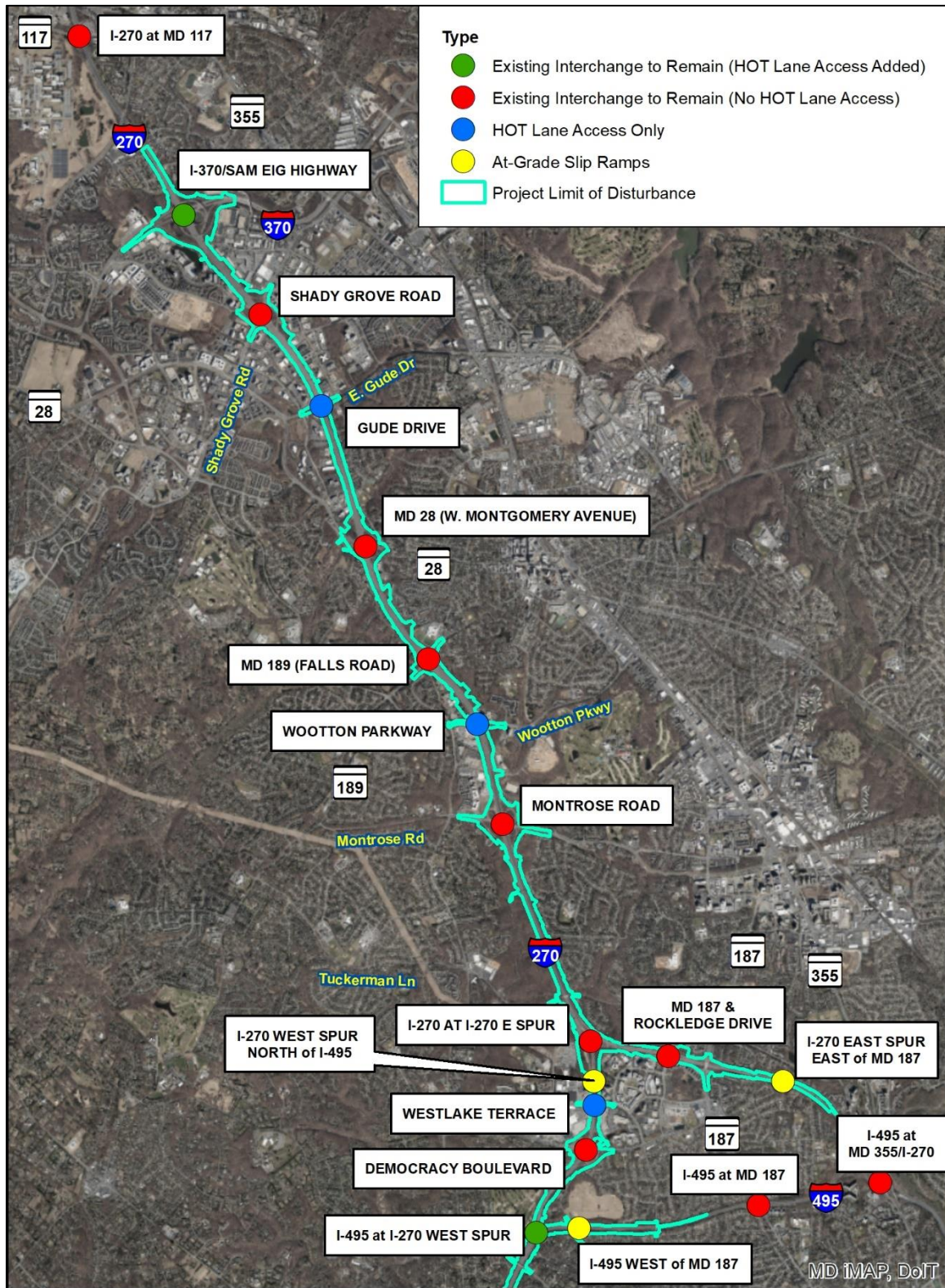




Figure 3-2: Study Interchanges and HOT Managed Lane Access Locations under the Preferred Alternative (Continued)





## 4 ROADWAY GEOMETRY AND DESIGN

Conceptual roadway geometry has been developed for the required roadway alignments. Following the NEPA process, the design team will continue to look for opportunities to optimize alignments to meet project operational and safety criteria while avoiding and minimizing impacts to resources such as wetlands, waterways, forests, parklands, cemeteries, historic districts, school properties, etc. Thus, the following description of geometry may evolve in final design.

### 4.1 DESIGN CRITERIA

The proposed project design was established in accordance with AASHTO, FHWA, and MDOT SHA design guidelines. The following documents were used in the development of the design criteria table provided in **Appendix D**:

- AASHTO. A Policy on Geometric Design of Highways and Streets, 2018.
- AASHTO. A Policy on Design Standards – Interstate System, May 2016.

These documents were used to develop the proposed design within the project limits. Where the design standards cannot be met, appropriate design exceptions will be obtained.

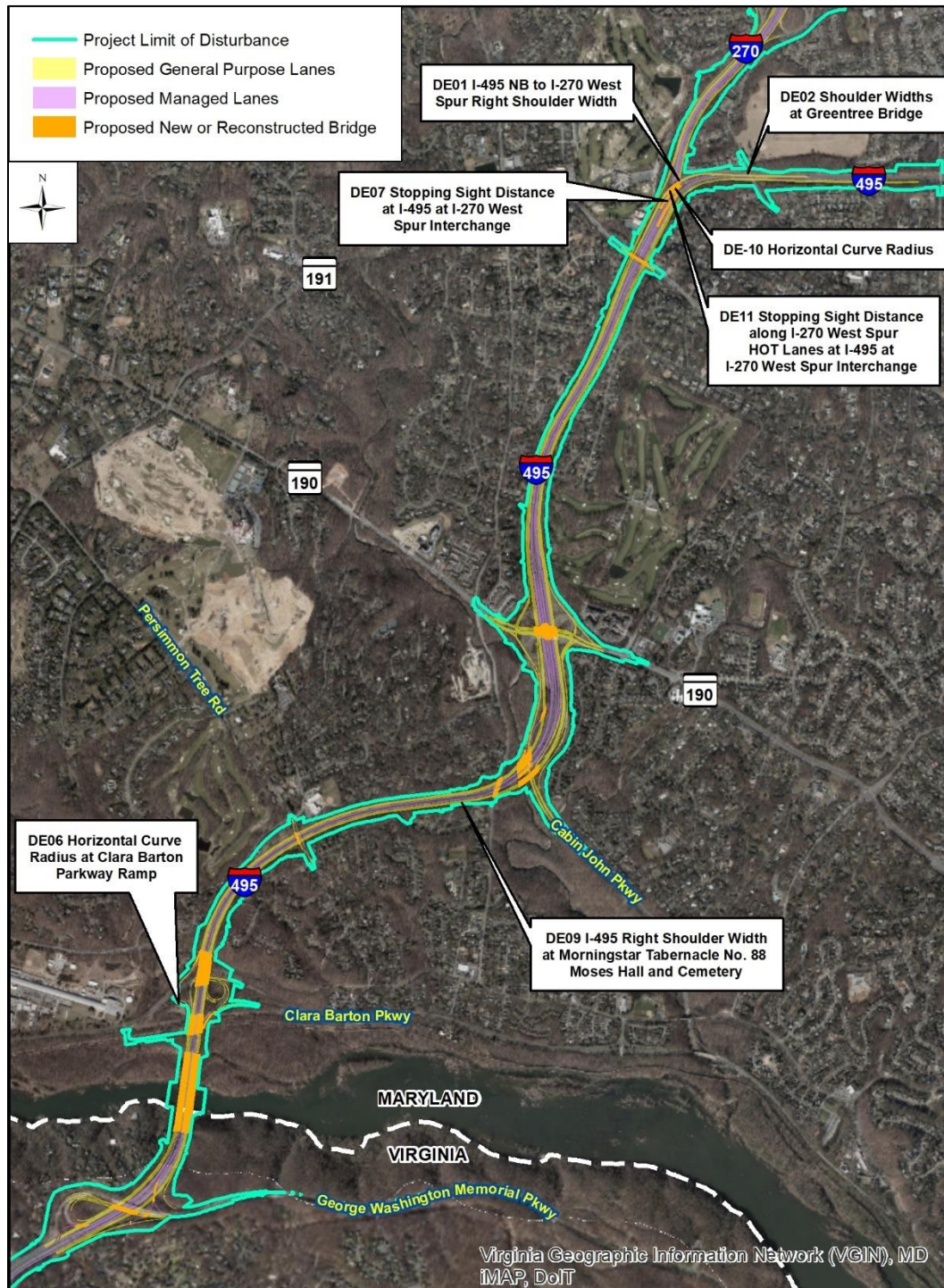
### 4.2 DESIGN EXCEPTIONS

The Preferred Alternative requires approval of several design exceptions to address instances where the design criteria as shown in **Appendix D** cannot be met due to various constraints including right of way, cultural and historic resource impacts and other geometric and physical constraints as described in the following summaries for each design exception. Several of the design exceptions result from constraints imposed by the existing horizontal and vertical alignment of I-495 and I-270 within the Project limits. Overall, the design criteria and design exceptions are based on the functional classification of the roadway as an urban freeway. A summary of the anticipated design exceptions is shown in **Table 4-1** and a map of the design exceptions is shown in **Figure 4-1**. Design exceptions (**Appendix E**) are under development and are anticipated to be submitted to FHWA in Fall 2022.

**Table 4-1: Anticipated Design Exceptions**

| #    | Design Exception  | Location  | Stations                           | Design Feature          | Required Value             | Value Provided           |
|------|---|---|------------------------------------|-------------------------|----------------------------|--------------------------|
| DE01 | I-495 NB to I-270 West Spur Right Shoulder Width  | NB I-495/I-270 West Spur HOT Lanes & General Purpose Lanes          | 2040+08 ± to 2042+90 ±             | Right Shoulder Width    | 10 ft                      | 6 ft min.                |
| DE02 | Shoulder Widths at Greentree Bridge   | I-495 East EB HOT Lanes (I-495 EB General Purpose Lanes Stationing) | 2013+04 to 2027+75                 | Left Shoulder Width     | 10 ft                      | 2 ft min.                |
|      |   | I-495 East WB HOT Lanes   | 2049+60 to 2062+84                 |                         |                            |                          |
| DE06 | Horizontal Curve Radius at Clara Barton Parkway Ramp  | Ramp from Clara Barton Parkway EB to I-495 General Purpose Lanes SB | Ramp CLBPC1 100+00.00 to 103+30.31 | Horizontal Curve Radius | 214 ft                     | 182 ft                   |
| DE07 | Stopping Sight Distance at I-495 at I-270 West Spur Interchange                                 | I-495 NB to EB General Purpose Lanes                                | 2004+00 to 2014+49                 | Stopping Sight Distance | 60 mph                     | 50 mph                   |
|      |   | I-495 NB to EB HOT Lanes  | 2025+21 to 2036+27                 |                         |                            |                          |
|      |   | I-495 WB to SB HOT Lanes  | 2036+23 to 2047+78                 |                         |                            |                          |
|      |   | I-495 WB to SB General Purpose Lanes                                | 2019+01 to 2031+47                 |                         |                            |                          |
|      |   | I-495 NB to EB General Purpose Lanes                                | 2012+60 to 2016+00                 |                         |                            |                          |
|      |   | I-495 WB to SB General Purpose Lanes                                | 2027+90 to 2029+70                 |                         |                            |                          |
| DE09 | I-495 Right Shoulder Width at Morningstar Tabernacle No. 88 Moses Hall and Cemetery             | I-495 NB General Purpose Lanes                                      | 1182+36 to 1184+70                 | Shoulder Width          | 10 ft paved<br>12 ft total | 6 ft paved<br>6 ft total |
| DE10 | Horizontal Curve Radius   | I-495 NB to EB General Purpose Lanes                                | 2004+00 to 2014+49                 | Horizontal Curve Radius | 60 mph                     | 50 mph                   |
|      |   | I-495 NB to EB HOT Lanes  | 2025+21 to 2036+27                 |                         |                            |                          |
|      |   | I-495 WB to SB HOT Lanes  | 2036+23 to 2047+78                 |                         |                            |                          |
|      |   | I-495 WB to SB General Purpose Lanes                                | 2019+01 to 2031+47                 |                         |                            |                          |
| DE11 | Stopping Sight Distance along I-270 West Spur HOT Lanes at I-495 at I-270 West Spur Interchange | I-270 West Spur NB HOT Lanes  | 2036+02 to 2041+59                 | Stopping Sight Distance | 645 ft                     | 570 ft                   |

**Figure 4-1: Locations of Anticipated Design Exceptions**



#### 4.2.1 Reduced Right Shoulder Width (DE01)

The purpose of this Design Exception is for a localized reduction in shoulder width to avoid the bridge abutment of an existing overpass bridge structure that is to remain in place. The shoulder width reduction is located at the I-495 Split Interchange, just north of the location where the I-270 West Spur Northbound departs from I-495 Northbound. The roadway requiring the shoulder width reduction is the departing I-270 West Spur connection under the existing bridge carrying I-495 Westbound to I-495 Southbound. Due to the space limitations beneath the bridge, a Design Exception is required for a substandard right shoulder to avoid replacing the existing abutment and bridge.

Under the proposed condition, the I-495 Northbound to I-270 West Spur connection will consist of two 12-foot HOT Lanes and three 12-foot General Purpose Lanes separated by a 4-foot buffer. 12-foot right and left shoulders are provided in the typical configuration. Beneath the existing I-495 Westbound to I-495 Southbound overpass structure, the right shoulder of the three General Purpose Lanes will be reduced from 12-feet to 6-feet for a distance of 282 feet. The reduced shoulder width approaching the bridge will transition from 12-feet to 6-feet over a distance of 136 feet providing a flare rate of 22:1 in accordance with AASHTO criteria. Departing the bridge, the shoulder width will transition from 6-feet to 12-feet over a distance of 32 feet to transition back to a full shoulder width as quickly as possible. To maximize the right shoulder width, the buffer between the HOT Lanes and General Purpose Lanes will be reduced to 2-feet in width at the location of the constrained width under the I-495 Westbound to I-495 Southbound overpass.

#### 4.2.2 Reduced Left Shoulder Widths (DE02)

The purpose of this Design Exception is for a localized reduction in shoulder width at two locations to avoid the bridge abutments of an existing overpass bridge structure that is to remain in place. The shoulder width reductions are located just east of the I-495 / I-270 West Spur Interchange where the I-495 Eastbound and Westbound General Purpose Lanes transition back to existing I-495 Eastbound and Westbound. The roadways requiring the shoulder width reduction are the I-495 Eastbound and Westbound General Purpose Lanes under the existing bridge carrying Greentree Road over I-495. Due to space limitations beneath the bridge, a Design Exception is required for a substandard left shoulder in both the eastbound and westbound direction to avoid replacing the existing abutments and bridge.

Under the existing condition, the I-495 Eastbound and Westbound lanes consist of three 12-foot lanes, a 12-foot left shoulder with barrier and a 10-foot paved right shoulder with guardrail. Under the proposed condition, I-495 Eastbound and Westbound will consist of four 12-foot lanes, a 2-foot left shoulder and a 12-foot right shoulder. Beneath the Greentree Road overpass bridge structure, the left shoulder widths of the eastbound and westbound travel lanes will be reduced to less than 12 feet (to a minimum of 2-feet) for a distance of 1,470 feet in the eastbound direction, and 1,320 feet in the westbound direction. The extended length of the reduced shoulders is due to the constrained median between the northbound and southbound HOT Lanes between the I-495 Split Interchange and the Greentree Road overpass bridge making it impractical to provide a 12-foot-wide left shoulder along this section of roadway. Departing the Greentree Road bridge, the shoulder width will transition from 2 feet to 12 feet over a distance of 625 feet to transition back to a full shoulder width.



#### **4.2.3 Horizontal Curve Radius at Clara Barton Parkway Ramp (DE06)**

Widening of the American Legion Bridge and I-495 to accommodate the HOT Lanes impacts the horizontal geometry of the Clara Barton Parkway Interchange. The horizontal curve radius and superelevation rate reduction is for the outer directional ramp connecting Clara Barton Parkway Eastbound to the I-495 Southbound General Purpose Lanes. Due to the proximity of the Parkway to the I-495 bridge over the Clara Barton Parkway and the American Legion Bridge this is a relatively short compact ramp in both the existing and proposed conditions. The horizontal curve radius and superelevation rate will meet criteria for a 25-mph ramp instead of the design speed of 30 mph, which is required to maintain the outer ramp tie-in without significant reconstruction of the Parkway and associated impacts to National Park Service (NPS) parkland.

Under the existing condition, the ramp is 16-feet wide with curb on both sides, has a radius of approximately 200 feet, and has a superelevation rate of approximately 7.5%; the design characteristics indicate that the existing ramp is consistent with a design speed of 25 mph. Under the proposed condition, the ramp is 16-feet wide and will have a 10' right shoulder and 4' left shoulder, with a radius of 182 feet and a superelevation rate of 7.6%. The proposed horizontal curve radius and superelevation values are consistent with a design speed of 25 mph. The lower range ramp design speed per AASHTO is 30 mph. Given the context of the parkway/parkland and the fact that the existing ramp operates satisfactorily with the existing geometry (25 mph) and with no notable crash history, an improvement in the ramp design speed is not proposed.

#### **4.2.4 Stopping Sight Distance (DE07)**

The purpose of this Design Exception is to request reductions of stopping sight distance at multiple locations within the I-495 and I-270 West Spur Interchange where existing corridor alignment constraints, minimizing residential property and wetland and stream impacts, and keeping the extent of interchange reconstruction to a practical limit, dictate the horizontal and vertical stopping sight distance. The design exception discusses four locations where horizontal stopping sight distance criteria cannot be met for 60 mph, and two locations where vertical (crest curve) stopping sight distance criteria cannot be met for 60 mph, all within the West Spur Interchange. Each location will meet 50 mph stopping sight distance criteria.

In the existing condition, the General Purpose Lanes currently have radii that are designed to a 50-mph design speed. Reconstructing the West Spur Interchange to increase the stopping sight distance to 60 mph at these six locations would cause significant property and environmental impacts. The roadway and overpass structures for the HOT Lanes are new construction, the geometry of which is dictated by the constraints of the existing General Purpose Lane geometry. The design exception documents retention of design elements meeting 50 mph within the interchange. The horizontal sight distance design exception locations described in DE07 also have horizontal curve radius constraints as described in DE10.

#### **4.2.5 Reduced Right Shoulder Width (DE09)**

The purpose of this Design Exception is for a localized reduction in shoulder width to avoid the historic Morningstar Tabernacle No. 88 Moses Hall and Cemetery grave sites. The shoulder width reduction is located along I-495 Northbound in advance of the I-495 bridges over Seven Locks Road. To avoid impacts

to identified grave sites located adjacent to existing I-495, a Design Exception is required for provision of a substandard right shoulder.

Under the existing condition, I-495 Northbound consists of four 12-foot lanes, a 12-foot left shoulder and an 11-foot right shoulder with guardrail. Under the proposed condition, I-495 Northbound will consist of two 12-foot HOT Managed Lanes and four 12-foot General Purpose Lanes separated by a 4-foot buffer, a 12-foot left shoulder with barrier and a 10-foot paved right shoulder with guardrail. Along the cemetery property, the right shoulder width will be reduced from 10-foot paved with guardrail to 6-feet with barrier for a distance of 200 feet. The reduced shoulder width approaching the cemetery property will transition from 10 foot paved with guardrail to 6 feet with barrier over a distance of 300 feet providing a flare rate of 96:1 which exceeds AASHTO criteria. Departing the cemetery property, the shoulder width will transition from 6 feet to 10 feet over a distance of 100 feet to transition back to a full shoulder width as quickly as possible.

#### **4.2.6 Horizontal Curve Radius (DE10)**

The purpose of this Design Exception is to request reductions of horizontal curve radius and superelevation rate at multiple locations within the I-495 and I-270 West Spur Interchange where existing corridor alignment constraints, minimizing residential property and wetland and stream impacts, and keeping the extent of interchange reconstruction to a practical limit, dictate a reduced horizontal curve radius and superelevation rate. The design exception discusses four locations where the horizontal curve radius and superelevation rate cannot be met for 60 mph, all within the West Spur Interchange. Each location will meet 50 mph horizontal curve radius and superelevation rate criteria.

In the existing condition, the General Purpose Lanes currently have radii and superelevation rates that are designed to a 50-mph design speed. Reconstructing the West Spur Interchange to increase the horizontal curve radii and superelevation rate to 60 MPH at these four locations would cause significant property and environmental impacts. The roadway and overpass structures for the HOT Lanes are new construction, the geometry of which is dictated by the constraints of the existing General Purpose Lane geometry. The design exception documents retention of these design elements meeting 50 mph within the interchange. The locations described in DE10 also have stopping sight distance constraints as described in DE07.

#### **4.2.7 Stopping Sight Distance (DE11)**

The purpose of this Design Exception is to request reductions of stopping sight distance at a single location along the northbound HOT Lanes at the location of the I-495/I-270 West Spur interchange where the constraints of the interchange geometry require provision of sight distance which aligns with a 60 mph design speed instead of the HOT Lanes design speed of 65 mph. Due to the bridge abutment placement for the I-495 Northbound HOT Lane bridge which crosses over the I-270 West Spur movement, the stopping sight distance will be constrained.

Under the proposed condition, the I-495 Northbound to I-270 West Spur connection will consist of two 12-foot HOT Lanes and three 12-foot General Purpose Lanes separated by a 4-foot buffer. 12-foot right and left shoulders are provided in the typical configuration, and a 12-foot left shoulder is provided at the location of this design exception. This 12-foot shoulder provides a horizontal sight offset (HSO) of 18 feet,



which exceeds the value required for 60 mph (17.4 feet) but does not provide the HSO required for 65 mph (23.2 feet.) Providing the 23.2-foot HSO would require substantial revisions to the interchange geometry, resulting in impacts to adjacent residential properties.

### 4.3 CONCEPTUAL GUIDE SIGNING PLAN

**Appendix F** contains a conceptual guide signing plan for the Preferred Alternative. The conceptual guide signing plan was developed using current MDOT SHA design standards and guidelines, including the *2009 Manual on Uniform Traffic Control Devices, Including Revisions 1 & 2 (MUTCD)* (FHWA, 2012a), the *2011 Maryland Manual on Uniform Traffic Control Devices (MDMUTCD)* (MDOT, 2016i), and the *2017 MDOT SHA Traffic Control Devices Design Manual (TCDDM)* (MDOT, 2017). The conceptual signing plan depicts major guide signs at interchanges and on their approaches, including Advance Guide signs, Exit Direction signs, and Gore signs as required per MUTCD/MDMUTCD Section 2E.30 and other pertinent sections. The following is a summary of some key design features of the Preferred Alternative conceptual guide signing:

- The conceptual guide signing plan depicts all signs with a consistent symbology with no reference to existing versus proposed signing. It is expected that existing compliant guide signing will be retained where possible consistent with the project's technical requirements. The technical requirement will require further evaluation of all existing signing and whether replacement is warranted. This will be further evaluated and reviewed during final design approvals as per the technical requirements, consistent with all standards, guidelines, and project approvals.
- Overhead sign structures of various types (i.e., full span, half span, cantilever, etc.) are depicted on the conceptual guide signing plan. These structure types do not represent the final structure type or configuration to be installed. Final structure type, configuration, and location will be determined during final design approvals as indicated above.
- Sign panels were designed in accordance with the latest edition of the standards and guidelines noted above.
- Designs for guide signs for I-495 and I-270 mainline General Purpose lane approaches to interchanges are consistent with MUTCD/MDMUTCD Chapter 2E, the figures contained therein, and other pertinent sections.
- Designs for guide signs for I-495 and I-270 mainline managed lane approaches to interchanges are consistent with MUTCD/MDMUTCD Chapter 2G, the figures contained therein, and other pertinent sections.
- Designs for guide signs for crossroads with access to the I-495 and I-270 General Purpose lanes are consistent with MUTCD/MDMUTCD Chapter 2D, the figures contained therein, and other pertinent sections.
- Designs for guide signs for crossroads with access to the I-495 and I-270 managed lanes are consistent with MUTCD/MDMUTCD Chapters 2F & 2G, the figures contained therein, and other pertinent sections.
- It should be noted that designs for guide signs for entrance to the I-495 and I-270 managed lanes from both the mainline and crossroads have been specifically designed in accordance with MDMUTCD Figure 2F-6, Option 3 (footnote (5) in the figure). This option for toll plaque and ETC pictograph placement and depiction on the guide signs represent MDOT's current practice for toll collection through a combination of registered ETC accounts and license plate character

recognition, which will be the toll collection practice for the I-495 and I-270 managed lanes. This layout has been specifically coordinated with Virginia's system projects and their FHWA counterparts for consistency.

- Toll rate signs are provided on each approach to the managed lane entrances, consistent with MUTCD/MDMUTCD Chapter 2G and to meet the project's proposed managed lane operational requirements.
- Where required, engineering judgement was utilized to adjust sign panel design and/or sign location to avoid potential conflicts (e.g., avoiding placement of downstream interchange advance guide signs within the middle of upstream interchanges). Where possible, to avoid sign clutter within the project corridor, collocation of express and General Purpose lanes signage was shown on a single sign structure.

Coordination with FHWA and NPS is ongoing. However, the conceptual guide signing for the Application for Interstate Access Point Approval is intended to demonstrate that the roadway can be signed adequately. The exact text on signing can be determined in final design.

#### **4.4 CROSSROAD INTERSECTION IMPROVEMENTS**

The need for intersection improvements at multiple locations along crossroads within the study network were identified during the analysis of the crossroad intersections. These improvements are detailed in **Section 6.5.2**.

## 5 TRAFFIC FORECASTS

The approved IAPA Framework Document (see **Appendix A**) outlines the understanding between FHWA and MDOT regarding the scope of work of the IAPA, including the study area, traffic forecasting and analysis methodology, model calibration, and study assumptions. However, since the document was signed, MDOT SHA decided to align the Preferred Alternative to be consistent with the previously determined phased delivery and permitting approach, which focuses on Phase 1 South. As a result, FHWA and MDOT SHA identified a new Preferred Alternative: Alternative 9 – Phase 1 South. The Preferred Alternative includes the same improvements proposed as part of Alternative 9 but is limited to the Phase 1 South limits only (as shown in **Figure ES-1**). Baseline conditions are described in Chapter 4 of the FEIS.

To estimate the impacts of future development growth and the Preferred Alternative, a series of traffic models were used to analyze interim year (2027) and design year (2045) No Build and Preferred Alternative conditions. Three major modeling components (regional travel demand model, VISUM model, VISSIM model) were utilized for future year volume development. As a first step, the regional travel demand model was run, and a subarea extraction process was developed to create inputs for the next step. The corresponding subarea network and origin-destination (O-D) trip tables were extracted and used as the basis for more refined modeling using VISUM. For the second step, a VISUM model was developed to estimate the number of trips entering and exiting the study area. And lastly, the corresponding VISUM traffic volumes were used in the VISSIM model for detailed operational analysis.

An overview of these three modeling platforms, their role and importance to the overall forecasting process, and how the results of these tools were used to help develop the project forecasts are summarized in the FEIS, Appendix A: Final Traffic Technical Report. Traffic volume diagrams are included in **Appendix B**.

## 6 TRAFFIC ANALYSIS

### 6.1 VISSIM ANALYSIS

The approved IAPA Framework Document (see **Appendix A**) outlines the understanding between FHWA and MDOT regarding the scope of work of the IAPA, including the study area, traffic forecasting and analysis methodology, model calibration, and study assumptions. However, since the document was signed, MDOT SHA decided to align the Preferred Alternative to be consistent with the previously determined phased delivery and permitting approach, which focuses on Phase 1 South. As a result, FHWA and MDOT SHA identified a new Preferred Alternative: Alternative 9 – Phase 1 South. The Preferred Alternative includes the same improvements proposed as part of Alternative 9 but is limited to the Phase 1 South limits only (as shown in **Figure ES-1**).

The base and future year traffic volumes from the VISUM analysis were imported into the VISSIM model for further modeling and traffic simulation. The VISSIM model assigns individual vehicles to a travel network that represents all roadways, traffic signals, stop signs, and yield signs within the model study area. This model provides a visual and realistic simulation of the vehicle interactions with each other and the traffic control devices in the network. VISSIM allows for flexibility to develop and analyze a wide range of complex vehicle movements and roadway geometry, including managed lanes and alternative interchange designs. VISSIM has the ability to shift unmet demand from one time period to subsequent time periods, which is useful for congested networks with latent demand.

VISSIM microsimulation models were used to provide operational analysis results for the following:

- Interstate mainline segments
- Ramp merge, diverge, and weave segments
- Ramp junctions/intersections

As the first step to microscopic modeling, the VISSIM base year model was calibrated to reflect existing traffic volumes and travel times within the IAPA study area network.

#### 6.1.1 VISSIM Model Development

During NEPA, VISSIM models were developed using Version 10. MDOT SHA Travel Forecasting and Analysis Division (TFAD) provided a previously calibrated VISSIM model for the study area. Lane geometry was confirmed based on aerial photography. Model calibration required specific updates, which included traffic volume inputs and routing decisions, traffic signal timings, turning speed reduction zones, driver and link behavior types, and lane change distances. These updates enabled the VISSIM model to simulate the typical weekday AM and PM peak periods under 2017 existing conditions (see VISSIM Calibration Memo in **Appendix G**) to reflect 2017 existing geometry, traffic volumes, and speeds across all lanes, including High Occupancy Vehicle (HOV) lanes and local lanes. The models do not include roadway improvements built after 2017, such as the improvements that are under construction along I-270 as part of the ICM project. To note, many of the ICM improvements were implemented as of August 2022; however, many other ICM improvements, including northbound ramp metering, will not be fully

implemented until later in 2022. The MLS Traffic Technical Report provides the modeling methodologies and assumptions in detail<sup>8</sup>.

The traffic analysis area developed during NEPA extended beyond the MLS limits to capture upstream and downstream effects. Evaluation of the Preferred Alternative used the same limits for the VISSIM simulation models as in the NEPA process, as shown in **Figure 6-1** and listed below:

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

A list of interchanges with proposed HOT Managed Lane access and proposed changes to General Purpose Lane access, along with slip ramp locations that provide access to/from the HOT Managed Lanes, is included in **Table 3-1**.

The VISSIM models were used to provide operational analysis results for freeways, ramps, and ramp junction intersections; such performance metrics include travel time and speed, density with corresponding HCM-based Level of Service (LOS), and maximum queue lengths. Synchro was used to develop the signal timing and phasing for input into the future-year VISSIM models as well as provide operational analysis results of delay with corresponding HCM-based LOS and queuing of the ramp junction intersections and their adjacent intersections.

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<sup>8</sup> [https://www.oplanesmd.com/wp-content/uploads/2020/07/APP-C\\_MLS\\_Traffic-Tech-Report-Appendices.pdf](https://www.oplanesmd.com/wp-content/uploads/2020/07/APP-C_MLS_Traffic-Tech-Report-Appendices.pdf)

**Figure 6-1: Limits of VISSIM Model Network and Interchange Locations Included along I-495 and I-270  
(Existing and No Build)**





### 6.1.2 VISSIM Calibration & Validation

Using the NEPA VISSIM microsimulation models as a base, refinements were made to improve calibration in some areas, including coding error corrections and driver behavior modifications at spot locations to better reflect 2017 conditions. Key details regarding VISSIM basic inputs and calibration requirements established for the analysis can be found within the VISSIM Calibration Memo (**Appendix G**).

Both the AM and PM microsimulation models included a seeding time of 1 hour in addition to four 1-hour simulation periods. Data is collected by VISSIM during the 4-hour peak periods of 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM, which is reflective of the identified peak periods. The initialization (seeding) periods are necessary to populate the network and produce the appropriate congestion prior to data recording. Five (5) runs were performed for each model scenario. The entry volume input data was coded for both the seeding period and each of the simulation hours in the peak period.

The validation targets for the I-270 and I-495 models include confirming the following:

- VISSIM travel times fall within a 95% confidence level of INRIX travel times. The cumulative upper and lower bounds of the 95% confidence intervals were determined by first calculating the margin of error for each segment along the corridor.
- VISSIM simulated volumes fall within +/- 10% of balanced traffic count volumes.

The existing travel time data along both highways showed high variability between travel times in both the AM and PM peak hours. Travelers experienced a significant drop in speed during the peak periods. The goal of calibrating the existing model was to develop a model that is representative of a typical day along the corridor, while also considering the volatility of the corridor and the reliability of each data set. Project speeds are reflective of May 2017 (Tuesdays, Wednesdays, and Thursdays), but the volumes were collected over multiple days, months, and years due to the size of the study. Both the I-495 and I-270 corridors frequently experience oversaturated conditions where the observed volume does not represent the actual demand on each roadway facility. The calibration process was, therefore, pivoted to use speed as the most reliable validation performance metric while volume was used as secondary benchmark criteria for comparison purposes<sup>9</sup>.

The complexity of the I-495 and I-270 VISSIM study area can be characterized by the size of the network, duration of the peak periods, and high variability of daily speeds and volumes. When evaluating the model simulated speeds and volumes compared to the field-collected data, the model is considered reasonably calibrated on most segments meeting the speed target criteria during both the AM and PM peak periods. This reasonableness provides the sensitivity necessary to evaluate the future year conditions for the purposes of the IAPA. Development and calibration of the VISSIM models are detailed in the “I-495 and I-270 Calibration Memo”, which can be found in **Appendix G**.

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<sup>9</sup> I-495 / I-270 P3 Program Managed Lanes Study – VISSIM Calibration Memo (March 26, 2020) (page 4)

### 6.1.3 VISSIM Future Year Model Development

Using the calibrated existing models as a base, the future (2027 and 2045) No Build and Preferred Alternative models were developed to account for changes to the network that occur between the baseline and future years. Like the base year analysis, the future year traffic operations were analyzed at all freeway segments, ramp locations, weaving segments, merges, diverges, signalized intersections, and stop-controlled intersections within the study area. Through an iterative process of identifying bottlenecks and areas of demand induced congestion, segment and intersection level improvements were applied to the VISSIM model to mitigate problem areas when possible. These improvement recommendations were incorporated and evaluated as part of future year 2045 crossroad level traffic analyses, as described in **Section 6.5.2**.

## 6.2 SYNCHRO CORRIDOR ANALYSIS

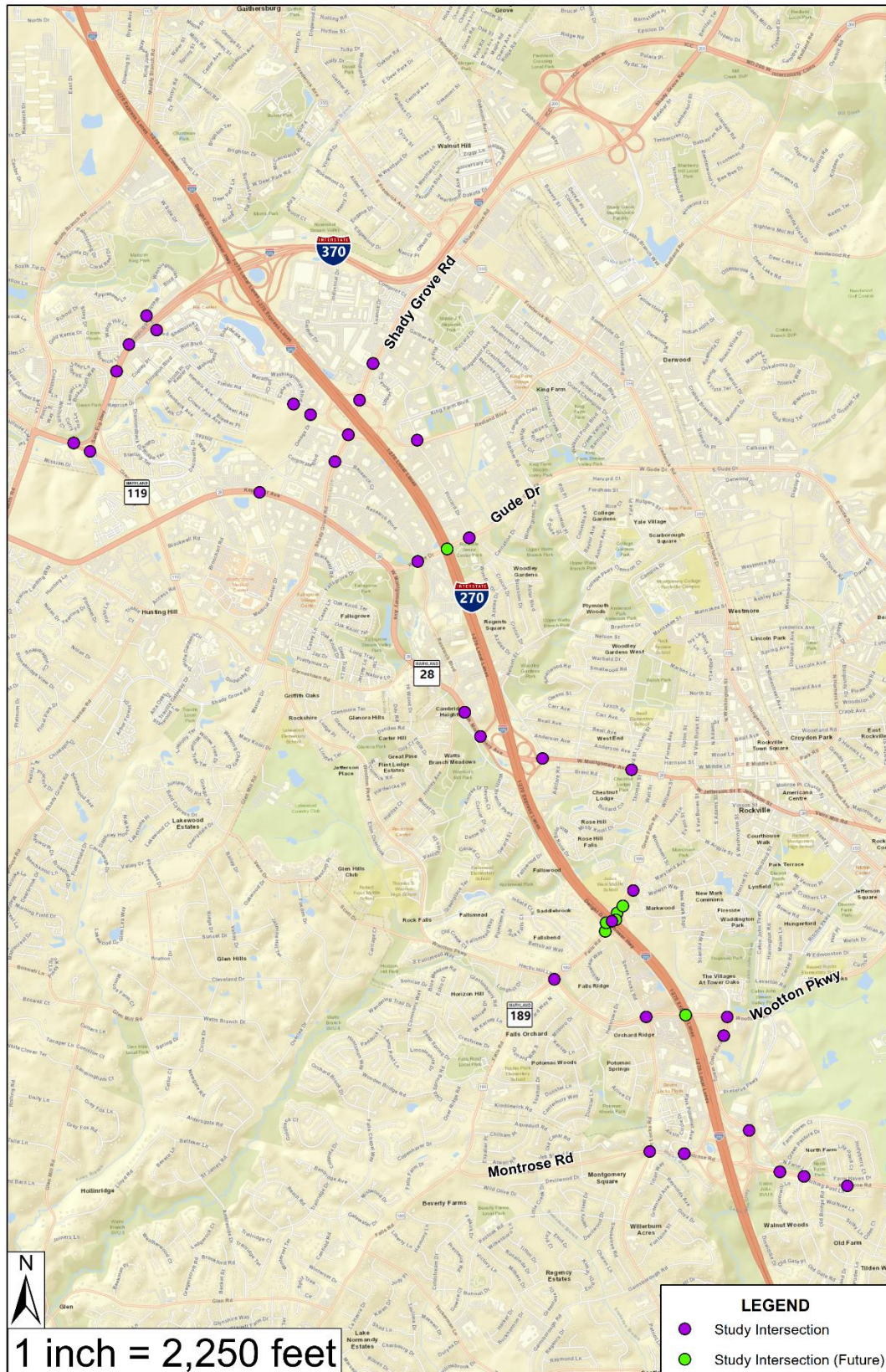
The VISSIM microsimulation model used in the Traffic Technical Report, which is part of the NEPA document, did not include all the signalized intersections required for the IAPA analysis (due to the size of the models, amount of data collection required, and model runtime). Therefore, Synchro models of the crossroads were developed and calibrated for the AM peak hour and PM peak hour to evaluate operations on the crossroads and to ensure operations along crossroads do not impact freeway operations. Synchro was also used to develop the signal timing and phasing for input into the future-year VISSIM models. Synchro is a deterministic traffic tool, i.e., a tool that assumes there is no variability in the driver-vehicle characteristics. Synchro is often used to analyze signalized and unsignalized intersections, but not freeways, interchanges, or ramps. Synchro uses Highway Capacity Manual (HCM) and Intersection Capacity Utilization (ICU) methodology to determine intersection capacity and LOS.

Synchro models were analyzed using Version 11.1.0.8. Based on input from FHWA, arterial crossroad analysis including the adjacent intersections were performed using Synchro for one adjacent intersection on crossroads (on both sides) beyond service interchanges that are modified by the Preferred Alternative, when within one mile. Additional intersections were included where needed, such as where requested by FHWA, or where signals are closely spaced. A total of 60 intersections are reported in the Existing and No Build condition, and 67 intersections are reported with the Preferred Alternative as new intersections are completed to provide HOT Managed Lanes access and as part of interchange modifications, including converting the one signal serving the I-270 at MD 189 interchange to 5 signals with the conversion of this interchange to a diverging diamond interchange (DDI). The locations of these intersections are shown in **Figure 6-2**. Intersection delays and Level of Service (LOS) are reported using the Highway Capacity Manual (HCM) 6<sup>th</sup> edition reports from Synchro in most cases, which are based on Chapter 19 of the HCM. At intersections that cannot be reported using HCM 6<sup>th</sup> edition due to non-standard phasing, HCM 2000 reports were used.

Synchro models were calibrated based on observed conditions in the field, including signal timings and observed queuing. The models were adjusted to match field conditions, including adjusting link speeds and turning speeds, linking origin-destination volumes, adjusting lane utilization and saturation flow rates, and adjusting lane alignments to better match queuing conditions. Signal timings and phasing were confirmed in the field and adjusted where needed to match field-recorded signal timings and phasing.

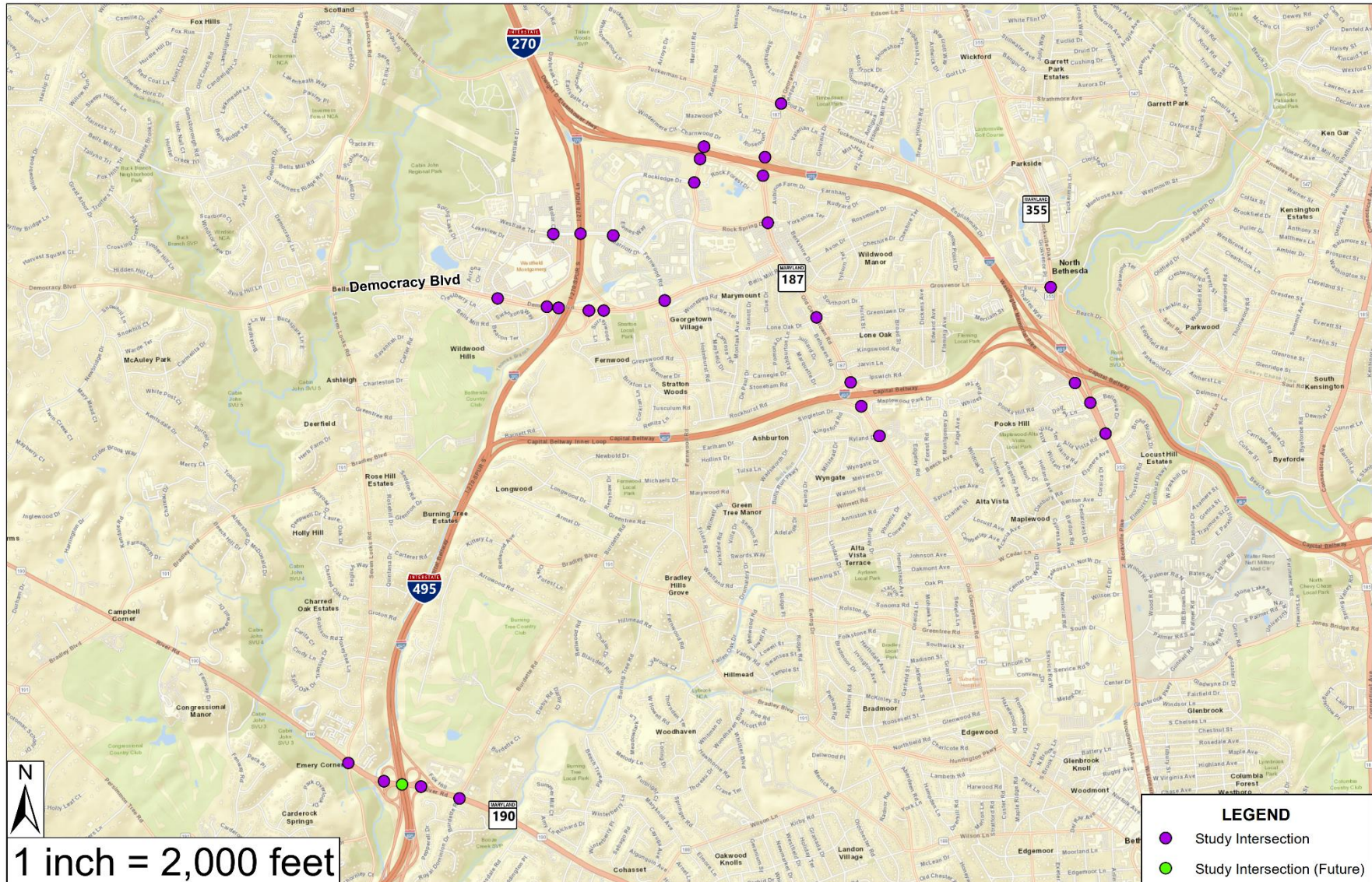


**Figure 6-2: Crossroad Intersection Locations**





**Figure 6-2: Crossroad Intersection Locations (Continued)**



### 6.3 MEASURES OF EFFECTIVENESS

Analysis was based on microsimulation results and HCM methodologies. **Figure 6-3** and **Table 6-1** show LOS criteria for freeways and ramps. **Table 6-2** shows LOS criteria for signalized intersections, which is based on overall intersection delay. **Table 6-3** shows LOS criteria for unsignalized intersections, which is based on the delay for the worst approach. Queues were measured along I-495, I-270, and other connecting freeways (where queuing exists), along on-ramps and off-ramps, and along all approaches to ramp termini intersections. Tables of the measures of effectiveness (MOE) results, as well as figures summarizing MOEs from VISSIM and Synchro, are provided in the following sections of this report. Per Federal Highway Administration's (FHWA) *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software (July 2004)*,

- Delay:
  - o "The HCM bases its LOS grades for intersections on estimates of mean control delay for the highest consecutive 15-minute period within the hour... The HCM does not use total delay to measure signal LOS. It uses 'control delay.' This is the component of total delay that results when a control signal causes a lane group to reduce speed or to stop."
  - o *Control delay from Synchro was used. Synchro defines control delay as "the component of delay caused by the downstream control device and does not include Queue Delay." Average vehicle delay from VISSIM was used. VISSIM defines vehicle delay as the difference between the theoretical travel time (i.e., "the travel time which could be achieved if there were no other vehicles and/or no signal controls or other reasons for stops") and the actual travel time. As VISSIM delay does not correlate to HCM-based delay, intersection LOS was only included with Synchro results.*
- Density
  - o "If microsimulation model reports of vehicle density are to be reported in terms of their LOS implications, it is important to first translate the densities reported by the software into the densities used by the HCM to report LOS for uninterrupted flow facilities."
  - o *As VISSIM does not report HCM-based LOS for density, LOS is reported by post-processing density using the HCM-based LOS that corresponds to the approximated density. Post processing includes applying passenger car equivalents (PCE) to VISSIM density outputs.*
- Queues
  - o "HCM 2000 defines a queue as 'A line of vehicles, bicycles, or persons waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue. Slowly moving vehicles or people joining the rear of the queue are usually considered part of the queue.' These definitions are not implementable within a microsimulation environment since 'waiting to be served' and 'slowly' are not easily defined. Consequently, alternative definitions based on maximum speed, acceleration, and proximity to other vehicles have been developed for use in microsimulation."
  - o *Average and maximum simulated queues from VISSIM are reported. 50<sup>th</sup> and 95<sup>th</sup> percentile queue lengths from Synchro are reported. These queues represent stopped vehicles.*



To address the above guidelines and in compliance with MDOT SHA's "Interstate Access Point Approval Process for the Maryland Department of Transportation State Highway Administration" (July 2017), MOEs documented include the following:

- Level of service (LOS)
  - VISSIM analysis results
    - Approximated average intersection vehicle delay (seconds/vehicle) results are provided for all ramp termini intersections.
    - Approximated average vehicle delay (seconds/vehicle) are reported for all ramp junction intersections.
    - Approximated average density (passenger cars/hour/lane) and LOS results are provided for all mainline, merge, diverge, and weaving sections on I-495 and I-270, by lane and average of all lanes.
  - Synchro analysis results
    - HCM-based average control delay (seconds/vehicle) and LOS from Synchro are provided by intersection and approach at all ramp termini intersections and the first signalized intersection on either side of the study interchange, with additional intersections included at specific locations.
- Queues
  - VISSIM analysis results (average and maximum queue lengths) are provided for all ramp termini intersections (all approaches and movements).
  - Synchro analysis results (50th and 95th percentile queue lengths) are provided at all ramp termini intersections and the first signalized intersection on either side of the study interchange, with additional intersections included at specific locations.
- Additional MOEs
  - Simulated throughput volume (vehicles per hour) along I-270 and I-495.
  - Simulated average speed (mph) along I-270 and I-495 by lane and average of all lanes.
  - Simulated average travel time (minutes) along I-270 and I-495



**Figure 6-3: Freeway Level of Service (LOS) (VISSIM) – Per HCM Exhibit 12-15**

**Table 6-1: Level of Service (LOS) Criteria – Freeways and Ramps (pc/hr/ln)**

| Level of Service | Freeway Segment (HCM 12-15)     | Freeway Weaving (HCM 13-6)      | Multilane/ C-D Road Weaving (HCM 13-6) | Freeway Merge and Diverge (HCM 14-3)* |
|------------------|---------------------------------|---------------------------------|--|---------------------------------------|
| A                | 0 – 11                          | 0 – 10                          | 0 – 12                                 | 0 – 10                                |
| B                | > 11 – 18                       | > 10 – 20                       | > 12 – 24                              | > 10 – 20                             |
| C                | > 18 – 26                       | > 20 – 28                       | > 24 – 32                              | > 20 – 28                             |
| D                | > 26 – 35                       | > 28 – 35                       | > 32 – 36                              | > 28 – 35                             |
| E                | > 35 – 45                       | > 35 – 43                       | > 36 – 40                              | > 35                                  |
| F                | Demand Exceeds Capacity or > 45 | Demand Exceeds Capacity or > 43 | Demand Exceeds Capacity or > 40        | Demand Exceeds Capacity               |

\*Per HCM, these criteria may also be applied to major merges and diverges; high-speed, uncontrolled merge or diverge ramps on multilane highway sections; and merges and diverges on freeway collector-distributor (C-D) roadways.

**Table 6-2: Level of Service (LOS) Criteria for Signalized Intersections – Per HCM Exhibit 19-8**

| Level of Service | Control Delay (sec/veh) | Description          |
|------------------|-------------------------|----------------------|
| A                | 0 – 10                  | Free flow            |
| B                | > 10 – 20               | Stable flow          |
| C                | > 20 – 35               | Stable flow          |
| D                | > 35 – 55               | Approaching unstable |
| E                | > 55 – 80               | Unstable flow        |
| F                | > 80                    | Forced flow          |

**Table 6-3: Level of Service (LOS) Criteria for Unsignalized Intersections – Per HCM Exhibit 20-2**

| Level of Service | Control Delay (sec/veh) | Description          |
|------------------|-------------------------|----------------------|
| A                | 0 – 10                  | Free flow            |
| B                | > 10 – 15               | Stable flow          |
| C                | > 15 – 25               | Stable flow          |
| D                | > 25 – 35               | Approaching unstable |
| E                | > 35 – 50               | Unstable flow        |
| F                | > 50                    | Forced flow          |

## 6.4 VISSIM RESULTS

VISSIM microsimulation models were used to provide operational analysis results for interstate mainline segments, ramp merge, diverge, and weave segments, and ramp junctions/intersections along I-495 from VA 267 to MD 185 and along I-270 from MD 117 to I-495, including both I-270 Spurs. The results of the VISSIM analysis are included in **Appendix H** and are summarized in the following sections.

### 6.4.1 Existing Conditions

The following figures and tables summarize existing (2017) operations along freeway segments. **Figure 6-4** summarizes the percentage of lane-miles operating at each LOS, based on density, during the AM peak period. **Figure 6-5** summarizes the percentage of lane-miles operating at each LOS, based on density, during the PM peak period. **Table 6-4** summarizes freeway speed and density by segment during the AM peak period. **Table 6-5** summarizes freeway speed and density by segment during the PM peak period.

Refer to **Table 6-1** for LOS thresholds for basic segments and for merge, diverge, and weave segments. **Appendix H** contains a summary of densities and speeds by lane. In addition, the number of lane changes through weave sections is summarized in **Appendix H**.

As shown, there are several segments operating at LOS 'F' with low speeds, including 49% of lane-miles along I-270 Southbound General Purpose Lanes and 54% all of lane-miles along I-270 Local Lanes during the AM peak period. During the PM peak period, 81% of lane-miles along the I-495 Inner Loop, 63% of lane-miles along the I-495 Outer Loop, and 53% of lane-miles along I-270 Northbound General Purpose Lanes operate at LOS 'F'.

### Bottleneck Locations

Several bottlenecks occur along the I-270 and I-495 corridors due to increased traffic demand, ramp merges and diverges, weaves, and lane drops. The following is a summary of notable bottleneck locations identified based on speed data and observation, including some that occur outside of the study area.

#### *I-270 Southbound (AM Peak)*

- **I-270 from Father Hurley Blvd to MD 124:** High traffic volumes merging onto I-270 from MD 124 Westbound and MD 118 create a bottleneck.
- **I-270 from I-370 to Montrose Rd:** A combination of closely spaced interchanges, slip ramps between I-270 Local and Express lanes, and high traffic volumes entering and exiting I-270 from I-370, MD 28, MD 189, and Montrose Rd create heavy weaving conditions and reduce capacity along this stretch of I-270. After Montrose Road, I-270 Local lanes end and merge with I-270 Express lanes, resulting in traffic weaving as vehicles approach the I-270 spurs.
- **I-270 West Spur from I-270 Split to I-495 West:** High traffic volume from I-270 Southbound merges with traffic volume from I-495 Westbound, creating a bottleneck on the I-270 West Spur.

#### *I-270 Northbound (PM Peak)*

- **I-270 East/West Spurs at I-270 Split:** High traffic volumes entering I-270 from I-495 Inner and Outer Loops, coupled with traffic weaving to I-270 Local or Express lanes, creates a bottleneck at the start of I-270 Northbound.
- **I-270 from I-370 to MD 124:** I-270 Local lanes ending after the MD 124 interchange and then merging with I-270 Express lanes' high traffic volumes causes a bottleneck.
- **I-270 between MD 109 and MD 121 interchanges:** A lane drop from 3 to 2 lanes, combined with high traffic volumes result in low speeds along this segment.

#### *I-495 Inner Loop (AM Peak)*

- **I-495 from American Legion Bridge to VA 193:** A weaving section occurs on the American Legion Bridge due to high traffic volumes entering from George Washington Memorial Parkway and exiting to Clara Barton Parkway, creating a bottleneck.

#### *I-495 Inner Loop (PM Peak)*

- **I-495 from VA 193 to I-270 West Spur:** High traffic volumes entering the Inner Loop from VA 193, George Washington Memorial Parkway, Cabin John Parkway, and MD 190, coupled with a heavy weaving section prior to the I-270 Northbound and I-495 Westbound split, creates a bottleneck on I-495.
- **I-495 from MD 187 to MD 97:** High traffic volume entering the Inner Loop from MD 97 creates a bottleneck when merging onto a very high-volume section of I-495.
- **I-495 from I-95 to MD 201:** High traffic volumes entering the Inner Loop from I-95, US 1, and MD 201, combined with high traffic volumes on I-495, create a bottleneck on I-495.

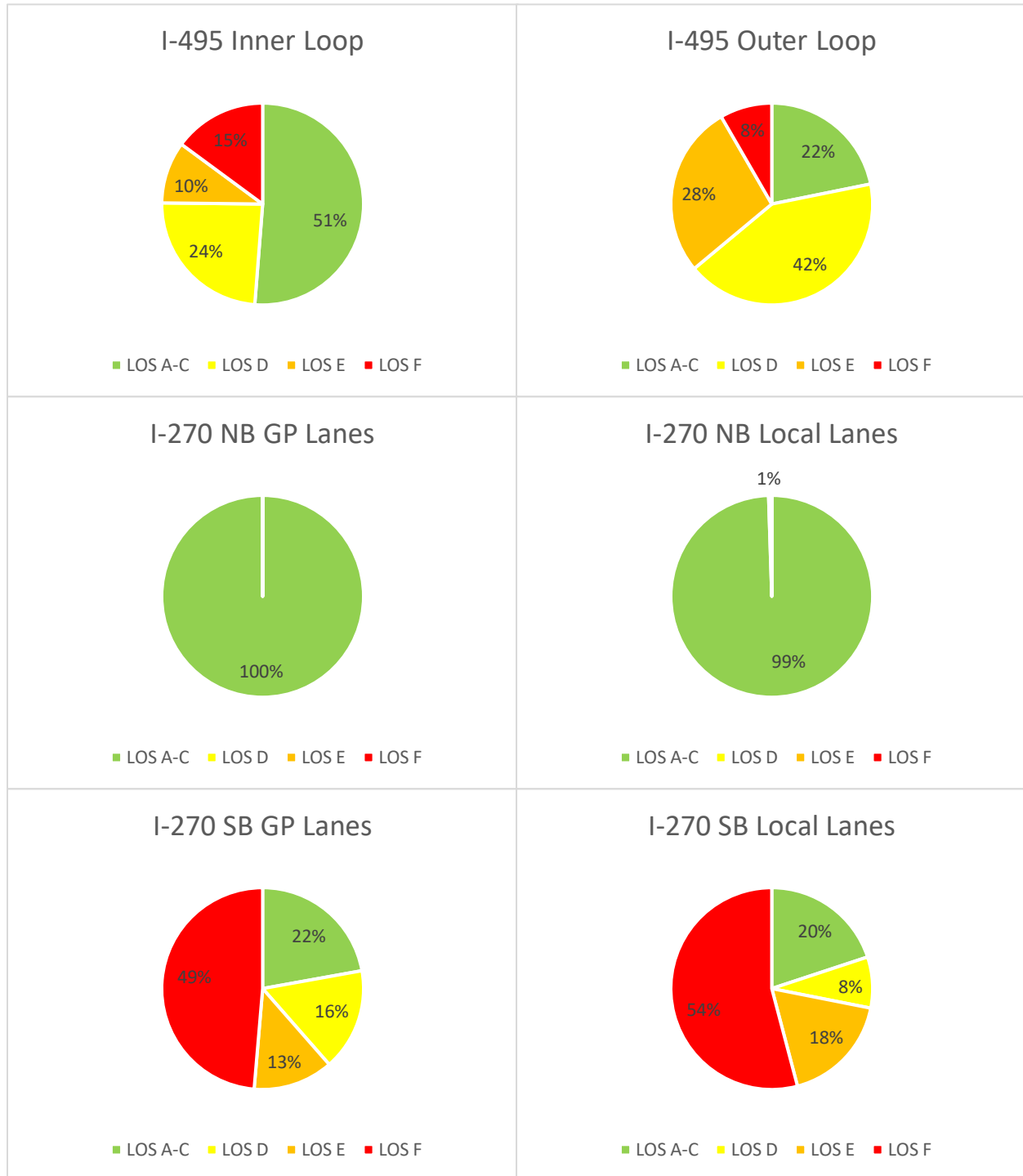
#### *I-495 Outer Loop (AM Peak)*

- **I-495 from I-95 and MD 97:** High traffic volume merging onto the Outer Loop from MD 97, combined with high traffic volume on I-495, creates a bottleneck that is exacerbated by additional heavy volume entering the Inner Loop from US 29, MD 193, MD 650, and I-95.

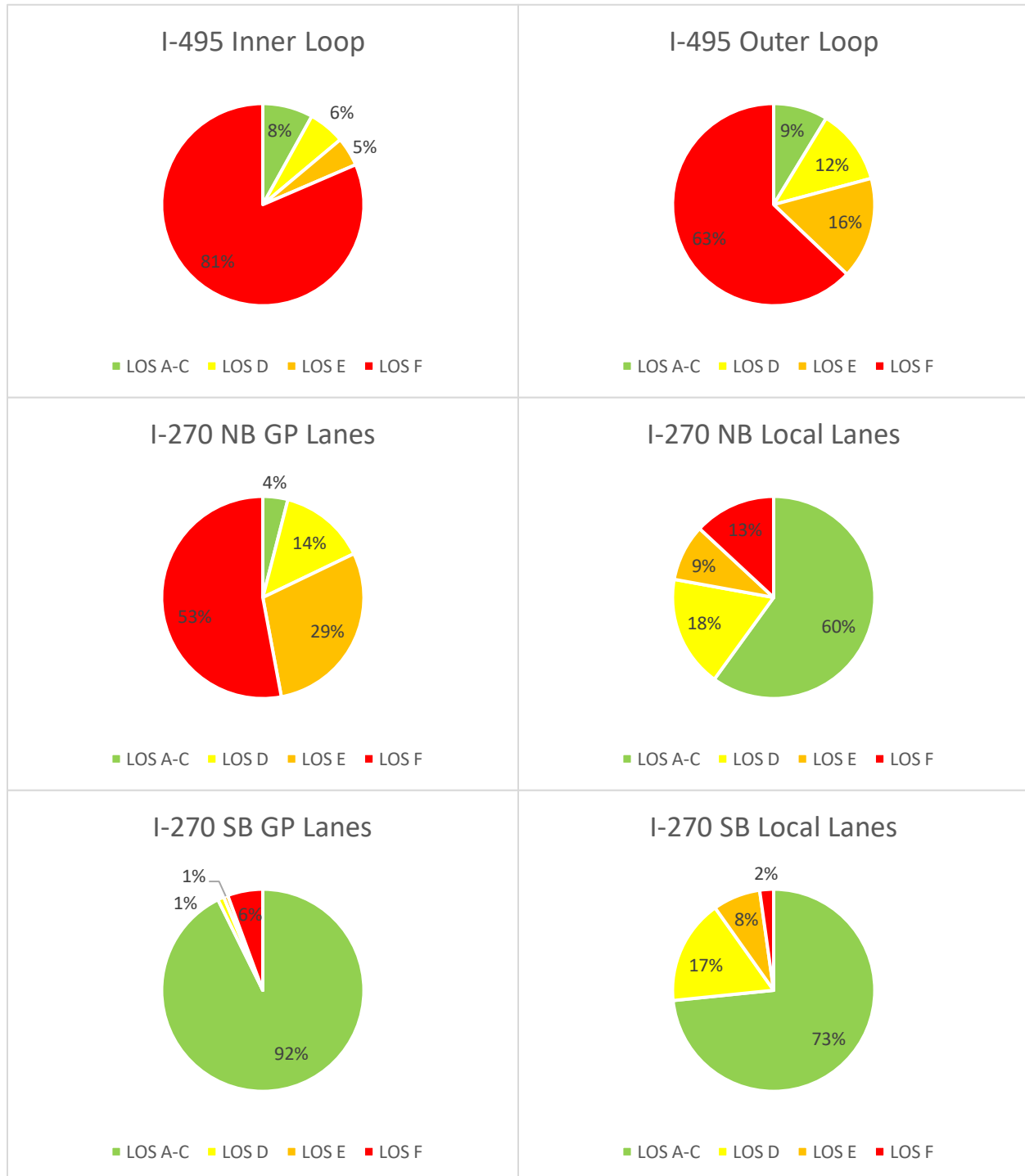
#### *I-495 Outer Loop (PM Peak)*

- **I-495 from Clara Barton Parkway to I-270 West Spur:** High traffic volumes merging onto the Outer Loop from MD 190 and Clara Barton Parkway create a bottleneck.

**Figure 6-4: 2017 Existing AM Mainline Segment LOS**



**Figure 6-5: 2017 Existing PM Mainline Segment LOS**





**Table 6-4: 2017 Existing AM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment**

| Location  | Type    | Average Speed (mph) |        |        |         | Average Density (pc/hr/ln) |        |        |         |
|---|---------|---------------------|--------|--------|---------|----------------------------|--------|--------|---------|
|   |         | 6-7 AM              | 7-8 AM | 8-9 AM | 9-10 AM | 6-7 AM                     | 7-8 AM | 8-9 AM | 9-10 AM |
| I-495 Inner Loop  |         |                     |        |        |         |                            |        |        |         |
| Between VA 267 & VA 193   | Basic   | 59                  | 59     | 59     | 52      | 20                         | 22     | 19     | 24      |
|   | Diverge | 58                  | 58     | 51     | 44      | 21                         | 23     | 26     | 40      |
| VA 193 Interchange  | Basic   | 58                  | 55     | 30     | 19      | 23                         | 26     | 62     | 103     |
| Between VA 193 & George Washington Memorial Parkway                 | Weave   | 58                  | 32     | 11     | 10      | 22                         | 50     | 121    | 127     |
| George Washington Memorial Parkway Interchange                      | Merge   | 57                  | 17     | 12     | 11      | 19                         | 90     | 131    | 132     |
|   | Basic   | 55                  | 23     | 20     | 19      | 28                         | 81     | 94     | 96      |
| Between George Washington Memorial Parkway & Clara Barton Parkway   | Weave   | 38                  | 26     | 25     | 23      | 44                         | 68     | 70     | 72      |
| Clara Barton Parkway Interchange                                    | Basic   | 50                  | 49     | 48     | 49      | 37                         | 41     | 40     | 39      |
| Between Clara Barton Parkway & MD 190                               | Merge   | 56                  | 55     | 55     | 55      | 22                         | 24     | 23     | 23      |
|   | Basic   | 57                  | 56     | 56     | 56      | 33                         | 35     | 35     | 34      |
|   | Diverge | 55                  | 55     | 55     | 55      | 24                         | 25     | 24     | 24      |
| MD 190 Interchange  | Basic   | 57                  | 57     | 56     | 56      | 30                         | 31     | 31     | 30      |
|   | Merge   | 58                  | 58     | 58     | 58      | 19                         | 21     | 20     | 20      |
|   | Basic   | 58                  | 58     | 58     | 58      | 24                         | 26     | 25     | 25      |
| Between MD 190 & I-270 West Spur                                    | Merge   | 58                  | 58     | 57     | 57      | 13                         | 16     | 18     | 18      |
|   | Basic   | 57                  | 57     | 56     | 56      | 26                         | 29     | 30     | 30      |
|   | Weave   | 58                  | 58     | 56     | 56      | 22                         | 24     | 26     | 25      |
| Between I-270 West Spur & MD 187                                    | Basic   | 57                  | 56     | 57     | 57      | 26                         | 27     | 23     | 23      |
|   | Diverge | 46                  | 40     | 46     | 49      | 23                         | 28     | 22     | 19      |
| MD 187 Interchange  | Basic   | 56                  | 56     | 57     | 57      | 23                         | 24     | 20     | 20      |
| Between MD 187 & I-270 East Spur                                    | Merge   | 54                  | 54     | 56     | 55      | 16                         | 18     | 15     | 15      |
|   | Basic   | 57                  | 56     | 57     | 57      | 24                         | 26     | 22     | 22      |
|   | Diverge | 52                  | 47     | 54     | 54      | 26                         | 30     | 23     | 23      |
| I-270 East Spur Interchange   | Basic   | 51                  | 50     | 51     | 51      | 35                         | 38     | 32     | 33      |
|   | Weave   | 59                  | 59     | 58     | 59      | 24                         | 29     | 26     | 26      |
|   | Weave   | 59                  | 54     | 52     | 59      | 17                         | 25     | 24     | 20      |
|   | Basic   | 60                  | 42     | 44     | 60      | 21                         | 44     | 36     | 24      |
| Between I-270 East Spur & MD 185                                    | Merge   | 60                  | 30     | 35     | 60      | 19                         | 63     | 47     | 23      |
|   | Basic   | 58                  | 47     | 51     | 57      | 27                         | 42     | 37     | 31      |
|   | Diverge | 58                  | 54     | 58     | 57      | 19                         | 26     | 22     | 22      |
| I-495 Outer Loop General Purpose Lanes                              |         |                     |        |        |         |                            |        |        |         |
| Between VA 267 & VA 193   | Basic   | 45                  | 43     | 41     | 43      | 38                         | 43     | 51     | 44      |
|   | Merge   | 53                  | 52     | 51     | 52      | 19                         | 23     | 27     | 24      |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Basic   | 52                  | 52     | 50     | 51      | 32                         | 35     | 39     | 35      |
|   | Merge   | 52                  | 51     | 45     | 49      | 19                         | 22     | 31     | 24      |
|   | Basic   | 53                  | 53     | 53     | 53      | 29                         | 32     | 34     | 31      |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 53                  | 52     | 52     | 52      | 32                         | 34     | 36     | 34      |
| Clara Barton Parkway Interchange                                    | Basic   | 51                  | 51     | 50     | 51      | 40                         | 41     | 42     | 39      |
| Between Clara Barton Parkway & MD 190                               | Diverge | 52                  | 52     | 51     | 52      | 30                         | 30     | 31     | 29      |
|   | Basic   | 50                  | 48     | 49     | 50      | 41                         | 44     | 43     | 40      |
|   | Merge   | 47                  | 34     | 38     | 47      | 37                         | 55     | 49     | 36      |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

LOS A-C
LOS D
LOS E
LOS F

**Table 6-4: 2017 Existing AM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | Average Speed (mph) |        |        |         | Average Density (pc/hr/ln) |        |        |         |
|--|---------|---------------------|--------|--------|---------|----------------------------|--------|--------|---------|
|  |         | 6-7 AM              | 7-8 AM | 8-9 AM | 9-10 AM | 6-7 AM                     | 7-8 AM | 8-9 AM | 9-10 AM |
| I-495 Outer Loop General Purpose Lanes (Continued) |         |                     |        |        |         |                            |        |        |         |
| MD 190 Interchange                                 | Basic   | 53                  | 45     | 51     | 53      | 35                         | 41     | 34     | 31      |
|  | Diverge | 52                  | 52     | 53     | 53      | 30                         | 30     | 28     | 28      |
| Between MD 190 & I-270 West Spur                   | Diverge | 53                  | 53     | 51     | 53      | 24                         | 25     | 28     | 25      |
|  | Basic   | 50                  | 44     | 45     | 50      | 39                         | 48     | 45     | 37      |
|  | Weave   | 51                  | 31     | 42     | 53      | 32                         | 54     | 39     | 29      |
| Between I-270 West Spur & MD 187                   | Basic   | 53                  | 52     | 53     | 53      | 25                         | 30     | 26     | 27      |
|  | Merge   | 53                  | 52     | 53     | 53      | 17                         | 21     | 17     | 18      |
| MD 187 Interchange                                 | Basic   | 53                  | 53     | 54     | 53      | 21                         | 24     | 21     | 22      |
| Between MD 187 & I-270 East Spur                   | Diverge | 53                  | 52     | 53     | 53      | 16                         | 19     | 16     | 17      |
|  | Basic   | 53                  | 53     | 53     | 53      | 23                         | 27     | 24     | 25      |
|  | Merge   | 49                  | 49     | 49     | 49      | 18                         | 23     | 22     | 22      |
|  |         |                     |        |        |         |                            |        |        |         |
| I-270 East Spur Interchange                        | Basic   | 53                  | 53     | 53     | 53      | 22                         | 25     | 22     | 23      |
|  | Diverge | 53                  | 53     | 53     | 53      | 29                         | 34     | 36     | 35      |
| Between I-270 East Spur & MD 185                   | Diverge | 53                  | 53     | 52     | 53      | 26                         | 29     | 34     | 32      |
|  | Basic   | 53                  | 51     | 44     | 50      | 32                         | 38     | 50     | 41      |
| I-270 Northbound General Purpose Lanes             |         |                     |        |        |         |                            |        |        |         |
| MD 117 Interchange                                 | Basic   | 64                  | 64     | 64     | 64      | 9                          | 12     | 14     | 16      |
| Between MD 117 & I-370                             | Diverge | 64                  | 63     | 63     | 63      | 11                         | 17     | 19     | 20      |
|  | Basic   | 64                  | 63     | 62     | 61      | 9                          | 13     | 15     | 17      |
|  | Merge   | 61                  | 60     | 59     | 57      | 9                          | 15     | 18     | 19      |
| I-370 Interchange                                  | Basic   | 64                  | 64     | 64     | 64      | 7                          | 9      | 12     | 12      |
|  | Merge   | 62                  | 61     | 60     | 60      | 6                          | 9      | 10     | 10      |
| Shady Grove Road Interchange                       | Basic   | 64                  | 64     | 64     | 64      | 6                          | 9      | 11     | 11      |
| Between Shady Grove Road & MD 28                   | Weave   | 64                  | 64     | 64     | 64      | 6                          | 9      | 12     | 11      |
| MD 28 Interchange                                  | Basic   | 64                  | 64     | 63     | 64      | 7                          | 10     | 13     | 13      |
|  | Diverge | 64                  | 63     | 61     | 62      | 10                         | 15     | 22     | 20      |
|  | Merge   | 63                  | 62     | 60     | 61      | 9                          | 13     | 19     | 17      |
| Between MD 28 & MD 189                             | Basic   | 64                  | 64     | 64     | 64      | 8                          | 10     | 13     | 13      |
| Between MD 189 & Montrose Road                     | Diverge | 64                  | 64     | 63     | 63      | 11                         | 13     | 19     | 19      |
|  | Basic   | 63                  | 63     | 63     | 63      | 10                         | 12     | 17     | 16      |
| Montrose Road Interchange                          | Diverge | 62                  | 62     | 62     | 62      | 12                         | 15     | 21     | 20      |
|  | Basic   | 64                  | 64     | 64     | 64      | 10                         | 12     | 17     | 17      |
| Between Montrose Road & Spur Split                 | Weave   | 64                  | 64     | 63     | 63      | 12                         | 15     | 21     | 20      |
|  | Weave   | 64                  | 64     | 63     | 63      | 13                         | 17     | 24     | 22      |
| Between Spur Split & MD 187                        | Basic   | 64                  | 63     | 62     | 63      | 13                         | 17     | 28     | 25      |
|  | Merge   | 62                  | 62     | 60     | 61      | 9                          | 11     | 19     | 17      |
|  | Weave   | 50                  | 49     | 61     | 58      | 6                          | 8      | 13     | 12      |
| MD 187 Interchange                                 | Basic   | 64                  | 64     | 63     | 63      | 9                          | 12     | 18     | 16      |
|  | Diverge | 64                  | 63     | 63     | 63      | 9                          | 11     | 15     | 14      |
|  | Basic   | 64                  | 64     | 63     | 63      | 11                         | 14     | 22     | 19      |
| Between MD 187 & I-495                             | Diverge | 64                  | 63     | 63     | 63      | 11                         | 14     | 19     | 16      |
|  | Basic   | 64                  | 63     | 62     | 63      | 13                         | 18     | 25     | 22      |
|  | Merge   | 61                  | 60     | 58     | 59      | 13                         | 19     | 27     | 22      |
|  | Basic   | 64                  | 64     | 63     | 63      | 12                         | 15     | 21     | 18      |
|  | Basic   | 59                  | 59     | 58     | 58      | 20                         | 25     | 34     | 29      |

<10 mph 10-20 mph 20-30 mph 30-40 mph 40-50 mph >50 mph

LOS A-C LOS D LOS E LOS F

**Table 6-4: 2017 Existing AM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | Average Speed (mph) |        |        |         | Average Density (pc/hr/ln) |        |        |         |
|--|---------|---------------------|--------|--------|---------|----------------------------|--------|--------|---------|
|  |         | 6-7 AM              | 7-8 AM | 8-9 AM | 9-10 AM | 6-7 AM                     | 7-8 AM | 8-9 AM | 9-10 AM |
| I-270 West Spur Northbound General Purpose Lanes |         |                     |        |        |         |                            |        |        |         |
| Between Spur Split & Democracy Boulevard         | Basic   | 64                  | 64     | 63     | 63      | 14                         | 16     | 21     | 21      |
|  | Merge   | 62                  | 62     | 62     | 62      | 8                          | 10     | 13     | 13      |
|  | Basic   | 64                  | 64     | 63     | 63      | 13                         | 16     | 20     | 20      |
|  | Merge   | 60                  | 60     | 59     | 59      | 12                         | 14     | 16     | 16      |
| Democracy Boulevard Interchange                  | Basic   | 64                  | 64     | 63     | 63      | 13                         | 14     | 18     | 18      |
|  | Merge   | 62                  | 61     | 60     | 60      | 11                         | 13     | 15     | 15      |
|  | Basic   | 64                  | 64     | 63     | 63      | 13                         | 14     | 18     | 17      |
| Between Democracy Boulevard & I-495              | Diverge | 63                  | 63     | 60     | 61      | 15                         | 17     | 21     | 21      |
|  | Basic   | 61                  | 60     | 55     | 57      | 17                         | 20     | 29     | 26      |
| I-270 Northbound Local Lanes                     |         |                     |        |        |         |                            |        |        |         |
| Between Middlebrook Road & MD 124                | Merge   | 42                  | 42     | 41     | 41      | 6                          | 8      | 10     | 10      |
| MD 124 Interchange                               | Merge   | 41                  | 41     | 41     | 41      | 2                          | 4      | 6      | 5       |
| Between MD 124 & MD 117                          | Diverge | 45                  | 46     | 46     | 44      | 5                          | 10     | 15     | 12      |
| Between MD 117 & I-370                           | Weave   | 44                  | 44     | 44     | 43      | 5                          | 9      | 14     | 12      |
|  | Basic   | 43                  | 43     | 42     | 43      | 3                          | 3      | 6      | 8       |
|  | Weave   | 43                  | 43     | 42     | 42      | 10                         | 14     | 17     | 22      |
| I-370 Interchange                                | Basic   | 43                  | 43     | 43     | 43      | 5                          | 7      | 10     | 13      |
|  | Merge   | 42                  | 42     | 42     | 42      | 4                          | 5      | 7      | 9       |
|  | Basic   | 44                  | 44     | 44     | 44      | 4                          | 3      | 5      | 8       |
| Between I-370 & Shady Grove Road                 | Diverge | 48                  | 46     | 46     | 45      | 7                          | 9      | 13     | 15      |
|  | Basic   | 49                  | 45     | 45     | 45      | 10                         | 13     | 19     | 22      |
|  | Diverge | 50                  | 48     | 47     | 46      | 7                          | 10     | 15     | 17      |
|  | Merge   | 48                  | 46     | 44     | 44      | 6                          | 9      | 13     | 15      |
| Shady Grove Road Interchange                     | Basic   | 51                  | 51     | 51     | 49      | 6                          | 8      | 11     | 13      |
|  | Weave   | 52                  | 52     | 52     | 51      | 5                          | 6      | 8      | 10      |
| Between Shady Grove Road & MD 28                 | Diverge | 43                  | 43     | 43     | 43      | 9                          | 11     | 17     | 19      |
|  | Basic   | 43                  | 43     | 42     | 42      | 14                         | 17     | 26     | 29      |
|  | Diverge | 43                  | 43     | 43     | 43      | 11                         | 13     | 20     | 21      |
|  | Weave   | 42                  | 41     | 40     | 41      | 8                          | 10     | 15     | 16      |
|  | Merge   | 43                  | 43     | 42     | 42      | 7                          | 7      | 11     | 13      |
| MD 28 Interchange                                | Basic   | 43                  | 43     | 43     | 43      | 9                          | 8      | 13     | 16      |
|  | Weave   | 42                  | 40     | 34     | 37      | 11                         | 14     | 25     | 24      |
|  | Basic   | 43                  | 43     | 42     | 42      | 16                         | 18     | 29     | 29      |
| Between MD 28 & MD 189                           | Diverge | 43                  | 43     | 41     | 41      | 11                         | 14     | 22     | 23      |
|  | Basic   | 43                  | 42     | 41     | 41      | 17                         | 21     | 34     | 35      |
|  | Weave   | 43                  | 42     | 41     | 41      | 13                         | 21     | 31     | 30      |
|  | Basic   | 42                  | 41     | 39     | 40      | 16                         | 26     | 40     | 38      |
|  | Merge   | 42                  | 41     | 36     | 38      | 10                         | 17     | 29     | 26      |
| MD 189 Interchange                               | Basic   | 42                  | 42     | 42     | 42      | 13                         | 19     | 29     | 28      |
| Between MD 189 & Montrose Road                   | Diverge | 42                  | 41     | 41     | 41      | 11                         | 17     | 26     | 25      |
|  | Basic   | 42                  | 42     | 41     | 41      | 17                         | 26     | 39     | 38      |
|  | Merge   | 43                  | 42     | 42     | 42      | 11                         | 17     | 26     | 25      |
|  | Basic   | 42                  | 42     | 41     | 41      | 15                         | 24     | 36     | 34      |
|  | Merge   | 41                  | 39     | 34     | 35      | 10                         | 16     | 27     | 25      |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

LOS A-C
LOS D
LOS E
LOS F

**Table 6-4: 2017 Existing AM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | Average Speed (mph) |        |        |         | Average Density (pc/hr/ln) |        |        |         |
|--|---------|---------------------|--------|--------|---------|----------------------------|--------|--------|---------|
|  |         | 6-7 AM              | 7-8 AM | 8-9 AM | 9-10 AM | 6-7 AM                     | 7-8 AM | 8-9 AM | 9-10 AM |
| I-270 Northbound Local Lanes (Continued)         |         |                     |        |        |         |                            |        |        |         |
| Montrose Road Interchange                        | Basic   | 43                  | 42     | 42     | 42      | 12                         | 16     | 24     | 24      |
|  | Weave   | 43                  | 42     | 41     | 41      | 9                          | 13     | 19     | 19      |
|  | Basic   | 43                  | 43     | 42     | 42      | 13                         | 16     | 24     | 23      |
| Between Montrose Road & Spur Split               | Diverge | 42                  | 42     | 41     | 41      | 15                         | 20     | 28     | 27      |
|  | Basic   | 45                  | 45     | 43     | 44      | 22                         | 28     | 41     | 38      |
| I-270 Southbound General Purpose Lanes           |         |                     |        |        |         |                            |        |        |         |
| MD 117 Interchange                               | Basic   | 27                  | 29     | 28     | 43      | 77                         | 75     | 76     | 46      |
| Between MD 117 & I-370                           | Merge   | 26                  | 33     | 35     | 49      | 74                         | 68     | 66     | 41      |
|  | Basic   | 29                  | 33     | 35     | 48      | 71                         | 63     | 60     | 39      |
|  | Basic   | 37                  | 40     | 40     | 49      | 56                         | 53     | 50     | 37      |
|  | Diverge | 41                  | 43     | 45     | 51      | 38                         | 39     | 36     | 29      |
| I-370 Interchange                                | Basic   | 40                  | 39     | 41     | 50      | 54                         | 53     | 45     | 34      |
|  | Diverge | 47                  | 41     | 37     | 53      | 36                         | 47     | 52     | 26      |
|  | Basic   | 41                  | 23     | 35     | 52      | 48                         | 80     | 38     | 22      |
| Shady Grove Road Interchange                     | Merge   | 32                  | 21     | 25     | 35      | 70                         | 118    | 102    | 59      |
|  | Basic   | 42                  | 39     | 40     | 47      | 46                         | 46     | 41     | 35      |
|  | Diverge | 46                  | 44     | 43     | 51      | 47                         | 49     | 46     | 37      |
| Between Shady Grove Road & MD 28                 | Basic   | 38                  | 38     | 52     | 53      | 47                         | 47     | 20     | 25      |
|  | Merge   | 27                  | 29     | 49     | 53      | 73                         | 64     | 18     | 20      |
|  | Basic   | 34                  | 32     | 46     | 52      | 57                         | 58     | 29     | 28      |
| MD 28 Interchange                                | Merge   | 32                  | 28     | 42     | 53      | 63                         | 75     | 37     | 26      |
|  | Basic   | 38                  | 35     | 46     | 51      | 53                         | 55     | 33     | 32      |
|  | Diverge | 44                  | 38     | 46     | 51      | 52                         | 61     | 40     | 36      |
| MD 189 Interchange                               | Basic   | 42                  | 26     | 35     | 53      | 43                         | 74     | 41     | 27      |
| Montrose Road Interchange                        | Merge   | 34                  | 22     | 27     | 53      | 58                         | 108    | 68     | 26      |
| Between Montrose Road & Spur Split               | Basic   | 35                  | 28     | 33     | 53      | 60                         | 78     | 57     | 32      |
|  | Weave   | 28                  | 31     | 35     | 52      | 68                         | 63     | 53     | 32      |
|  | Diverge | 36                  | 43     | 43     | 53      | 18                         | 18     | 17     | 15      |
|  | Weave   | 32                  | 40     | 40     | 53      | 63                         | 47     | 45     | 30      |
| Spur Split through MD 187 Interchange            | Basic   | 54                  | 54     | 54     | 57      | 18                         | 23     | 22     | 20      |
|  | Diverge | 62                  | 61     | 60     | 63      | 18                         | 25     | 25     | 21      |
|  | Basic   | 63                  | 63     | 63     | 63      | 15                         | 19     | 17     | 16      |
|  | Merge   | 60                  | 59     | 59     | 60      | 13                         | 18     | 16     | 15      |
|  | Basic   | 63                  | 62     | 62     | 63      | 16                         | 20     | 18     | 17      |
| Between MD 187 & I-495                           | Merge   | 61                  | 60     | 59     | 60      | 14                         | 20     | 19     | 17      |
|  | Basic   | 63                  | 62     | 62     | 63      | 17                         | 22     | 21     | 19      |
|  | Diverge | 63                  | 63     | 63     | 63      | 16                         | 22     | 20     | 19      |
|  | Basic   | 63                  | 63     | 63     | 63      | 16                         | 24     | 21     | 22      |
| I-270 West Spur Southbound General Purpose Lanes |         |                     |        |        |         |                            |        |        |         |
| Spur Split to Democracy Boulevard                | Basic   | 21                  | 22     | 24     | 53      | 93                         | 82     | 72     | 32      |
|  | Weave   | 32                  | 27     | 30     | 53      | 53                         | 62     | 56     | 25      |
| Democracy Boulevard                              | Basic   | 47                  | 35     | 35     | 53      | 42                         | 59     | 57     | 27      |
| Democracy Boulevard to I-495                     | Merge   | 49                  | 38     | 38     | 52      | 19                         | 31     | 31     | 14      |
|  | Merge   | 47                  | 35     | 37     | 51      | 37                         | 56     | 52     | 28      |
|  | Basic   | 50                  | 41     | 46     | 52      | 39                         | 50     | 43     | 31      |

<10 mph 10-20 mph 20-30 mph 30-40 mph 40-50 mph >50 mph

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**Table 6-4: 2017 Existing AM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location                         | Type                      | Average Speed (mph) |        |        |         | Average Density (pc/hr/ln) |        |        |         |
|----------------------------------|---------------------------|---------------------|--------|--------|---------|----------------------------|--------|--------|---------|
|                                  |                           | 6-7 AM              | 7-8 AM | 8-9 AM | 9-10 AM | 6-7 AM                     | 7-8 AM | 8-9 AM | 9-10 AM |
| I-270 Southbound Local Lanes     |                           |                     |        |        |         |                            |        |        |         |
| I-370 Interchange                | Basic                     | 46                  | 22     | 15     | 38      | 20                         | 59     | 89     | 32      |
| Between I-370 & Shady Grove Road | Weave                     | 41                  | 18     | 16     | 32      | 27                         | 71     | 78     | 43      |
|                                  | Diverge                   | 42                  | 41     | 41     | 41      | 27                         | 28     | 27     | 27      |
| Shady Grove Road Interchange     | Basic                     | 42                  | 42     | 42     | 42      | 32                         | 23     | 19     | 20      |
|                                  | Merge                     | 41                  | 42     | 42     | 42      | 25                         | 19     | 17     | 17      |
|                                  | Basic                     | 41                  | 42     | 42     | 42      | 39                         | 29     | 26     | 26      |
| Between Shady Grove Road & MD 28 | Merge                     | 42                  | 42     | 41     | 42      | 27                         | 22     | 21     | 21      |
|                                  | Basic                     | 40                  | 40     | 33     | 40      | 42                         | 35     | 41     | 33      |
|                                  | Merge                     | 35                  | 29     | 20     | 31      | 40                         | 47     | 82     | 44      |
|                                  | Diverge                   | 39                  | 39     | 37     | 39      | 53                         | 53     | 56     | 48      |
|                                  | Diverge                   | 41                  | 40     | 39     | 41      | 43                         | 45     | 47     | 38      |
|                                  | Basic                     | 40                  | 39     | 38     | 42      | 37                         | 36     | 36     | 29      |
|                                  | Diverge                   | 40                  | 39     | 38     | 42      | 26                         | 25     | 27     | 19      |
| MD 28 Interchange                | Basic                     | 36                  | 34     | 27     | 42      | 40                         | 38     | 47     | 20      |
|                                  | Merge                     | 33                  | 28     | 18     | 40      | 31                         | 35     | 50     | 16      |
|                                  | Basic                     | 24                  | 16     | 12     | 36      | 65                         | 85     | 100    | 28      |
| Between MD 28 & MD 189           | Merge                     | 12                  | 9      | 7      | 10      | 106                        | 128    | 149    | 119     |
|                                  | Basic                     | 17                  | 14     | 12     | 15      | 104                        | 113    | 125    | 110     |
|                                  | Merge                     | 16                  | 16     | 15     | 17      | 90                         | 89     | 95     | 90      |
|                                  | Basic                     | 37                  | 32     | 30     | 34      | 59                         | 66     | 69     | 63      |
|                                  | Diverge                   | 41                  | 34     | 31     | 34      | 36                         | 45     | 51     | 45      |
| MD 189 Interchange               | Basic                     | 35                  | 20     | 15     | 18      | 55                         | 86     | 108    | 97      |
| Between MD 189 & Montrose Road   | Merge                     | 27                  | 16     | 14     | 16      | 54                         | 89     | 104    | 88      |
|                                  | Diverge                   | 32                  | 30     | 31     | 30      | 67                         | 72     | 69     | 71      |
|                                  | Basic                     | 37                  | 37     | 37     | 37      | 47                         | 43     | 43     | 42      |
|                                  | Diverge                   | 37                  | 37     | 37     | 37      | 31                         | 29     | 29     | 28      |
|                                  | Montrose Road Interchange | Basic               | 37     | 37     | 37      | 37                         | 43     | 40     | 40      |
| Weave                            |                           | 36                  | 35     | 35     | 34      | 35                         | 37     | 37     | 36      |
| Basic                            |                           | 37                  | 34     | 37     | 38      | 38                         | 46     | 38     | 31      |
| Merge                            |                           | 39                  | 31     | 35     | 39      | 27                         | 42     | 37     | 27      |
| Basic                            |                           | 36                  | 30     | 33     | 38      | 42                         | 62     | 55     | 40      |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

LOS A-C
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**Table 6-5: 2017 Existing PM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment**

| Location  | Type    | Average Speed (mph) |        |        |        | Average Density (pc/hr/ln) |        |        |        |
|---|---------|---------------------|--------|--------|--------|----------------------------|--------|--------|--------|
|   |         | 3-4 PM              | 4-5 PM | 5-6 PM | 6-7 PM | 3-4 PM                     | 4-5 PM | 5-6 PM | 6-7 PM |
| I-495 Inner Loop General Purpose Lanes                              |         |                     |        |        |        |                            |        |        |        |
| Between VA 267 & VA 193   | Basic   | 59                  | 51     | 10     | 10     | 17                         | 23     | 120    | 109    |
|   | Diverge | 58                  | 40     | 7      | 10     | 19                         | 30     | 129    | 106    |
| VA 193 Interchange  | Basic   | 58                  | 20     | 7      | 8      | 20                         | 64     | 142    | 132    |
| Between VA 193 & George Washington Memorial Parkway                 | Weave   | 51                  | 10     | 7      | 8      | 24                         | 120    | 146    | 139    |
| George Washington Memorial Parkway Interchange                      | Merge   | 33                  | 10     | 9      | 10     | 36                         | 132    | 131    | 129    |
|   | Basic   | 37                  | 19     | 18     | 20     | 47                         | 87     | 89     | 82     |
| Between George Washington Memorial Parkway & Clara Barton Parkway   | Weave   | 32                  | 18     | 17     | 19     | 56                         | 94     | 100    | 92     |
| Clara Barton Parkway Interchange                                    | Basic   | 28                  | 16     | 14     | 16     | 70                         | 110    | 118    | 110    |
| Between Clara Barton Parkway & MD 190                               | Merge   | 19                  | 13     | 11     | 13     | 85                         | 122    | 130    | 121    |
|   | Basic   | 21                  | 17     | 15     | 18     | 90                         | 107    | 112    | 103    |
|   | Diverge | 23                  | 20     | 19     | 20     | 63                         | 68     | 72     | 68     |
| MD 190 Interchange  | Basic   | 16                  | 14     | 12     | 13     | 112                        | 121    | 127    | 123    |
|   | Merge   | 19                  | 16     | 15     | 16     | 83                         | 90     | 93     | 90     |
|   | Basic   | 18                  | 16     | 15     | 16     | 98                         | 107    | 113    | 109    |
| Between MD 190 & I-270 West Spur                                    | Merge   | 26                  | 22     | 21     | 23     | 46                         | 54     | 54     | 46     |
|   | Basic   | 29                  | 26     | 24     | 24     | 71                         | 76     | 82     | 81     |
|   | Weave   | 51                  | 43     | 38     | 39     | 31                         | 42     | 50     | 49     |
| Between I-270 West Spur & MD 187                                    | Basic   | 54                  | 52     | 31     | 26     | 26                         | 26     | 54     | 73     |
|   | Diverge | 46                  | 28     | 13     | 19     | 22                         | 40     | 89     | 76     |
| MD 187 Interchange  | Basic   | 54                  | 16     | 7      | 18     | 23                         | 86     | 154    | 108    |
| Between MD 187 & I-270 East Spur                                    | Merge   | 53                  | 13     | 9      | 19     | 17                         | 79     | 108    | 78     |
|   | Basic   | 51                  | 12     | 9      | 16     | 26                         | 110    | 134    | 105    |
|   | Diverge | 45                  | 16     | 13     | 16     | 32                         | 85     | 100    | 87     |
| I-270 East Spur Interchange   | Basic   | 40                  | 16     | 13     | 15     | 47                         | 107    | 120    | 108    |
|   | Weave   | 35                  | 13     | 12     | 14     | 51                         | 116    | 122    | 113    |
|   | Weave   | 33                  | 19     | 17     | 19     | 46                         | 87     | 91     | 87     |
|   | Basic   | 31                  | 18     | 17     | 17     | 55                         | 93     | 96     | 94     |
| Between I-270 East Spur & MD 185                                    | Merge   | 29                  | 16     | 15     | 15     | 49                         | 82     | 85     | 84     |
|   | Basic   | 28                  | 17     | 17     | 16     | 72                         | 102    | 103    | 107    |
|   | Diverge | 27                  | 22     | 21     | 20     | 63                         | 81     | 85     | 88     |
| I-495 Outer Loop General Purpose Lanes                              |         |                     |        |        |        |                            |        |        |        |
| Between VA 267 & VA 193   | Basic   | 20                  | 20     | 20     | 20     | 91                         | 90     | 85     | 78     |
|   | Merge   | 21                  | 21     | 24     | 25     | 73                         | 72     | 58     | 52     |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Basic   | 19                  | 18     | 20     | 20     | 89                         | 89     | 83     | 76     |
|   | Merge   | 13                  | 13     | 15     | 22     | 110                        | 107    | 87     | 56     |
|   | Basic   | 25                  | 18     | 26     | 52     | 64                         | 84     | 55     | 26     |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 48                  | 41     | 51     | 52     | 36                         | 47     | 31     | 31     |
| Clara Barton Parkway Interchange                                    | Basic   | 43                  | 42     | 43     | 44     | 44                         | 44     | 41     | 41     |

<10 mph 10-20 mph 20-30 mph 30-40 mph 40-50 mph >50 mph

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**Table 6-5: 2017 Existing PM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | Average Speed (mph) |        |        |        | Average Density (pc/hr/ln) |        |        |        |
|--|---------|---------------------|--------|--------|--------|----------------------------|--------|--------|--------|
|  |         | 3-4 PM              | 4-5 PM | 5-6 PM | 6-7 PM | 3-4 PM                     | 4-5 PM | 5-6 PM | 6-7 PM |
| I-495 Outer Loop General Purpose Lanes (Continued) |         |                     |        |        |        |                            |        |        |        |
| Between Clara Barton Parkway & MD 190              | Diverge | 36                  | 35     | 36     | 36     | 56                         | 58     | 58     | 56     |
|  | Basic   | 32                  | 30     | 30     | 31     | 63                         | 67     | 66     | 64     |
|  | Merge   | 22                  | 19     | 17     | 19     | 79                         | 91     | 97     | 90     |
| MD 190 Interchange                                 | Basic   | 26                  | 15     | 14     | 15     | 72                         | 103    | 108    | 104    |
|  | Diverge | 34                  | 21     | 18     | 19     | 45                         | 79     | 87     | 81     |
| Between MD 190 & I-270 West Spur                   | Diverge | 40                  | 26     | 23     | 23     | 27                         | 44     | 50     | 46     |
|  | Basic   | 44                  | 22     | 14     | 14     | 37                         | 77     | 101    | 103    |
|  | Weave   | 51                  | 30     | 15     | 14     | 26                         | 58     | 96     | 98     |
| Between I-270 West Spur & MD 187                   | Basic   | 52                  | 42     | 20     | 14     | 29                         | 39     | 80     | 120    |
|  | Merge   | 52                  | 53     | 45     | 26     | 19                         | 18     | 26     | 78     |
| MD 187 Interchange                                 | Basic   | 53                  | 53     | 48     | 36     | 24                         | 22     | 25     | 45     |
| Between MD 187 & I-270 East Spur                   | Diverge | 53                  | 50     | 46     | 45     | 17                         | 18     | 20     | 21     |
|  | Basic   | 53                  | 53     | 53     | 51     | 27                         | 25     | 24     | 23     |
|  | Merge   | 49                  | 49     | 49     | 49     | 24                         | 22     | 21     | 19     |
| I-270 East Spur Interchange                        | Basic   | 53                  | 53     | 52     | 48     | 24                         | 22     | 22     | 21     |
|  | Diverge | 53                  | 53     | 47     | 33     | 33                         | 33     | 43     | 74     |
| Between I-270 East Spur & MD 185                   | Diverge | 52                  | 53     | 49     | 37     | 30                         | 30     | 35     | 60     |
|  | Basic   | 44                  | 48     | 46     | 31     | 48                         | 40     | 44     | 66     |
| I-270 Northbound General Purpose Lanes             |         |                     |        |        |        |                            |        |        |        |
| Between MD 124 & MD 117                            | Basic   | 22                  | 22     | 22     | 23     | 83                         | 85     | 87     | 80     |
| Between MD 117 & I-370                             | Diverge | 25                  | 24     | 25     | 26     | 75                         | 76     | 81     | 71     |
|  | Basic   | 22                  | 22     | 22     | 25     | 76                         | 78     | 78     | 69     |
|  | Merge   | 20                  | 18     | 18     | 21     | 64                         | 71     | 85     | 65     |
| I-370 Interchange                                  | Basic   | 29                  | 30     | 30     | 31     | 63                         | 68     | 71     | 65     |
|  | Merge   | 35                  | 35     | 31     | 33     | 37                         | 50     | 56     | 50     |
| Shady Grove Road Interchange                       | Basic   | 49                  | 41     | 35     | 36     | 34                         | 46     | 62     | 57     |
| Between Shady Grove Road & MD 28                   | Weave   | 53                  | 51     | 37     | 30     | 31                         | 34     | 57     | 73     |
| MD 28 Interchange                                  | Basic   | 52                  | 52     | 49     | 47     | 36                         | 36     | 38     | 41     |
|  | Diverge | 51                  | 51     | 51     | 50     | 39                         | 42     | 41     | 42     |
|  | Merge   | 51                  | 46     | 49     | 51     | 30                         | 37     | 33     | 31     |
| Between MD 28 & MD 189                             | Basic   | 53                  | 52     | 53     | 53     | 31                         | 33     | 32     | 32     |
| Between MD 189 & Montrose Road                     | Diverge | 52                  | 52     | 52     | 52     | 32                         | 34     | 34     | 35     |
|  | Basic   | 52                  | 52     | 52     | 51     | 35                         | 36     | 36     | 37     |
| Montrose Road Interchange                          | Diverge | 48                  | 43     | 43     | 39     | 38                         | 48     | 47     | 56     |
|  | Basic   | 52                  | 52     | 52     | 52     | 36                         | 37     | 37     | 38     |
| Between Montrose Road & Spur Split                 | Weave   | 51                  | 50     | 50     | 50     | 37                         | 37     | 37     | 37     |
|  | Weave   | 43                  | 37     | 36     | 36     | 48                         | 58     | 59     | 60     |
| Between Spur Split & MD 187                        | Basic   | 43                  | 32     | 30     | 29     | 44                         | 62     | 66     | 67     |
|  | Merge   | 47                  | 24     | 19     | 19     | 28                         | 60     | 77     | 76     |
|  | Weave   | 54                  | 34     | 27     | 30     | 18                         | 45     | 65     | 59     |
| MD 187 Interchange                                 | Basic   | 58                  | 39     | 28     | 28     | 22                         | 49     | 77     | 78     |
|  | Diverge | 58                  | 44     | 36     | 31     | 17                         | 39     | 69     | 80     |
|  | Basic   | 57                  | 44     | 34     | 29     | 24                         | 37     | 64     | 73     |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

LOS A-C
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LOS E
LOS F

**Table 6-5: 2017 Existing PM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | Average Speed (mph) |        |        |        | Average Density (pc/hr/ln) |        |        |        |
|--|---------|---------------------|--------|--------|--------|----------------------------|--------|--------|--------|
|  |         | 3-4 PM              | 4-5 PM | 5-6 PM | 6-7 PM | 3-4 PM                     | 4-5 PM | 5-6 PM | 6-7 PM |
| I-270 Northbound General Purpose Lanes (Continued) |         |                     |        |        |        |                            |        |        |        |
| Between MD 187 & I-495                             | Diverge | 58                  | 50     | 38     | 33     | 19                         | 29     | 60     | 70     |
|  | Basic   | 58                  | 54     | 40     | 32     | 25                         | 27     | 51     | 68     |
|  | Merge   | 56                  | 55     | 39     | 26     | 20                         | 21     | 54     | 106    |
|  | Basic   | 59                  | 59     | 44     | 28     | 18                         | 18     | 36     | 72     |
|  | Basic   | 56                  | 56     | 43     | 24     | 28                         | 28     | 49     | 93     |
| I-270 West Spur Northbound General Purpose Lanes   |         |                     |        |        |        |                            |        |        |        |
| Between Spur Split & Democracy Boulevard           | Basic   | 41                  | 38     | 38     | 38     | 51                         | 56     | 57     | 55     |
|  | Merge   | 41                  | 38     | 35     | 38     | 36                         | 39     | 41     | 38     |
|  | Basic   | 39                  | 36     | 35     | 35     | 54                         | 58     | 60     | 60     |
|  | Merge   | 35                  | 29     | 28     | 30     | 60                         | 75     | 81     | 74     |
| Democracy Boulevard Interchange                    | Basic   | 36                  | 29     | 28     | 30     | 61                         | 75     | 79     | 73     |
|  | Merge   | 29                  | 21     | 20     | 21     | 82                         | 119    | 131    | 123    |
|  | Basic   | 40                  | 28     | 27     | 28     | 50                         | 77     | 86     | 81     |
| Between Democracy Boulevard & I-495                | Diverge | 48                  | 35     | 33     | 34     | 35                         | 64     | 74     | 67     |
|  | Basic   | 49                  | 37     | 34     | 35     | 36                         | 51     | 58     | 55     |
| I-270 Northbound Local Lanes                       |         |                     |        |        |        |                            |        |        |        |
| Between Middlebrook Rd & MD 124                    | Merge   | 29                  | 35     | 17     | 30     | 30                         | 21     | 57     | 25     |
| MD 124 Interchange                                 | Merge   | 36                  | 43     | 27     | 30     | 19                         | 10     | 42     | 22     |
| Between MD 124 & MD 117                            | Diverge | 47                  | 47     | 47     | 47     | 22                         | 22     | 23     | 22     |
| Between MD 117 & I-370                             | Weave   | 46                  | 45     | 46     | 45     | 26                         | 27     | 26     | 27     |
|  | Basic   | 53                  | 53     | 52     | 52     | 19                         | 22     | 22     | 20     |
|  | Weave   | 51                  | 46     | 24     | 31     | 23                         | 30     | 70     | 44     |
| I-370 Interchange                                  | Basic   | 53                  | 53     | 24     | 29     | 19                         | 22     | 67     | 43     |
|  | Merge   | 49                  | 49     | 26     | 27     | 13                         | 15     | 43     | 30     |
|  | Basic   | 54                  | 53     | 46     | 48     | 13                         | 16     | 18     | 15     |
| Between I-370 & Shady Grove Road                   | Diverge | 51                  | 47     | 46     | 46     | 24                         | 28     | 28     | 27     |
|  | Basic   | 48                  | 30     | 24     | 23     | 38                         | 68     | 83     | 84     |
|  | Diverge | 52                  | 36     | 27     | 26     | 27                         | 50     | 62     | 66     |
|  | Merge   | 51                  | 27     | 16     | 16     | 23                         | 64     | 98     | 94     |
| Shady Grove Road Interchange                       | Basic   | 53                  | 26     | 14     | 14     | 22                         | 55     | 88     | 91     |
|  | Weave   | 52                  | 21     | 10     | 9      | 16                         | 45     | 95     | 101    |
| Between Shady Grove Road & MD 28                   | Diverge | 53                  | 43     | 43     | 50     | 17                         | 27     | 39     | 16     |
|  | Basic   | 53                  | 44     | 39     | 53     | 25                         | 30     | 33     | 18     |
|  | Diverge | 53                  | 53     | 53     | 53     | 22                         | 21     | 20     | 17     |
|  | Weave   | 47                  | 47     | 49     | 51     | 17                         | 16     | 15     | 13     |
|  | Merge   | 49                  | 49     | 49     | 50     | 18                         | 17     | 15     | 12     |
| MD 28 Interchange                                  | Basic   | 52                  | 52     | 52     | 53     | 21                         | 19     | 17     | 13     |
|  | Weave   | 44                  | 40     | 43     | 44     | 23                         | 25     | 22     | 19     |
|  | Basic   | 52                  | 52     | 53     | 53     | 28                         | 28     | 26     | 22     |
| Between MD 28 & MD 189                             | Diverge | 51                  | 51     | 51     | 51     | 21                         | 21     | 20     | 17     |
|  | Basic   | 50                  | 50     | 51     | 51     | 33                         | 32     | 30     | 26     |
|  | Weave   | 49                  | 50     | 50     | 51     | 33                         | 31     | 31     | 27     |
|  | Basic   | 47                  | 48     | 50     | 51     | 46                         | 42     | 38     | 33     |
|  | Merge   | 32                  | 39     | 45     | 47     | 42                         | 33     | 27     | 23     |
| MD 189 Interchange                                 | Basic   | 48                  | 52     | 53     | 53     | 35                         | 30     | 28     | 24     |

<10 mph   10-20 mph   20-30 mph   30-40 mph   40-50 mph   >50 mph

LOS A-C   LOS D   LOS E   LOS F

**Table 6-5: 2017 Existing PM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location                                 | Type    | Average Speed (mph) |        |        |        | Average Density (pc/hr/ln) |        |        |        |
|--|---------|---------------------|--------|--------|--------|----------------------------|--------|--------|--------|
|  |         | 3-4 PM              | 4-5 PM | 5-6 PM | 6-7 PM | 3-4 PM                     | 4-5 PM | 5-6 PM | 6-7 PM |
| I-270 Northbound Local Lanes (Continued) |         |                     |        |        |        |                            |        |        |        |
| Between MD 189 & Montrose Road           | Diverge | 49                  | 49     | 49     | 49     | 26                         | 25     | 26     | 22     |
|  | Basic   | 51                  | 51     | 51     | 52     | 39                         | 37     | 38     | 33     |
|  | Merge   | 51                  | 51     | 51     | 51     | 26                         | 25     | 25     | 22     |
|  | Basic   | 49                  | 50     | 50     | 51     | 38                         | 35     | 35     | 30     |
|  | Merge   | 46                  | 48     | 48     | 49     | 27                         | 24     | 24     | 20     |
| Montrose Road Interchange                | Basic   | 52                  | 53     | 53     | 53     | 24                         | 20     | 21     | 19     |
|  | Weave   | 47                  | 48     | 48     | 48     | 20                         | 17     | 17     | 15     |
|  | Basic   | 53                  | 53     | 53     | 53     | 23                         | 20     | 21     | 18     |
| Between Montrose Road & Spur Split       | Diverge | 50                  | 50     | 49     | 50     | 24                         | 21     | 22     | 19     |
|  | Basic   | 52                  | 53     | 52     | 53     | 34                         | 30     | 31     | 27     |
| I-270 Southbound General Purpose Lanes   |         |                     |        |        |        |                            |        |        |        |
| MD 117 Interchange                       | Basic   | 63                  | 63     | 62     | 63     | 18                         | 20     | 22     | 21     |
| Between MD 117 & I-370                   | Merge   | 63                  | 62     | 61     | 62     | 23                         | 27     | 29     | 25     |
|  | Basic   | 63                  | 62     | 61     | 63     | 19                         | 22     | 24     | 21     |
|  | Basic   | 63                  | 62     | 61     | 63     | 18                         | 21     | 23     | 21     |
|  | Diverge | 63                  | 63     | 62     | 63     | 16                         | 19     | 20     | 18     |
| I-370 Interchange                        | Basic   | 63                  | 63     | 63     | 63     | 16                         | 17     | 18     | 18     |
|  | Diverge | 64                  | 64     | 64     | 64     | 13                         | 14     | 15     | 15     |
|  | Basic   | 64                  | 64     | 64     | 64     | 12                         | 13     | 14     | 14     |
| Shady Grove Road Interchange             | Merge   | 60                  | 60     | 60     | 60     | 16                         | 17     | 19     | 18     |
|  | Basic   | 61                  | 61     | 60     | 60     | 17                         | 18     | 20     | 19     |
|  | Diverge | 61                  | 61     | 60     | 61     | 19                         | 20     | 22     | 22     |
| Between Shady Grove Road & MD 28         | Basic   | 61                  | 61     | 60     | 61     | 14                         | 14     | 16     | 16     |
|  | Merge   | 61                  | 61     | 60     | 61     | 14                         | 14     | 16     | 15     |
|  | Basic   | 61                  | 61     | 60     | 60     | 17                         | 18     | 20     | 19     |
| MD 28 Interchange                        | Merge   | 61                  | 61     | 60     | 61     | 16                         | 16     | 19     | 17     |
|  | Basic   | 60                  | 60     | 59     | 60     | 19                         | 20     | 23     | 22     |
|  | Diverge | 60                  | 60     | 59     | 60     | 21                         | 22     | 25     | 23     |
| MD 189 Interchange                       | Basic   | 60                  | 60     | 59     | 60     | 15                         | 16     | 18     | 17     |
| Montrose Road Interchange                | Merge   | 61                  | 61     | 60     | 61     | 15                         | 15     | 17     | 16     |
| Between Montrose Road & Spur Split       | Basic   | 60                  | 60     | 60     | 60     | 21                         | 22     | 25     | 23     |
|  | Weave   | 60                  | 60     | 60     | 60     | 19                         | 20     | 21     | 21     |
|  | Diverge | 61                  | 61     | 60     | 61     | 10                         | 10     | 11     | 11     |
|  | Weave   | 60                  | 60     | 60     | 60     | 18                         | 20     | 21     | 20     |
| Spur Split through MD 187 Interchange    | Basic   | 59                  | 59     | 59     | 59     | 15                         | 15     | 15     | 16     |
|  | Diverge | 59                  | 59     | 58     | 58     | 17                         | 18     | 18     | 18     |
|  | Basic   | 59                  | 59     | 59     | 59     | 16                         | 16     | 15     | 17     |
|  | Merge   | 56                  | 56     | 56     | 56     | 15                         | 16     | 15     | 15     |
|  | Basic   | 59                  | 58     | 58     | 59     | 18                         | 19     | 18     | 19     |
| Between MD 187 & I-495                   | Merge   | 59                  | 59     | 59     | 60     | 14                         | 15     | 14     | 14     |
|  | Basic   | 63                  | 48     | 36     | 58     | 19                         | 30     | 51     | 21     |
|  | Diverge | 63                  | 33     | 25     | 45     | 19                         | 53     | 78     | 33     |
|  | Basic   | 55                  | 16     | 16     | 25     | 27                         | 93     | 95     | 59     |

<10 mph 10-20 mph 20-30 mph 30-40 mph 40-50 mph >50 mph

LOS A-C LOS D LOS E LOS F

**Table 6-5: 2017 Existing PM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | Average Speed (mph) |        |        |        | Average Density (pc/hr/ln) |        |        |        |
|--|---------|---------------------|--------|--------|--------|----------------------------|--------|--------|--------|
|  |         | 3-4 PM              | 4-5 PM | 5-6 PM | 6-7 PM | 3-4 PM                     | 4-5 PM | 5-6 PM | 6-7 PM |
| I-270 West Spur Southbound General Purpose Lanes |         |                     |        |        |        |                            |        |        |        |
| Spur Split to Democracy Boulevard                | Basic   | 59                  | 58     | 58     | 58     | 18                         | 20     | 22     | 20     |
|  | Weave   | 59                  | 59     | 59     | 47     | 14                         | 15     | 17     | 21     |
| Democracy Boulevard                              | Basic   | 60                  | 60     | 45     | 9      | 15                         | 16     | 22     | 107    |
| Democracy Boulevard to I-495                     | Merge   | 55                  | 55     | 21     | 13     | 10                         | 10     | 38     | 72     |
|  | Merge   | 56                  | 46     | 10     | 6      | 16                         | 23     | 91     | 144    |
|  | Basic   | 56                  | 37     | 15     | 13     | 20                         | 39     | 80     | 93     |
| I-270 Southbound Local Lanes                     |         |                     |        |        |        |                            |        |        |        |
| I-370 Interchange                                | Basic   | 59                  | 59     | 58     | 58     | 7                          | 7      | 8      | 8      |
| Between I-370 & Shady Grove Road                 | Weave   | 53                  | 53     | 52     | 52     | 12                         | 12     | 13     | 12     |
|  | Diverge | 53                  | 53     | 53     | 53     | 10                         | 10     | 11     | 10     |
| Shady Grove Road Interchange                     | Basic   | 54                  | 54     | 54     | 54     | 12                         | 12     | 12     | 12     |
|  | Merge   | 52                  | 51     | 51     | 52     | 13                         | 13     | 14     | 12     |
|  | Basic   | 53                  | 53     | 53     | 53     | 19                         | 19     | 20     | 19     |
| Between Shady Grove Road & MD 28                 | Merge   | 52                  | 52     | 52     | 52     | 16                         | 17     | 19     | 16     |
|  | Basic   | 53                  | 52     | 51     | 53     | 24                         | 26     | 30     | 24     |
|  | Merge   | 52                  | 51     | 44     | 52     | 20                         | 22     | 29     | 21     |
|  | Diverge | 52                  | 52     | 50     | 52     | 30                         | 33     | 38     | 31     |
|  | Diverge | 53                  | 53     | 53     | 53     | 23                         | 25     | 26     | 23     |
|  | Basic   | 53                  | 53     | 53     | 53     | 19                         | 20     | 21     | 18     |
|  | Diverge | 51                  | 51     | 51     | 51     | 13                         | 14     | 15     | 13     |
| MD 28 Interchange                                | Basic   | 54                  | 54     | 54     | 54     | 13                         | 14     | 15     | 13     |
|  | Merge   | 45                  | 45     | 45     | 45     | 12                         | 12     | 12     | 11     |
|  | Basic   | 53                  | 53     | 53     | 53     | 16                         | 16     | 17     | 16     |
| Between MD 28 & MD 189                           | Merge   | 52                  | 52     | 49     | 52     | 18                         | 18     | 21     | 18     |
|  | Basic   | 52                  | 52     | 47     | 52     | 26                         | 27     | 35     | 27     |
|  | Merge   | 52                  | 51     | 43     | 49     | 23                         | 24     | 36     | 26     |
|  | Basic   | 51                  | 50     | 46     | 50     | 35                         | 37     | 46     | 38     |
|  | Diverge | 51                  | 50     | 47     | 50     | 24                         | 25     | 30     | 25     |
| MD 189 Interchange                               | Basic   | 53                  | 53     | 53     | 53     | 26                         | 27     | 30     | 27     |
| Between MD 189 & Montrose Road                   | Merge   | 51                  | 50     | 48     | 50     | 22                         | 23     | 25     | 23     |
|  | Diverge | 49                  | 49     | 47     | 49     | 35                         | 36     | 40     | 36     |
|  | Basic   | 52                  | 53     | 52     | 53     | 18                         | 20     | 21     | 19     |
|  | Diverge | 50                  | 51     | 51     | 51     | 12                         | 13     | 14     | 13     |
| Montrose Road Interchange                        | Basic   | 54                  | 54     | 54     | 54     | 15                         | 16     | 17     | 16     |
|  | Weave   | 40                  | 42     | 40     | 41     | 20                         | 20     | 21     | 20     |
|  | Basic   | 51                  | 51     | 51     | 51     | 14                         | 16     | 14     | 16     |
|  | Merge   | 53                  | 53     | 53     | 53     | 12                         | 14     | 12     | 12     |
|  | Basic   | 53                  | 53     | 53     | 53     | 16                         | 19     | 16     | 16     |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

LOS A-C
LOS D
LOS E
LOS F



### 6.4.2 2027 No Build vs Preferred Alternative Conditions

The following subsections summarize and compare the 2027 No Build and the Preferred Alternative conditions with references to 2017 Existing conditions, at both the system-wide and segment levels; the various VISSIM microsimulation performance metrics for comparison purposes include:

- Network Performance and Latent Demand/Delay
- Throughput
- Freeway Density and LOS
- Freeway Speeds
- Freeway Travel Times
- Ramp Queue Spillback

#### 6.4.2.1 Network Performance Analysis

Network performance metrics quantify system-wide operations for the entire study area. Such metrics include latent demand and delay, which are the number of unserved vehicles (i.e., those that cannot get into the network) and their associated delay during each analysis hour. When excessive congestion is present within the study area, hourly demand and throughput are not necessarily equal. The hourly demand is all vehicles that desire to make it through the network in a particular hour while the hourly throughput is the number of vehicles that can make it through the network during their designated hour when experiencing heavy congestion and slower speeds. Vehicles that cannot travel within the network during their designated hour are quantified as latent demand and are recorded as throughput during a later hour; vehicles that cannot enter the network by the end of the last analysis hour are quantified as latent demand (i.e., unserved vehicles) and do not contribute to network-based performance metrics. This excess demand creates peak spreading and is a critical metric when comparing heavily congested scenarios. Because these vehicles are not quantified as part of network-based performance metrics, operational comparisons may be skewed. For example, travel times and speeds may appear better for one scenario but only because the number of vehicles contributing to these metrics is significantly lower than that of another scenario.

When comparing 2027 No Build and Preferred Alternative conditions, **Table 6-6** captures the significant differences in latent demand, particularly during the 5-7 PM hours. The No Build has between 20,000 and 40,000 unserved vehicles during these latter PM hours whereas the Preferred Alternative has approximately one-third of the No Build latent demand. One major vehicle input into the study area network is I-495 Inner Loop at the VA 193 interchange, which feeds both I-495 and I-270. At the end of the AM and PM peak periods under No Build conditions, this input has approximately 40 and 1,300 unserved vehicles, respectively. The Preferred Alternative has no unserved vehicles at the end of the AM peak period and less than 300 unserved vehicles at the end of the PM peak period.

As shown, the Preferred Alternative serves more vehicles in the study area during the entire AM and PM peak periods. Serving significantly more vehicles while experiencing congestion due to external constraints (i.e., bottlenecks outside of the study area that impact operations within the study area), may result in operational repercussions at vulnerable areas within the study area.

**Table 6-6: 2027 Network Performance Metrics Comparison**

| Hour                  | Scenario                     | Latent Demand (vehicles) | Latent Delay (hours) | Total Delay (hours) | Total Delay + Latent Delay (hours) | Speed (mph) | Total Travel Time (hours) |
|-----------------------|------------------------------|--------------------------|----------------------|---------------------|------------------------------------|-------------|---------------------------|
| <b>AM Peak Period</b> |                              |                          |                      |                     |                                    |             |                           |
| <b>6-7 AM</b>         | <b>No Build</b>              | 2482                     | 1302                 | 8517                | 9819                               | 38          | 28739                     |
|                       | <b>Preferred Alternative</b> | 2110                     | 1092                 | 8324                | 9416                               | 39          | 28930                     |
|                       | <b>Network Benefit</b>       | <b>372</b>               | <b>210</b>           | <b>193</b>          | <b>403</b>                         | <b>1</b>    | <b>-191</b>               |
| <b>7-8 AM</b>         | <b>No Build</b>              | 12252                    | 6536                 | 17719               | 24255                              | 29          | 39115                     |
|                       | <b>Preferred Alternative</b> | 11383                    | 5879                 | 16297               | 22176                              | 31          | 38355                     |
|                       | <b>Network Benefit</b>       | <b>869</b>               | <b>657</b>           | <b>1422</b>         | <b>2079</b>                        | <b>2</b>    | <b>760</b>                |
| <b>8-9 AM</b>         | <b>No Build</b>              | 24048                    | 18306                | 23027               | 41333                              | 26          | 44841                     |
|                       | <b>Preferred Alternative</b> | 21104                    | 16906                | 18860               | 35766                              | 30          | 41541                     |
|                       | <b>Network Benefit</b>       | <b>2944</b>              | <b>1400</b>          | <b>4167</b>         | <b>5567</b>                        | <b>4</b>    | <b>3300</b>               |
| <b>9-10 AM</b>        | <b>No Build</b>              | 29609                    | 26710                | 21901               | 48611                              | 26          | 42896                     |
|                       | <b>Preferred Alternative</b> | 23174                    | 21918                | 16851               | 38769                              | 31          | 38594                     |
|                       | <b>Network Benefit</b>       | <b>6435</b>              | <b>4792</b>          | <b>5050</b>         | <b>9842</b>                        | <b>5</b>    | <b>4302</b>               |
| <b>PM Peak Period</b> |                              |                          |                      |                     |                                    |             |                           |
| <b>3-4 PM</b>         | <b>No Build</b>              | 1468                     | 851                  | 9678                | 10529                              | 37          | 33253                     |
|                       | <b>Preferred Alternative</b> | 563                      | 429                  | 6891                | 7320                               | 41          | 31363                     |
|                       | <b>Network Benefit</b>       | <b>905</b>               | <b>422</b>           | <b>2787</b>         | <b>3209</b>                        | <b>4</b>    | <b>1890</b>               |
| <b>4-5 PM</b>         | <b>No Build</b>              | 7142                     | 3734                 | 18519               | 22253                              | 29          | 41877                     |
|                       | <b>Preferred Alternative</b> | 2188                     | 1159                 | 12621               | 13780                              | 35          | 37537                     |
|                       | <b>Network Benefit</b>       | <b>4954</b>              | <b>2575</b>          | <b>5898</b>         | <b>8473</b>                        | <b>6</b>    | <b>4340</b>               |
| <b>5-6 PM</b>         | <b>No Build</b>              | 21831                    | 13300                | 29508               | 42808                              | 22          | 51830                     |
|                       | <b>Preferred Alternative</b> | 7234                     | 4218                 | 19956               | 24174                              | 29          | 44375                     |
|                       | <b>Network Benefit</b>       | <b>14597</b>             | <b>9082</b>          | <b>9552</b>         | <b>18634</b>                       | <b>7</b>    | <b>7455</b>               |
| <b>6-7 PM</b>         | <b>No Build</b>              | 36817                    | 29315                | 31240               | 60555                              | 21          | 52566                     |
|                       | <b>Preferred Alternative</b> | 12172                    | 9806                 | 21967               | 31773                              | 27          | 45110                     |
|                       | <b>Network Benefit</b>       | <b>24645</b>             | <b>19509</b>         | <b>9273</b>         | <b>28782</b>                       | <b>6</b>    | <b>7456</b>               |

#### 6.4.2.2 Throughputs

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. Benefits of increased throughput on the highway include reduced peak spreading and reduced burden on the surrounding roadway network.

**Table 6-7 and Table 6-8** summarize freeway throughputs at key locations during the AM and PM peak periods, respectively, with a comparison to 2017 Existing and 2027 No Build conditions. **Figure 6-6 and Figure 6-7** provide graphical representations of the key locations to visually capture the differences between Existing, No Build, and Preferred Alternative conditions. **Appendix H** contains a summary of volumes by lane.

As shown in both summary tables and figures, the 2027 AM and PM Preferred Alternative increases throughputs throughout the project limits when compared to the 2027 No Build conditions. Also, as previously discussed, the Preferred Alternative serves approximately 16% and 67% more demand during the entire AM and PM peak periods, respectively, when compared to No Build conditions. The Preferred Alternative also has no unserved vehicles at the I-495 Inner Loop input in Virginia, which feeds both I-495 and I-270, at the end of the AM peak period and 80% less unserved vehicles at the end of the PM peak period.

For the AM peak period, Preferred Alternative increased throughput ranges from 5% to 13% along I-495 Inner Loop and I-270 Northbound as well as from 10% to 12% along I-495 Outer Loop and I-270 Southbound; all of which having the highest increase between the I-270 West Spur and the MD 187 interchange when compared to No Build conditions.

For the PM peak period, Preferred Alternative increased throughput ranges from 9% to 18% along I-495 Inner Loop and I-270 Northbound as well as from 13% to 18% along I-495 Outer Loop and I-270 Southbound; all of which having the highest increases between the I-270 West Spur and the MD 187 interchange as well as between the I-270 split and the Montrose Road interchange when compared to No Build conditions.

When compared to 2017 Existing conditions, the 2027 Preferred Alternative has increased total throughput at all key locations during the four-hour AM peak period. Like the AM, all key locations have increased total throughput during the four-hour PM peak period, except for the I-270 Northbound segment between the Shady Grove Road and I-370 interchanges; this degradation is caused by increased throughput more quickly reaching the existing bottleneck north of I-370 (outside the study area) in the first two hours of the PM peak period. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

**Table 6-7: 2027 AM Throughput Comparison**

| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Inner Loop & I-270 Northbound Key Locations                 |          |          |                       |                       |       |                           |
| Between George Washington Memorial Parkway & Clara Barton Parkway |          |          |                       |                       |       |                           |
| 6-7 AM  | 7972     | 8456     | 2105                  | 6910                  | 9015  | 7%                        |
| 7-8 AM  | 8390     | 9183     | 2305                  | 8243                  | 10548 | 15%                       |
| 8-9 AM  | 8317     | 9158     | 2113                  | 8146                  | 10259 | 12%                       |
| 9-10 AM   | 8191     | 9168     | 2116                  | 7488                  | 9604  | 5%                        |
| AM Total  | 32870    | 35965    | 8639                  | 30787                 | 39426 | 10%                       |
| Between I-270 West Spur & MD 187                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 4286     | 4270     | 694                   | 3949                  | 4643  | 9%                        |
| 7-8 AM  | 4509     | 4628     | 799                   | 4495                  | 5294  | 14%                       |
| 8-9 AM  | 3930     | 3945     | 735                   | 3819                  | 4554  | 15%                       |
| 9-10 AM   | 3856     | 3791     | 804                   | 3464                  | 4268  | 13%                       |
| AM Total  | 16581    | 16634    | 3032                  | 15727                 | 18759 | 13%                       |
| Between I-270 Split & Montrose Road                               |          |          |                       |                       |       |                           |
| 6-7 AM  | 4475     | 4867     | 1305                  | 3722                  | 5027  | 3%                        |
| 7-8 AM  | 5588     | 6148     | 1428                  | 4968                  | 6396  | 4%                        |
| 8-9 AM  | 7874     | 8027     | 1918                  | 6871                  | 8789  | 9%                        |
| 9-10 AM   | 7496     | 7728     | 1781                  | 6463                  | 8244  | 7%                        |
| AM Total  | 25433    | 26770    | 6432                  | 22024                 | 28456 | 6%                        |
| Between Shady Grove Road & I-370                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 2588     | 3258     | 946                   | 2361                  | 3307  | 2%                        |
| 7-8 AM  | 3535     | 4412     | 897                   | 3678                  | 4575  | 4%                        |
| 8-9 AM  | 4761     | 5776     | 1241                  | 4945                  | 6186  | 7%                        |
| 9-10 AM   | 4829     | 5678     | 1148                  | 4800                  | 5948  | 5%                        |
| AM Total  | 15713    | 19124    | 4232                  | 15784                 | 20016 | 5%                        |

**Table 6-7: 2027 AM Throughput Comparison (Continued)**

| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Outer Loop & I-270 Southbound Key Locations                 |          |          |                       |                       |       |                           |
| Between I-370 & Shady Grove Road                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 10566    | 10337    | 2062                  | 9187                  | 11249 | 9%                        |
| 7-8 AM  | 9787     | 9408     | 2041                  | 8409                  | 10450 | 11%                       |
| 8-9 AM  | 8862     | 8887     | 2166                  | 7721                  | 9887  | 11%                       |
| 9-10 AM   | 9506     | 9067     | 2232                  | 7573                  | 9805  | 8%                        |
| AM Total  | 38721    | 37699    | 8501                  | 32890                 | 41391 | 10%                       |
| Between Montrose Road & I-270 Split                               |          |          |                       |                       |       |                           |
| 6-7 AM  | 9707     | 10452    | 2379                  | 9367                  | 11746 | 12%                       |
| 7-8 AM  | 10203    | 11001    | 2356                  | 9806                  | 12162 | 11%                       |
| 8-9 AM  | 9818     | 10361    | 2352                  | 9073                  | 11425 | 10%                       |
| 9-10 AM   | 9639     | 9718     | 2400                  | 8121                  | 10521 | 8%                        |
| AM Total  | 39367    | 41532    | 9487                  | 36367                 | 45854 | 10%                       |
| Between MD 187 & I-270 West Spur                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 3830     | 3669     | 630                   | 3323                  | 3953  | 8%                        |
| 7-8 AM  | 4604     | 4317     | 722                   | 4010                  | 4732  | 10%                       |
| 8-9 AM  | 4073     | 3370     | 706                   | 3549                  | 4255  | 26%                       |
| 9-10 AM   | 4203     | 4115     | 704                   | 3642                  | 4346  | 6%                        |
| AM Total  | 16710    | 15471    | 2762                  | 14524                 | 17286 | 12%                       |
| Between Clara Barton Parkway & George Washington Memorial Parkway |          |          |                       |                       |       |                           |
| 6-7 AM  | 8202     | 8361     | 2284                  | 6865                  | 9149  | 9%                        |
| 7-8 AM  | 8873     | 8666     | 2155                  | 8014                  | 10169 | 17%                       |
| 8-9 AM  | 9254     | 8516     | 2269                  | 7413                  | 9682  | 14%                       |
| 9-10 AM   | 8693     | 8961     | 2353                  | 6861                  | 9214  | 3%                        |
| AM Total  | 35022    | 34504    | 9061                  | 29153                 | 38214 | 11%                       |

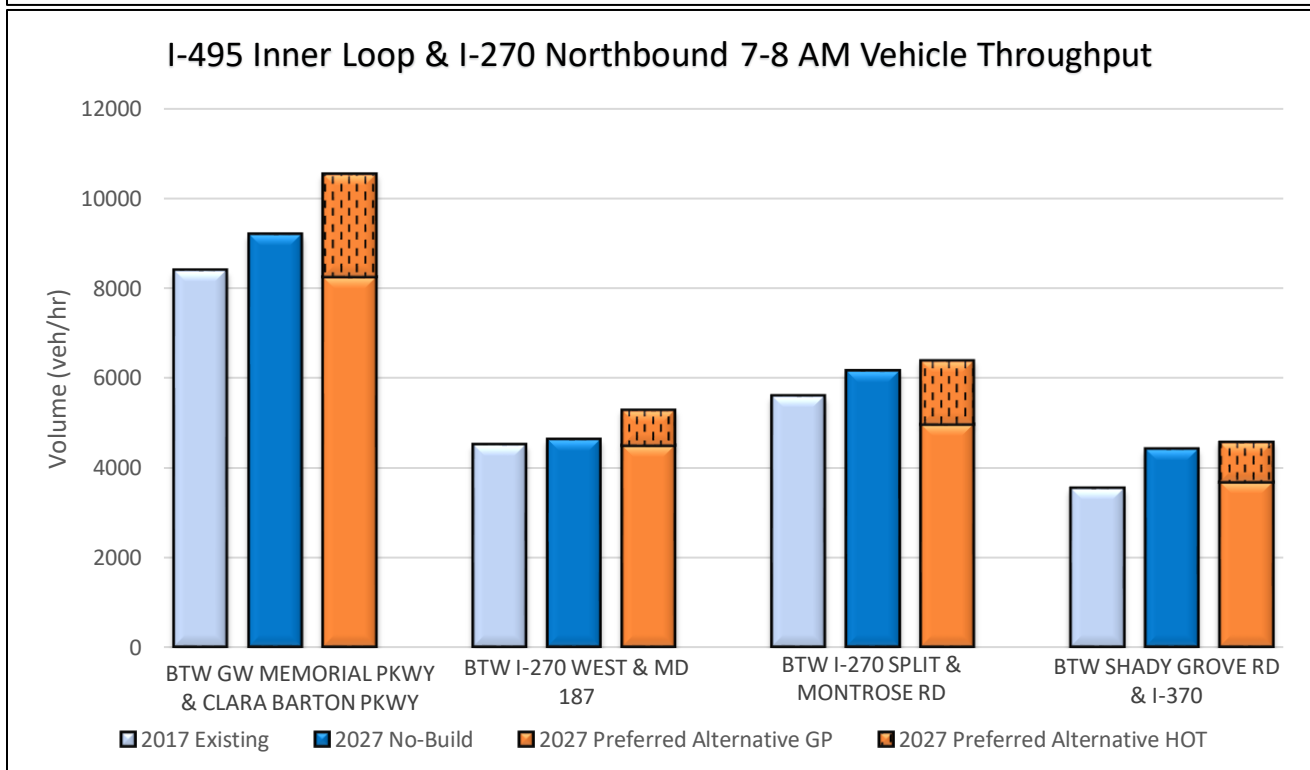
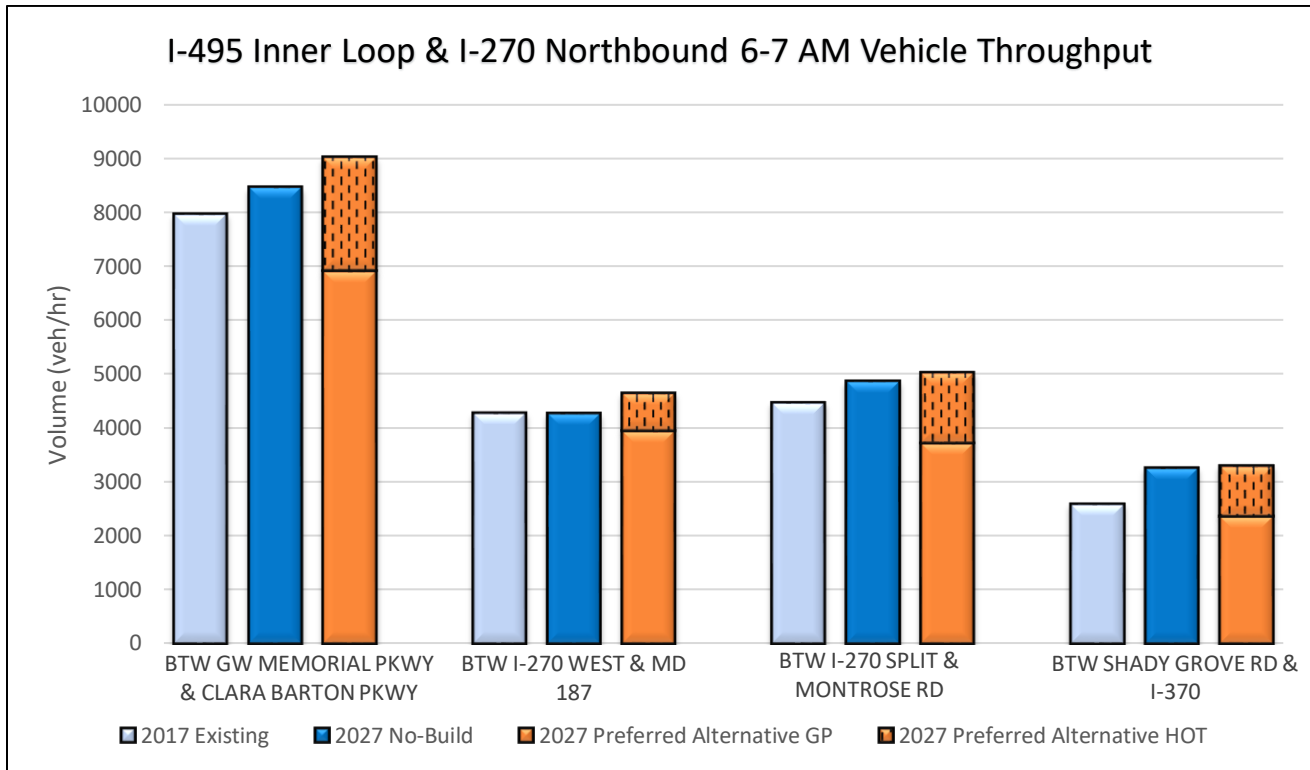


**Table 6-8: 2027 PM Throughput Comparison**

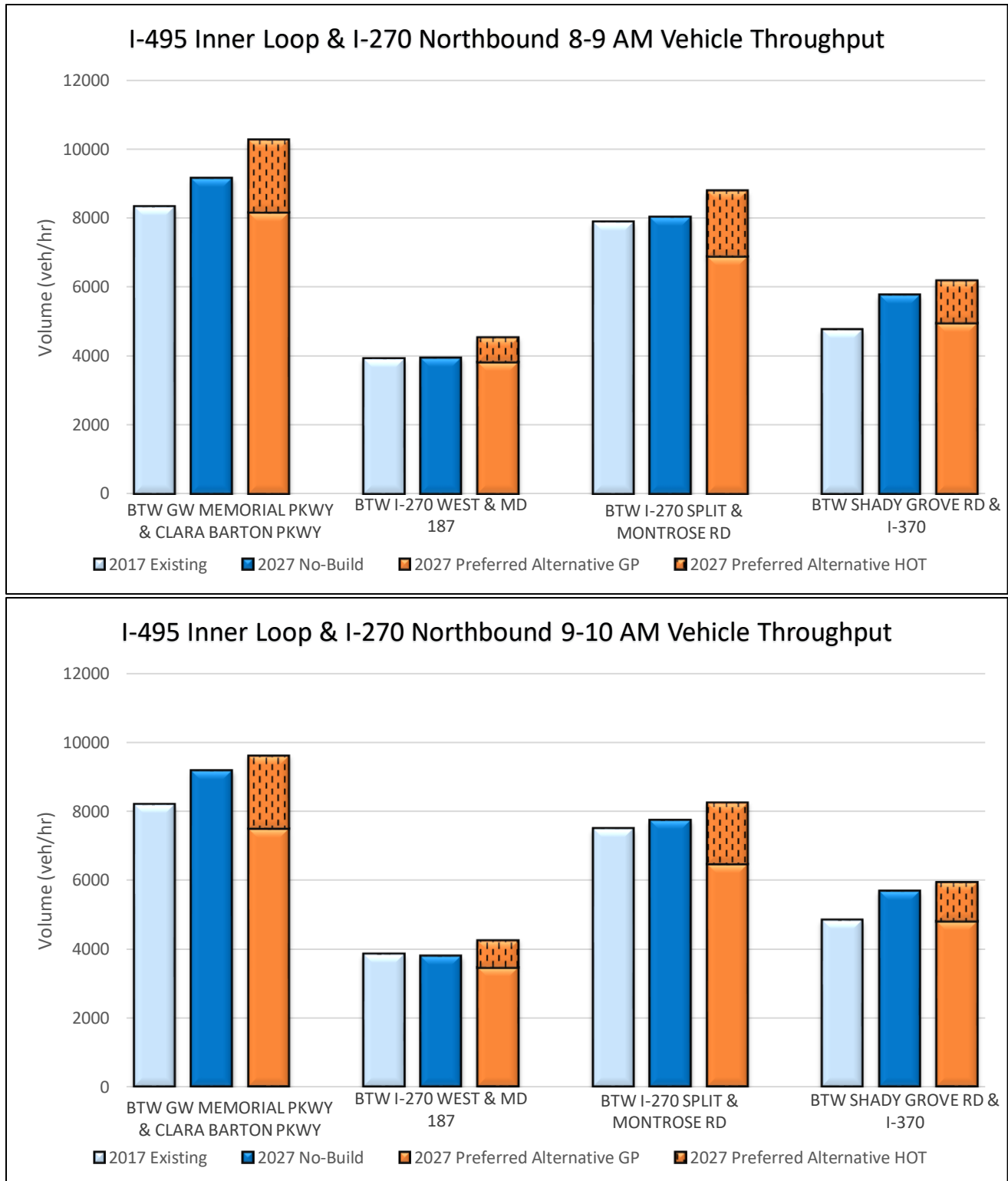
| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Inner Loop & I-270 Northbound Key Locations                 |          |          |                       |                       |       |                           |
| Between George Washington Memorial Parkway & Clara Barton Parkway |          |          |                       |                       |       |                           |
| 3-4 PM  | 8462     | 8425     | 2722                  | 6519                  | 9241  | 10%                       |
| 4-5 PM  | 7938     | 8517     | 2771                  | 6679                  | 9450  | 11%                       |
| 5-6 PM  | 7612     | 6667     | 2621                  | 5126                  | 7747  | 16%                       |
| 6-7 PM  | 8136     | 5653     | 2233                  | 4921                  | 7154  | 27%                       |
| PM Total  | 32148    | 29262    | 10347                 | 23245                 | 33592 | 15%                       |
| Between I-270 West Spur & MD 187                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 4172     | 4261     | 581                   | 4412                  | 4993  | 17%                       |
| 4-5 PM  | 3892     | 3800     | 546                   | 3316                  | 3862  | 2%                        |
| 5-6 PM  | 3449     | 1946     | 576                   | 2395                  | 2971  | 53%                       |
| 6-7 PM  | 3619     | 3364     | 506                   | 3507                  | 4013  | 19%                       |
| PM Total  | 15132    | 13371    | 2209                  | 13630                 | 15839 | 18%                       |
| Between I-270 Split & Montrose Road                               |          |          |                       |                       |       |                           |
| 3-4 PM  | 10824    | 11078    | 3400                  | 8594                  | 11994 | 8%                        |
| 4-5 PM  | 10770    | 11354    | 3387                  | 8818                  | 12205 | 7%                        |
| 5-6 PM  | 10862    | 7744     | 3224                  | 8195                  | 11419 | 47%                       |
| 6-7 PM  | 10603    | 7856     | 2921                  | 6506                  | 9427  | 20%                       |
| PM Total  | 43059    | 38032    | 12932                 | 32113                 | 45045 | 18%                       |
| Between Shady Grove Road & I-370                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 10653    | 10756    | 2779                  | 8381                  | 11160 | 4%                        |
| 4-5 PM  | 10469    | 8737     | 2629                  | 8232                  | 10861 | 24%                       |
| 5-6 PM  | 10112    | 7272     | 2203                  | 6306                  | 8509  | 17%                       |
| 6-7 PM  | 10021    | 9310     | 2318                  | 6593                  | 8911  | -4%                       |
| PM Total  | 41255    | 36075    | 9929                  | 29512                 | 39441 | 9%                        |

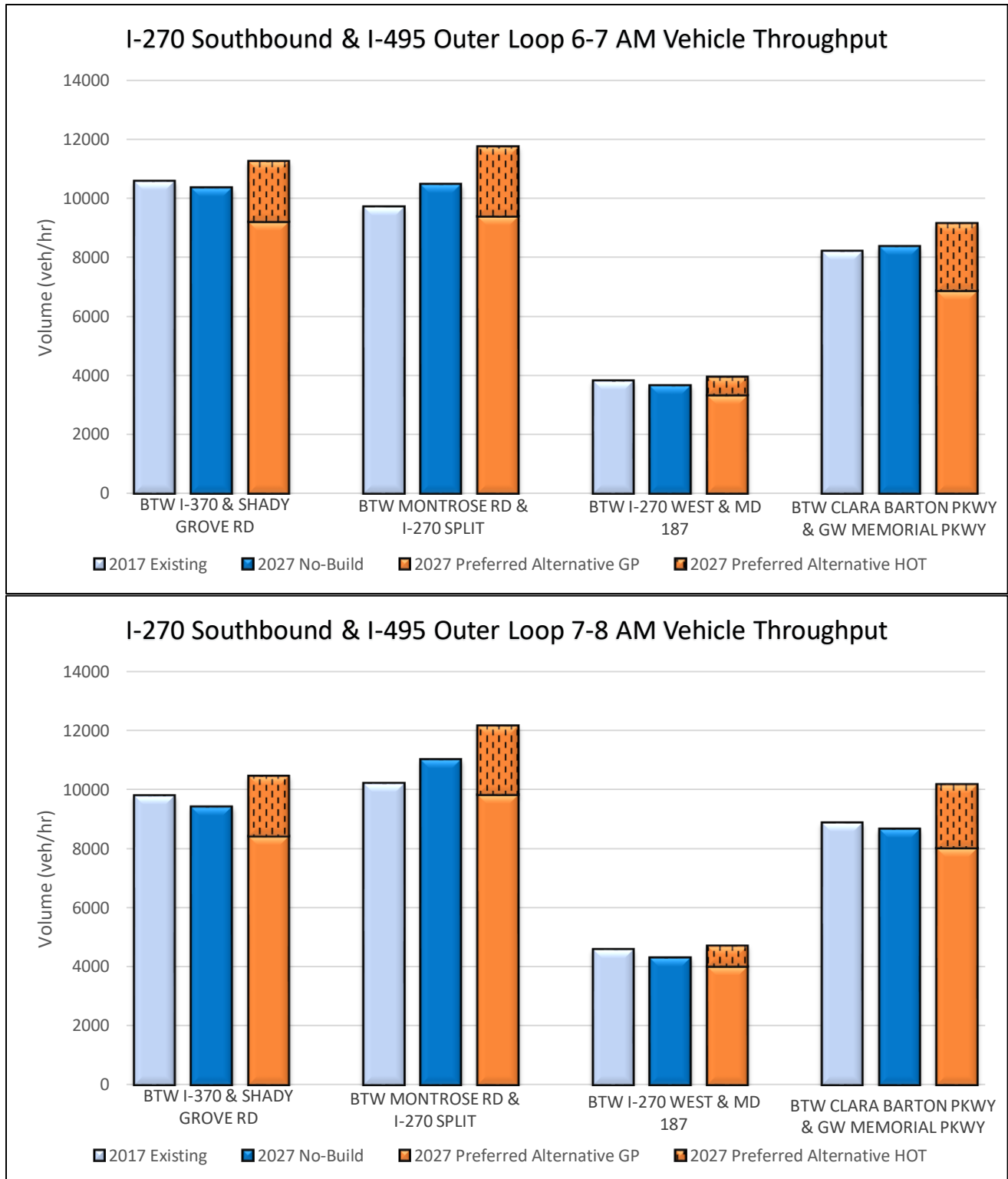
**Table 6-8: 2027 PM Throughput Comparison (Continued)**

| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Outer Loop & I-270 Southbound Key Locations                 |          |          |                       |                       |       |                           |
| Between I-370 & Shady Grove Road                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 5578     | 6343     | 1530                  | 5380                  | 6910  | 9%                        |
| 4-5 PM  | 5806     | 6211     | 1580                  | 5658                  | 7238  | 17%                       |
| 5-6 PM  | 6307     | 6023     | 1595                  | 5668                  | 7263  | 21%                       |
| 6-7 PM  | 6102     | 6548     | 1592                  | 5623                  | 7215  | 10%                       |
| PM Total  | 23793    | 25125    | 6297                  | 22329                 | 28626 | 14%                       |
| Between Montrose Road & I-270 Split                               |          |          |                       |                       |       |                           |
| 3-4 PM  | 6721     | 7282     | 2249                  | 6254                  | 8503  | 17%                       |
| 4-5 PM  | 7215     | 7499     | 2386                  | 6697                  | 9083  | 21%                       |
| 5-6 PM  | 7487     | 7012     | 2356                  | 6574                  | 8930  | 27%                       |
| 6-7 PM  | 7277     | 7610     | 2227                  | 6075                  | 8302  | 9%                        |
| PM Total  | 28700    | 29403    | 9218                  | 25600                 | 34818 | 18%                       |
| Between MD 187 & I-270 West Spur                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 4469     | 4587     | 410                   | 4398                  | 4808  | 5%                        |
| 4-5 PM  | 4121     | 4355     | 400                   | 4031                  | 4431  | 2%                        |
| 5-6 PM  | 3898     | 3526     | 283                   | 3990                  | 4273  | 21%                       |
| 6-7 PM  | 3599     | 2149     | 341                   | 3428                  | 3769  | 75%                       |
| PM Total  | 16087    | 14617    | 1434                  | 15847                 | 17281 | 18%                       |
| Between Clara Barton Parkway & George Washington Memorial Parkway |          |          |                       |                       |       |                           |
| 3-4 PM  | 8034     | 9247     | 1987                  | 7920                  | 9907  | 7%                        |
| 4-5 PM  | 8107     | 8878     | 1992                  | 8069                  | 10061 | 13%                       |
| 5-6 PM  | 7742     | 8627     | 1721                  | 7722                  | 9443  | 9%                        |
| 6-7 PM  | 7865     | 7320     | 1713                  | 7301                  | 9014  | 23%                       |
| PM Total  | 31748    | 34072    | 7413                  | 31012                 | 38425 | 13%                       |

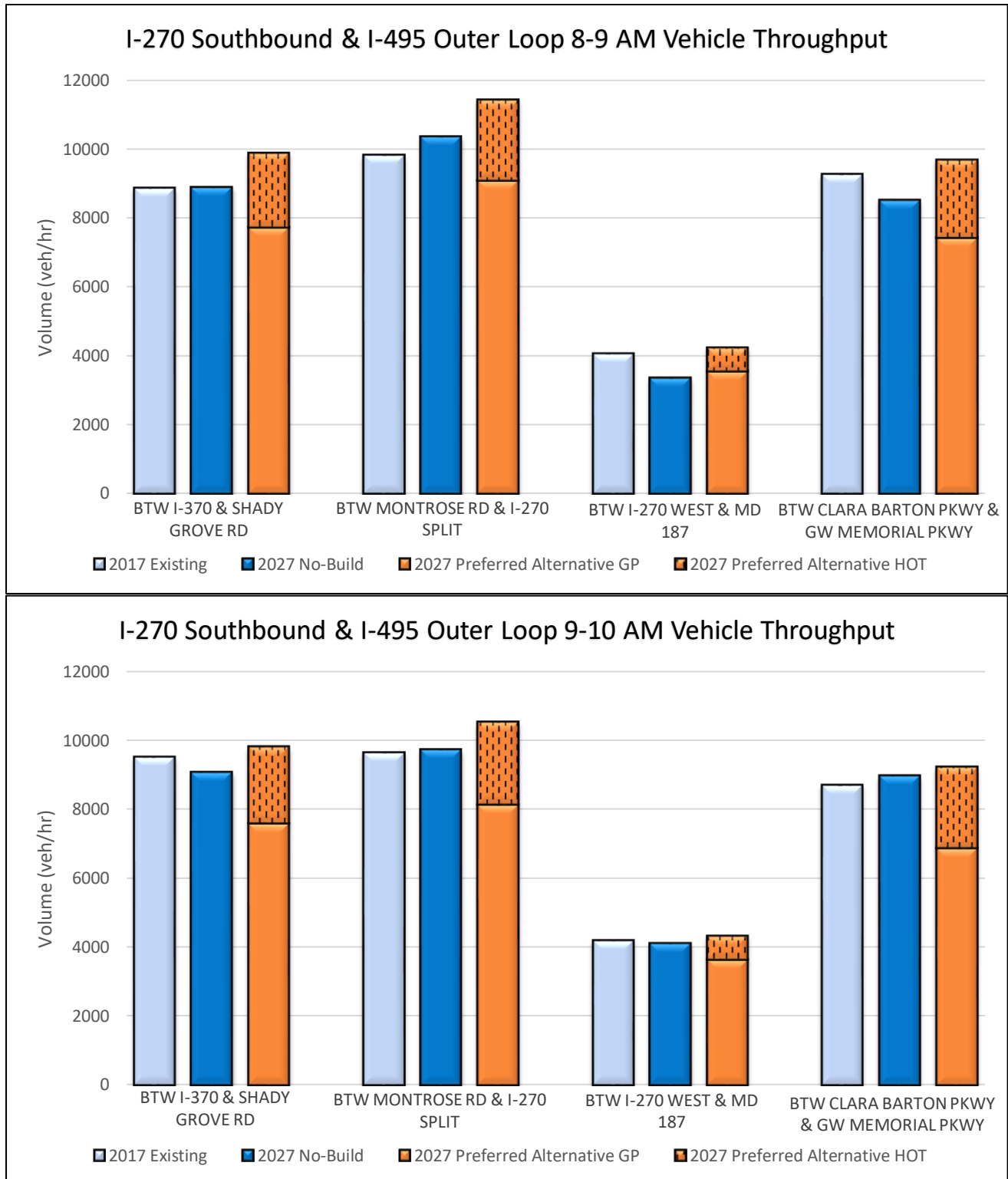
**Figure 6-6: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr)**


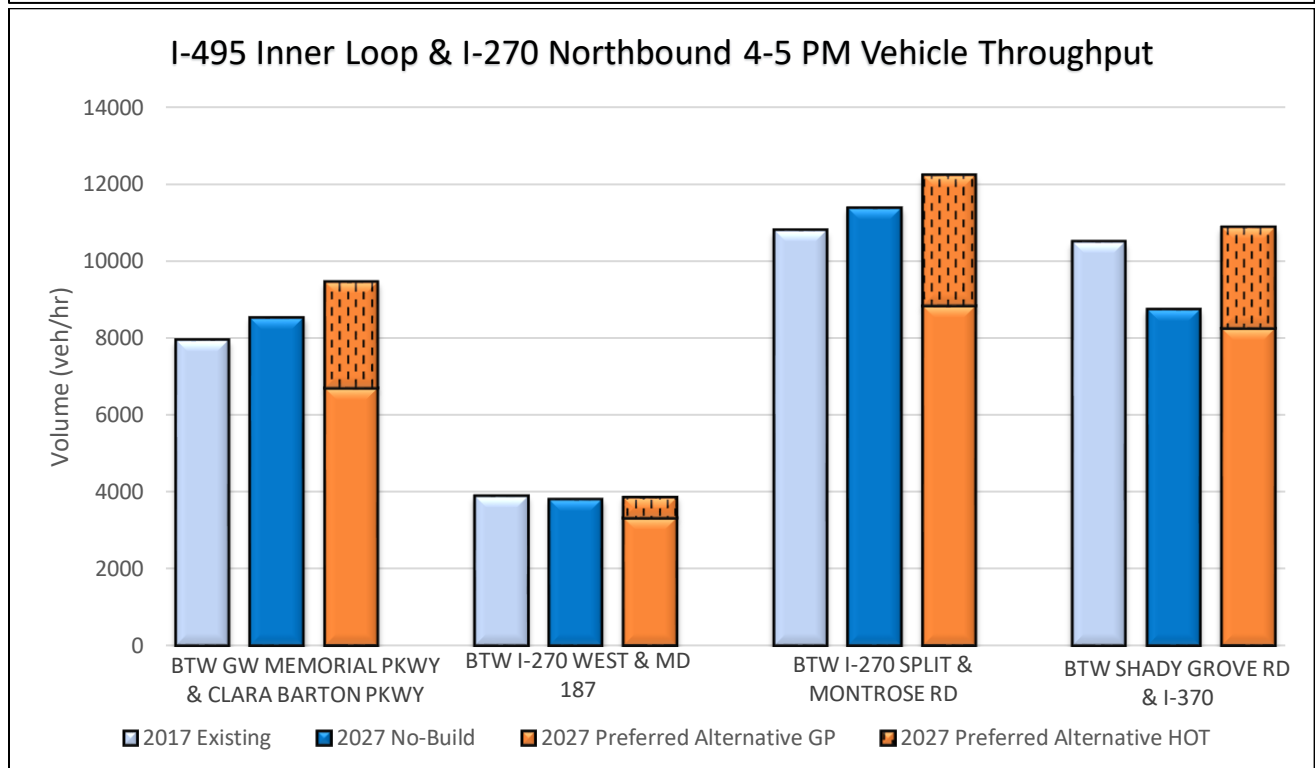
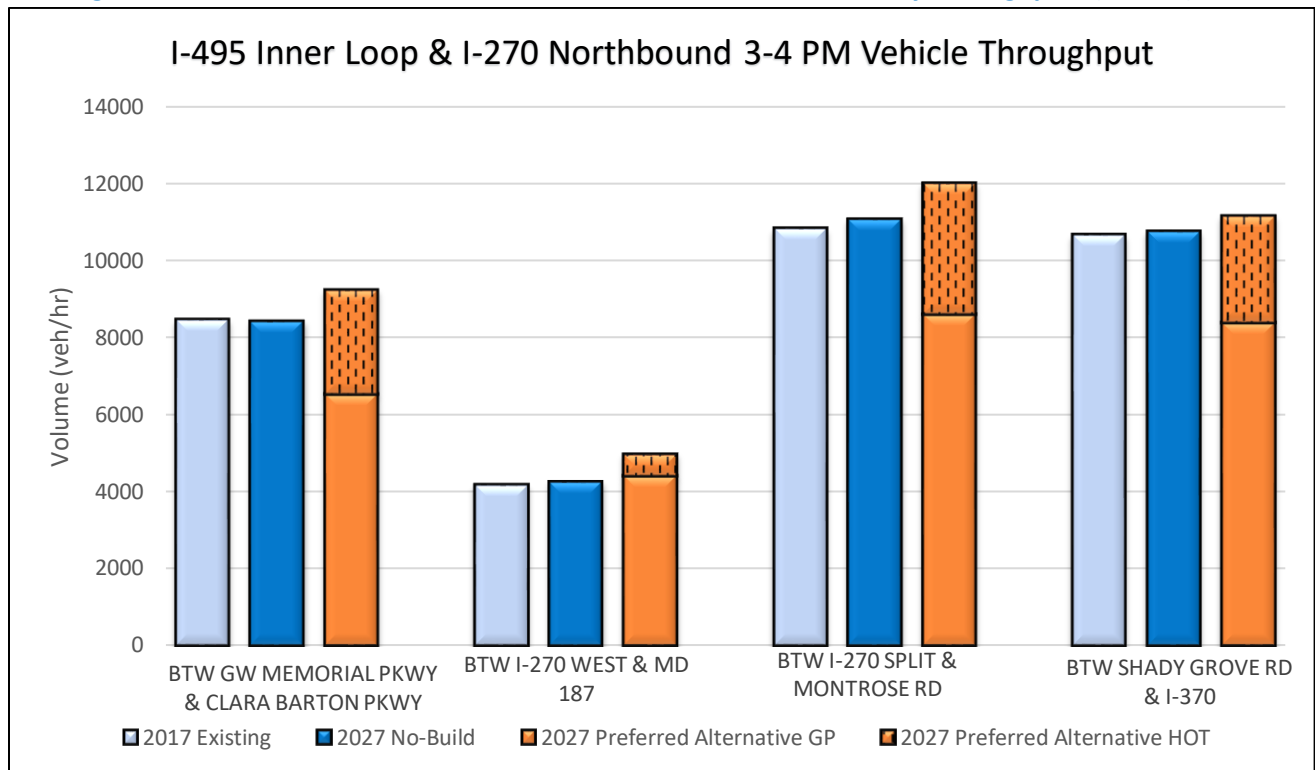
**Figure 6-6: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)**



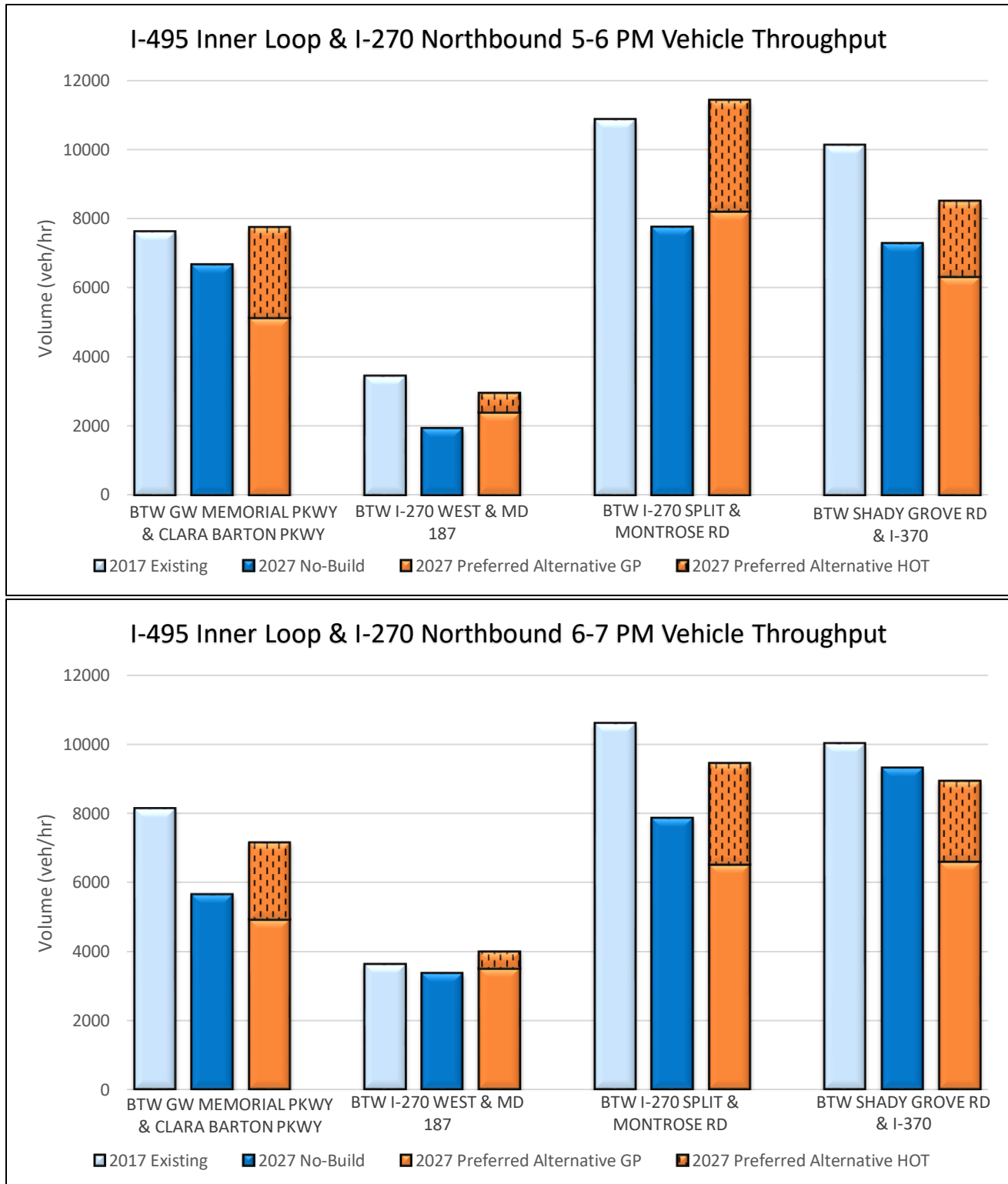
**Figure 6-6: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)**


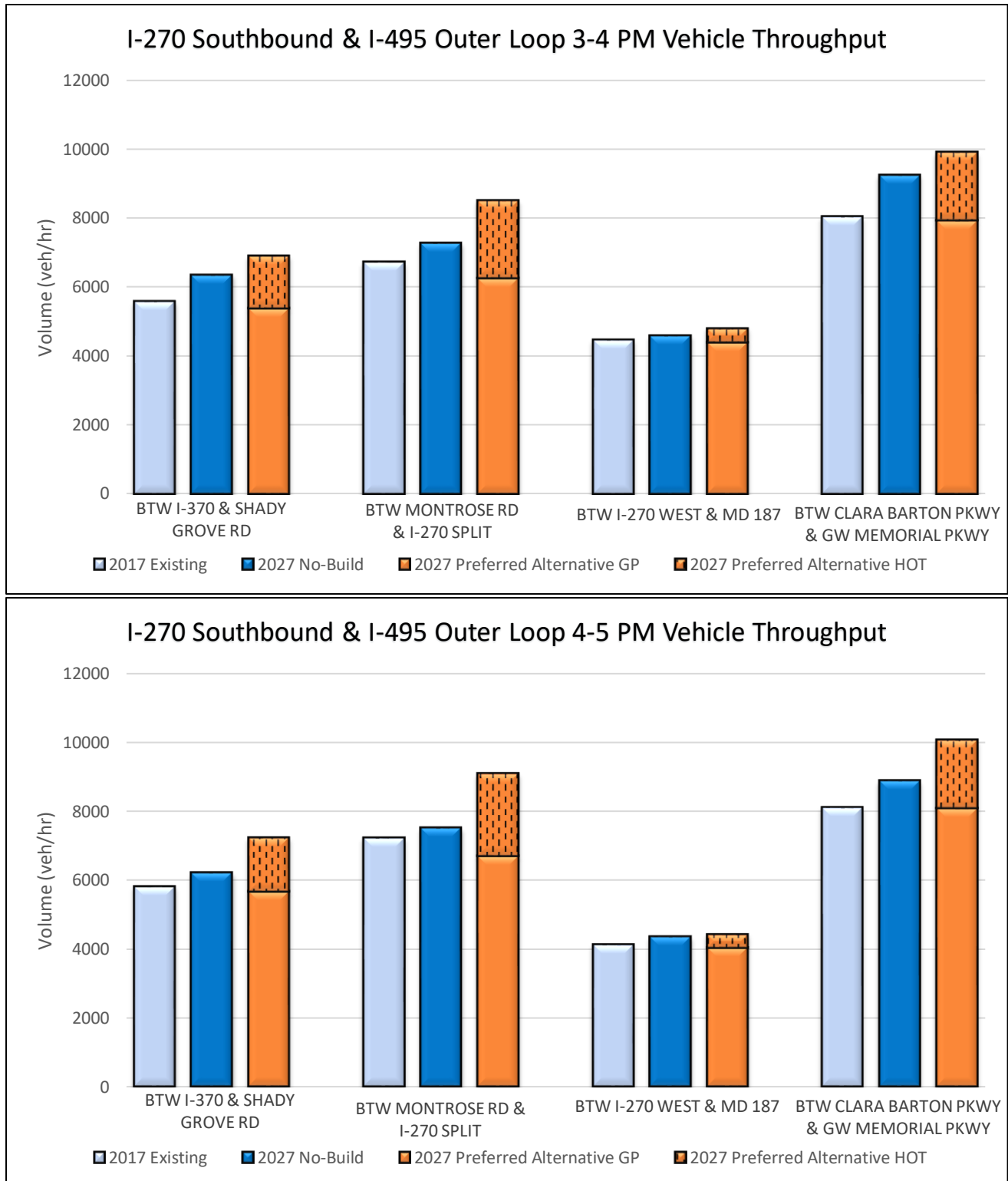


**Figure 6-6: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)**


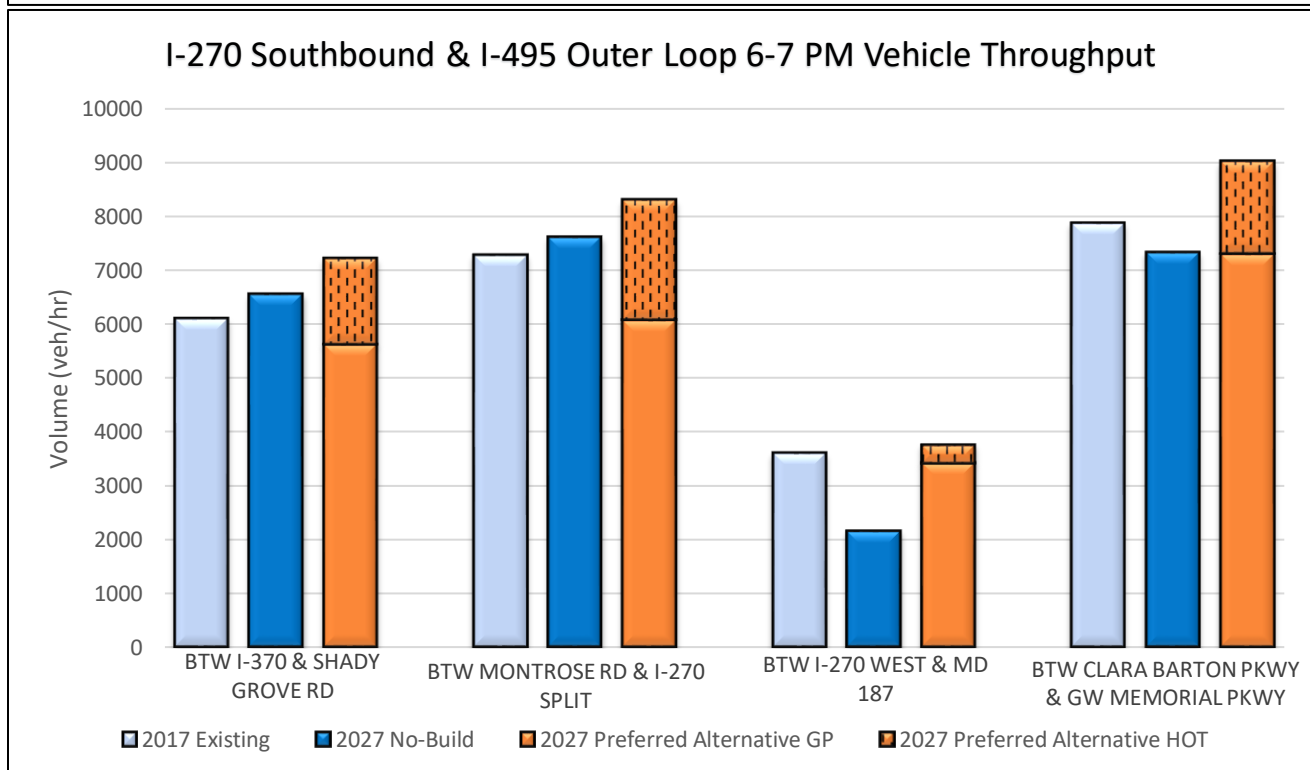
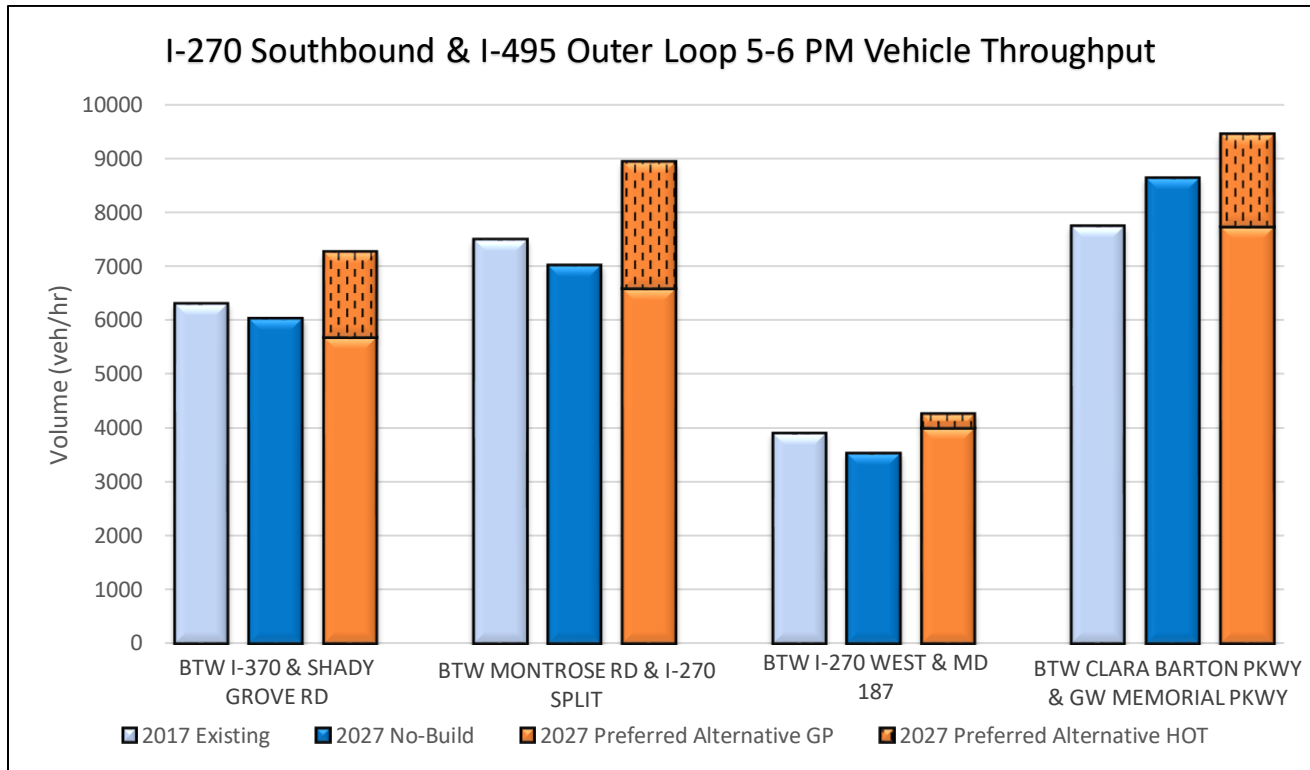
**Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr)**


**Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)**



**Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)**


**Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)**





### 6.4.2.3 Freeway Density and LOS Analysis

As summarized in **Section 4.1**, there are several background projects included in the No Build condition, including I-270 Innovative Congestion Management (ICM), that relieve bottlenecks and improve operations. While these projects will improve mobility and safety, they will not address the long-term roadway capacity needs for the I-270 corridor.

**Figure 6-8 and Figure 6-9** compare the percentage of lane-miles operating at each LOS between No Build and Preferred Alternative AM conditions along I-495 and I-270, respectively; the lane-mile percentages are based on density for the entire AM peak period. Because the overall I-270 roadway system is comprised of varying facility type operations, rather than comparing individually (i.e., Local lanes compared to HOT lanes), the overall roadway system was compared between No Build and Build (i.e., No Build General Purpose + Local lanes compared to Preferred Alternative General Purpose + HOT lanes).

Along the I-495 Inner Loop, the lane-miles operating with LOS 'D' or better increases from 58% (approximately 98 lane-miles) under No Build conditions to 76% (approximately 128 lane-miles) while reducing those of LOS 'F' from 31% (approximately 53 lane-miles) to 22% (approximately 36 lane-miles) with the Preferred Alternative. Along the I-495 Outer Loop, the lane-miles of LOS 'F' are reduced from 33% (approximately 52 lane-miles) under No Build conditions to 3% (approximately 4 lane-miles) with the Preferred Alternative.

During the AM peak period, the I-270 Northbound lane-miles with LOS 'D' or better increases from 98% (approximately 275 lane-miles) to 99% (approximately 318 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Similarly, the I-270 Southbound lane-miles with LOS 'D' or better increases from 79% (approximately 223 lane-miles) to 83% (approximately 263 lane-miles) while reducing those of LOS 'F' from 11% (approximately 30 lane-miles) to 8% (approximately 26 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Because of the I-270 ICM, the number of lane-miles operating at LOS 'F' is reduced along I-270 Southbound from 2017 Existing conditions; and because of the Preferred Alternative, these LOS 'F' reductions are even more substantial. The overall I-270 roadway system operations are substantially better even though an uptick of LOS D, E, and/or F lane-miles is anticipated for the I-270 General Purpose lanes by themselves with the Preferred Alternative.

**Figure 6-8: 2027 AM I-495 Mainline Segment LOS – No Build vs Preferred Alternative**

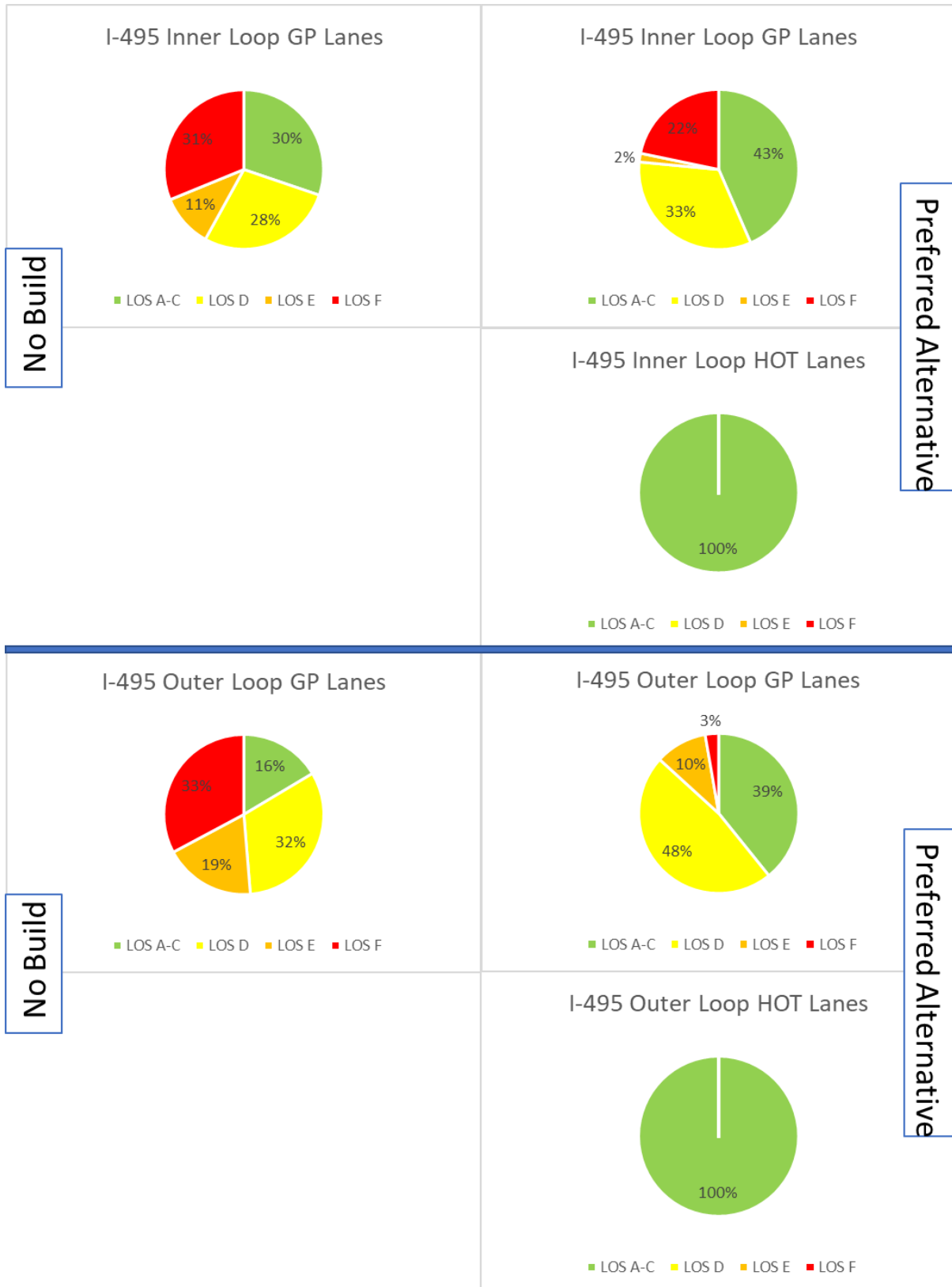
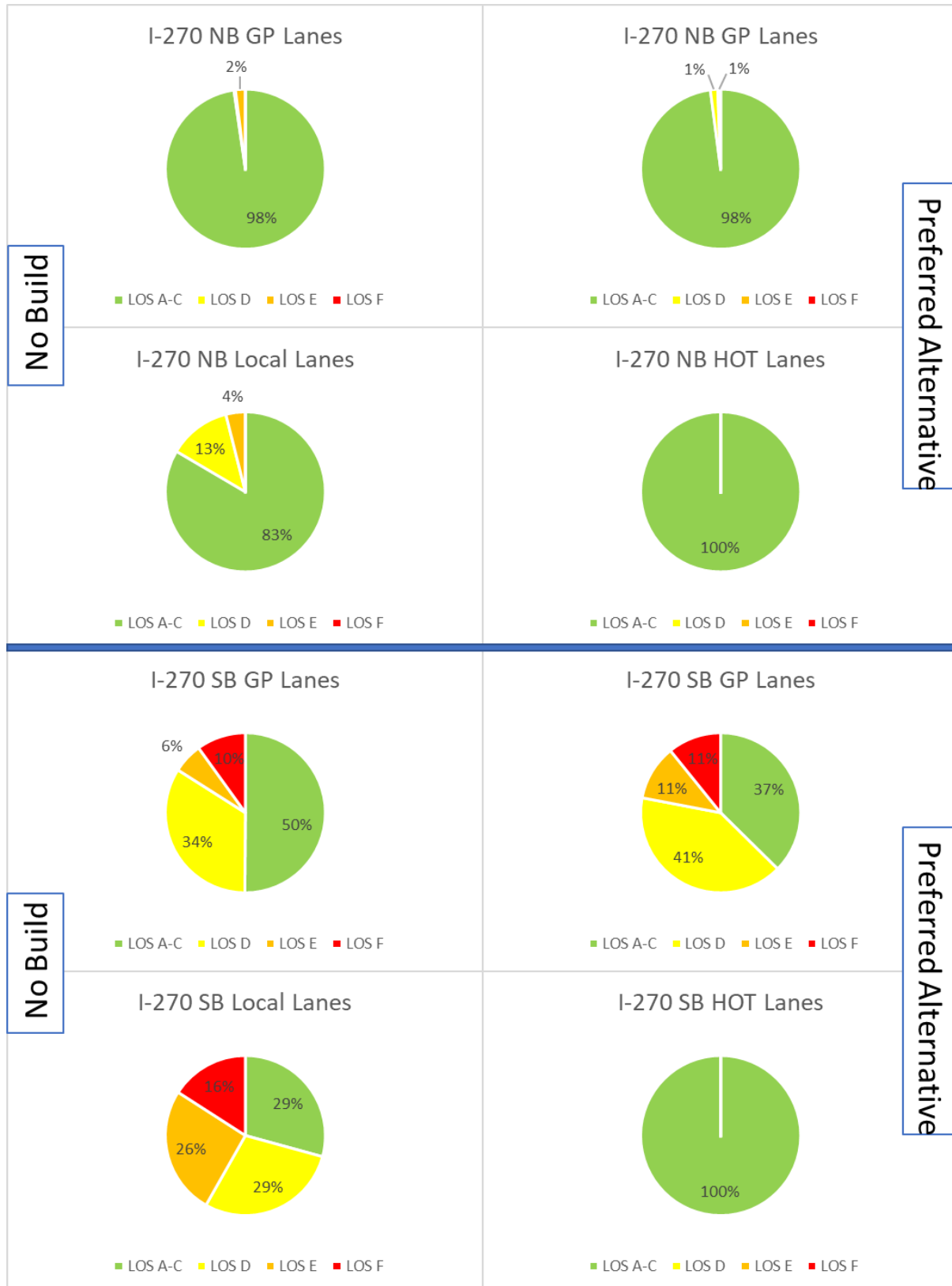


Figure 6-9: 2027 AM I-270 Mainline Segment LOS – No Build vs Preferred Alternative



**Figure 6-10 and Figure 6-11** compare the percentage of lane-miles operating at each LOS between No Build and Preferred Alternative PM conditions along I-495 and I-270, respectively; the lane-mile percentages are based on density for the entire PM peak period. Because the overall I-270 roadway system is comprised of varying facility type operations, rather than comparing individually (i.e., Local lanes compared to HOT lanes), the overall roadway system was compared between No Build and Build (i.e., No Build General Purpose + Local lanes compared to Preferred Alternative General Purpose + HOT lanes).

Under both 2027 No Build and Preferred Alternative PM peak period conditions, existing bottlenecks at locations outside of the study area become exacerbated, such as along I-270 Northbound from I-370 to MD 124; from MD 109 to MD 121; I-495 Inner Loop from MD 185 to MD 97; and from I-95 to MD 201. The resultant congestion impacts traffic operations within the project limits. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

Existing bottlenecks within the study area, that are exacerbated under No Build conditions, are mitigated with the Preferred Alternative, such as along the I-495 Inner Loop from the VA 193 interchange to I-270 West Spur. This mitigation results in increased vehicle throughput on both I-495 Inner Loop and I-270 Northbound but still produces higher percentages of lane-miles operating at LOS 'F'. Nevertheless, the Preferred Alternative serves approximately 67% more vehicles during the entire PM peak period, with 80% less unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

The lane-miles of LOS 'F' are reduced from 80% (approximately 135 lane-miles) to 66% (approximately 110 lane-miles) along the I-495 Inner Loop and from 25% (approximately 40 lane-miles) to 6% (approximately 10 lane-miles) along the I-495 Outer Loop between No Build and Preferred Alternative, respectively.

The PM peak period I-270 Northbound lane-miles with LOS 'D' or better increases from 32% (approximately 98 lane-miles) to 47% (approximately 149 lane-miles) while reducing those of LOS 'F' from 59% (approximately 178 lane-miles) to 46% (approximately 146 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Similarly, the I-270 Southbound lane-miles with LOS 'D' or better increases from 96% (approximately 269 lane-miles) to 99% (approximately 312 lane-miles) while reducing those of LOS 'F' from 4% (approximately 11 lane-miles) to less than 1% (approximately 1 lane-mile) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively.

Figure 6-10: 2027 PM I-495 Mainline Segment LOS – No Build vs Preferred Alternative

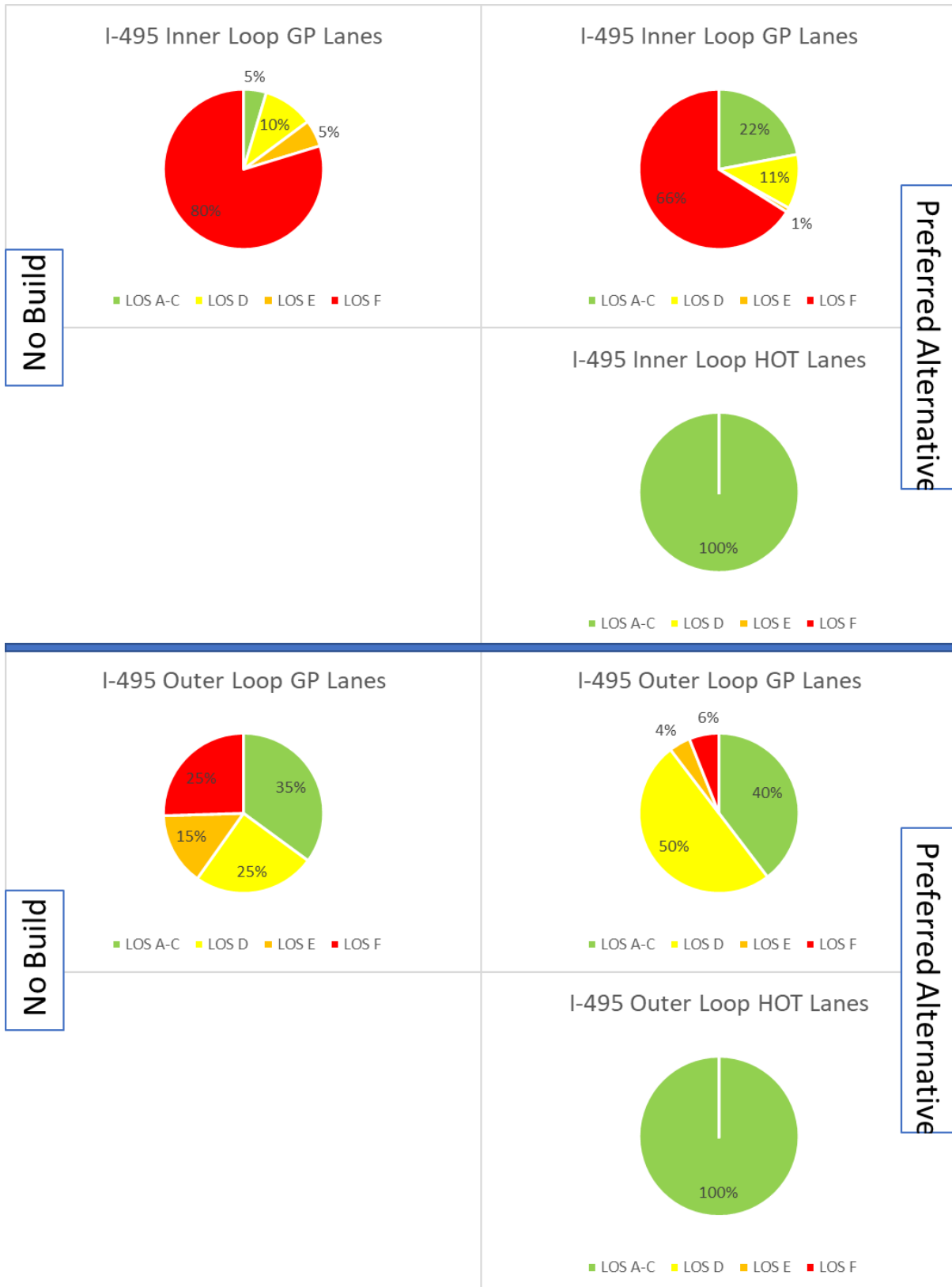
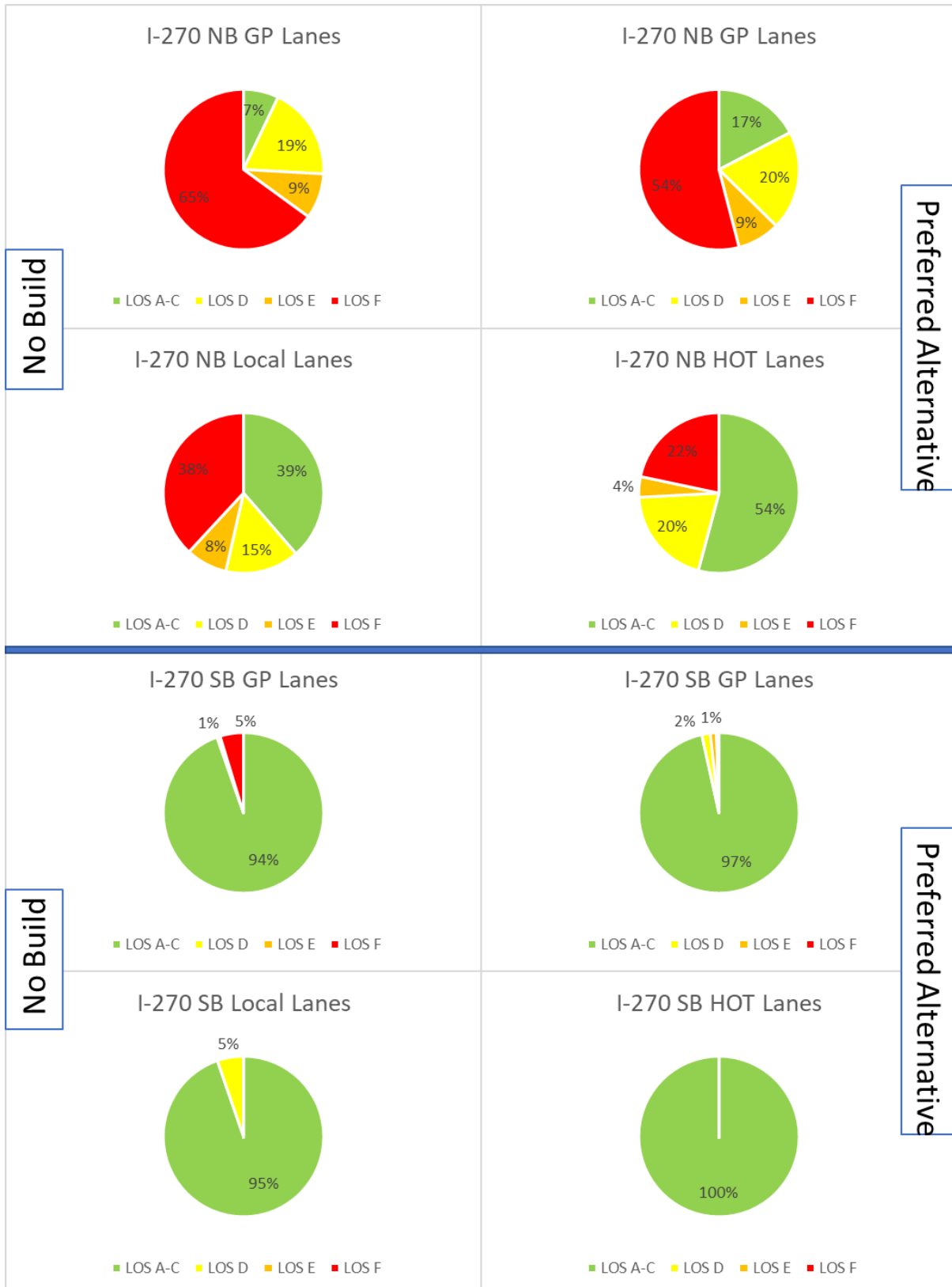




Figure 6-11: 2027 PM I-270 Mainline Segment LOS – No Build vs Preferred Alternative



**Table 6-9 and Table 6-10** detail freeway density by segment for both No Build and Preferred Alternative conditions, during the AM and PM peak periods, respectively. Refer to **Table 6-1** for LOS thresholds for basic segments and for merge, diverge, and weave segments. **Appendix H** contains a summary of densities and speeds by lane as well as the number of lane changes through weave sections.

Under 2027 AM peak period No Build conditions, the existing bottlenecks at locations within the study area become exacerbated, specifically along the I-495 Inner Loop from the VA 193 interchange to the American Legion Bridge. These bottlenecks are mitigated under 2027 Preferred Alternative conditions, resulting in increased vehicle throughput on both I-495 Inner Loop and I-270 Northbound with consequential operational degradations at the higher throughput downstream areas, particularly east of the proposed Managed Lanes facility between the MD 355 and MD 185 interchanges. Even with these operational degradations, the Preferred Alternative serves approximately 16% more vehicles during the entire AM peak period, with no unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

The Preferred Alternative significantly improves density along the I-495 Outer Loop General Purpose Lanes between the MD 185 and MD 190 interchanges, particularly in the latter hours of the AM peak period, as shown in **Table 6-9**. Overall, I-270 Northbound and Southbound operate similarly with comparable density characteristics between No Build and Preferred Alternative conditions.

Operations at truncation points are similar or improved with the Preferred Alternative compared to No Build conditions. Slip ramps are located along I-270 West Spur Northbound and Southbound, serving vehicles traveling from the HOT Lanes to the General Purpose Lanes and from the General Purpose Lanes to the HOT lanes, in both directions of I-270 West Spur. Along I-270 West Spur Northbound, the slip ramp from the General Purpose Lanes to the HOT Lanes runs from approximately 1,800 ft north of I-495 to approximately 200 ft north of Democracy Blvd, and the slip ramp from the HOT Lanes to the General Purpose Lanes runs from approximately 500 ft north of Westlake Terrace to approximately 1,300 ft north of Westlake Terrace. Along I-270 West Spur Southbound, the slip ramp from the HOT Lanes to the General Purpose Lanes runs from just south of Westlake Terrace to approximately 700 ft south of Westlake Terrace, and the slip ramp from the General Purpose Lanes to the HOT Lanes runs from approximately 1,500 ft north of I-495 to approximately 500 ft north of I-495. In 2027, all General Purpose Lane segments along I-270 West Spur operate at LOS 'D' or better, and all HOT Lane segments along I-270 West Spur operate at LOS 'C' or better during all AM peak hours.

**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 25       | 24         | 28       | 26         | 84       | 23         | 109      | 21         |
|   | Diverge | 27       | 25         | 35       | 30         | 118      | 24         | 121      | 23         |
| VA 193 Interchange  | Basic   | 29       | 28         | 48       | 30         | 121      | 26         | 116      | 25         |
|   | Merge   | 19       | 19         | 46       | 22         | 122      | 26         | 97       | 21         |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 26       | 25         | 66       | 28         | 122      | 27         | 120      | 24         |
|   | Diverge | 26       | 26         | 66       | 29         | 106      | 28         | 104      | 26         |
| George Washington Memorial Parkway Interchange                    | Basic   | 27       | 24         | 86       | 29         | 104      | 29         | 104      | 26         |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 30       | 25         | 86       | 31         | 93       | 31         | 93       | 27         |
|   | Diverge | 43       | N/A        | 53       | N/A        | 54       | N/A        | 52       | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 37       | 28         | 44       | 35         | 43       | 34         | 43       | 30         |
| Between Clara Barton Parkway & MD 190                             | Merge   | 23       | 20         | 26       | 24         | 26       | 24         | 28       | 22         |
|   | Basic   | 35       | 28         | 39       | 35         | 39       | 34         | 48       | 31         |
|   | Diverge | 25       | 20         | 27       | 24         | 27       | 24         | 38       | 22         |
| MD 190 Interchange  | Basic   | 31       | 26         | 34       | 31         | 34       | 30         | 68       | 27         |
|   | Merge   | 20       | 18         | 22       | 22         | 23       | 21         | 91       | 19         |
|   | Basic   | 25       | N/A        | 28       | N/A        | 32       | N/A        | 111      | N/A        |
| Between MD 190 & I-270 West Spur                                  | Merge   | 13       | 19         | 17       | 23         | 28       | 24         | 89       | 22         |
|   | Basic   | 27       | 22         | 32       | 27         | 60       | 28         | 99       | 25         |
|   | Weave   | 22       | 22         | 26       | 28         | 51       | 34         | 67       | 25         |
| Between I-270 West Spur & MD 187                                  | Basic   | 26       | 25         | 28       | 30         | 24       | 54         | 23       | 26         |
|   | Merge   | N/A      | 20         | N/A      | 28         | N/A      | 88         | N/A      | 56         |
|   | Basic   |          | 28         |          | 46         | N/A      | 111        |          | 84         |
|   | Diverge | 23       | 19         | 28       | 37         | 22       | 91         | 18       | 74         |
| MD 187 Interchange  | Basic   | 23       | 24         | 25       | 57         | 20       | 140        | 20       | 121        |
| Between MD 187 & I-270 East Spur                                  | Merge   | 16       | 16         | 18       | 48         | 15       | 108        | 14       | 92         |
|   | Basic   | 24       | N/A        | 27       | N/A        | 22       | N/A        | 22       | N/A        |
|   | Diverge | 25       | 27         | 28       | 58         | 23       | 98         | 22       | 91         |
| I-270 East Spur Interchange                                       | Basic   | 35       | 38         | 41       | 71         | 34       | 101        | 32       | 90         |
|   | Weave   | 24       | 26         | 35       | 64         | 31       | 95         | 26       | 88         |
|   | Weave   | 18       | 19         | 31       | 54         | 29       | 78         | 20       | 74         |
|   | Basic   | 22       | N/A        | 39       | N/A        | 37       | N/A        | 25       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 18       | 19         | 37       | 57         | 35       | 78         | 22       | 71         |
|   | Basic   | 27       | 29         | 42       | 44         | 37       | 46         | 31       | 45         |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 10       | 14         | 10       | 15         | 9        | 13         | 9        | 13         |
| George Washington Memorial Parkway Interchange                    | Diverge | 7        | 9          | 7        | 10         | 6        | 9          | 6        | 9          |
|   | Merge   | 6        | N/A        | 8        | N/A        | 8        | N/A        | 8        | N/A        |
|   | Basic   | 13       | 12         | 19       | 13         | 18       | 13         | 18       | 13         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 11         | N/A      | 12         | N/A      | 11         | N/A      | 11         |
|   | Basic   |          | 17         |          | 19         |          | 17         |          | 17         |
|   | Diverge |          | 11         |          | 12         |          | 11         |          | 11         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 15         | N/A      | 17         | N/A      | 16         | N/A      | 16         |
|   | Merge   |          | 10         |          | 12         |          | 11         |          | 11         |
|   | Basic   |          | 10         |          | 12         |          | 11         |          | 11         |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 10         |          | 11         |          | 11         |          | 12         |
|   | Basic   |          | 11         |          | 13         |          | 12         |          | 13         |
|   | Diverge |          | 11         |          | 13         |          | 12         |          | 13         |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 12         |          | 14         |          | 15         |          | 15         |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 24       | 20         | 25       | 26         | 27       | 25         | 27       | 22         |
|   | Merge   | 10       | 8          | 12       | 12         | 15       | 14         | 14       | 11         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 18       | 17         | 20       | 21         | 22       | 22         | 22       | 19         |
|   | Basic   | 27       | 25         | 29       | 29         | 29       | 28         | 30       | 26         |
|   | Diverge | 19       | 19         | 22       | 24         | 23       | 23         | 24       | 22         |
|   | Basic   | 30       | 27         | 32       | 34         | 33       | 31         | 34       | 29         |
|   | Diverge | 20       | 29         | 20       | 35         | 19       | 34         | 20       | 31         |
|   | Basic   | 33       | N/A        | 36       | N/A        | 38       | N/A        | 39       | N/A        |
| Weave   | 32      | 34       |            | 34       |            | 35       |            |          |            |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Basic   | N/A      | 26         | N/A      | 31         | N/A      | 29         | N/A      | 26         |
|   | Merge   |          | 20         |          | 24         |          | 25         |          | 23         |
| Clara Barton Parkway Interchange                                    | Basic   | 38       | 32         | 37       | 36         | 34       | 30         | 38       | 28         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 25       | 24         | 24       | 27         | 22       | 24         | 24       | 23         |
|   | Basic   | 42       | 32         | 41       | 37         | 36       | 31         | 40       | 29         |
|   | Merge   | 37       | 21         | 35       | 25         | 29       | 23         | 36       | 22         |
| MD 190 Interchange  | Basic   | 36       | 32         | 34       | 33         | 30       | 27         | 32       | 27         |
|   | Diverge | 32       | 27         | 30       | 26         | 26       | 26         | 29       | 24         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 25       | 21         | 63       | 22         | 103      | 21         | 66       | 20         |
|   | Basic   | 49       | 34         | 59       | 36         | 72       | 30         | 55       | 27         |
|   | Weave   | 48       | 40         | 66       | 43         | 90       | 28         | 52       | 22         |
| Between I-270 West Spur & MD 187                                    | Basic   | 26       | 22         | 76       | 26         | 132      | 23         | 102      | 24         |
|   | Diverge | N/A      | 18         | N/A      | 22         | N/A      | 20         | N/A      | 20         |
|   | Basic   |          | 25         |          | 30         |          | 27         |          | 28         |
|   | Merge   | 16       | 17         | 34       | 21         | 122      | 18         | 107      | 19         |
| MD 187 Interchange  | Basic   | 20       | 22         | 30       | 25         | 113      | 22         | 112      | 23         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 15       | 16         | 20       | 19         | 73       | 16         | 73       | 17         |
|   | Basic   | 22       | 24         | 28       | 28         | 95       | 25         | 96       | 26         |
|   | Merge   | 17       | 19         | 22       | 23         | 70       | 23         | 67       | 22         |
| I-270 East Spur Interchange   | Basic   | 20       | 22         | 24       | 25         | 76       | 22         | 74       | 23         |
|   | Diverge | 26       | 28         | 32       | 33         | 73       | 36         | 70       | 34         |
| Between I-270 East Spur & MD 185                                    | Diverge | 25       | 26         | 29       | 30         | 49       | 34         | 46       | 32         |
|   | Basic   | 30       | 32         | 38       | 39         | 75       | 51         | 70       | 42         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic   | 6        | 15         | 6        | 12         | 6        | 16         | 6        | 16         |
| George Washington Memorial Parkway Interchange      | Merge   | 4        | 10         | 4        | 8          | 4        | 11         | 4        | 11         |
|   | Basic   | 5        | 13         | 5        | 10         | 5        | 13         | 6        | 15         |
|   | Diverge | N/A      | 12         | N/A      | 12         | N/A      | 12         | N/A      | 13         |
|   | Basic   | 12       | 18         | 12       | 17         | 11       | 18         | 13       | 19         |
|   | Merge   | N/A      | 12         | N/A      | 11         | N/A      | 12         | N/A      | 13         |
|   | Basic   |          | 16         |          | 15         |          | 15         |          |            |
|   | Diverge |          | 14         |          | 14         |          | 14         |          |            |
|   | Basic   |          | 14         |          | 14         |          | 14         |          |            |
| Between MD 190 & I-270 West Spur                    | Diverge |          | 12         |          | 12         |          | 12         |          | 12         |
|   | Basic   |          | 15         |          | 16         |          | 15         |          | 15         |
|   | Merge   |          | 15         |          | 15         |          | 15         |          | 15         |
| Between I-270 West Spur & MD 187                    | Basic   |          | 11         |          | 13         |          | 12         |          | 12         |
| I-270 Northbound General Purpose Lanes              |         |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic   | 8        | 9          | 10       | 12         | 12       | 15         | 12       | 15         |
| Between MD 117 & I-370                              | Diverge | 12       | 11         | 17       | 17         | 20       | 22         | 17       | 20         |
|   | Basic   | 9        | 10         | 12       | 14         | 15       | 18         | 14       | 17         |
|   | Merge   | 9        | 9          | 14       | 14         | 16       | 16         | 14       | 16         |
| I-370 Interchange                                   | Basic   | 8        | 10         | 11       | 14         | 14       | 19         | 13       | 18         |
|   | Merge   | 8        | 9          | 10       | 13         | 12       | 17         | 11       | 16         |
|   | Basic   | N/A      | 9          | N/A      | 16         | N/A      | 20         | N/A      | 19         |
|   | Diverge |          | 7          |          | 10         |          | 14         |          | 13         |
| Between I-370 & Shady Grove Road                    | Weave   | N/A      | 7          | N/A      | 11         | N/A      | 14         | N/A      | 14         |
| Shady Grove Road Interchange                        | Basic   | N/A      | 8          | N/A      | 12         | N/A      | 16         | N/A      | 16         |
|   | Merge   |          | 8          |          | 12         |          | 16         |          | 16         |
|   | Basic   |          | 8          |          | 7          |          | 11         |          | 11         |
| Between Shady Grove Road & MD 28                    | Weave   | 8        | N/A        | 11       | N/A        | 14       | N/A        | 14       | N/A        |
|   | Diverge | N/A      | 7          | N/A      | 11         | N/A      | 15         | N/A      | 15         |
|   | Basic   |          | 8          |          | 11         |          | 16         |          | 15         |
|   | Basic   |          | 9          |          | 14         |          | 19         |          | 18         |
|   | Merge   |          | 7          |          | 10         |          | 13         |          | 12         |
| MD 28 Interchange                                   | Basic   | 9        | 9          | 13       | 13         | 16       | 18         | 16       | 17         |
|   | Weave   | 9        | 9          | 13       | 14         | 16       | 21         | 16       | 19         |
|   | Basic   | N/A      | 11         | N/A      | 16         | N/A      | 22         | N/A      | 21         |
| Between MD 28 & MD 189                              | Basic   | 10       | 9          | 13       | 14         | 16       | 20         | 16       | 19         |
| MD 189 Interchange                                  | Basic   | N/A      | 10         | N/A      | 14         | N/A      | 20         | N/A      | 19         |
| Between MD 189 & Montrose Road                      | Diverge | 14       | 9          | 18       | 14         | 23       | 19         | 23       | 18         |
|   | Basic   | 11       | 11         | 15       | 16         | 18       | 23         | 19       | 22         |
|   | Merge   | N/A      | 10         | N/A      | 16         | N/A      | 25         | N/A      | 22         |
| Montrose Road Interchange                           | Diverge | 14       | N/A        | 16       | N/A        | 21       | N/A        | 20       | N/A        |
|   | Basic   | N/A      | 9          | N/A      | 13         | N/A      | 19         | N/A      | 18         |
|   | Weave   |          | 8          |          | 11         |          | 16         |          | 15         |
|   | Basic   | 10       | 10         | 13       | 13         | 16       | 18         | 16       | 17         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |



**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between Montrose Road & Spur Split                 | Weave   | 11       | 10         | 14       | 13         | 19       | 18         | 18       | 17         |
|  | Weave   | 12       | N/A        | 15       | N/A        | 20       | N/A        | 19       | N/A        |
| Between Spur Split & MD 187                        | Basic   | 13       | 9          | 18       | 13         | 27       | 20         | 25       | 18         |
|  | Merge   | 9        | 7          | 12       | 10         | 18       | 15         | 17       | 14         |
|  | Weave   | 6        | N/A        | 9        | N/A        | 12       | N/A        | 11       | N/A        |
| MD 187 Interchange                                 | Basic   | 9        | 13         | 12       | 16         | 16       | 24         | 15       | 22         |
|  | Diverge | 8        | 11         | 11       | 14         | 14       | 21         | 13       | 18         |
|  | Basic   | 11       | 15         | 15       | 20         | 20       | 31         | 18       | 27         |
| Between MD 187 & I-495                             | Diverge | 10       | 12         | 14       | 17         | 17       | 23         | 15       | 20         |
|  | Basic   | 13       | 18         | 18       | 26         | 23       | 36         | 21       | 31         |
|  | Diverge | N/A      | 13         | N/A      | 18         | N/A      | 28         | N/A      | 23         |
|  | Basic   |          | 13         |          | 19         |          | 27         |          | 22         |
|  | Merge   | 13       | 13         | 19       | 18         | 29       | 24         | 23       | 21         |
|  | Basic   | 12       | 12         | 15       | 15         | 22       | 20         | 18       | 18         |
|  | Basic   | 19       | 19         | 24       | 24         | 36       | 33         | 29       | 30         |
| I-270 West Spur Northbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Between Spur Split & Democracy Boulevard           | Basic   | 12       | 11         | 14       | 14         | 17       | 17         | 17       | 16         |
|  | Merge   | 9        | 10         | 12       | 12         | 15       | 15         | 15       | 14         |
|  | Basic   | 11       | 9          | 14       | 11         | 17       | 15         | 16       | 15         |
|  | Merge   | 13       | 6          | 15       | 7          | 17       | 9          | 17       | 9          |
| Democracy Boulevard Interchange                    | Basic   | 15       | 9          | 17       | 10         | 20       | 14         | 20       | 13         |
|  | Merge   | 13       | 9          | 15       | 11         | 16       | 14         | 15       | 13         |
|  | Basic   | 14       | 13         | 16       | 15         | 20       | 20         | 19       | 18         |
| Between Democracy Boulevard & I-495                | Diverge | 16       | 12         | 19       | 15         | 22       | 20         | 22       | 19         |
|  | Basic   | 19       | 11         | 23       | 15         | 35       | 20         | 35       | 18         |
|  | Diverge | N/A      | 12         | N/A      | 16         | N/A      | 21         | N/A      | 19         |
|  | Basic   |          | 13         |          | 17         |          | 23         |          | 20         |
| I-270 Northbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| Between MD 124 & MD 117                            | Diverge | 11       | N/A        | 19       | N/A        | 25       | N/A        | 23       | N/A        |
| Between MD 117 & I-370                             | Weave   | 11       |            | 20       |            | 36       |            | 28       |            |
|  | Basic   | 10       |            | 14       |            | 24       |            | 24       |            |
|  | Weave   | 12       |            | 18       |            | 25       |            | 23       |            |
| I-370 Interchange                                  | Basic   | 8        |            | 10       |            | 17       |            | 18       |            |
|  | Merge   | 6        |            | 7        |            | 11       |            | 12       |            |
|  | Basic   | 7        |            | 6        |            | 11       |            | 12       |            |
| Between I-370 & Shady Grove Road                   | Diverge | 9        |            | 12       |            | 18       |            | 19       |            |
|  | Basic   | 9        |            | 11       |            | 18       |            | 18       |            |
|  | Diverge | 8        |            | 11       |            | 18       |            | 18       |            |
|  | Merge   | 7        |            | 10       |            | 15       |            | 15       |            |
| Shady Grove Road Interchange                       | Basic   | 8        |            | 9        |            | 14       |            | 15       |            |
|  | Weave   | 6        |            | 7        |            | 10       |            | 11       |            |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 10       | N/A        | 12       | N/A        | 18       | N/A        | 18       | N/A        |
|  | Basic   | 14       |            | 18       |            | 27       |            | 27       |            |
|  | Diverge | 12       |            | 14       |            | 23       |            | 22       |            |
|  | Weave   | 9        |            | 10       |            | 17       |            | 16       |            |
|  | Merge   | 7        |            | 8        |            | 15       |            | 14       |            |
| MD 28 Interchange                                | Basic   | 10       |            | 10       |            | 18       |            | 18       |            |
|  | Weave   | 12       |            | 15       |            | 25       |            | 23       |            |
|  | Basic   | 17       |            | 19       |            | 33       |            | 30       |            |
| Between MD 28 & MD 189                           | Diverge | 12       |            | 15       |            | 34       |            | 27       |            |
|  | Basic   | 12       |            | 15       |            | 25       |            | 23       |            |
|  | Weave   | 11       |            | 16       |            | 24       |            | 23       |            |
|  | Basic   | 12       |            | 18       |            | 27       |            | 24       |            |
|  | Merge   | 12       |            | 18       |            | 27       |            | 24       |            |
| MD 189 Interchange                               | Basic   | 16       |            | 20       |            | 32       |            | 29       |            |
| Between MD 189 & Montrose Road                   | Diverge | 13       |            | 18       |            | 27       |            | 25       |            |
|  | Basic   | 19       |            | 27       |            | 41       |            | 37       |            |
|  | Merge   | 13       |            | 18       |            | 28       |            | 25       |            |
|  | Basic   | 15       |            | 24       |            | 35       |            | 33       |            |
|  | Merge   | 10       |            | 17       |            | 27       |            | 24       |            |
| Montrose Road Interchange                        | Basic   | 11       |            | 15       |            | 21       |            | 21       |            |
|  | Weave   | 8        |            | 11       |            | 16       |            | 16       |            |
|  | Basic   | 12       |            | 14       |            | 19       |            | 19       |            |
| Between Montrose Road & Spur Split               | Diverge | 14       |            | 19       |            | 28       |            | 24       |            |
|  | Basic   | 19       |            | 25       |            | 33       |            | 31       |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 9          | N/A      | 8          | N/A      | 11         | N/A      | 11         |
|  | Diverge |          | 8          |          | 7          |          | 10         |          | 9          |
|  | Basic   |          | 8          |          | 7          |          | 10         |          | 9          |
|  | Merge   |          | 5          |          | 5          |          | 7          |          | 6          |
| Gude Drive Interchange                           | Basic   |          | 6          |          | 6          |          | 9          |          | 8          |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 8          |          | 8          |          | 11         |          | 10         |
|  | Basic   |          | 11         |          | 11         |          | 14         |          | 13         |
|  | Merge   |          | 7          |          | 7          |          | 10         |          | 9          |
| Wootton Parkway Interchange                      | Basic   |          | 8          |          | 9          |          | 12         |          | 11         |
| Between Wootton Parkway & Spur Split             | Diverge |          | 7          |          | 8          |          | 11         |          | 10         |
|  | Basic   |          | 10         |          | 11         |          | 15         |          | 14         |
|  | Weave   |          | 7          |          | 8          |          | 10         |          | 9          |
| Spur Split through MD 187 Interchange            | Basic   |          | 3          |          | 4          |          | 6          |          | 5          |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 9          | N/A      | 10         | N/A      | 12         | N/A      | 11         |
|  | Merge   |          | 6          |          | 6          |          | 8          |          | 8          |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 8          |          | 9          |          | 11         |          | 9          |
|  | Weave   |          | 7          |          | 8          |          | 9          |          | 8          |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 9          | N/A      | 10         | N/A      | 11         | N/A      | 11         |
|  | Diverge |          | 7          |          | 8          |          | 8          |          | 9          |
|  | Basic   |          | 10         |          | 13         |          | 13         |          | 13         |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |
| MD 117 Interchange                                       | Basic   | 98       | 87         | 105      | 92         | 106      | 93         | 98       | 67         |
| Between MD 117 & I-370                                   | Merge   | 62       | 77         | 59       | 82         | 60       | 85         | 60       | 70         |
|  | Basic   | 56       | 40         | 40       | 39         | 40       | 38         | 42       | 37         |
|  | Basic   | 53       | N/A        | 42       | N/A        | 43       | N/A        | 44       | N/A        |
|  | Diverge | 33       | 31         | 30       | 30         | 31       | 30         | 31       | 30         |
| I-370 Interchange  | Basic   | 43       | 40         | 34       | 36         | 31       | 33         | 35       | 34         |
|  | Diverge | 33       | 30         | 28       | 29         | 25       | 27         | 28       | 27         |
|  | Basic   | 29       | 35         | 23       | 30         | 21       | 27         | 21       | 28         |
|  | Basic   |          | 28         |          | 24         |          | 22         |          | 23         |
| Between I-370 & Shady Grove Road                         | Weave   | N/A      | 25         | N/A      | 23         | N/A      | 21         | N/A      | 21         |
|  | Diverge |          | 29         |          | 31         |          | 30         |          | 29         |
| Shady Grove Road Interchange                             | Merge   | 31       | N/A        | 26       | N/A        | 23       | N/A        | 21       | N/A        |
|  | Basic   | 39       | 32         | 33       | 27         | 29       | 24         | 27       | 23         |
|  | Diverge | 41       | 27         | 35       | 23         | 30       | 21         | 29       | 20         |
| Between Shady Grove Road & MD 28                         | Basic   | 30       | 35         | 25       | 29         | 23       | 26         | 22       | 25         |
|  | Merge   | 24       | 26         | 20       | 25         | 19       | 23         | 18       | 23         |
|  | Basic   | 33       | 35         | 28       | 30         | 26       | 27         | 25       | 27         |
| MD 28 Interchange  | Diverge | N/A      | 26         | N/A      | 23         | N/A      | 22         | N/A      | 22         |
|  | Basic   |          | 33         |          | 29         |          | 25         |          | 24         |
|  | Merge   | 28       | 24         | 26       | 22         | 25       | 21         | 22       | 20         |
|  | Basic   | 36       | 28         | 32       | 25         | 30       | 22         | 28       | 21         |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 16         | N/A      | 18         | N/A      | 17         | N/A      | 16         |
|  | Basic   |          | 32         |          | 29         |          | 26         |          | 25         |
|  | Diverge | 41       | 30         | 36       | 30         | 33       | 29         | 30       | 27         |
| MD 189 Interchange                                       | Basic   | 31       | 36         | 27       | 31         | 25       | 27         | 25       | 27         |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 34         | N/A      | 32         | N/A      | 30         | N/A      | 27         |
|  | Basic   |          | 41         |          | 38         |          | 33         |          | 32         |
| Montrose Road Interchange                                | Merge   | 28       | N/A        | 29       | N/A        | 27       | N/A        | 28       | N/A        |
|  | Diverge | N/A      | 28         | N/A      | 28         | N/A      | 27         | N/A      | 27         |
|  | Basic   |          | 36         |          | 34         |          | 31         |          | 29         |
|  | Weave   |          | 34         |          | 35         |          | 31         |          | 29         |
|  | Basic   |          | 36         |          | 36         |          | 32         |          | 29         |
| Between Montrose Road & Spur Split                       | Basic   | 28       | N/A        | 27       | N/A        | 26       | N/A        | 26       | N/A        |
|  | Weave   | 29       |            | 34       |            | 30       |            | 27       |            |
|  | Diverge | 18       |            | 20       |            | 20       |            | 19       |            |
|  | Weave   | 26       |            | 31       |            | 28       |            | 44       |            |
| Spur Split through MD 187 Interchange                    | Basic   | 18       | 21         | 23       | 26         | 22       | 26         | 20       | 23         |
|  | Diverge | 16       | 15         | 21       | 19         | 20       | 19         | 18       | 17         |
|  | Basic   | 16       | 23         | 20       | 28         | 19       | 26         | 18       | 24         |
|  | Merge   | 15       | 15         | 20       | 20         | 19       | 19         | 18       | 17         |
|  | Basic   | 17       | 23         | 21       | 29         | 20       | 29         | 19       | 25         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 16       | 16         | 22       | 22         | 22       | 22         | 21       | 20         |
|  | Basic   | 17       | 24         | 24       | 32         | 23       | 32         | 21       | 29         |
|  | Weave   | N/A      | 18         | N/A      | 24         | N/A      | 23         | N/A      | 21         |
|  | Diverge | 17       | N/A        | 23       | N/A        | 22       | N/A        | 20       | N/A        |
|  | Basic   | 16       | 18         | 25       | 30         | 23       | 32         | 23       | 27         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 27       | 27         | 24       | 24         | 22       | 21         | 20       | 19         |
|  | Weave   | 24       | N/A        | 22       | N/A        | 26       | N/A        | 21       | N/A        |
|  | Diverge | N/A      | 27         | N/A      | 27         | N/A      | 24         | N/A      | 20         |
| Merge  | 23      |          | 19         |          | 16         |          | 14         |          |            |
| Democracy Boulevard                                | Basic   | 28       | 34         | 25       | 31         | 33       | 26         | 24       | 22         |
|  | Diverge | N/A      | 34         | N/A      | 29         | N/A      | 23         | N/A      | 19         |
|  | Basic   |          | 31         |          | 27         |          | 21         |          | 18         |
| Democracy Boulevard to I-495                       | Merge   | 17       | 22         | 17       | 23         | 36       | 19         | 20       | 16         |
|  | Merge   | 31       | N/A        | 29       | N/A        | 45       | N/A        | 29       | N/A        |
|  | Basic   | 41       | 32         | 42       | 30         | 54       | 25         | 36       | 21         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 21       | N/A        | 24       | N/A        | 24       | N/A        | 30       | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 27       |            | 32       |            | 31       |            | 30       |            |
|  | Diverge | 26       |            | 25       |            | 25       |            | 29       |            |
| Shady Grove Road Interchange                       | Basic   | 30       |            | 21       |            | 18       |            | 24       |            |
|  | Merge   | 24       |            | 18       |            | 17       |            | 20       |            |
|  | Basic   | 36       |            | 27       |            | 25       |            | 30       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 26       |            | 21       |            | 20       |            | 24       |            |
|  | Basic   | 39       |            | 32       |            | 30       |            | 36       |            |
|  | Merge   | 33       |            | 31       |            | 29       |            | 32       |            |
|  | Diverge | 33       |            | 31       |            | 29       |            | 32       |            |
|  | Diverge | 42       |            | 39       |            | 35       |            | 41       |            |
|  | Basic   | 38       |            | 31       |            | 26       |            | 33       |            |
|  | Diverge | 25       |            | 21       |            | 18       |            | 22       |            |
| MD 28 Interchange                                  | Basic   | 33       |            | 26       |            | 20       |            | 25       |            |
|  | Merge   | 23       |            | 19       |            | 16       |            | 20       |            |
|  | Basic   | 35       |            | 29       |            | 24       |            | 29       |            |
| Between MD 28 & MD 189                             | Merge   | 31       |            | 29       |            | 25       |            | 28       |            |
|  | Basic   | 31       |            | 29       |            | 25       |            | 28       |            |
|  | Merge   | 34       |            | 31       |            | 26       |            | 27       |            |
|  | Basic   | 39       |            | 36       |            | 32       |            | 33       |            |
|  | Diverge | 37       |            | 36       |            | 32       |            | 32       |            |
| MD 189 Interchange                                 | Basic   | 53       |            | 48       |            | 41       |            | 44       |            |
| Between MD 189 & Montrose Road                     | Merge   | 41       |            | 43       |            | 39       |            | 39       |            |
|  | Diverge | 42       |            | 43       |            | 40       |            | 40       |            |
|  | Basic   | 46       |            | 42       |            | 38       |            | 35       |            |
|  | Diverge | 31       |            | 28       |            | 25       |            | 24       |            |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-9: 2027 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Montrose Road Interchange                        | Basic   | 43       | N/A        | 40       | N/A        | 36       | N/A        | 32       | N/A        |
|  | Weave   | 37       |            | 37       |            | 35       |            | 31       |            |
|  | Basic   | 39       |            | 43       |            | 36       |            | 28       |            |
|  | Merge   | 27       |            | 36       |            | 34       |            | 25       |            |
|  | Basic   | 41       |            | 53       |            | 49       |            | 38       |            |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                | Basic   | N/A      | 16         | N/A      | 20         | N/A      | 20         | N/A      | 20         |
| Between I-370 & Gude Drive                       | Merge   |          | 17         |          | 17         |          | 18         |          | 18         |
|  | Basic   |          | 17         |          | 16         |          | 18         |          | 18         |
|  | Diverge |          | 11         |          | 11         |          | 12         |          | 12         |
| Gude Drive Interchange                           | Basic   |          | 15         |          | 14         |          | 15         |          | 16         |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 13         |          | 13         |          | 13         |          | 14         |
|  | Basic   |          | 18         |          | 18         |          | 19         |          | 19         |
|  | Diverge |          | 13         |          | 13         |          | 13         |          | 13         |
| Wootton Parkway Interchange                      | Basic   |          | 16         |          | 15         |          | 16         |          | 17         |
| Between Wootton Parkway and Spur Split           | Merge   |          | 13         |          | 13         |          | 13         |          | 13         |
|  | Basic   |          | 19         |          | 19         |          | 19         |          | 19         |
|  | Diverge |          | 13         |          | 13         |          | 13         |          | 13         |
| Spur Split through MD 187 Interchange            | Basic   |          | 7          |          | 8          |          | 7          |          | 7          |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 16         | N/A      | 15         | N/A      | 15         | N/A      | 16         |
|  | Diverge |          | 10         |          | 10         |          | 10         |          | 10         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 12         |          | 12         |          | 12         |          | 12         |
|  | Diverge |          | 8          |          | 9          |          | 8          |          | 8          |
|  | Basic   |          | 12         |          | 11         |          | 11         |          | 11         |
| Westlake Terrace/Fernwood Road to I-<br>495      | Merge   |          | 8          |          | 8          |          | 8          |          | 8          |
|  | Basic   |          | 12         |          | 12         |          | 12         |          | 12         |
|  | Merge   |          | 12         |          | 12         |          | 12         |          | 12         |
|  | Basic   |          | 18         |          | 18         |          | 18         |          | 18         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

Under both 2027 No Build and Preferred Alternative PM peak period conditions, existing bottlenecks at locations outside of the study area become exacerbated, such as along I-270 Northbound from I-370 to MD 124; from MD 109 to MD 121; I-495 Inner Loop from MD 185 to MD 97; and from I-95 to MD 201. The resultant congestion impacts traffic operations within the project limits, as shown in **Table 6-10**. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

Like the AM, the existing bottlenecks at locations within the study area become exacerbated under 2027 PM No Build conditions, specifically along the I-495 Inner Loop from the VA 193 interchange to I-270 West Spur. These bottlenecks are mitigated under 2027 Preferred Alternative conditions, resulting in increased vehicle throughput on both I-495 Inner Loop and I-270 Northbound with consequential operational degradations at the higher throughput downstream areas. Even with these operational degradations, the Preferred Alternative serves approximately 67% more vehicles during the entire PM peak period, with 80% less unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

The Preferred Alternative significantly improves density along the I-495 Outer Loop General Purpose lanes between I-270 East Spur and the MD 185 interchange during the latter PM hours as well as between I-270 West Spur and the Clara Barton interchange during the entire PM peak period. The Preferred Alternative also provides benefit along I-270 Southbound between the I-270 Spur split and I-495 during the 5-7 PM hours.

Operations at truncation points are similar or improved with the Preferred Alternative compared to No Build conditions. Slip ramps are located along I-270 West Spur Northbound and Southbound, serving vehicles traveling from the HOT Lanes to the General Purpose Lanes and from the General Purpose Lanes to the HOT lanes, in both directions of I-270 West Spur. In 2027, all General Purpose Lane segments along I-270 West Spur operate at LOS 'D' or better during all PM peak hours, except during the 6-7 PM hour when one segments operates at LOS 'F' due to spillback from the downstream bottleneck, though with significantly improved operations compared to the No Build condition. All HOT Lane segments along I-270 West Spur operate at LOS 'C' or better during all PM peak hours.



**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 17       | 14         | 28       | 15         | 93       | 15         | 157      | 64         |
|   | Diverge | 18       | 15         | 53       | 16         | 104      | 18         | 156      | 81         |
| VA 193 Interchange  | Basic   | 23       | 17         | 101      | 17         | 133      | 35         | 167      | 114        |
|   | Merge   | 31       | 15         | 139      | 16         | 179      | 54         | 204      | 165        |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 45       | 18         | 122      | 19         | 159      | 59         | 180      | 138        |
|   | Diverge | 60       | 20         | 126      | 21         | 168      | 69         | 192      | 145        |
| George Washington Memorial Parkway Interchange                    | Basic   | 70       | 23         | 97       | 23         | 125      | 77         | 146      | 115        |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 70       | 24         | 95       | 25         | 123      | 100        | 139      | 134        |
|   | Diverge | 62       | N/A        | 79       | N/A        | 111      | N/A        | 123      | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 83       | 26         | 105      | 25         | 137      | 125        | 147      | 158        |
| Between Clara Barton Parkway & MD 190                             | Merge   | 98       | 21         | 119      | 21         | 154      | 125        | 164      | 154        |
|   | Basic   | 93       | 27         | 99       | 27         | 138      | 159        | 140      | 156        |
|   | Diverge | 69       | 19         | 72       | 26         | 102      | 131        | 100      | 118        |
| MD 190 Interchange  | Basic   | 110      | 26         | 114      | 41         | 154      | 184        | 152      | 158        |
|   | Merge   | 125      | 26         | 126      | 51         | 167      | 200        | 159      | 173        |
|   | Basic   | 117      | 24         | 118      | 55         | 160      | 186        | 153      | 158        |
| Between MD 190 & I-270 West Spur                                  | Merge   | 125      | 24         | 126      | 59         | 164      | 176        | 151      | 157        |
|   | Basic   | 52       | 28         | 51       | 71         | 119      | 158        | 109      | 129        |
|   | Weave   | 29       | 29         | 29       | 82         | 103      | 147        | 83       | 117        |
| Between I-270 West Spur & MD 187                                  | Basic   | 27       | 29         | 46       | 115        | 183      | 178        | 128      | 147        |
|   | Merge   | N/A      | 21         | N/A      | 90         | 127      | N/A        | 100      |            |
|   | Basic   |          | 34         |          | 138        | 164      |            | 133      |            |
|   | Diverge | 24       | 29         | 52       | 103        | 132      | 117        | 97       | 94         |
| MD 187 Interchange  | Basic   | 24       | 48         | 85       | 159        | 194      | 175        | 133      | 148        |
| Between MD 187 & I-270 East Spur                                  | Merge   | 17       | 41         | 70       | 112        | 156      | 128        | 101      | 105        |
|   | Basic   | 26       | N/A        | 96       | N/A        | 172      | N/A        | 125      | N/A        |
|   | Diverge | 29       | 62         | 91       | 126        | 155      | 137        | 101      | 115        |
| I-270 East Spur Interchange                                       | Basic   | 38       | 66         | 107      | 121        | 162      | 133        | 102      | 111        |
|   | Weave   | 31       | 65         | 107      | 116        | 148      | 126        | 93       | 113        |
|   | Weave   | 26       | 55         | 85       | 87         | 109      | 95         | 71       | 88         |
|   | Basic   | 35       | N/A        | 98       | N/A        | 127      | N/A        | 81       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 31       | 64         | 91       | 93         | 123      | 104        | 72       | 98         |
|   | Basic   | 54       | 77         | 114      | 99         | 128      | 108        | 90       | 106        |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 12       | 19         | 12       | 19         | 14       | 19         | 67       | 15         |
| George Washington Memorial Parkway Interchange                    | Diverge | 8        | 12         | 8        | 13         | 24       | 12         | 153      | 10         |
|   | Merge   | 11       | N/A        | 12       | N/A        | 54       | N/A        | 158      | N/A        |
|   | Basic   | 34       | 18         | 35       | 18         | 85       | 18         | 134      | 15         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 15         | N/A      | 15         | N/A      | 14         | N/A      | 12         |
|   | Basic   |          | 22         |          | 22         |          | 21         |          | 18         |
|   | Diverge |          | 15         |          | 15         |          | 14         |          | 12         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 19         | N/A      | 19         | N/A      | 17         | N/A      | 14         |
|   | Merge   |          | 18         |          | 19         |          | 18         |          | 16         |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 12         |          | 13         |          | 12         |          | 10         |
|   | Basic   |          | 19         |          | 20         |          | 20         |          | 17         |
|   | Diverge |          | 19         |          | 20         |          | 19         |          | 17         |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 10         |          | 9          |          | 17         |          | 9          |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 27       | 28         | 26       | 29         | 23       | 26         | 19       | 23         |
|   | Merge   | 19       | 18         | 17       | 19         | 14       | 17         | 9        | 13         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 24       | 25         | 23       | 25         | 20       | 23         | 16       | 21         |
|   | Basic   | 26       | 28         | 25       | 29         | 24       | 27         | 21       | 26         |
|   | Diverge | 22       | 24         | 21       | 24         | 24       | 24         | 68       | 23         |
|   | Basic   | 29       | 33         | 29       | 33         | 28       | 32         | 37       | 30         |
|   | Diverge | 35       | 36         | 33       | 37         | 32       | 36         | 36       | 34         |
|   | Basic   | 36       | N/A        | 35       | N/A        | 35       | N/A        | 36       | N/A        |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 37       |            | 42       |            | 41       |            | 34       |            |
|   | Basic   | N/A      | 31         | N/A      | 31         | N/A      | 30         | N/A      | 28         |
|   | Merge   |          | 23         |          | 26         |          | 24         |          | 22         |
| Clara Barton Parkway Interchange                                    | Basic   | 42       | 34         | 60       | 33         | 62       | 32         | 36       | 30         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 36       | 26         | 49       | 26         | 48       | 24         | 24       | 23         |
|   | Basic   | 58       | 33         | 74       | 32         | 73       | 31         | 34       | 29         |
|   | Merge   | 48       | 24         | 64       | 24         | 64       | 22         | 24       | 22         |
| MD 190 Interchange  | Basic   | 41       | 30         | 62       | 29         | 78       | 28         | 25       | 26         |
|   | Diverge | 27       | 22         | 38       | 22         | 54       | 21         | 18       | 19         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 21       | 16         | 25       | 16         | 31       | 16         | 13       | 14         |
|   | Basic   | 32       | 27         | 35       | 26         | 43       | 26         | 21       | 23         |
|   | Weave   | 27       | 22         | 26       | 22         | 28       | 21         | 17       | 19         |
| Between I-270 West Spur & MD 187                                    | Basic   | 30       | 29         | 29       | 26         | 25       | 26         | 14       | 22         |
|   | Diverge | N/A      | 22         | N/A      | 20         | N/A      | 19         | N/A      | 17         |
|   | Basic   |          | 31         |          | 28         |          | 27         |          | 24         |
|   | Merge   | 19       | 20         | 19       | 19         | 15       | 19         | 10       | 16         |
| MD 187 Interchange  | Basic   | 25       | 27         | 23       | 24         | 18       | 23         | 9        | 19         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 18       | 19         | 17       | 18         | 13       | 17         | 6        | 13         |
|   | Basic   | 28       | 29         | 26       | 27         | 20       | 26         | 10       | 21         |
|   | Merge   | 25       | 26         | 23       | 23         | 18       | 22         | 10       | 19         |
| I-270 East Spur Interchange   | Basic   | 24       | 25         | 23       | 24         | 20       | 23         | 10       | 19         |
|   | Diverge | 33       | 35         | 33       | 33         | 94       | 33         | 157      | 57         |
| Between I-270 East Spur & MD 185                                    | Diverge | 30       | 32         | 30       | 32         | 75       | 32         | 115      | 57         |
|   | Basic   | 52       | 52         | 49       | 45         | 81       | 42         | 139      | 66         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic   | 12       | 12         | 11       | 12         | 10       | 10         | 8        | 9          |
| George Washington Memorial Parkway Interchange      | Merge   | 8        | 9          | 8        | 9          | 7        | 7          | 5        | 6          |
|   | Basic   | 10       | 8          | 10       | 8          | 9        | 7          | 8        | 7          |
|   | Diverge | N/A      | 11         | N/A      | 11         | N/A      | 9          | N/A      | 9          |
|   | Basic   | 22       | 16         | 21       | 16         | 20       | 14         | 16       | 14         |
|   | Merge   | N/A      | 11         | N/A      | 11         | N/A      | 9          | N/A      | 9          |
|   | Basic   |          | 13         |          | 13         |          | 11         |          | 11         |
|   | Diverge |          | 10         |          | 10         |          | 9          |          | 8          |
|   | Basic   |          | 10         |          | 10         |          | 9          |          | 8          |
| Diverge   | 9       |          | 9          |          | 8          |          | 8          |          |            |
| Basic   | 12      |          | 12         |          | 11         |          | 10         |          |            |
| Between MD 190 & I-270 West Spur                    | Basic   | 12       | 12         | 12       | 11         | 10       |            |          |            |
|   | Merge   | 12       | 12         | 11       | 10         |          |            |          |            |
| Between I-270 West Spur & MD 187                    | Basic   | 7        | 7          | 5        | 6          |          |            |          |            |
| I-270 Northbound General Purpose Lanes              |         |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic   | 79       | 77         | 123      | 88         | 114      | 102        | 80       | 87         |
| Between MD 117 & I-370                              | Diverge | 55       | 65         | 116      | 96         | 122      | 119        | 93       | 100        |
|   | Basic   | 51       | 60         | 110      | 97         | 105      | 114        | 79       | 100        |
|   | Merge   | 51       | 53         | 144      | 90         | 152      | 109        | 107      | 95         |
| I-370 Interchange                                   | Basic   | 40       | 56         | 114      | 106        | 120      | 124        | 96       | 108        |
|   | Merge   | 21       | 47         | 92       | 112        | 116      | 128        | 95       | 112        |
|   | Basic   | N/A      | 41         | N/A      | 114        | N/A      | 138        | N/A      | 116        |
| Diverge   | 31      |          | 79         |          | 104        |          | 92         |          |            |
| Between I-370 & Shady Grove Road                    | Weave   |          | 29         |          | 78         |          | 109        |          | 97         |
| Shady Grove Road Interchange                        | Basic   | 32       | 81         | 142      | 126        |          |            |          |            |
|   | Merge   | 25       | 79         | 87       | 89         |          |            |          |            |
|   | Basic   | 32       | 28         | 102      | 67         | 138      | 133        | 110      | 122        |
| Between Shady Grove Road & MD 28                    | Weave   | 32       | N/A        | 79       | N/A        | 130      | N/A        | 102      | N/A        |
|   | Diverge | N/A      | 19         | N/A      | 46         | N/A      | 86         | N/A      | 87         |
|   | Basic   |          | 27         |          | 51         |          | 131        |          | 132        |
|   | Basic   |          | 33         |          | 45         |          | 118        |          | 132        |
|   | Merge   |          | 22         |          | 34         |          | 132        |          | 168        |
| MD 28 Interchange                                   | Basic   | 35       | 30         | 62       | 39         | 111      | 121        | 89       | 152        |
|   | Weave   | 31       | 30         | 55       | 37         | 129      | 104        | 103      | 125        |
|   | Basic   | N/A      | 38         | N/A      | 43         | N/A      | 103        | N/A      | 114        |
| Between MD 28 & MD 189                              | Basic   | 33       | N/A        | 52       | N/A        | 115      | N/A        | 101      | N/A        |
|   | Weave   | N/A      | 35         | N/A      | 46         | N/A      | 89         | N/A      | 134        |
| MD 189 Interchange                                  | Basic   | N/A      | 32         | N/A      | 36         | N/A      | 86         | N/A      | 159        |
| Between MD 189 & Montrose Road                      | Diverge | 40       | 28         | 63       | 28         | 146      | 69         | 122      | 140        |
|   | Basic   | 36       | 35         | 45       | 37         | 134      | 65         | 116      | 148        |
|   | Merge   | N/A      | 36         | N/A      | 52         | N/A      | 69         | N/A      | 194        |
| Montrose Road Interchange                           | Diverge | 32       | N/A        | 41       | N/A        | 161      | N/A        | 153      | N/A        |
|   | Basic   | N/A      | 30         | N/A      | 31         | N/A      | 47         | N/A      | 156        |
|   | Weave   |          | 26         |          | 27         |          | 39         |          | 156        |
|   | Basic   | 31       | 29         | 35       | 30         | 128      | 39         | 122      | 153        |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type   | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |     |
|--|--|----------|------------|----------|------------|----------|------------|----------|------------|-----|
|  |  | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |     |
| I-270 Northbound General Purpose Lanes (Continued) |  |          |            |          |            |          |            |          |            |     |
| Between Montrose Road & Spur Split                 | Weave  | 31       | 28         | 32       | 28         | 107      | 30         | 104      | 128        |     |
|  | Weave  | 33       | N/A        | 35       | N/A        | 95       | N/A        | 89       | N/A        |     |
| Between Spur Split & MD 187                        | Basic  | 42       | 26         | 54       | 29         | 116      | 28         | 115      | 130        |     |
|  | Merge  | 27       | 19         | 63       | 22         | 128      | 22         | 131      | 107        |     |
|  | Weave  | 19       | N/A        | 55       | N/A        | 113      | N/A        | 126      | N/A        |     |
| MD 187 Interchange                                 | Basic  | 22       | 29         | 62       | 29         | 111      | 29         | 113      | 110        |     |
|  | Diverge  | 17       | 20         | 53       | 20         | 113      | 20         | 117      | 72         |     |
|  | Basic  | 24       | 32         | 49       | 32         | 107      | 32         | 111      | 102        |     |
| Between MD 187 & I-495                             | Diverge  | 19       | 23         | 41       | 23         | 103      | 23         | 109      | 67         |     |
|  | Basic  | 26       | 35         | 34       | 35         | 99       | 34         | 111      | 93         |     |
|  | Diverge  | N/A      | 27         | N/A      | 27         | N/A      | 26         | N/A      | 82         |     |
|  | Basic  |          | 27         |          | 27         |          | 26         |          | 83         |     |
|  | Merge  |          | 21         |          | 26         |          | 24         |          | 25         | 142 |
|  | Basic  | 18       | 19         | 19       | 18         | 93       | 18         | 123      | 77         |     |
|  | Basic  | 29       | 29         | 29       | 29         | 120      | 29         | 170      | 81         |     |
|  | I-270 West Spur Northbound General Purpose Lanes |          |            |          |            |          |            |          |            |     |
|  | Between Spur Split & Democracy Boulevard         | Basic    | 29         | 26       | 30         | 26       | 73         | 22       | 67         | 52  |
| Merge  |  | 22       | 20         | 24       | 20         | 39       | 17         | 34       | 32         |     |
| Basic  |  | 26       | 21         | 26       | 19         | 46       | 15         | 54       | 31         |     |
| Merge  |  | 28       | 14         | 29       | 13         | 48       | 11         | 56       | 21         |     |
| Democracy Boulevard Interchange                    | Basic  | 31       | 17         | 31       | 14         | 34       | 10         | 41       | 24         |     |
|  | Merge  | 24       | 17         | 24       | 14         | 33       | 10         | 53       | 23         |     |
|  | Basic  | 28       | 23         | 29       | 19         | 24       | 12         | 39       | 27         |     |
| Between Democracy Boulevard & I-495                | Diverge  | 24       | 18         | 24       | 15         | 21       | 10         | 34       | 19         |     |
|  | Basic  | 32       | N/A        | 32       | N/A        | 24       | N/A        | 36       | N/A        |     |
|  | Diverge  | N/A      | 19         | N/A      | 15         | N/A      | 11         | N/A      | 19         |     |
|  | Basic  |          | 20         |          | 16         |          | 12         |          | 20         |     |
| I-270 Northbound Local Lanes                       |  |          |            |          |            |          |            |          |            |     |
| Between MD 124 & MD 117                            | Diverge  | 25       | N/A        | 18       | N/A        | 54       | N/A        | 38       | N/A        |     |
| Between MD 117 & I-370                             | Weave  | 31       |            | 23       |            | 36       |            | 49       |            |     |
|  | Basic  | 22       |            | 20       |            | 23       |            | 31       |            |     |
|  | Weave  | 39       |            | 122      |            | 134      |            | 110      |            |     |
| I-370 Interchange                                  | Basic  | 36       |            | 140      |            | 164      |            | 139      |            |     |
|  | Merge  | 23       |            | 144      |            | 182      |            | 162      |            |     |
|  | Basic  | 22       |            | 133      |            | 181      |            | 162      |            |     |
| Between I-370 & Shady Grove Road                   | Diverge  | 29       |            | 105      |            | 143      |            | 121      |            |     |
|  | Basic  | 28       |            | 103      |            | 146      |            | 114      |            |     |
|  | Diverge  | 28       |            | 97       |            | 143      |            | 120      |            |     |
|  | Merge  | 21       |            | 102      |            | 166      |            | 150      |            |     |
| Shady Grove Road Interchange                       | Basic  | 23       |            | 100      |            | 174      |            | 150      |            |     |
|  | Weave  | 18       |            | 87       |            | 164      |            | 142      |            |     |
|  |  | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |     |

**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 16       | N/A        | 31       | N/A        | 34       | N/A        | 74       | N/A        |
|  | Basic   | 24       |            | 27       |            | 20       |            | 94       |            |
|  | Diverge | 23       |            | 24       |            | 15       |            | 47       |            |
|  | Weave   | 18       |            | 15       |            | 10       |            | 24       |            |
|  | Merge   | 18       |            | 16       |            | 10       |            | 21       |            |
| MD 28 Interchange                                | Basic   | 21       |            | 18       |            | 9        |            | 17       |            |
|  | Weave   | 28       |            | 36       |            | 22       |            | 31       |            |
|  | Basic   | 33       |            | 34       |            | 20       |            | 30       |            |
| Between MD 28 & MD 189                           | Diverge | 28       |            | 33       |            | 23       |            | 48       |            |
|  | Basic   | 25       |            | 28       |            | 22       |            | 46       |            |
|  | Weave   | 25       |            | 37       |            | 130      |            | 103      |            |
|  | Basic   | 28       |            | 35       |            | 135      |            | 99       |            |
|  | Merge   | 29       |            | 34       |            | 135      |            | 94       |            |
| MD 189 Interchange                               | Basic   | 32       |            | 36       |            | 146      |            | 102      |            |
| Between MD 189 & Montrose Road                   | Diverge | 27       |            | 28       |            | 92       |            | 67       |            |
|  | Basic   | 39       |            | 40       |            | 125      |            | 96       |            |
|  | Merge   | 27       |            | 28       |            | 90       |            | 79       |            |
|  | Basic   | 37       |            | 34       |            | 118      |            | 95       |            |
|  | Merge   | 26       |            | 24       |            | 112      |            | 82       |            |
| Montrose Road Interchange                        | Basic   | 22       |            | 18       |            | 62       |            | 46       |            |
|  | Weave   | 18       | 15         | 28       | 17         |          |            |          |            |
|  | Basic   | 21       | 18         | 20       | 12         |          |            |          |            |
| Between Montrose Road & Spur Split               | Diverge | 21       | 19         | 13       | 12         |          |            |          |            |
|  | Basic   | 30       | 27         | 18       | 18         |          |            |          |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 33         | N/A      | 115        | N/A      | 127        | N/A      | 112        |
|  | Diverge |          | 23         |          | 63         |          | 79         |          | 83         |
|  | Basic   |          | 23         |          | 64         |          | 116        |          | 119        |
|  | Merge   |          | 15         |          | 41         |          | 99         |          | 107        |
| Gude Drive Interchange                           | Basic   |          | 21         | 34       | 118        | 156      |            |          |            |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 18         | 18       | 63         | 103      |            |          |            |
|  | Basic   |          | 26         | 26       | 50         | 117      |            |          |            |
|  | Merge   |          | 17         | 17       | 21         | 69       |            |          |            |
| Wootton Parkway Interchange                      | Basic   |          | 24         | 23       | 25         | 71       |            |          |            |
| Between Wootton Parkway & Spur Split             | Diverge |          | 18         | 18       | 18         | 37       |            |          |            |
|  | Basic   |          | 28         | 27       | 26         | 39       |            |          |            |
|  | Weave   |          | 18         | 18       | 17         | 17       |            |          |            |
| Spur Split through MD 187 Interchange            | Basic   | 7        | 7          | 8        | 6          |          |            |          |            |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 24         | N/A      | 24         | N/A      | 22         | N/A      | 21         |
|  | Merge   |          | 16         |          | 16         |          | 15         |          | 14         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 18         | 18       | 16         | 15       |            |          |            |
|  | Weave   |          | 17         | 17       | 16         | 16       |            |          |            |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 23         | N/A      | 25         | N/A      | 24         | N/A      | 20         |
|  | Diverge |          | 16         |          | 17         |          | 17         |          | 14         |
|  | Basic   |          | 25         |          | 26         |          | 25         |          | 21         |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |
| MD 117 Interchange                                       | Basic   | 20       | 20         | 20       | 22         | 22       | 23         | 22       | 22         |
| Between MD 117 & I-370                                   | Merge   | 25       | 23         | 27       | 26         | 29       | 27         | 26       | 23         |
|  | Basic   | 20       | 17         | 22       | 19         | 23       | 20         | 22       | 18         |
|  | Diverge | 19       | 18         | 19       | 20         | 21       | 21         | 20       | 18         |
| I-370 Interchange  | Basic   | 18       | 18         | 18       | 19         | 19       | 19         | 20       | 19         |
|  | Diverge | 15       | 13         | 15       | 15         | 15       | 15         | 16       | 15         |
|  | Basic   | 14       | 15         | 15       | 16         | 14       | 17         | 16       | 16         |
|  | Basic   | N/A      | 12         | N/A      | 13         | N/A      | 13         | N/A      | 13         |
| Between I-370 & Shady Grove Road                         | Weave   |          | 13         |          | 14         |          | 13         |          | 13         |
| Diverge  | 18      |          | 19         |          | 19         |          | 18         |          |            |
| Shady Grove Road Interchange                             | Merge   | 16       | N/A        | 17       | N/A        | 16       | N/A        | 18       | N/A        |
|  | Basic   | 19       | 16         | 19       | 17         | 19       | 17         | 21       | 17         |
|  | Diverge | 21       | 17         | 22       | 18         | 20       | 18         | 23       | 17         |
| Between Shady Grove Road & MD 28                         | Basic   | 17       | 18         | 16       | 19         | 16       | 20         | 19       | 20         |
|  | Merge   | 15       | 19         | 14       | 21         | 15       | 23         | 16       | 19         |
|  | Basic   | 20       | 21         | 19       | 22         | 19       | 23         | 21       | 22         |
| MD 28 Interchange  | Diverge | N/A      | 17         | N/A      | 18         | N/A      | 19         | N/A      | 17         |
|  | Basic   |          | 18         |          | 19         |          | 21         |          | 19         |
|  | Merge   | 16       | 15         | 15       | 15         | 16       | 16         | 16       | 15         |
|  | Basic   | 20       | 16         | 19       | 17         | 20       | 18         | 22       | 17         |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 13         | N/A      | 14         | N/A      | 15         | N/A      | 14         |
|  | Basic   |          | 19         |          | 21         |          | 22         |          | 21         |
|  | Diverge | 22       | 22         | 21       | 23         | 21       | 25         | 23       | 23         |
| MD 189 Interchange                                       | Basic   | 17       | 20         | 17       | 22         | 16       | 22         | 19       | 22         |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 20         | N/A      | 21         | N/A      | 21         | N/A      | 20         |
|  | Basic   |          | 23         |          | 24         |          | 25         |          | 24         |
| Montrose Road Interchange                                | Merge   | 15       | N/A        | 15       | N/A        | 15       | N/A        | 16       | N/A        |
|  | Diverge | N/A      | 23         | N/A      | 24         | N/A      | 25         | N/A      | 24         |
|  | Basic   |          | 21         |          | 23         |          | 23         |          | 22         |
|  | Weave   |          | 21         |          | 22         |          | 22         |          | 20         |
|  | Basic   |          | 21         |          | 23         |          | 22         |          | 21         |
| Between Montrose Road & Spur Split                       | Basic   | 17       | N/A        | 17       | N/A        | 17       | N/A        | 19       | N/A        |
|  | Weave   | 18       |            | 18       |            | 17       |            | 19       |            |
|  | Diverge | 12       |            | 11       |            | 10       |            | 13       |            |
|  | Weave   | 16       | 19         | 17       | 20         | 16       | 20         | 17       | 18         |
| Spur Split through MD 187 Interchange                    | Basic   | 15       | 21         | 15       | 21         | 13       | 21         | 16       | 20         |
|  | Diverge | 15       | 13         | 15       | 13         | 14       | 14         | 16       | 12         |
|  | Basic   | 16       | 24         | 16       | 24         | 28       | 30         | 25       | 23         |
|  | Merge   | 15       | 19         | 16       | 20         | 56       | 25         | 39       | 17         |
|  | Basic   | 18       | 28         | 19       | 29         | 59       | 36         | 50       | 25         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |



**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 15       | 21         | 15       | 21         | 75       | 27         | 56       | 18         |
|  | Basic   | 19       | 29         | 24       | 30         | 83       | 39         | 50       | 26         |
|  | Merge   | N/A      | 21         | N/A      | 22         | N/A      | 37         | N/A      | 19         |
|  | Diverge | 19       | 21         | 36       | 26         | 94       | 36         | 56       | 19         |
|  | Basic   | 24       | 27         | 63       | 46         | 109      | 51         | 68       | 30         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 15       | 11         | 16       | 13         | 15       | 13         | 15       | 11         |
|  | Weave   | 13       | N/A        | 14       | N/A        | 13       | N/A        | 13       | N/A        |
|  | Diverge | N/A      | 12         | N/A      | 14         | N/A      | 14         | N/A      | 12         |
| Democracy Boulevard                                | Merge   | N/A      | 12         | N/A      | 13         | N/A      | 13         | N/A      | 13         |
|  | Basic   | 13       | 16         | 14       | 17         | 12       | 17         | 14       | 16         |
|  | Diverge | N/A      | 12         | N/A      | 13         | N/A      | 13         | N/A      | 13         |
|  | Basic   | N/A      | 12         | N/A      | 13         | N/A      | 13         | N/A      | 13         |
| Democracy Boulevard to I-495                       | Merge   | 11       | 12         | 12       | 13         | 11       | 13         | 11       | 11         |
|  | Merge   | 19       | N/A        | 19       | N/A        | 17       | N/A        | 18       | N/A        |
|  | Basic   | 22       | 16         | 23       | 17         | 20       | 17         | 21       | 16         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 8        | N/A        | 6        | N/A        | 10       | N/A        | 9        | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 13       |            | 12       |            | 12       |            | 14       |            |
|  | Diverge | 12       |            | 10       |            | 10       |            | 10       |            |
| Shady Grove Road Interchange                       | Basic   | 12       |            | 9        |            | 10       |            | 10       |            |
|  | Merge   | 12       |            | 10       |            | 10       |            | 11       |            |
|  | Basic   | 18       |            | 15       |            | 15       |            | 17       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 15       |            | 14       |            | 14       |            | 15       |            |
|  | Basic   | 23       |            | 21       |            | 21       |            | 22       |            |
|  | Merge   | 17       |            | 18       |            | 17       |            | 17       |            |
|  | Diverge | 17       |            | 18       |            | 17       |            | 17       |            |
|  | Diverge | 20       |            | 21       |            | 19       |            | 20       |            |
|  | Basic   | 19       |            | 20       |            | 19       |            | 19       |            |
|  | Diverge | 13       |            | 14       |            | 13       |            | 13       |            |
| MD 28 Interchange                                  | Basic   | 14       |            | 15       |            | 14       |            | 14       |            |
|  | Merge   | 12       |            | 12       |            | 11       |            | 12       |            |
|  | Basic   | 16       |            | 17       |            | 16       |            | 16       |            |
| Between MD 28 & MD 189                             | Merge   | 18       |            | 19       |            | 19       |            | 18       |            |
|  | Basic   | 18       |            | 19       |            | 18       |            | 18       |            |
|  | Merge   | 19       |            | 18       |            | 20       |            | 18       |            |
|  | Basic   | 23       |            | 23       |            | 24       |            | 23       |            |
|  | Diverge | 23       |            | 23       |            | 24       |            | 23       |            |
| MD 189 Interchange                                 | Basic   | 26       |            | 26       |            | 28       |            | 26       |            |
| Between MD 189 & Montrose Road                     | Merge   | 21       |            | 21       |            | 22       |            | 21       |            |
|  | Diverge | 21       |            | 21       |            | 22       |            | 23       |            |
|  | Basic   | 20       |            | 20       |            | 20       |            | 24       |            |
|  | Diverge | 14       |            | 13       |            | 14       |            | 17       |            |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-10: 2027 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Montrose Road Interchange                        | Basic   | 17       | N/A        | 16       | N/A        | 17       | N/A        | 21       | N/A        |
|  | Weave   | 19       |            | 20       |            | 18       |            | 26       |            |
|  | Basic   | 16       |            | 17       |            | 13       |            | 17       |            |
|  | Merge   | 13       |            | 14       |            | 12       |            | 14       |            |
|  | Basic   | 20       |            | 21       |            | 18       |            | 20       |            |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                | Basic   | N/A      | 10         | N/A      | 12         | N/A      | 11         | N/A      | 11         |
| Between I-370 & Gude Drive                       | Merge   |          | 12         |          | 13         |          | 13         |          | 13         |
|  | Basic   |          | 12         |          | 13         |          | 13         |          | 13         |
|  | Diverge |          | 8          |          | 8          |          | 8          |          | 8          |
| Gude Drive Interchange                           | Basic   |          | 10         |          | 10         |          | 11         |          | 11         |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 10         |          | 11         |          | 11         |          | 11         |
|  | Basic   |          | 16         |          | 16         |          | 16         |          | 16         |
|  | Diverge |          | 10         |          | 11         |          | 11         |          | 11         |
| Wootton Parkway Interchange                      | Basic   |          | 12         |          | 14         |          | 14         |          | 13         |
| Between Wootton Parkway and Spur Split           | Merge   |          | 12         |          | 13         |          | 13         |          | 12         |
|  | Basic   |          | 18         |          | 19         |          | 19         |          | 18         |
|  | Diverge |          | 12         |          | 13         |          | 13         |          | 12         |
| Spur Split through MD 187 Interchange            | Basic   |          | 6          |          | 6          |          | 6          |          | 6          |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 15         | N/A      | 16         | N/A      | 16         | N/A      | 15         |
|  | Diverge |          | 10         |          | 11         |          | 11         |          | 10         |
| Westlake Terrace/Fernwood Road Interchange       | Basic   |          | 13         |          | 13         |          | 14         |          | 12         |
|  | Diverge |          | 9          |          | 10         |          | 10         |          | 9          |
|  | Basic   |          | 8          |          | 8          |          | 7          |          | 6          |
| Westlake Terrace/Fernwood Road to I-495          | Merge   |          | 6          |          | 7          |          | 6          |          | 5          |
|  | Basic   |          | 9          |          | 11         |          | 9          |          | 8          |
|  | Merge   |          | 10         |          | 10         |          | 9          |          | 8          |
|  | Basic   |          | 14         |          | 16         |          | 14         |          | 12         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

#### 6.4.2.4 Freeway Speed Analysis

**Table 6-11 and Table 6-12** compare freeway speed by segment between No Build and Preferred Alternative conditions during the AM and PM peak periods, respectively. **Figure 6-12 to Figure 6-19** summarize and compare freeway speed along I-495 and I-270 during the AM and PM peak periods between 2017 Existing, No Build, and Preferred Alternative conditions.

Along the I-495 Inner Loop during the AM peak period, speeds improve approaching the American Legion Bridge and the I-270 West Spur but decrease east of the I-270 West Spur as throughput increases from the Preferred Alternative mitigation of the existing bottleneck near the American Legion Bridge. The Preferred Alternative serves all vehicles at the I-495 Inner Loop input in this area south of VA 193, unlike the No Build conditions.

Along the I-495 Outer Loop, speeds significantly improve at all congested segments, particularly between the MD 185 and MD 190 interchanges, as shown in **Table 6-11**. During all AM peak period hours, speeds in the HOT lanes are at or near free-flow conditions.

Along I-270 Northbound and Southbound, speeds are generally at or near free-flow during the AM peak period under both No Build and Preferred Alternative conditions. However, small pockets of congestion shown in the No Build conditions are mitigated with the Preferred Alternative, particularly around the Watkins Mill Road and MD 117 interchanges.

**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 58       | 58         | 57       | 58         | 17       | 58         | 13       | 58         |
|   | Diverge | 57       | 57         | 48       | 53         | 12       | 57         | 12       | 58         |
| VA 193 Interchange  | Basic   | 57       | 56         | 35       | 56         | 12       | 57         | 13       | 58         |
|   | Merge   | 52       | 53         | 23       | 49         | 10       | 46         | 11       | 49         |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 56       | 57         | 24       | 55         | 12       | 54         | 13       | 55         |
|   | Diverge | 57       | 57         | 24       | 57         | 15       | 56         | 15       | 57         |
| George Washington Memorial Parkway Interchange                    | Basic   | 57       | 57         | 19       | 56         | 16       | 56         | 16       | 56         |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 49       | 56         | 19       | 54         | 17       | 54         | 17       | 55         |
|   | Diverge | 40       | N/A        | 34       | N/A        | 34       | N/A        | 35       | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 52       | 57         | 49       | 55         | 49       | 55         | 49       | 56         |
| Between Clara Barton Parkway & MD 190                             | Merge   | 56       | 57         | 55       | 56         | 55       | 56         | 51       | 57         |
|   | Basic   | 57       | 57         | 56       | 56         | 56       | 56         | 45       | 56         |
|   | Diverge | 56       | 57         | 55       | 56         | 55       | 56         | 39       | 56         |
| MD 190 Interchange  | Basic   | 57       | 57         | 56       | 56         | 56       | 56         | 29       | 57         |
|   | Merge   | 58       | 58         | 58       | 58         | 57       | 58         | 17       | 58         |
|   | Basic   | 58       | N/A        | 58       | N/A        | 52       | N/A        | 14       | N/A        |
| Between MD 190 & I-270 West Spur                                  | Merge   | 58       | 58         | 58       | 57         | 45       | 57         | 15       | 57         |
|   | Basic   | 57       | 58         | 56       | 57         | 33       | 57         | 19       | 58         |
|   | Weave   | 58       | 57         | 58       | 56         | 37       | 49         | 29       | 56         |
| Between I-270 West Spur & MD 187                                  | Basic   | 56       | 52         | 56       | 51         | 56       | 36         | 57       | 48         |
|   | Merge   | N/A      | 58         | N/A      | 49         | N/A      | 28         | N/A      | 35         |
|   | 57      |          | 41         |          | 15         |          | 22         |          |            |
|   | Diverge | 45       | 54         | 42       | 37         | 45       | 16         | 50       | 20         |
| MD 187 Interchange  | Basic   | 56       | 57         | 56       | 29         | 57       | 9          | 57       | 12         |
| Between MD 187 & I-270 East Spur                                  | Merge   | 55       | 55         | 54       | 23         | 55       | 9          | 56       | 11         |
|   | Basic   | 57       | N/A        | 56       | N/A        | 57       | N/A        | 57       | N/A        |
|   | Diverge | 55       | 54         | 54       | 28         | 55       | 16         | 56       | 18         |
| I-270 East Spur Interchange                                       | Basic   | 51       | 50         | 48       | 29         | 49       | 19         | 52       | 22         |
|   | Weave   | 59       | 59         | 53       | 28         | 52       | 18         | 59       | 20         |
|   | Weave   | 59       | 59         | 49       | 30         | 47       | 23         | 59       | 25         |
|   | Basic   | 60       | N/A        | 44       | N/A        | 44       | N/A        | 59       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 60       | 60         | 41       | 27         | 42       | 21         | 60       | 22         |
|   | Basic   | 59       | 58         | 48       | 47         | 52       | 46         | 58       | 46         |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 64       | 64         | 64       | 64         | 64       | 64         | 64       | 64         |
| George Washington Memorial Parkway Interchange                    | Diverge | 63       | 63         | 64       | 63         | 64       | 63         | 64       | 63         |
|   | Merge   | 64       | N/A        | 63       | N/A        | 63       | N/A        | 63       | N/A        |
|   | Basic   | 59       | 64         | 57       | 64         | 58       | 64         | 58       | 64         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          |            |
|   | Diverge |          | 63         |          | 63         |          | 63         |          |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |
|   | Merge   |          | 64         |          | 64         |          | 64         |          |            |
|   | Basic   |          | 65         |          | 64         |          | 64         |          |            |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 64         | 63       | 63         | 62       |            |          |            |
|   | Basic   |          | 64         | 64       | 64         |          |            |          |            |
|   | Diverge |          | 63         | 63       | 63         |          |            |          |            |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 58         | 58       | 53         | 56       |            |          |            |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 53       | 54         | 53       | 53         | 53       | 53         | 53       | 53         |
|   | Merge   | 54       | 54         | 54       | 54         | 53       | 53         | 53       | 54         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 53       | 54         | 53       | 53         | 53       | 53         | 53       | 54         |
|   | Basic   | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|   | Diverge | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|   | Basic   | 53       | 53         | 53       | 52         | 53       | 52         | 53       | 52         |
|   | Diverge | 52       | 52         | 52       | 51         | 51       | 51         | 51       | 51         |
|   | Basic   | 52       | N/A        | 51       | N/A        | 50       | N/A        | 50       | N/A        |
| Weave   | 53      | 52       |            | 52       |            | 52       |            | 52       |            |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Basic   | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
|   | Merge   |          | 50         |          | 49         |          | 48         |          | 49         |
| Clara Barton Parkway Interchange                                    | Basic   | 53       | 52         | 53       | 52         | 53       | 52         | 53       | 53         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|   | Basic   | 49       | 53         | 50       | 52         | 51       | 53         | 50       | 53         |
|   | Merge   | 46       | 54         | 47       | 53         | 48       | 53         | 46       | 53         |
| MD 190 Interchange  | Basic   | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|   | Diverge | 52       | 53         | 52       | 52         | 51       | 53         | 52       | 53         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 53       | 53         | 39       | 53         | 30       | 53         | 38       | 53         |
|   | Basic   | 43       | 50         | 37       | 49         | 30       | 51         | 38       | 52         |
|   | Weave   | 38       | 42         | 26       | 41         | 20       | 47         | 34       | 53         |
| Between I-270 West Spur & MD 187                                    | Basic   | 50       | 52         | 21       | 52         | 10       | 52         | 20       | 52         |
|   | Diverge | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
|   | Basic   |          | 53         |          | 53         |          | 53         |          |            |
|   | Merge   |          | 53         |          | 52         |          | 34         |          | 52         |
| MD 187 Interchange  | Basic   | 53       | 53         | 45       | 53         | 20       | 53         | 18       | 53         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 53       | 53         | 48       | 53         | 26       | 53         | 24       | 53         |
|   | Basic   | 53       | 53         | 52       | 53         | 26       | 53         | 23       | 53         |
|   | Merge   | 49       | 49         | 49       | 49         | 26       | 49         | 25       | 49         |
| I-270 East Spur Interchange   | Basic   | 53       | 53         | 53       | 53         | 27       | 53         | 28       | 53         |
|   | Diverge | 53       | 53         | 53       | 53         | 32       | 53         | 34       | 53         |
| Between I-270 East Spur & MD 185                                    | Diverge | 53       | 53         | 53       | 53         | 36       | 52         | 37       | 53         |
|   | Basic   | 53       | 53         | 51       | 51         | 31       | 44         | 34       | 49         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic   | 65       | 64         | 65       | 64         | 65       | 63         | 65       | 63         |
| George Washington Memorial Parkway Interchange      | Merge   | 59       | 58         | 58       | 58         | 58       | 57         | 59       | 58         |
|   | Basic   | 65       | 64         | 65       | 64         | 66       | 64         | 65       | 64         |
|   | Diverge | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |
|   | Basic   | 58       | 63         | 58       | 63         | 58       | 63         | 58       | 63         |
|   | Merge   | N/A      | 62         | N/A      | 62         | N/A      | 62         | N/A      | 62         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          |            |
|   | Diverge |          | 63         |          | 63         |          | 63         |          |            |
|   | Basic   |          | 63         |          | 63         |          | 63         |          |            |
| Between MD 190 & I-270 West Spur                    | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |
|   | Basic   |          | 64         |          | 64         |          | 64         |          |            |
|   | Merge   |          | 63         |          | 63         |          | 63         |          |            |
| Between I-270 West Spur & MD 187                    | Basic   |          | 58         |          | 58         |          | 58         |          | 58         |
| I-270 Northbound General Purpose Lanes              |         |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic   | 65       | 60         | 64       | 59         | 64       | 58         | 64       | 58         |
| Between MD 117 & I-370                              | Diverge | 64       | 60         | 64       | 58         | 63       | 56         | 63       | 57         |
|   | Basic   | 64       | 60         | 64       | 58         | 63       | 57         | 63       | 58         |
|   | Merge   | 63       | 59         | 62       | 57         | 61       | 56         | 62       | 57         |
| I-370 Interchange                                   | Basic   | 65       | 59         | 64       | 58         | 64       | 57         | 64       | 57         |
|   | Merge   | 52       | 59         | 51       | 58         | 51       | 57         | 51       | 58         |
|   | Basic   | N/A      | 62         | N/A      | 59         | N/A      | 58         | N/A      | 59         |
|   | Diverge |          | 60         |          | 57         |          | 55         |          | 56         |
| Between I-370 & Shady Grove Road                    | Weave   |          | 61         |          | 59         |          | 59         |          | 59         |
| Shady Grove Road Interchange                        | Basic   |          | 62         |          | 60         |          | 59         |          | 59         |
|   | Merge   |          | 61         |          | 59         |          | 58         |          | 58         |
|   | Basic   | 65       | 62         | 64       | 60         | 64       | 60         | 64       | 60         |
| Between Shady Grove Road & MD 28                    | Weave   | 64       | N/A        | 64       | N/A        | 63       | N/A        | 64       | N/A        |
|   | Diverge | N/A      | 62         | N/A      | 60         | N/A      | 59         | N/A      | 59         |
|   | Basic   |          | 61         |          | 60         |          | 59         |          | 59         |
|   | Basic   |          | 62         |          | 60         |          | 59         |          | 60         |
|   | Merge   |          | 59         |          | 58         |          | 57         |          | 57         |
| MD 28 Interchange                                   | Basic   | 64       | 62         | 64       | 60         | 64       | 59         | 64       | 60         |
|   | Weave   | 64       | 60         | 63       | 57         | 63       | 54         | 63       | 56         |
|   | Basic   | N/A      | 62         | N/A      | 60         | N/A      | 59         | N/A      | 60         |
| Between MD 28 & MD 189                              | Basic   | 64       | 62         | 64       | 60         | 63       | 59         | 63       | 60         |
| MD 189 Interchange                                  | Basic   | N/A      | 63         | N/A      | 61         | N/A      | 60         | N/A      | 61         |
| Between MD 189 & Montrose Road                      | Diverge | 64       | 62         | 64       | 60         | 63       | 59         | 62       | 60         |
|   | Basic   | 64       | 63         | 64       | 61         | 64       | 60         | 64       | 61         |
|   | Merge   | N/A      | 61         | N/A      | 59         | N/A      | 55         | N/A      | 57         |
| Montrose Road Interchange                           | Diverge | 64       | N/A        | 64       | N/A        | 62       | N/A        | 63       | N/A        |
|   | Basic   | N/A      | 64         | N/A      | 63         | N/A      | 62         | N/A      | 63         |
|   | Weave   |          | 62         |          | 61         |          | 60         |          | 60         |
|   | Basic   | 64       | 64         | 64       | 64         | 64       | 63         | 64       | 63         |

<10 mph 10-20 mph 20-30 mph 30-40 mph 40-50 mph >50 mph



**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type   | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|--|----------|------------|----------|------------|----------|------------|----------|------------|
|  |  | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound General Purpose Lanes (Continued) |  |          |            |          |            |          |            |          |            |
| Between Montrose Road & Spur Split                 | Weave  | 64       | 64         | 64       | 64         | 63       | 63         | 63       | 63         |
|  | Weave  | 64       | N/A        | 64       | N/A        | 63       | N/A        | 63       | N/A        |
| Between Spur Split & MD 187                        | Basic  | 64       | 64         | 63       | 64         | 62       | 63         | 62       | 63         |
|  | Merge  | 63       | 62         | 62       | 59         | 59       | 56         | 58       | 57         |
|  | Weave  | 50       | N/A        | 60       | N/A        | 58       | N/A        | 58       | N/A        |
| MD 187 Interchange                                 | Basic  | 64       | 64         | 64       | 64         | 63       | 63         | 63       | 63         |
|  | Diverge  | 64       | 59         | 63       | 58         | 63       | 57         | 63       | 58         |
|  | Basic  | 64       | 63         | 64       | 63         | 63       | 61         | 63       | 63         |
| Between MD 187 & I-495                             | Diverge  | 64       | 63         | 63       | 63         | 63       | 61         | 63       | 62         |
|  | Basic  | 64       | 63         | 63       | 63         | 62       | 60         | 62       | 62         |
|  | Diverge  | N/A      | 63         | N/A      | 63         | N/A      | 57         | N/A      | 61         |
|  | Basic  |          | 64         |          | 63         |          | 60         |          | 62         |
|  | Merge  | 60       | 60         | 60       | 59         | 52       | 58         | 56       | 59         |
|  | Basic  | 64       | 63         | 64       | 63         | 54       | 63         | 60       | 63         |
|  | Basic  | 59       | 59         | 59       | 59         | 50       | 58         | 55       | 58         |
|  | I-270 West Spur Northbound General Purpose Lanes |          |            |          |            |          |            |          |            |
| Between Spur Split & Democracy Boulevard           | Basic  | 65       | 64         | 64       | 64         | 64       | 63         | 64       | 64         |
|  | Merge  | 63       | 63         | 63       | 61         | 62       | 61         | 62       | 62         |
|  | Basic  | 65       | 64         | 64       | 64         | 64       | 64         | 64       | 64         |
|  | Merge  | 63       | 57         | 62       | 56         | 62       | 56         | 62       | 56         |
| Democracy Boulevard Interchange                    | Basic  | 64       | 65         | 64       | 64         | 63       | 64         | 63       | 64         |
|  | Merge  | 62       | 63         | 60       | 62         | 59       | 61         | 59       | 61         |
|  | Basic  | 64       | 64         | 64       | 63         | 62       | 62         | 63       | 63         |
| Between Democracy Boulevard & I-495                | Diverge  | 63       | 62         | 62       | 62         | 59       | 60         | 60       | 61         |
|  | Basic  | 62       | 63         | 60       | 63         | 50       | 61         | 49       | 62         |
|  | Diverge  | N/A      | 62         | N/A      | 62         | N/A      | 59         | N/A      | 60         |
|  | Basic  |          | 62         |          | 62         |          | 58         |          | 61         |
| I-270 Northbound Local Lanes                       |  |          |            |          |            |          |            |          |            |
| Between MD 124 & MD 117                            | Diverge  | 43       | N/A        | 43       | N/A        | 42       | N/A        | 42       | N/A        |
| Between MD 117 & I-370                             | Weave  | 42       |            | 41       |            | 33       |            | 37       |            |
|  | Basic  | 42       |            | 42       |            | 42       |            | 42       |            |
|  | Weave  | 43       |            | 42       |            | 42       |            | 42       |            |
| I-370 Interchange                                  | Basic  | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Merge  | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Basic  | 45       |            | 44       |            | 44       |            | 44       |            |
| Between I-370 & Shady Grove Road                   | Diverge  | 50       |            | 48       |            | 45       |            | 46       |            |
|  | Basic  | 50       |            | 49       |            | 46       |            | 47       |            |
|  | Diverge  | 51       |            | 50       |            | 47       |            | 48       |            |
|  | Merge  | 48       |            | 47       |            | 45       |            | 45       |            |
| Shady Grove Road Interchange                       | Basic  | 53       |            | 53       |            | 51       |            | 51       |            |
|  | Weave  | 51       |            | 52       |            | 51       |            | 51       |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 43       | N/A        | 43       | N/A        | 43       | N/A        | 43       | N/A        |
|  | Basic   | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Diverge | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Weave   | 42       |            | 41       |            | 40       |            | 41       |            |
|  | Merge   | 43       |            | 43       |            | 42       |            | 42       |            |
| MD 28 Interchange                                | Basic   | 43       |            | 43       |            | 43       |            | 43       |            |
|  | Weave   | 42       |            | 39       |            | 37       |            | 38       |            |
|  | Basic   | 43       |            | 42       |            | 41       |            | 42       |            |
| Between MD 28 & MD 189                           | Diverge | 42       |            | 40       |            | 30       |            | 35       |            |
|  | Basic   | 43       |            | 43       |            | 41       |            | 42       |            |
|  | Weave   | 43       |            | 42       |            | 42       |            | 42       |            |
|  | Basic   | 43       |            | 42       |            | 42       |            | 42       |            |
|  | Merge   | 43       |            | 42       |            | 42       |            | 42       |            |
| MD 189 Interchange                               | Basic   | 42       |            | 42       |            | 42       |            | 42       |            |
| Between MD 189 & Montrose Road                   | Diverge | 42       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 42       |            | 42       |            | 41       |            | 41       |            |
|  | Merge   | 43       |            | 43       |            | 41       |            | 42       |            |
|  | Basic   | 42       |            | 42       |            | 41       |            | 41       |            |
|  | Merge   | 41       |            | 40       |            | 34       |            | 36       |            |
| Montrose Road Interchange                        | Basic   | 43       |            | 42       |            | 42       |            | 42       |            |
|  | Weave   | 42       |            | 42       |            | 41       |            | 41       |            |
|  | Basic   | 43       |            | 43       |            | 42       |            | 42       |            |
| Between Montrose Road & Spur Split               | Diverge | 41       |            | 39       |            | 35       |            | 38       |            |
|  | Basic   | 45       |            | 45       |            | 44       |            | 44       |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 63         | N/A      | 64         | N/A      | 63         | N/A      | 63         |
|  | Diverge |          | 63         |          | 64         |          | 63         |          | 63         |
|  | Basic   |          | 64         |          | 64         |          | 63         |          | 63         |
|  | Merge   |          | 63         |          | 63         |          | 62         |          | 63         |
| Gude Drive Interchange                           | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 57         |          | 57         |          | 57         |          | 57         |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|  | Merge   |          | 62         |          | 62         |          | 62         |          | 62         |
| Wootton Parkway Interchange                      | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |
| Between Wootton Parkway & Spur Split             | Diverge |          | 59         |          | 58         |          | 58         |          | 57         |
|  | Basic   |          | 64         |          | 64         |          | 63         |          | 63         |
|  | Weave   |          | 64         |          | 64         |          | 64         |          | 64         |
| Spur Split through MD 187 Interchange            | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 64         | N/A      | 64         | N/A      | 64         | N/A      | 64         |
|  | Merge   |          | 64         |          | 64         |          | 64         |          | 64         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 63         |          | 63         |          | 62         |          | 63         |
|  | Weave   |          | 63         |          | 62         |          | 61         |          | 62         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 64         | N/A      | 64         | N/A      | 64         | N/A      | 64         |
|  | Diverge |          | 64         |          | 63         |          | 64         |          | 63         |
|  | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |
| MD 117 Interchange                                       | Basic   | 20       | 24         | 18       | 22         | 17       | 21         | 20       | 30         |
| Between MD 117 & I-370                                   | Merge   | 30       | 27         | 32       | 25         | 32       | 24         | 32       | 29         |
|  | Basic   | 36       | 43         | 46       | 44         | 46       | 44         | 45       | 46         |
|  | Basic   | 37       | N/A        | 44       | N/A        | 44       | N/A        | 43       | N/A        |
|  | Diverge | 49       | 47         | 52       | 49         | 52       | 50         | 52       | 49         |
| I-370 Interchange  | Basic   | 47       | 52         | 51       | 52         | 52       | 53         | 50       | 52         |
|  | Diverge | 52       | 49         | 53       | 49         | 53       | 49         | 52       | 49         |
|  | Basic   | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|  | Basic   | N/A      | 54         | N/A      | 54         | N/A      | 54         | N/A      | 54         |
| Between I-370 & Shady Grove Road                         | Weave   |          | 53         |          | 53         |          | 53         |          | 53         |
| Diverge  | 52      |          | 52         |          | 52         |          | 52         |          | 52         |
| Shady Grove Road Interchange                             | Merge   | 48       | N/A        | 52       | N/A        | 53       | N/A        | 53       | N/A        |
|  | Basic   | 47       | 53         | 50       | 53         | 52       | 53         | 52       | 53         |
|  | Diverge | 51       | 49         | 52       | 50         | 53       | 50         | 53       | 50         |
| Between Shady Grove Road & MD 28                         | Basic   | 53       | 52         | 53       | 53         | 53       | 53         | 53       | 53         |
|  | Merge   | 53       | 50         | 53       | 50         | 53       | 50         | 53       | 50         |
|  | Basic   | 52       | 52         | 53       | 53         | 53       | 53         | 53       | 53         |
| MD 28 Interchange  | Diverge | N/A      | 53         | N/A      | 54         | N/A      | 54         | N/A      | 54         |
|  | Basic   |          | 53         |          | 53         |          | 53         |          | 53         |
|  | Merge   | 52       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|  | Basic   | 51       | 53         | 51       | 53         | 52       | 53         | 52       | 53         |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 52         | N/A      | 52         | N/A      | 52         | N/A      | 52         |
|  | Basic   |          | 52         |          | 52         |          | 53         |          | 53         |
|  | Diverge | 51       | 53         | 51       | 52         | 52       | 53         | 52       | 53         |
| MD 189 Interchange                                       | Basic   | 53       | 52         | 53       | 53         | 53       | 53         | 53       | 53         |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 48         | N/A      | 51         | N/A      | 51         | N/A      | 53         |
|  | Basic   |          | 49         |          | 50         |          | 51         |          | 51         |
| Montrose Road Interchange                                | Merge   | 53       | N/A        | 53       | N/A        | 53       | N/A        | 53       | N/A        |
|  | Diverge | N/A      | 51         | N/A      | 51         | N/A      | 51         | N/A      | 51         |
|  | Basic   |          | 53         |          | 53         |          | 53         |          | 53         |
|  | Weave   |          | 51         |          | 49         |          | 49         |          | 49         |
|  | Basic   |          | 52         |          | 51         |          | 52         |          | 52         |
| Between Montrose Road & Spur Split                       | Basic   | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
|  | Weave   |          | 52         |          | 49         |          | 51         |          | 52         |
|  | Diverge |          | 53         |          | 53         |          | 53         |          | 53         |
|  | Weave   | 53       | 52         | 53       | 43         | 53       | 45         | 54       | 52         |
| Spur Split through MD 187 Interchange                    | Basic   | 58       | 61         | 57       | 60         | 57       | 60         | 58       | 61         |
|  | Diverge | 63       | 63         | 63       | 62         | 63       | 62         | 63       | 63         |
|  | Basic   | 63       | 63         | 63       | 63         | 63       | 63         | 64       | 63         |
|  | Merge   | 60       | 56         | 57       | 52         | 58       | 52         | 58       | 53         |
|  | Basic   | 63       | 63         | 62       | 61         | 62       | 61         | 63       | 62         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 62       | 61         | 59       | 57         | 59       | 57         | 59       | 57         |
|  | Basic   | 63       | 63         | 61       | 61         | 61       | 61         | 62       | 61         |
|  | Weave   | N/A      | 63         | N/A      | 62         | N/A      | 62         | N/A      | 63         |
|  | Diverge | 63       | N/A        | 63       | N/A        | 63       | N/A        | 63       | N/A        |
|  | Basic   | 63       | 64         | 63       | 53         | 63       | 48         | 63       | 56         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 53       | 53         | 53       | 53         | 52       | 54         | 52       | 54         |
|  | Weave   | 53       | N/A        | 53       | N/A        | 48       | N/A        | 50       | N/A        |
|  | Diverge | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
| Democracy Boulevard                                | Merge   |          | 54         |          | 55         |          | 55         |          | 55         |
|  | Basic   | 53       | 53         | 53       | 53         | 47       | 53         | 49       | 53         |
|  | Diverge | N/A      | 50         | N/A      | 51         | N/A      | 52         | N/A      | 52         |
|  | Basic   |          | 52         |          | 52         |          | 53         |          | 53         |
| Democracy Boulevard to I-495                       | Merge   | 52       | 53         | 52       | 53         | 43       | 53         | 46       | 54         |
|  | Merge   | 51       | N/A        | 51       | N/A        | 42       | N/A        | 46       | N/A        |
|  | Basic   | 51       | 53         | 47       | 53         | 40       | 53         | 47       | 53         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 45       | N/A        | 44       | N/A        | 43       | N/A        | 41       | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 41       |            | 36       |            | 37       |            | 39       |            |
|  | Diverge | 42       |            | 41       |            | 41       |            | 41       |            |
| Shady Grove Road Interchange                       | Basic   | 42       |            | 42       |            | 42       |            | 42       |            |
|  | Merge   | 41       |            | 41       |            | 42       |            | 41       |            |
|  | Basic   | 41       |            | 42       |            | 42       |            | 42       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 41       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 41       |            | 42       |            | 42       |            | 41       |            |
|  | Merge   | 41       |            | 42       |            | 42       |            | 41       |            |
|  | Diverge | 41       |            | 42       |            | 42       |            | 42       |            |
|  | Diverge | 41       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 41       |            | 42       |            | 42       |            | 41       |            |
|  | Diverge | 42       |            | 42       |            | 42       |            | 42       |            |
| MD 28 Interchange                                  | Basic   | 42       |            | 42       |            | 42       |            | 42       |            |
|  | Merge   | 38       |            | 38       |            | 39       |            | 39       |            |
|  | Basic   | 41       |            | 42       |            | 42       |            | 42       |            |
| Between MD 28 & MD 189                             | Merge   | 42       |            | 42       |            | 42       |            | 42       |            |
|  | Basic   | 42       |            | 42       |            | 42       |            | 42       |            |
|  | Merge   | 40       |            | 40       |            | 42       |            | 41       |            |
|  | Basic   | 40       |            | 41       |            | 41       |            | 41       |            |
|  | Diverge | 41       |            | 42       |            | 42       |            | 42       |            |
| MD 189 Interchange                                 | Basic   | 38       |            | 38       |            | 38       |            | 38       |            |
| Between MD 189 & Montrose Road                     | Merge   | 36       |            | 36       |            | 36       |            | 36       |            |
|  | Diverge | 36       |            | 36       |            | 36       |            | 36       |            |
|  | Basic   | 36       |            | 36       |            | 37       |            | 37       |            |
|  | Diverge | 37       |            | 37       |            | 37       |            | 37       |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-11: 2027 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |    |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|----|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |    |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |    |
| Montrose Road Interchange                        | Basic   | 36       | N/A        | 36       | N/A        | 37       | N/A        | 37       | N/A        |    |
|  | Weave   | 36       |            | 36       |            | 35       |            | 36       |            |    |
|  | Basic   | 37       |            | 37       |            | 38       |            | 39       |            |    |
|  | Merge   | 38       |            | 36       |            | 37       |            | 39       |            |    |
|  | Basic   | 37       |            | 37       |            | 37       |            | 39       |            |    |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |    |
| I-370 Interchange                                | Basic   | N/A      | 58         | N/A      | 57         | N/A      | 57         | N/A      | 57         |    |
| Between I-370 & Gude Drive                       | Merge   |          | 62         |          | 62         |          | 62         |          | 62         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 62         |          | 62         |          | 62         |          | 62         |    |
| Gude Drive Interchange                           | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 55         |          | 54         |          | 54         |          | 53         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 59         |          | 58         |          | 58         |          | 59         |    |
| Wootton Parkway Interchange                      | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
| Between Wootton Parkway and Spur Split           | Merge   |          | 62         |          | 62         |          | 62         |          | 63         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Spur Split through MD 187 Interchange            | Basic   |          | 64         |          | 64         |          | 64         |          | 64         | 64 |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |    |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |    |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Westlake Terrace/Fernwood Road Interchange       | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 60         |          | 59         |          | 59         |          | 59         |    |
|  | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |    |
| Westlake Terrace/Fernwood Road to I-495          | Merge   |          | 64         |          | 64         |          | 64         |          | 64         |    |
|  | Basic   |          | 63         |          | 63         |          | 64         |          | 63         |    |
|  | Merge   |          | 61         |          | 61         |          | 61         |          | 61         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

As shown in **Table 6-12**, speeds improve along the I-495 Inner Loop General Purpose lanes between the VA 193 and MD 190 interchanges during the 3-4 PM and 4-5 PM hours, with smaller speed increases during the 5-6 PM and 6-7 PM hours as throughput increases across the PM peak period. Along the I-495 Outer Loop, speeds increase at all congested segments during the PM peak period with the Preferred Alternative, particularly between the Clara Barton Parkway interchange and the I-270 West Spur.

Along I-270 Northbound during the first three hours of the PM peak period, speeds improve with the Preferred Alternative but decrease during the 6-7 PM hour; this degradation is caused by increased throughput more quickly reaching the existing bottleneck north of I-370 (outside the study area) in the first three hours of the PM peak period. By the 6-7 PM hour, the I-270 Northbound throughput is slightly decreased between Shady Grove Road and I-370 but still increased farther south between the I-270 Split and Montrose Road. Speeds in the I-270 Northbound HOT lanes are at or near free-flow conditions throughout the entire PM peak period, except for the area in which the HOT lanes tie into the General Purpose lanes (i.e., just north of the bridge over I-370). The slower speeds at this tie-in point and south through the Wootton Parkway interchange are also attributed to the existing bottleneck north of I-370; the queue first formed outside of the study area, due to the increased throughput reaching this point more quickly, spills back in both the I-270 Northbound General Purpose and HOT lanes within the study area. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

Nevertheless, the Preferred Alternative serves approximately 67% more vehicles during the entire PM peak period, with 80% less unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

With the Preferred Alternative, speeds improve in the I-270 Southbound General Purpose lanes, particularly between the I-270 Spur Split and I-495. Speeds in the HOT lanes are at or near free-flow conditions throughout the entire PM peak period.



**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 59       | 59         | 43       | 59         | 12       | 56         | 4        | 31         |
|   | Diverge | 58       | 58         | 30       | 58         | 10       | 53         | 4        | 22         |
| VA 193 Interchange  | Basic   | 52       | 59         | 19       | 59         | 8        | 32         | 4        | 10         |
|   | Merge   | 36       | 52         | 15       | 52         | 5        | 17         | 3        | 7          |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 31       | 55         | 16       | 55         | 6        | 17         | 4        | 8          |
|   | Diverge | 25       | 57         | 14       | 57         | 7        | 15         | 5        | 8          |
| George Washington Memorial Parkway Interchange                    | Basic   | 25       | 57         | 16       | 56         | 10       | 15         | 6        | 13         |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 25       | 56         | 16       | 56         | 10       | 11         | 7        | 9          |
|   | Diverge | 31       | N/A        | 23       | N/A        | 13       | N/A        | 10       | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 26       | 56         | 18       | 56         | 10       | 8          | 8        | 7          |
| Between Clara Barton Parkway & MD 190                             | Merge   | 18       | 55         | 14       | 55         | 8        | 6          | 7        | 6          |
|   | Basic   | 21       | 55         | 19       | 53         | 10       | 6          | 9        | 8          |
|   | Diverge | 22       | 55         | 21       | 45         | 14       | 13         | 14       | 15         |
| MD 190 Interchange  | Basic   | 16       | 55         | 15       | 36         | 8        | 4          | 8        | 8          |
|   | Merge   | 14       | 55         | 14       | 30         | 7        | 5          | 7        | 8          |
|   | Basic   | 14       | 55         | 14       | 25         | 7        | 4          | 8        | 7          |
| Between MD 190 & I-270 West Spur                                  | Merge   | 14       | 54         | 14       | 21         | 6        | 4          | 8        | 7          |
|   | Basic   | 39       | 54         | 40       | 20         | 11       | 7          | 14       | 11         |
|   | Weave   | 53       | 54         | 53       | 19         | 19       | 9          | 23       | 15         |
| Between I-270 West Spur & MD 187                                  | Basic   | 54       | 51         | 34       | 10         | 4        | 5          | 10       | 8          |
|   | Merge   | N/A      | 55         | N/A      | 13         | N/A      | 8          | N/A      | 13         |
|   | Basic   |          | 50         |          | 9          |          | 6          |          | 11         |
|   | Diverge | 44       | 43         | 24       | 14         | 9        | 13         | 12       | 16         |
| MD 187 Interchange  | Basic   | 54       | 36         | 15       | 6          | 3        | 5          | 9        | 8          |
| Between MD 187 & I-270 East Spur                                  | Merge   | 53       | 30         | 12       | 9          | 4        | 6          | 10       | 10         |
|   | Basic   | 53       | N/A        | 13       | N/A        | 4        | N/A        | 11       | N/A        |
|   | Diverge | 49       | 27         | 12       | 9          | 5        | 8          | 14       | 12         |
| I-270 East Spur Interchange                                       | Basic   | 50       | 32         | 14       | 13         | 6        | 11         | 19       | 16         |
|   | Weave   | 56       | 30         | 14       | 14         | 8        | 12         | 20       | 14         |
|   | Weave   | 51       | 29         | 18       | 19         | 13       | 16         | 23       | 18         |
|   | Basic   | 47       | N/A        | 15       | N/A        | 10       | N/A        | 22       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 42       | 27         | 12       | 18         | 9        | 14         | 19       | 16         |
|   | Basic   | 38       | 26         | 14       | 18         | 11       | 16         | 22       | 16         |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 64       | 64         | 64       | 64         | 60       | 64         | 37       | 64         |
| George Washington Memorial Parkway Interchange                    | Diverge | 63       | 63         | 63       | 63         | 39       | 63         | 15       | 63         |
|   | Merge   | 62       | N/A        | 62       | N/A        | 17       | N/A        | 5        | N/A        |
|   | Basic   | 43       | 63         | 41       | 63         | 15       | 63         | 9        | 63         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 62         | N/A      | 62         | N/A      | 62         | N/A      | 62         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|   | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |
|   | Merge   |          | 63         |          | 63         |          | 63         |          | 63         |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 62         |          | 61         |          | 61         |          | 61         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|   | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 59         |          | 59         |          | 49         |          | 59         |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 53       | 53         | 53       | 53         | 54       | 53         | 54       | 53         |
|   | Merge   | 53       | 53         | 53       | 53         | 54       | 53         | 54       | 53         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 54       | 54         | 54       | 54         | 54       | 54         | 55       | 54         |
|   | Basic   | 54       | 53         | 54       | 53         | 54       | 53         | 54       | 53         |
|   | Diverge | 54       | 53         | 54       | 53         | 51       | 54         | 33       | 54         |
|   | Basic   | 54       | 52         | 54       | 52         | 53       | 53         | 45       | 53         |
|   | Diverge | 53       | 51         | 53       | 51         | 53       | 51         | 50       | 52         |
|   | Basic   | 52       | N/A        | 52       | N/A        | 52       | N/A        | 48       | N/A        |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 51       |            | 44       |            | 43       |            | 47       |            |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Basic   | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
|   | Merge   |          | 49         |          | 49         |          | 50         |          | 50         |
| Clara Barton Parkway Interchange                                    | Basic   | 48       | 51         | 33       | 51         | 31       | 52         | 46       | 52         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 43       | 53         | 33       | 53         | 33       | 53         | 48       | 53         |
|   | Basic   | 36       | 53         | 25       | 53         | 25       | 53         | 47       | 53         |
|   | Merge   | 35       | 53         | 23       | 53         | 24       | 53         | 47       | 53         |
| MD 190 Interchange  | Basic   | 45       | 53         | 29       | 53         | 25       | 53         | 52       | 54         |
|   | Diverge | 54       | 53         | 42       | 54         | 31       | 53         | 55       | 54         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 54       | 53         | 48       | 53         | 36       | 53         | 56       | 54         |
|   | Basic   | 54       | 53         | 50       | 53         | 40       | 53         | 56       | 54         |
|   | Weave   | 53       | 54         | 53       | 54         | 48       | 54         | 55       | 54         |
| Between I-270 West Spur & MD 187                                    | Basic   | 51       | 52         | 52       | 52         | 49       | 52         | 53       | 52         |
|   | Diverge | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
|   | Basic   |          | 53         |          | 53         |          | 53         |          | 53         |
|   | Merge   |          | 52         |          | 52         |          | 52         |          | 53         |
| MD 187 Interchange  | Basic   | 53       | 53         | 53       | 53         | 54       | 53         | 54       | 54         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 53       | 53         | 53       | 53         | 53       | 53         | 54       | 53         |
|   | Basic   | 53       | 53         | 53       | 53         | 53       | 53         | 54       | 53         |
|   | Merge   | 49       | 49         | 49       | 49         | 49       | 49         | 49       | 49         |
| I-270 East Spur Interchange   | Basic   | 53       | 53         | 53       | 53         | 49       | 53         | 44       | 52         |
|   | Diverge | 53       | 53         | 53       | 53         | 23       | 53         | 11       | 36         |
| Between I-270 East Spur & MD 185                                    | Diverge | 52       | 52         | 52       | 52         | 27       | 52         | 13       | 39         |
|   | Basic   | 42       | 43         | 43       | 47         | 23       | 49         | 8        | 32         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic   | 64       | 63         | 64       | 63         | 64       | 63         | 65       | 64         |
| George Washington Memorial Parkway Interchange      | Merge   | 58       | 56         | 58       | 56         | 58       | 57         | 59       | 58         |
|   | Basic   | 65       | 64         | 65       | 64         | 65       | 64         | 65       | 64         |
|   | Diverge | N/A      | 64         | N/A      | 64         | N/A      | 64         | N/A      | 64         |
|   | Basic   | 60       | 63         | 59       | 63         | 59       | 63         | 60       | 63         |
|   | Merge   | N/A      | 61         | N/A      | 61         | N/A      | 62         | N/A      | 61         |
|   | Basic   |          | 64         |          | 64         |          | 64         |          |            |
|   | Diverge |          | 64         |          | 64         |          | 64         |          |            |
|   | Basic   |          | 64         |          | 64         |          | 64         |          |            |
| Between MD 190 & I-270 West Spur                    | Diverge |          | 63         |          | 64         |          | 64         |          |            |
|   | Basic   |          | 64         |          | 64         |          | 64         |          |            |
|   | Merge   |          | 64         |          | 64         |          | 64         |          |            |
| Between I-270 West Spur & MD 187                    | Basic   |          | 59         |          | 59         |          | 59         |          | 59         |
| I-270 Northbound General Purpose Lanes              |         |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic   | 22       | 25         | 12       | 23         | 16       | 20         | 26       | 23         |
| Between MD 117 & I-370                              | Diverge | 32       | 30         | 13       | 22         | 17       | 17         | 24       | 22         |
|   | Basic   | 34       | 28         | 12       | 17         | 15       | 13         | 22       | 17         |
|   | Merge   | 30       | 27         | 9        | 18         | 12       | 14         | 17       | 17         |
| I-370 Interchange                                   | Basic   | 43       | 31         | 13       | 19         | 14       | 16         | 19       | 18         |
|   | Merge   | 39       | 33         | 9        | 13         | 6        | 10         | 9        | 12         |
|   | Basic   | N/A      | 39         | N/A      | 12         | N/A      | 8          | N/A      | 11         |
|   | Diverge |          | 47         |          | 24         |          | 14         |          | 18         |
| Between I-370 & Shady Grove Road                    | Weave   | N/A      | 50         | N/A      | 28         | N/A      | 18         | N/A      | 20         |
| Shady Grove Road Interchange                        | Basic   |          | 50         |          | 22         |          | 10         |          | 13         |
|   | Merge   |          | 51         |          | 18         |          | 9          |          | 12         |
|   | Basic   | 51       | 52         | 14       | 24         | 9        | 8          | 13       | 10         |
| Between Shady Grove Road & MD 28                    | Weave   | 53       | N/A        | 21       | N/A        | 11       | N/A        | 18       | N/A        |
|   | Diverge | N/A      | 53         | N/A      | 34         | N/A      | 20         | N/A      | 20         |
|   | Basic   |          | 53         |          | 38         |          | 13         |          | 13         |
|   | Basic   |          | 52         |          | 43         |          | 10         |          | 9          |
|   | Merge   |          | 50         |          | 43         |          | 9          |          | 7          |
| MD 28 Interchange                                   | Basic   | 52       | 53         | 29       | 47         | 14       | 11         | 21       | 7          |
|   | Weave   | 53       | 51         | 30       | 44         | 9        | 12         | 16       | 9          |
|   | Basic   | N/A      | 48         | N/A      | 45         | N/A      | 14         | N/A      | 12         |
| Between MD 28 & MD 189                              | Basic   | 52       | N/A        | 35       | N/A        | 11       | N/A        | 16       | N/A        |
|   | Weave   | N/A      | 48         | N/A      | 41         | N/A      | 16         | N/A      | 11         |
| MD 189 Interchange                                  | Basic   | N/A      | 53         | N/A      | 51         | N/A      | 19         | N/A      | 10         |
| Between MD 189 & Montrose Road                      | Diverge | 48       | 53         | 35       | 53         | 12       | 25         | 18       | 13         |
|   | Basic   | 53       | 52         | 46       | 52         | 11       | 28         | 16       | 9          |
|   | Merge   | N/A      | 48         | N/A      | 42         | N/A      | 28         | N/A      | 8          |
| Montrose Road Interchange                           | Diverge | 52       | N/A        | 47       | N/A        | 8        | N/A        | 11       | N/A        |
|   | Basic   | N/A      | 53         | N/A      | 52         | N/A      | 34         | N/A      | 9          |
|   | Weave   |          | 52         |          | 52         |          | 36         |          | 8          |
|   | Basic   | 53       | 54         | 50       | 54         | 9        | 42         | 12       | 9          |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between Montrose Road & Spur Split                 | Weave   | 52       | 53         | 52       | 53         | 13       | 49         | 15       | 10         |
|  | Weave   | 51       | N/A        | 50       | N/A        | 15       | N/A        | 21       | N/A        |
| Between Spur Split & MD 187                        | Basic   | 47       | 57         | 39       | 56         | 13       | 56         | 14       | 10         |
|  | Merge   | 47       | 47         | 24       | 46         | 7        | 46         | 8        | 10         |
|  | Weave   | 49       | N/A        | 27       | N/A        | 16       | N/A        | 16       | N/A        |
| MD 187 Interchange                                 | Basic   | 58       | 58         | 30       | 57         | 23       | 57         | 23       | 15         |
|  | Diverge | 59       | 59         | 35       | 58         | 26       | 58         | 26       | 29         |
|  | Basic   | 57       | 56         | 35       | 56         | 23       | 56         | 23       | 19         |
| Between MD 187 & I-495                             | Diverge | 58       | 58         | 41       | 58         | 28       | 58         | 27       | 32         |
|  | Basic   | 58       | 57         | 49       | 57         | 24       | 57         | 23       | 24         |
|  | Diverge | N/A      | 55         | N/A      | 55         | N/A      | 57         | N/A      | 22         |
|  | Basic   |          | 57         |          | 56         |          | 57         |          | 22         |
|  | Merge   | 55       | 55         | 53       | 56         | 18       | 56         | 16       | 19         |
|  | Basic   | 59       | 60         | 58       | 60         | 18       | 60         | 14       | 21         |
|  | Basic   | 56       | 56         | 56       | 56         | 10       | 56         | 5        | 26         |
| I-270 West Spur Northbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Between Spur Split & Democracy Boulevard           | Basic   | 53       | 53         | 53       | 53         | 19       | 53         | 28       | 32         |
|  | Merge   | 51       | 55         | 50       | 54         | 27       | 54         | 33       | 42         |
|  | Basic   | 54       | 54         | 53       | 54         | 35       | 54         | 33       | 46         |
|  | Merge   | 53       | 49         | 53       | 48         | 39       | 48         | 39       | 41         |
| Democracy Boulevard Interchange                    | Basic   | 52       | 55         | 52       | 55         | 42       | 55         | 43       | 47         |
|  | Merge   | 52       | 54         | 52       | 54         | 41       | 53         | 40       | 46         |
|  | Basic   | 54       | 54         | 54       | 55         | 49       | 55         | 44       | 48         |
| Between Democracy Boulevard & I-495                | Diverge | 54       | 54         | 54       | 54         | 51       | 55         | 46       | 49         |
|  | Basic   | 52       | N/A        | 52       | N/A        | 49       | N/A        | 45       | N/A        |
|  | Diverge | N/A      | 54         | N/A      | 54         | N/A      | 54         | N/A      | 50         |
|  | Basic   |          | 54         |          | 54         |          | 53         |          | 49         |
| I-270 Northbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| Between MD 124 & MD 117                            | Diverge | 48       | N/A        | 49       | N/A        | 29       | N/A        | 39       | N/A        |
| Between MD 117 & I-370                             | Weave   | 41       |            | 42       |            | 36       |            | 30       |            |
|  | Basic   | 53       |            | 51       |            | 45       |            | 43       |            |
|  | Weave   | 41       |            | 10       |            | 8        |            | 13       |            |
| I-370 Interchange                                  | Basic   | 44       |            | 8        |            | 6        |            | 10       |            |
|  | Merge   | 45       |            | 5        |            | 4        |            | 6        |            |
|  | Basic   | 50       |            | 7        |            | 4        |            | 6        |            |
| Between I-370 & Shady Grove Road                   | Diverge | 52       |            | 15       |            | 11       |            | 14       |            |
|  | Basic   | 52       |            | 13       |            | 7        |            | 13       |            |
|  | Diverge | 52       |            | 14       |            | 7        |            | 12       |            |
|  | Merge   | 51       |            | 10       |            | 5        |            | 8        |            |
| Shady Grove Road Interchange                       | Basic   | 53       |            | 11       |            | 5        |            | 8        |            |
|  | Weave   | 52       |            | 10       |            | 4        |            | 7        |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 53       | N/A        | 38       | N/A        | 37       | N/A        | 17       | N/A        |
|  | Basic   | 53       |            | 40       |            | 39       |            | 12       |            |
|  | Diverge | 53       |            | 49       |            | 49       |            | 29       |            |
|  | Weave   | 48       |            | 48       |            | 49       |            | 40       |            |
|  | Merge   | 47       |            | 47       |            | 47       |            | 40       |            |
| MD 28 Interchange                                | Basic   | 52       |            | 52       |            | 52       |            | 45       |            |
|  | Weave   | 41       |            | 33       |            | 34       |            | 32       |            |
|  | Basic   | 50       |            | 48       |            | 48       |            | 44       |            |
| Between MD 28 & MD 189                           | Diverge | 45       |            | 38       |            | 34       |            | 23       |            |
|  | Basic   | 51       |            | 46       |            | 35       |            | 24       |            |
|  | Weave   | 51       |            | 38       |            | 7        |            | 12       |            |
|  | Basic   | 52       |            | 43       |            | 8        |            | 14       |            |
|  | Merge   | 48       |            | 42       |            | 7        |            | 15       |            |
| MD 189 Interchange                               | Basic   | 53       |            | 48       |            | 7        |            | 16       |            |
| Between MD 189 & Montrose Road                   | Diverge | 49       |            | 47       |            | 16       |            | 24       |            |
|  | Basic   | 51       |            | 50       |            | 11       |            | 20       |            |
|  | Merge   | 49       |            | 47       |            | 10       |            | 14       |            |
|  | Basic   | 49       |            | 50       |            | 11       |            | 17       |            |
|  | Merge   | 45       |            | 47       |            | 8        |            | 15       |            |
| Montrose Road Interchange                        | Basic   | 53       |            | 53       |            | 14       |            | 29       |            |
|  | Weave   | 48       |            | 48       |            | 29       |            | 37       |            |
|  | Basic   | 53       |            | 54       |            | 41       |            | 51       |            |
| Between Montrose Road & Spur Split               | Diverge | 49       |            | 50       |            | 50       |            | 51       |            |
|  | Basic   | 53       |            | 53       |            | 51       |            | 51       |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 53         | N/A      | 14         | N/A      | 11         | N/A      | 14         |
|  | Diverge |          | 61         |          | 33         |          | 23         |          | 24         |
|  | Basic   |          | 62         |          | 30         |          | 12         |          | 12         |
|  | Merge   |          | 62         |          | 36         |          | 11         |          | 10         |
| Gude Drive Interchange                           | Basic   |          | 63         |          | 45         |          | 10         |          | 7          |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 60         |          | 59         |          | 27         |          | 17         |
|  | Basic   |          | 63         |          | 63         |          | 40         |          | 15         |
|  | Merge   |          | 62         |          | 62         |          | 54         |          | 22         |
| Wootton Parkway Interchange                      | Basic   |          | 63         |          | 63         |          | 58         |          | 29         |
| Between Wootton Parkway & Spur Split             | Diverge |          | 62         |          | 62         |          | 62         |          | 46         |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 50         |
|  | Weave   |          | 63         |          | 63         |          | 63         |          | 58         |
| Spur Split through MD 187 Interchange            | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 62         | N/A      | 62         | N/A      | 62         | N/A      | 63         |
|  | Merge   |          | 60         |          | 60         |          | 60         |          | 60         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|  | Weave   |          | 63         |          | 63         |          | 63         |          | 60         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 62         | N/A      | 62         | N/A      | 62         | N/A      | 63         |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |
| MD 117 Interchange                                       | Basic   | 63       | 63         | 63       | 63         | 63       | 63         | 63       | 63         |
| Between MD 117 & I-370                                   | Merge   | 61       | 61         | 60       | 61         | 60       | 60         | 61       | 61         |
|  | Basic   | 63       | 63         | 62       | 63         | 62       | 63         | 62       | 63         |
|  | Diverge | 63       | 63         | 63       | 62         | 63       | 62         | 63       | 63         |
| I-370 Interchange  | Basic   | 63       | 63         | 63       | 63         | 63       | 63         | 63       | 63         |
|  | Diverge | 64       | 57         | 64       | 57         | 63       | 57         | 63       | 57         |
|  | Basic   | 64       | 63         | 64       | 63         | 64       | 63         | 64       | 63         |
|  | Basic   | N/A      | 65         | N/A      | 65         | N/A      | 65         | N/A      | 65         |
| Between I-370 & Shady Grove Road                         | Weave   |          | 60         |          | 60         |          | 60         |          | 60         |
| Diverge  | 60      |          | 60         |          | 60         |          | 60         |          |            |
| Shady Grove Road Interchange                             | Merge   | 60       | N/A        | 60       | N/A        | 60       | N/A        | 60       | N/A        |
|  | Basic   | 61       | 60         | 61       | 60         | 61       | 60         | 60       | 60         |
|  | Diverge | 61       | 57         | 61       | 57         | 61       | 57         | 61       | 57         |
| Between Shady Grove Road & MD 28                         | Basic   | 61       | 60         | 61       | 60         | 61       | 59         | 60       | 60         |
|  | Merge   | 61       | 56         | 61       | 56         | 61       | 56         | 60       | 56         |
|  | Basic   | 61       | 59         | 61       | 59         | 61       | 58         | 60       | 59         |
| MD 28 Interchange  | Diverge | N/A      | 59         | N/A      | 59         | N/A      | 58         | N/A      | 59         |
|  | Basic   |          | 59         |          | 59         |          | 58         |          | 59         |
|  | Merge   | 61       | 58         | 61       | 57         | 61       | 57         | 61       | 58         |
|  | Basic   | 60       | 58         | 60       | 58         | 60       | 58         | 60       | 58         |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 57         | N/A      | 56         | N/A      | 56         | N/A      | 57         |
|  | Basic   |          | 58         |          | 57         |          | 57         |          | 58         |
|  | Diverge | 60       | 58         | 60       | 57         | 60       | 57         | 60       | 57         |
| MD 189 Interchange                                       | Basic   | 60       | 58         | 60       | 58         | 60       | 57         | 59       | 58         |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 57         | N/A      | 57         | N/A      | 57         | N/A      | 57         |
|  | Basic   |          | 57         |          | 57         |          | 57         |          | 57         |
| Montrose Road Interchange                                | Merge   | 61       | N/A        | 61       | N/A        | 61       | N/A        | 60       | N/A        |
|  | Diverge | N/A      | 54         | N/A      | 54         | N/A      | 53         | N/A      | 54         |
|  | Basic   |          | 58         |          | 57         |          | 57         |          | 57         |
|  | Weave   |          | 54         |          | 54         |          | 54         |          | 55         |
|  | Basic   |          | 57         |          | 57         |          | 57         |          | 57         |
| Between Montrose Road & Spur Split                       | Basic   | 61       | N/A        | 61       | N/A        | 61       | N/A        | 60       | N/A        |
|  | Weave   | 60       |            | 60       |            | 60       |            | 59       |            |
|  | Diverge | 60       |            | 60       |            | 60       |            | 60       |            |
|  | Weave   | 61       | 57         | 60       | 57         | 61       | 57         | 60       | 57         |
| Spur Split through MD 187 Interchange                    | Basic   | 59       | 58         | 60       | 58         | 60       | 58         | 59       | 58         |
|  | Diverge | 59       | 59         | 59       | 58         | 59       | 56         | 59       | 58         |
|  | Basic   | 59       | 58         | 59       | 58         | 45       | 51         | 50       | 58         |
|  | Merge   | 55       | 51         | 54       | 50         | 36       | 46         | 35       | 53         |
|  | Basic   | 59       | 57         | 58       | 56         | 38       | 50         | 37       | 57         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph



**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 59       | 54         | 59       | 54         | 30       | 48         | 33       | 55         |
|  | Basic   | 63       | 62         | 55       | 61         | 28       | 54         | 38       | 62         |
|  | Merge   | N/A      | 63         | N/A      | 62         | N/A      | 53         | N/A      | 63         |
|  | Diverge | 63       | 63         | 40       | 56         | 24       | 54         | 36       | 62         |
|  | Basic   | 62       | 58         | 23       | 36         | 14       | 35         | 30       | 48         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 59       | 59         | 59       | 59         | 59       | 59         | 59       | 59         |
|  | Weave   | 59       | N/A        | 59       | N/A        | 59       | N/A        | 59       | N/A        |
|  | Diverge | N/A      | 59         | N/A      | 58         | N/A      | 58         | N/A      | 58         |
| Democracy Boulevard                                | Merge   |          | 58         |          | 57         |          | 57         |          |            |
|  | Basic   | 59       | 58         | 59       | 58         | 59       | 58         |          |            |
|  | Diverge | N/A      | 58         | N/A      | 57         | N/A      | 57         | 57       |            |
|  | Basic   |          | 58         |          | 58         |          | 57         | 57       |            |
| Democracy Boulevard to I-495                       | Merge   | 56       | 56         | 55       | 56         | 56       | 56         | 56       | 56         |
|  | Merge   | 57       | N/A        | 56       | N/A        | 57       | N/A        | 57       | N/A        |
|  | Basic   | 57       | 56         | 57       | 56         | 57       | 56         | 58       | 56         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 56       | N/A        | 57       | N/A        | 57       | N/A        | 57       | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 52       |            | 52       |            | 50       |            | 49       |            |
|  | Diverge | 53       |            | 53       |            | 53       |            | 52       |            |
| Shady Grove Road Interchange                       | Basic   | 54       |            | 54       |            | 54       |            | 54       |            |
|  | Merge   | 51       |            | 51       |            | 52       |            | 51       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 52       |            | 52       |            | 52       |            | 51       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 52       |            |
|  | Merge   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 51       |            | 51       |            | 51       |            | 51       |            |
| MD 28 Interchange                                  | Basic   | 54       |            | 54       |            | 54       |            | 54       |            |
|  | Merge   | 45       |            | 45       |            | 45       |            | 45       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
| Between MD 28 & MD 189                             | Merge   | 52       |            | 52       |            | 52       |            | 52       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Merge   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Basic   | 53       |            | 52       |            | 52       |            | 53       |            |
|  | Diverge | 53       |            | 52       |            | 53       |            | 52       |            |
| MD 189 Interchange                                 | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
| Between MD 189 & Montrose Road                     | Merge   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 53       |            | 53       |            | 53       |            | 50       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 48       |            |
|  | Diverge | 51       |            | 51       |            | 51       |            | 47       |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-12: 2027 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

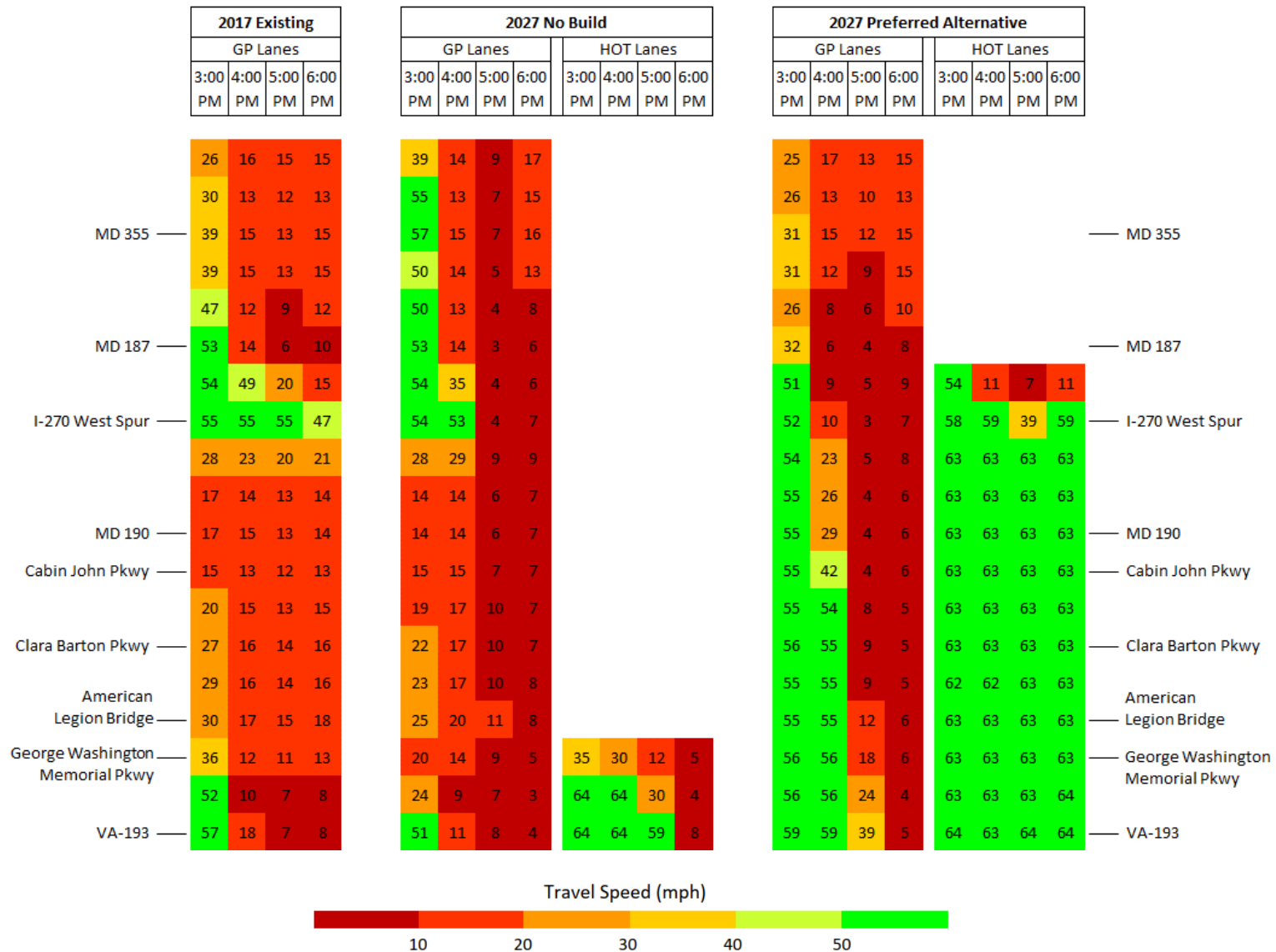
| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |    |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|----|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |    |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |    |
| Montrose Road Interchange                        | Basic   | 54       | N/A        | 54       | N/A        | 53       | N/A        | 49       | N/A        |    |
|  | Weave   | 44       |            | 44       |            | 44       |            | 41       |            |    |
|  | Basic   | 52       |            | 52       |            | 52       |            | 52       |            |    |
|  | Merge   | 53       |            | 52       |            | 53       |            | 52       |            |    |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |    |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |    |
| I-370 Interchange                                | Basic   | N/A      | 60         | N/A      | 60         | N/A      | 60         | N/A      | 60         |    |
| Between I-370 & Gude Drive                       | Merge   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 58         |          | 58         |          | 58         |          | 59         |    |
| Gude Drive Interchange                           | Basic   |          | 64         |          | 64         |          | 64         |          | 64         | 64 |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 61         |          | 61         |          | 61         |          | 61         | 61 |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
|  | Diverge |          | 62         |          | 62         |          | 63         |          | 62         |    |
| Wootton Parkway Interchange                      | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
| Between Wootton Parkway and Spur Split           | Merge   |          | 61         |          | 61         |          | 61         |          | 61         | 62 |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Spur Split through MD 187 Interchange            | Basic   |          | 64         |          | 64         |          | 64         |          | 64         | 64 |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |    |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |    |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Westlake Terrace/Fernwood Road Interchange       | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 56         |          | 57         |          | 55         |          | 55         |    |
|  | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |    |
| Westlake Terrace/Fernwood Road to I-495          | Merge   |          | 63         |          | 63         |          | 63         |          | 63         | 64 |
|  | Basic   |          | 64         |          | 64         |          | 64         |          | 64         | 64 |
|  | Merge   |          | 62         |          | 62         |          | 62         |          | 62         | 62 |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 64 |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

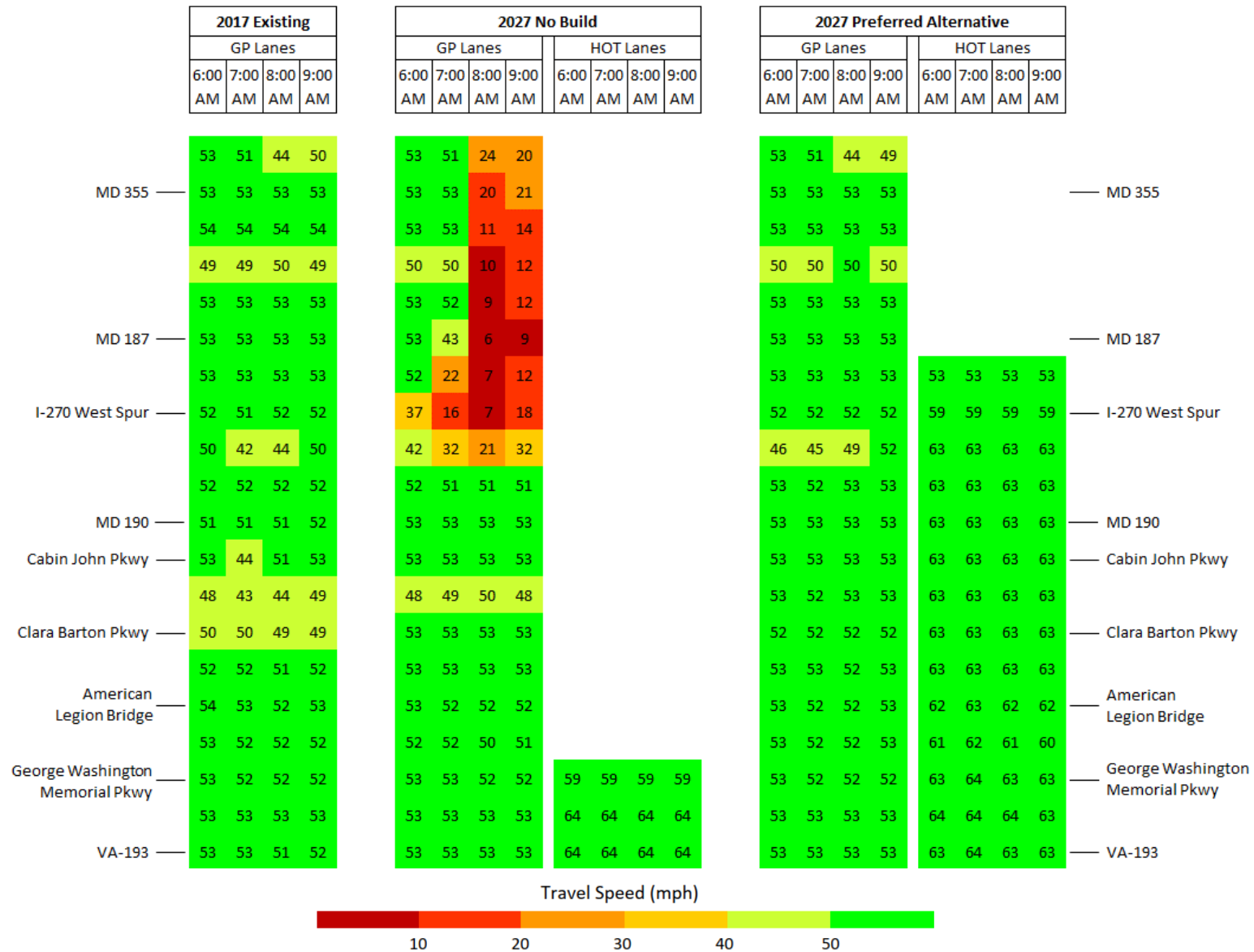
**Figure 6-12: I-495 Inner Loop 2027 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**



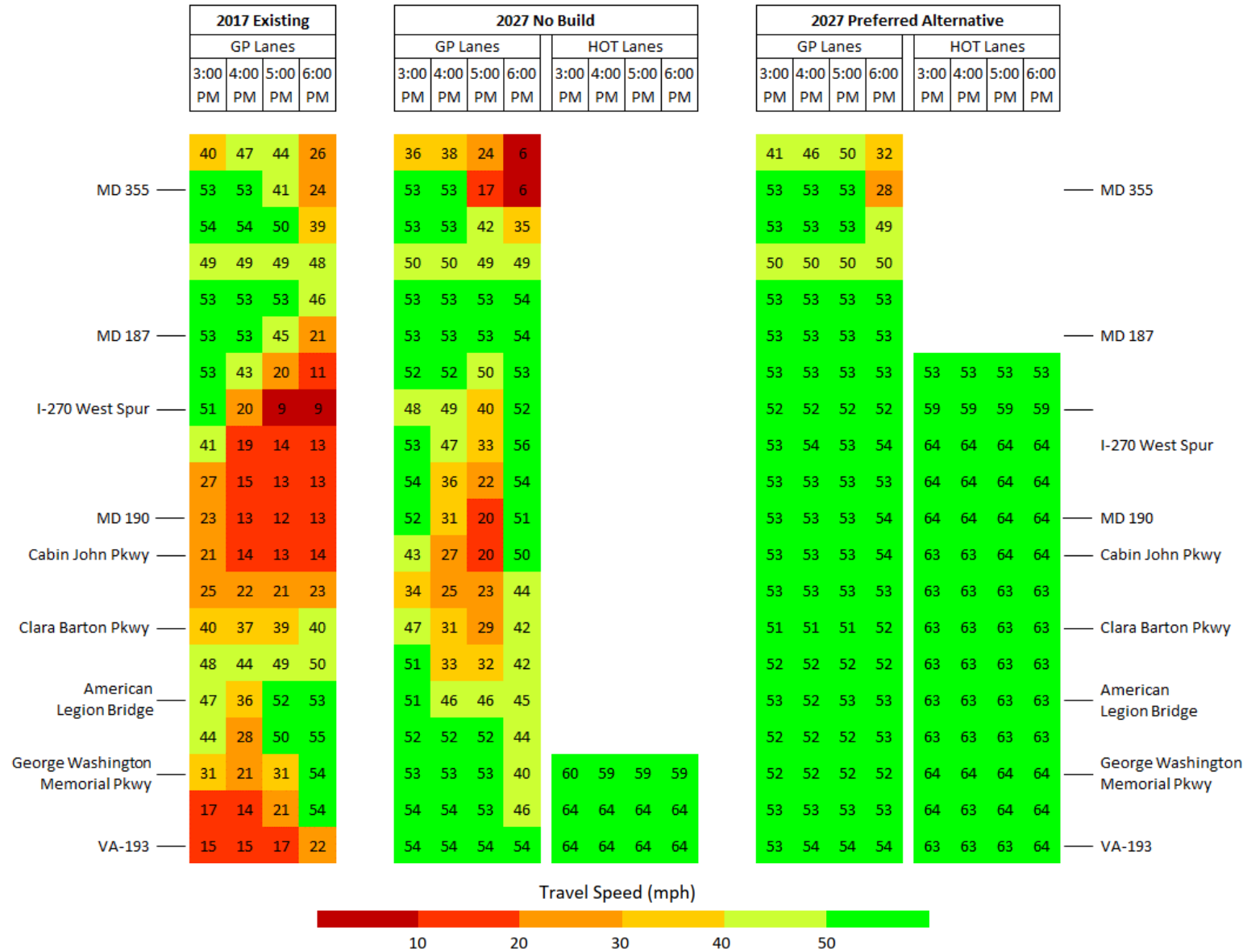
**Figure 6-13: I-495 Inner Loop 2027 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**



**Figure 6-14: I-495 Outer Loop 2027 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**

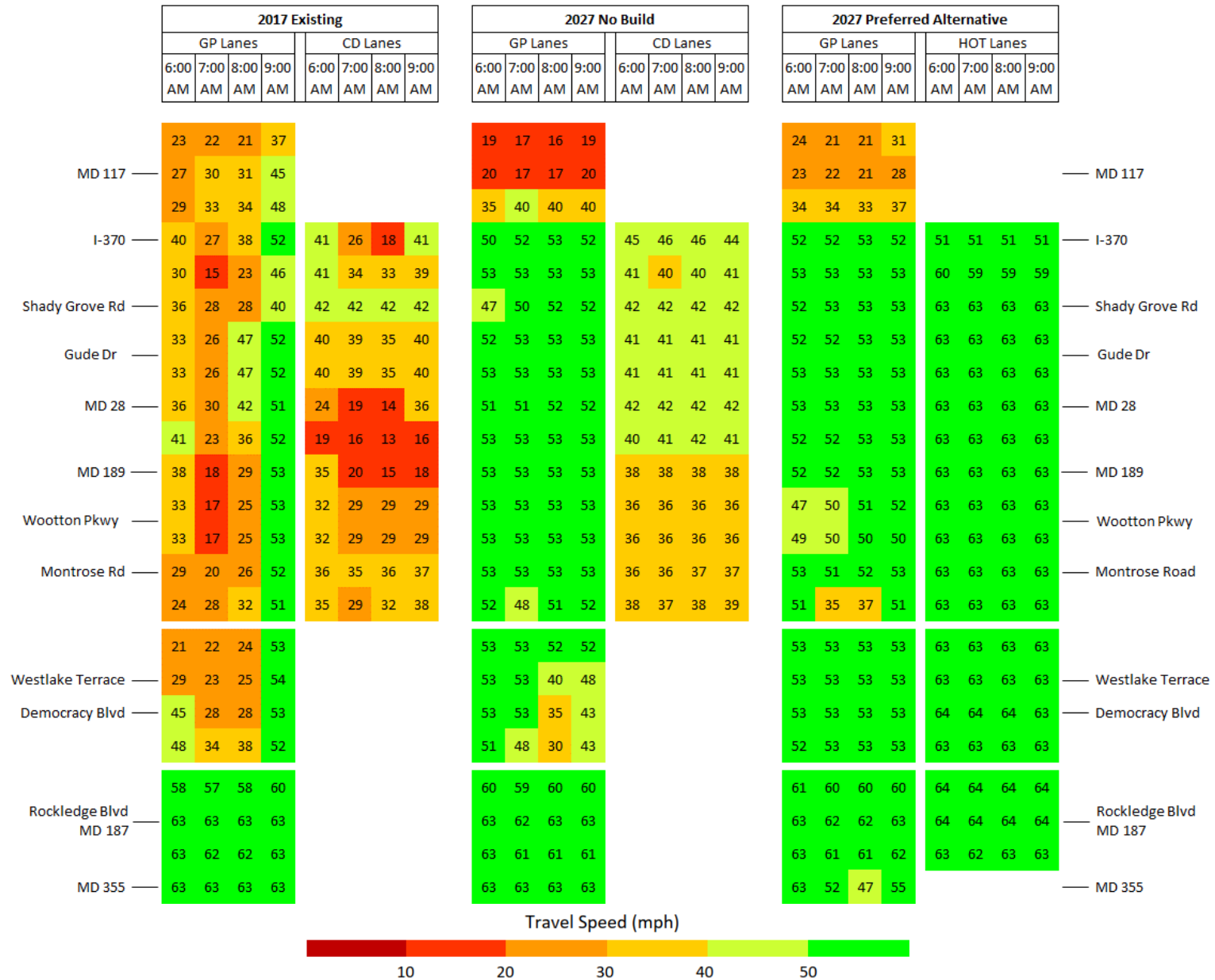


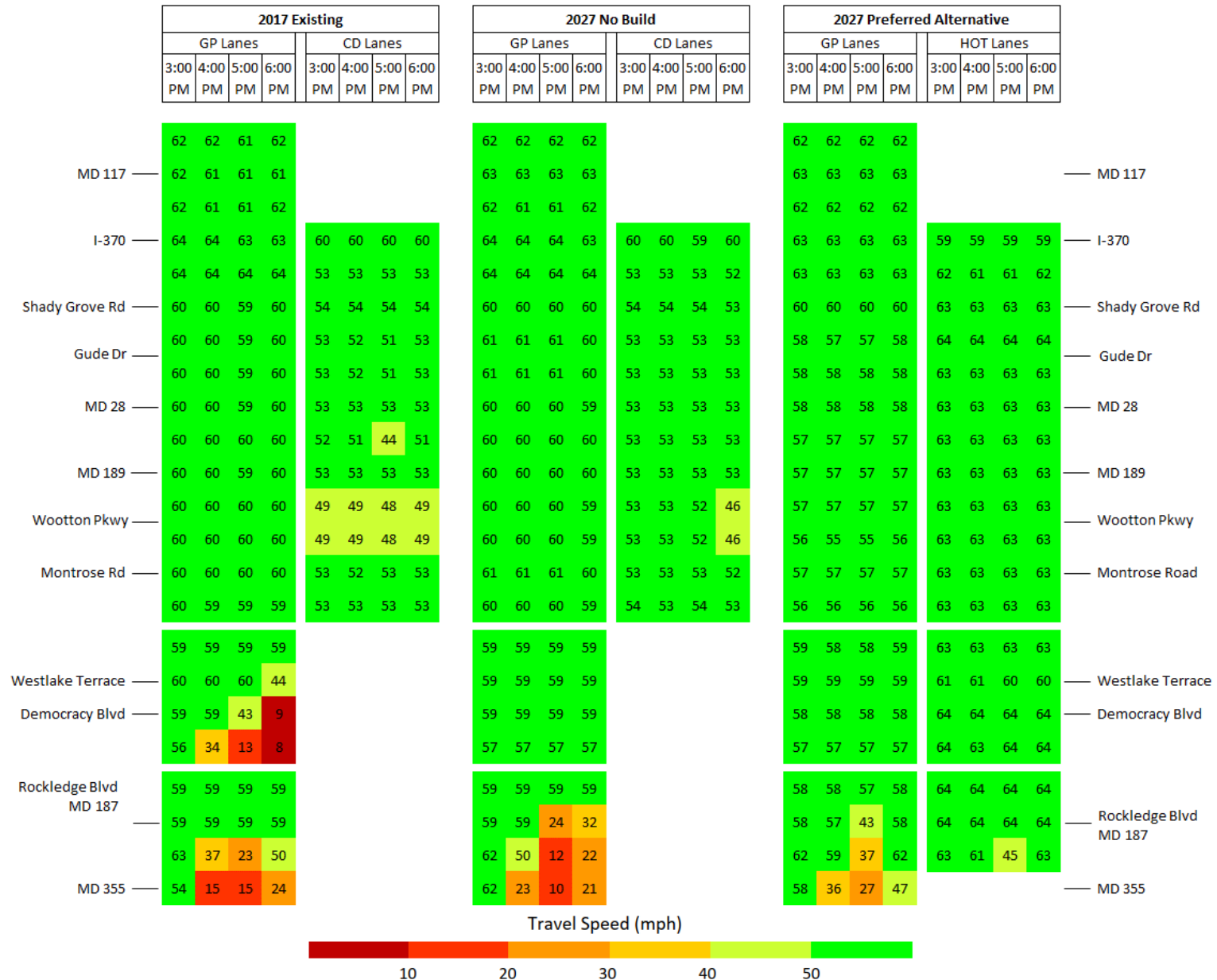
**Figure 6-15: I-495 Outer Loop 2027 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**



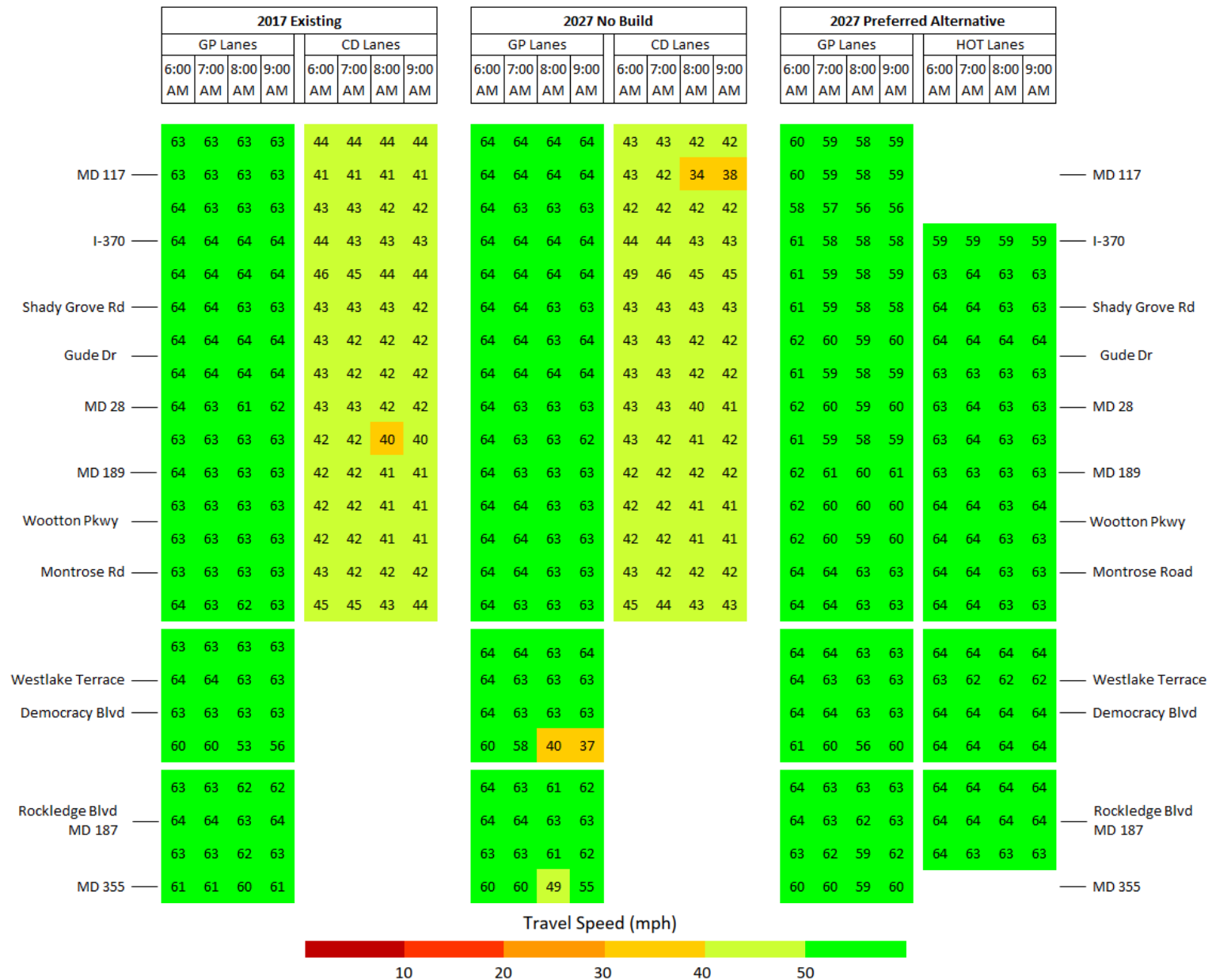


**Figure 6-16: I-270 Southbound 2027 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**

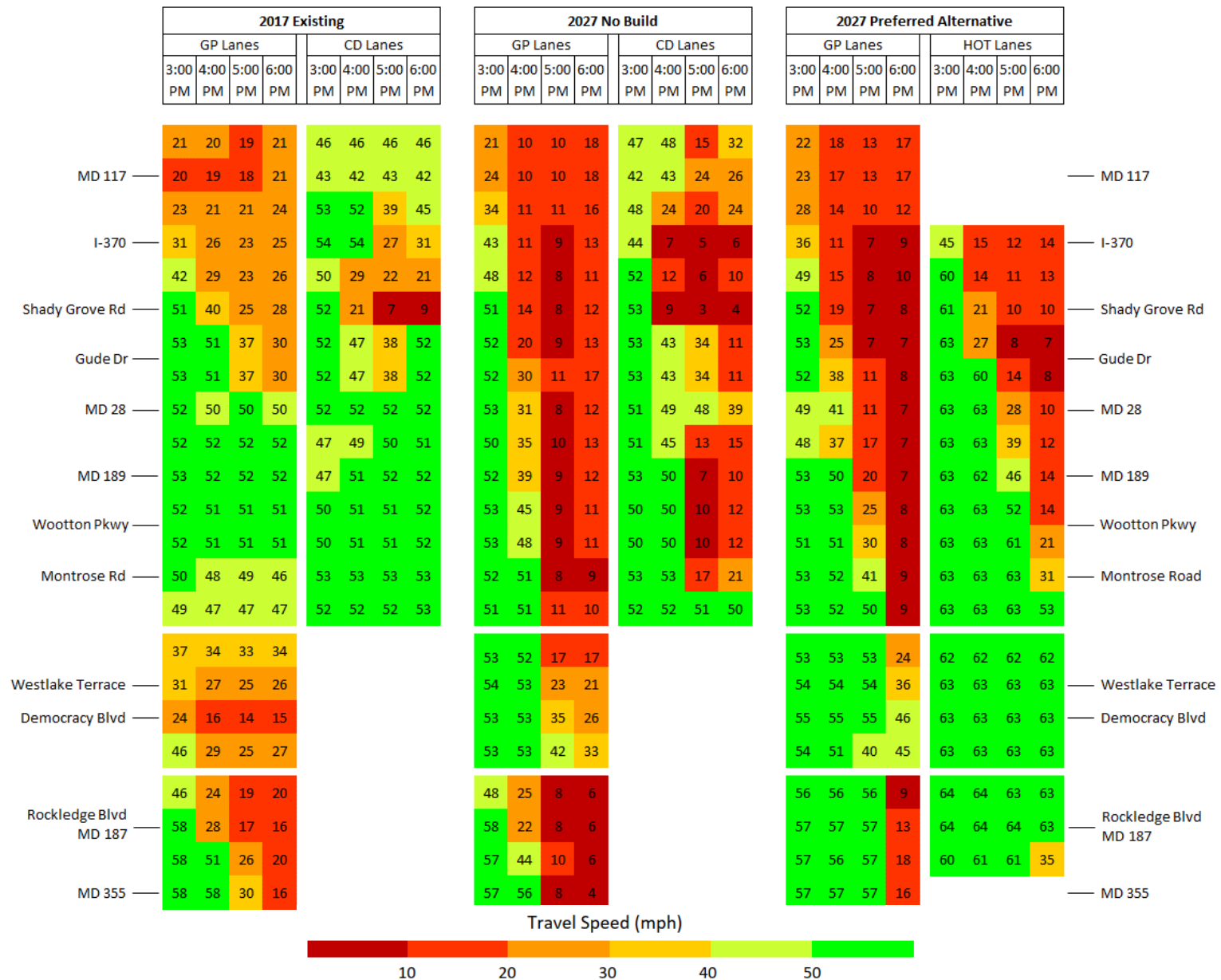


**Figure 6-17: I-270 Southbound 2027 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**


**Figure 6-18: I-270 Northbound 2027 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**



**Figure 6-19: I-270 Northbound 2027 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**



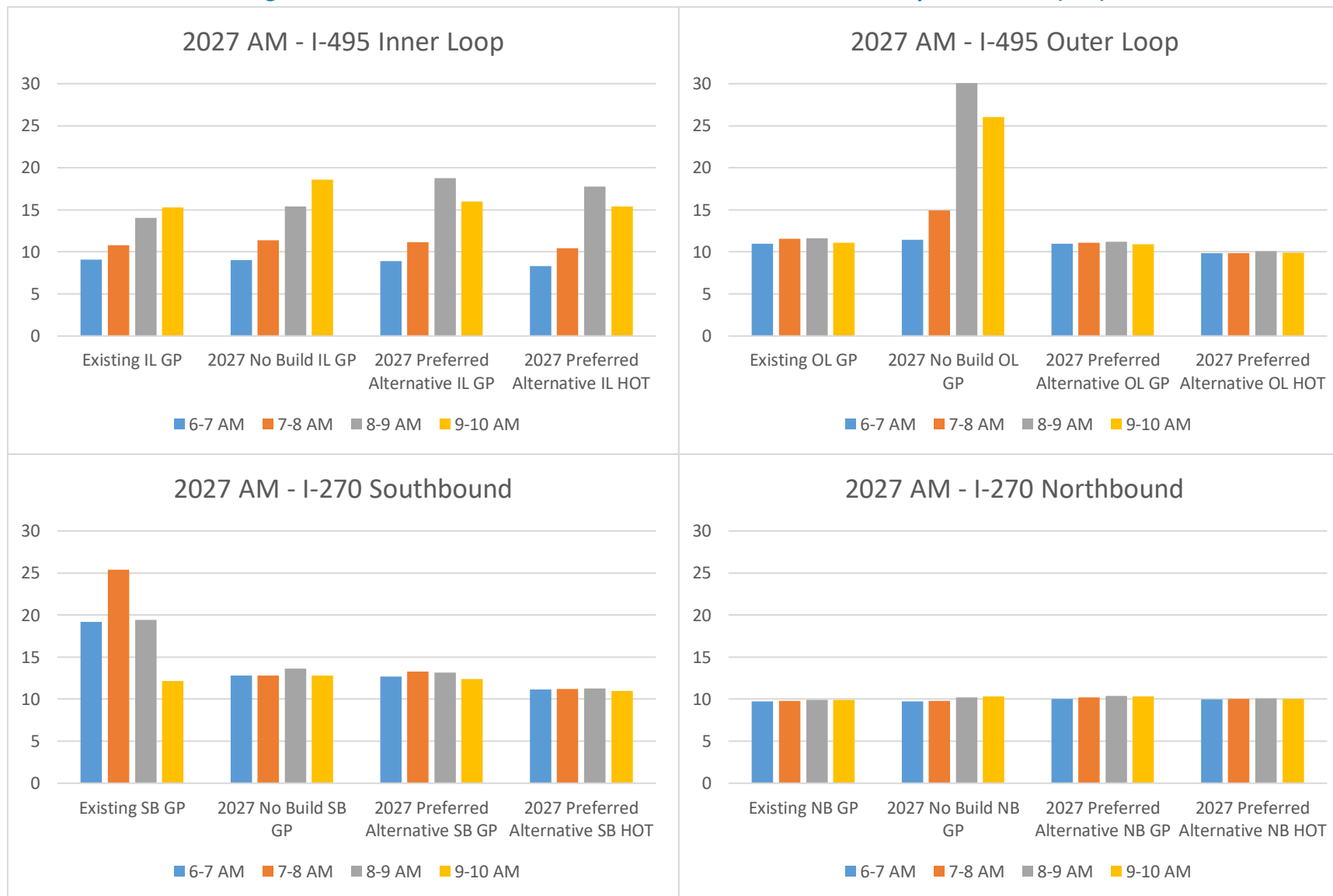
#### 6.4.2.5 Freeway Travel Time Analysis

A comparison of overall corridor travel times for 2027 AM conditions is summarized in **Figure 6-20** while **Figure 6-21 to Figure 6-24** display cumulative travel times of the General Purpose mainline and HOT lanes for each of the analysis hours between interchanges along the corridors. Travel times are summarized for the 9.5-mile section of I-495 from VA 193 to MD 185; this segmentation includes the 4.0-mile segment from I-270 West Spur and MD 185, east of the HOT lanes termination. Along I-270, travel times are summarized along the 1.5-mile section of I-270 West Spur as well as the 12.0-mile section of I-270 (including the I-270 East Spur but excluding the I-270 local lanes) from I-495 to MD 124; this segmentation includes the 1.6-mile section from I-370 to MD 124, north of the HOT lanes termination.

Overall, travel times improve in the General Purpose lanes, with greater improvement in the HOT lanes. All travel times for No Build conditions along I-270 are a weighted average of travel times along the General Purpose and HOV lanes.

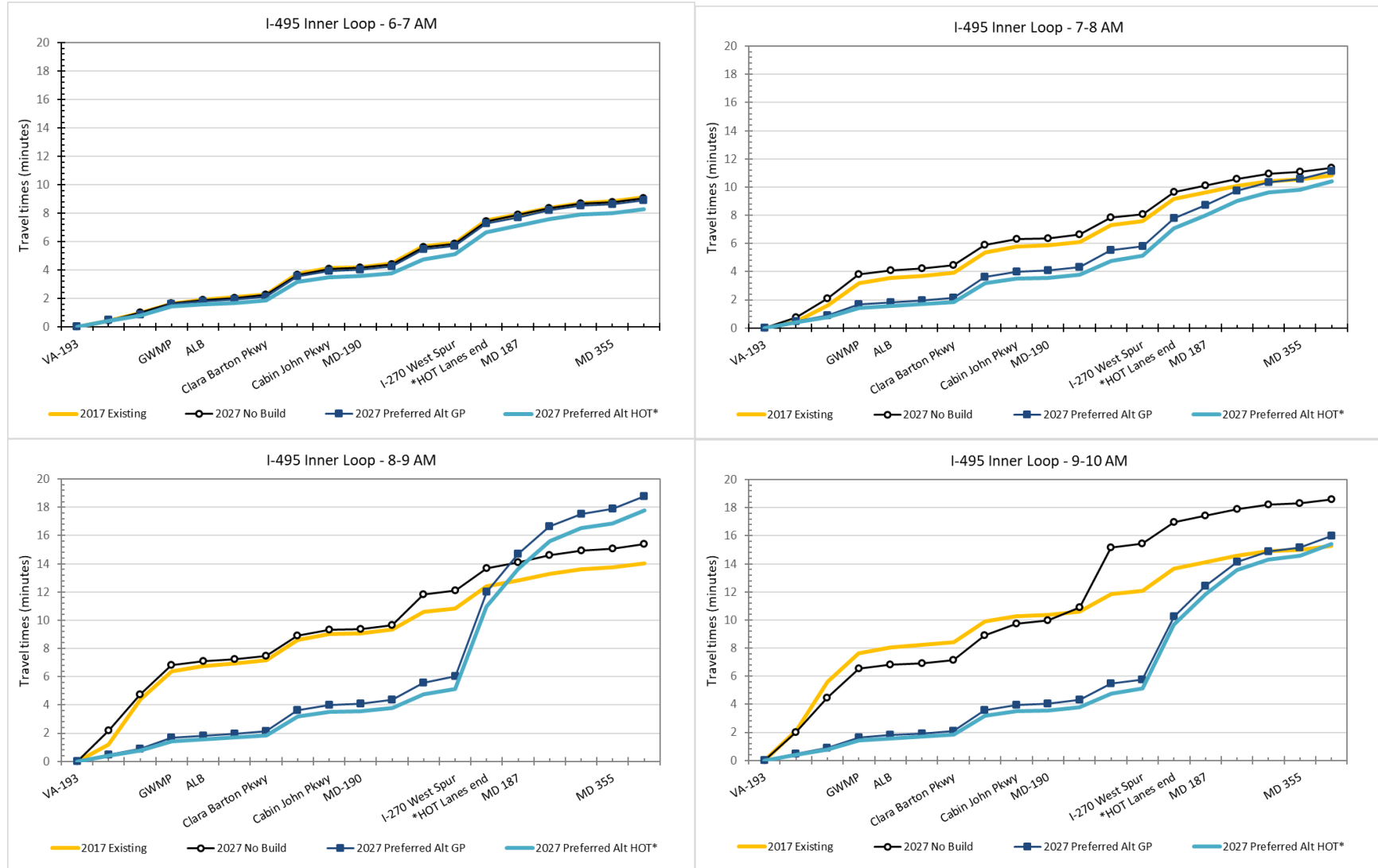
During the AM peak period along the I-495 Inner Loop, the 2027 Preferred Alternative shows similar or improved travel times along both the General Purpose and HOT lanes between the VA 193 interchange and I-270 West Spur (as shown in **Figure 6-21**). Travel times east of the I-270 West Spur do, however, increase during the 8-9 AM hour due to increased throughput and congestion, east of the proposed Managed Lanes facility. Nevertheless, in three of the four AM peak hours, the Preferred Alternative General Purpose lanes have the same or better cumulative travel times with increased throughput when compared to the No Build conditions; furthermore, the cumulative travel times are the same or similar with increased throughput when compared to Existing conditions. Along the I-495 Outer Loop, travel times greatly improve along both the General Purpose and HOT lanes during all four AM peak hours, with significant reductions in the 8-10 AM hours, more so following the 2017 Existing travel time trends (as shown in **Figure 6-22**).

No Build and Preferred Alternative travel times are comparable along the I-270 Southbound General Purpose lanes, with greater travel time savings along the Preferred Alternative HOT lanes (as shown in **Figure 6-23**). Because of the I-270 ICM, both No Build and Preferred Alternative southbound travel times are significantly less than 2017 Existing conditions, particularly in the 7-8 AM hour. Like the southbound direction, No Build and Preferred Alternative travel times are comparable for the I-270 Northbound General Purpose lanes but also for the HOT lanes, as this off-peak direction experiences minimal congestion during the AM peak period (as shown in **Figure 6-24**). Both No Build and Preferred Alternative experience similar northbound travel time trends when compared to the 2017 Existing conditions.

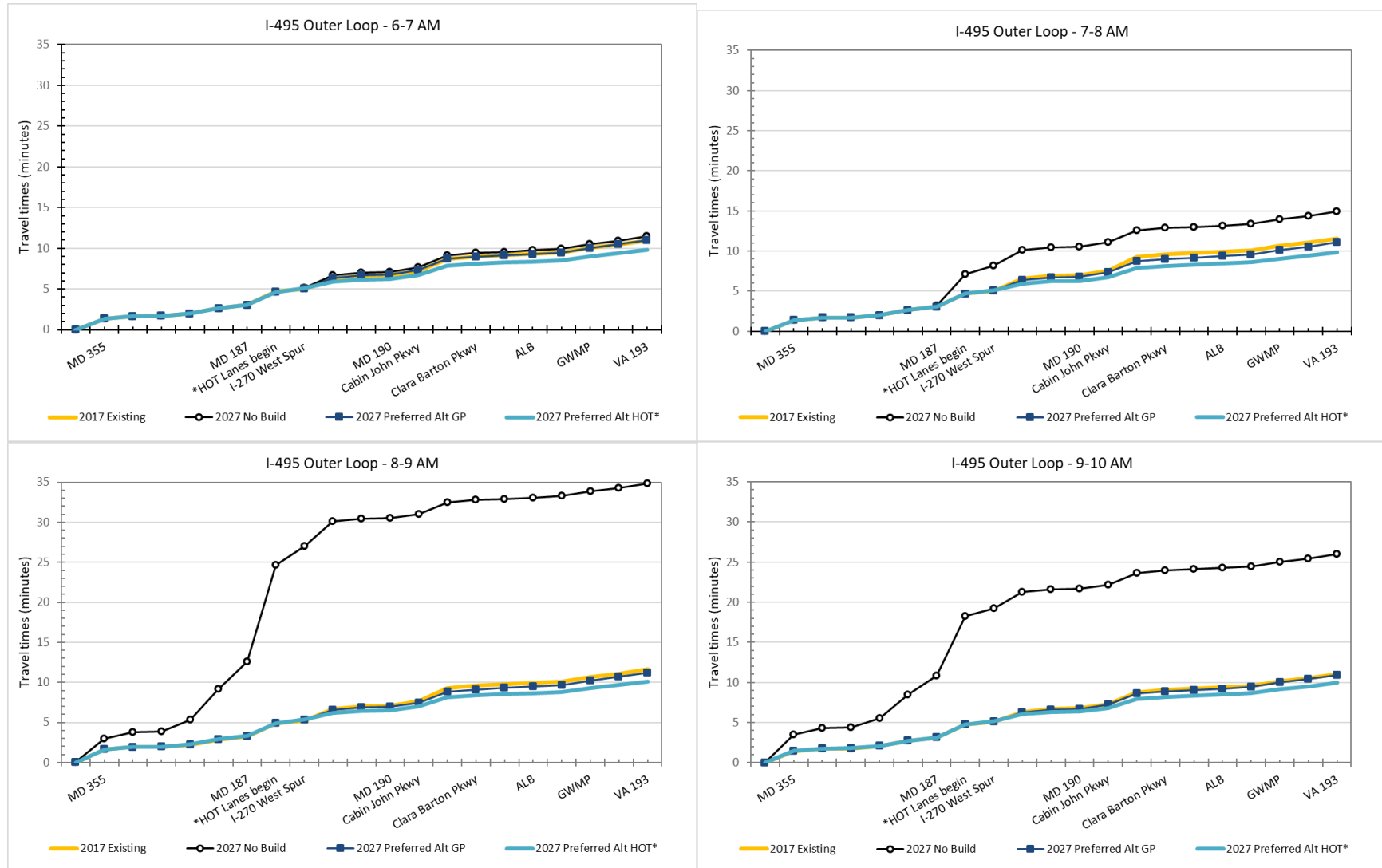
**Figure 6-20: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Travel Times (min)**




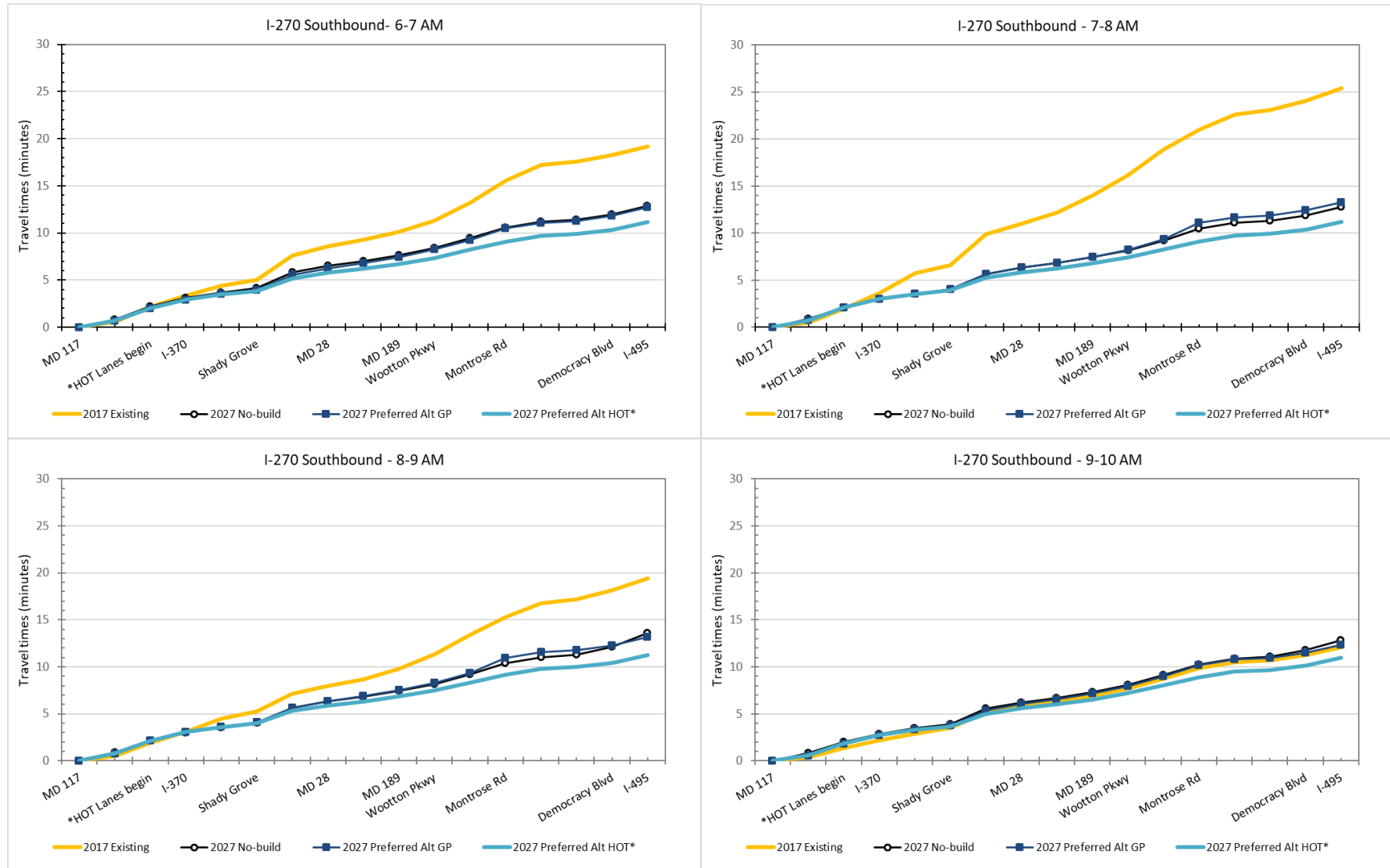
**Figure 6-21: I-495 Inner Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**



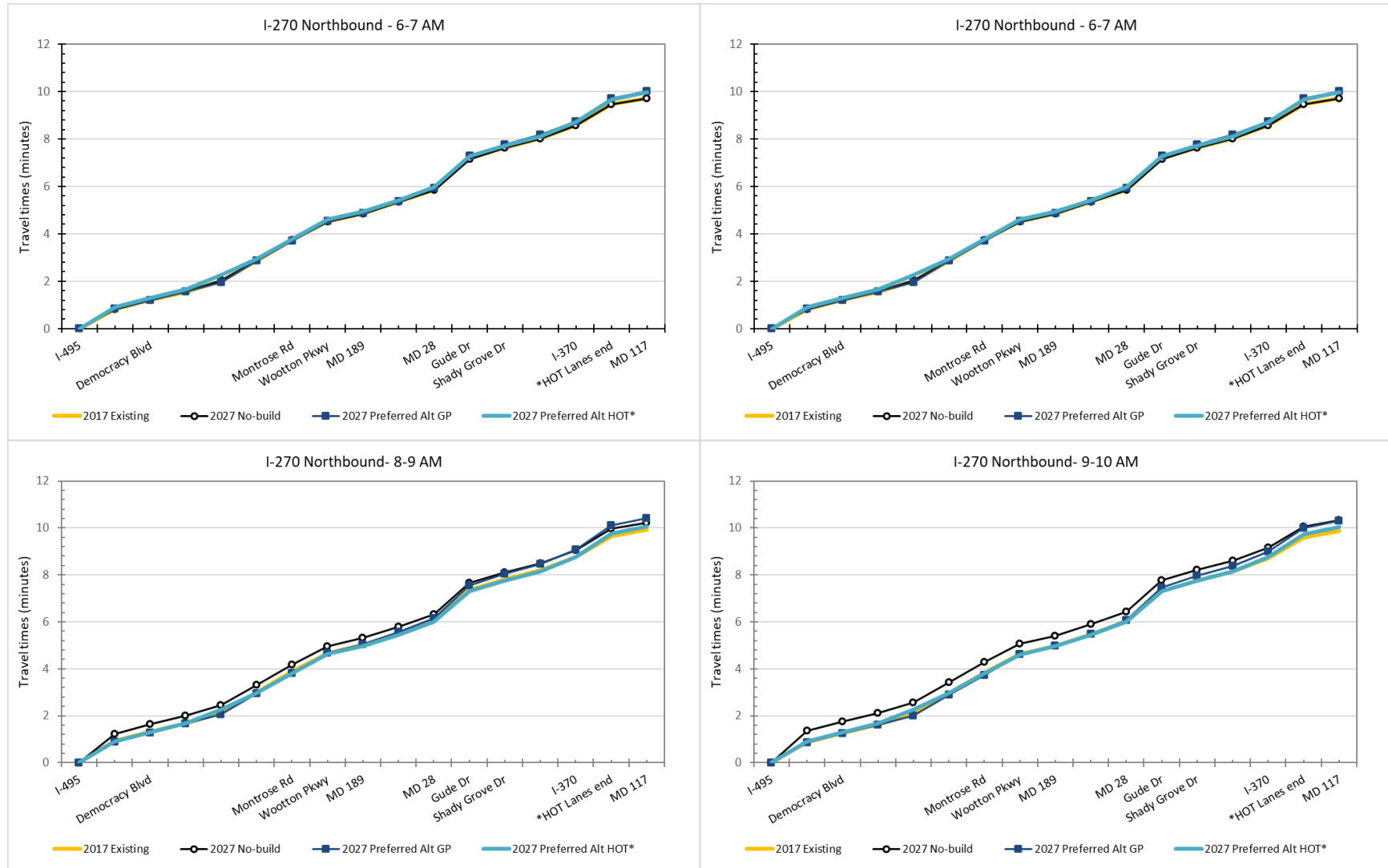
**Figure 6-22: I-495 Outer Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**



**Figure 6-23: I-270 Southbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**



**Figure 6-24: I-270 Northbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**

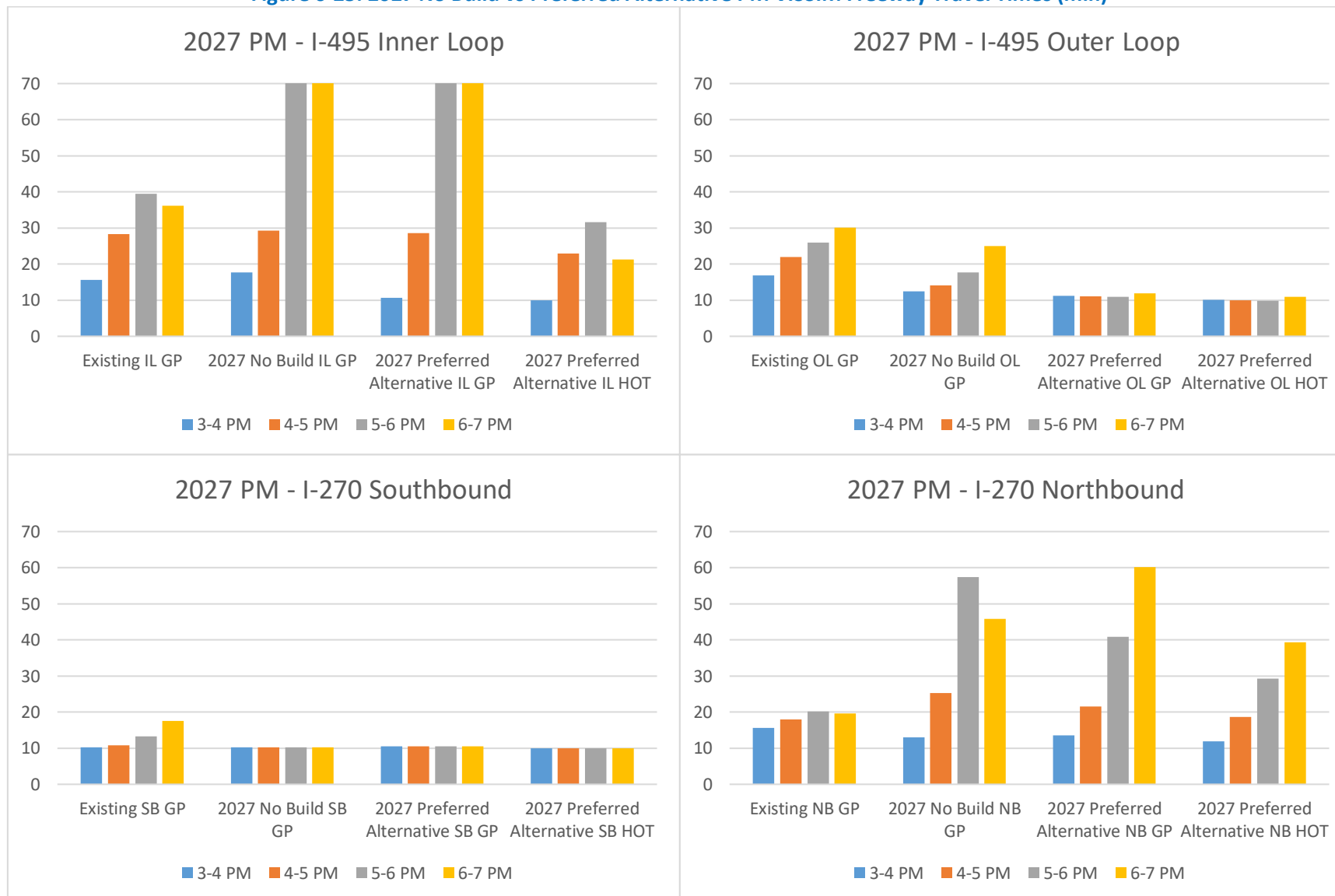


Like the AM peak period, a comparison of overall corridor travel times for 2027 PM peak period conditions is summarized in **Figure 6-25** while **Figure 6-26 to Figure 6-29** display cumulative travel times of the General Purpose lanes and HOT lanes for each of the analysis hours between interchanges along the corridors. Under the Preferred Alternative conditions, travel times generally improve in the General Purpose lanes, with greater improvement in the HOT lanes. As previously stated, all travel times for No Build conditions along I-270 are a weighted average of travel times along the General Purpose and HOV lanes.

During the PM peak period along the I-495 Inner Loop, the 2027 Preferred Alternative shows travel time improvements along both the General Purpose and HOT lanes during the 3-5 PM hours, with substantial improvement in the HOT lanes between 5-7 PM hours as the General Purpose lane trends taper off to be more like No Build conditions (as shown in **Figure 6-26**). Travel times along the I-495 Outer Loop General Purpose and HOT lanes improve during all four PM peak hours, with greatest improvement between 5-7 PM hours for both roadway facilities (as shown in **Figure 6-27**).

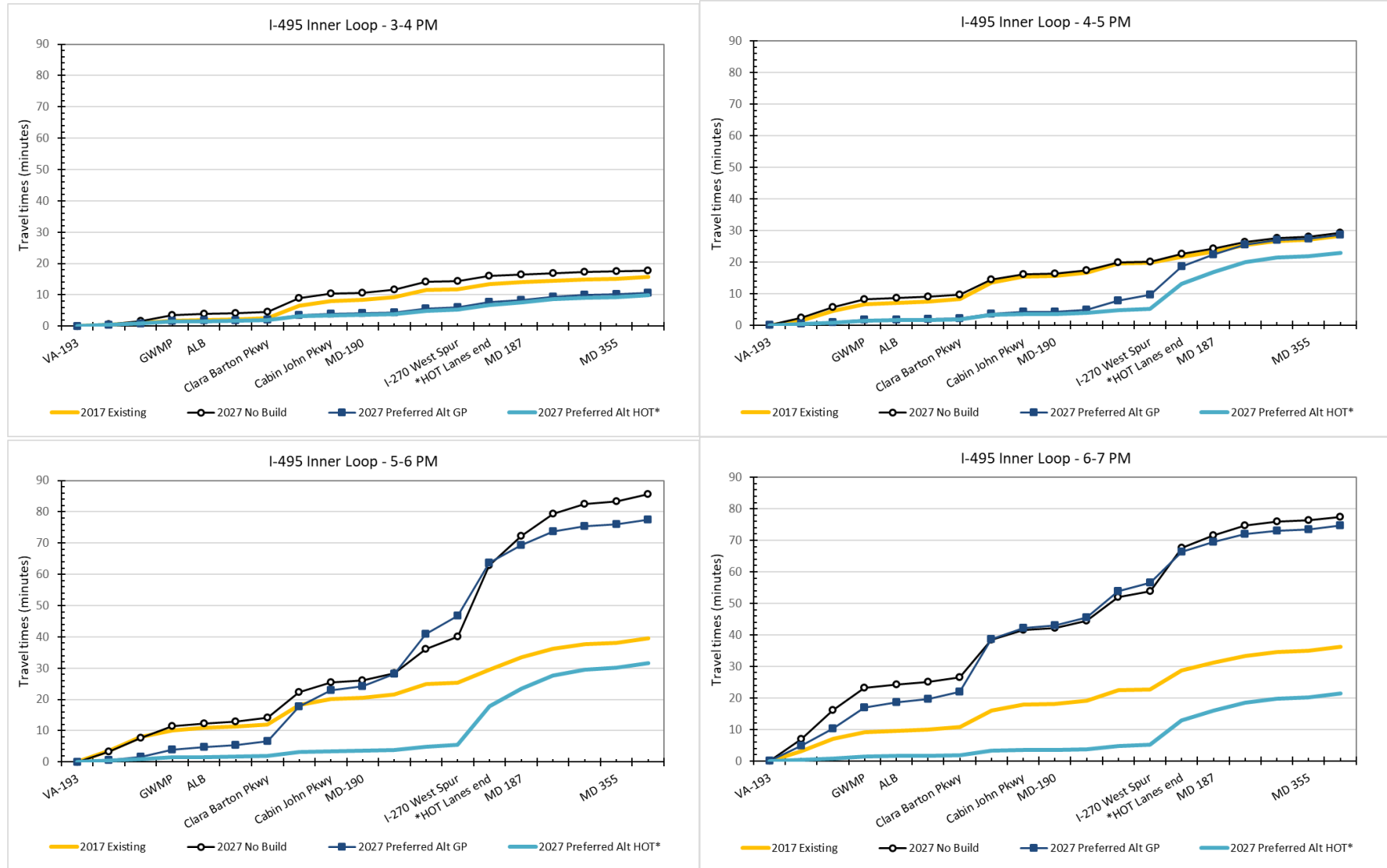
No Build and Preferred Alternative travel times are comparable in both the I-270 Southbound General Purpose and HOT lanes, as this off-peak direction experiences minimal congestion during the PM peak period (as shown in **Figure 6-28**). Both No Build and Preferred Alternative experience similar southbound travel time trends when compared to the 2017 Existing conditions. Travel times along the I-270 Northbound General Purpose lanes are reduced between 4-6 PM hours, with an increase during the 6-7 PM hour due to increased throughput. Travel times within the HOT lanes decrease during all PM peak hours, with the greatest reduction during the 5-6 PM hour (as shown in **Figure 6-29**).

**Figure 6-25: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Travel Times (min)**

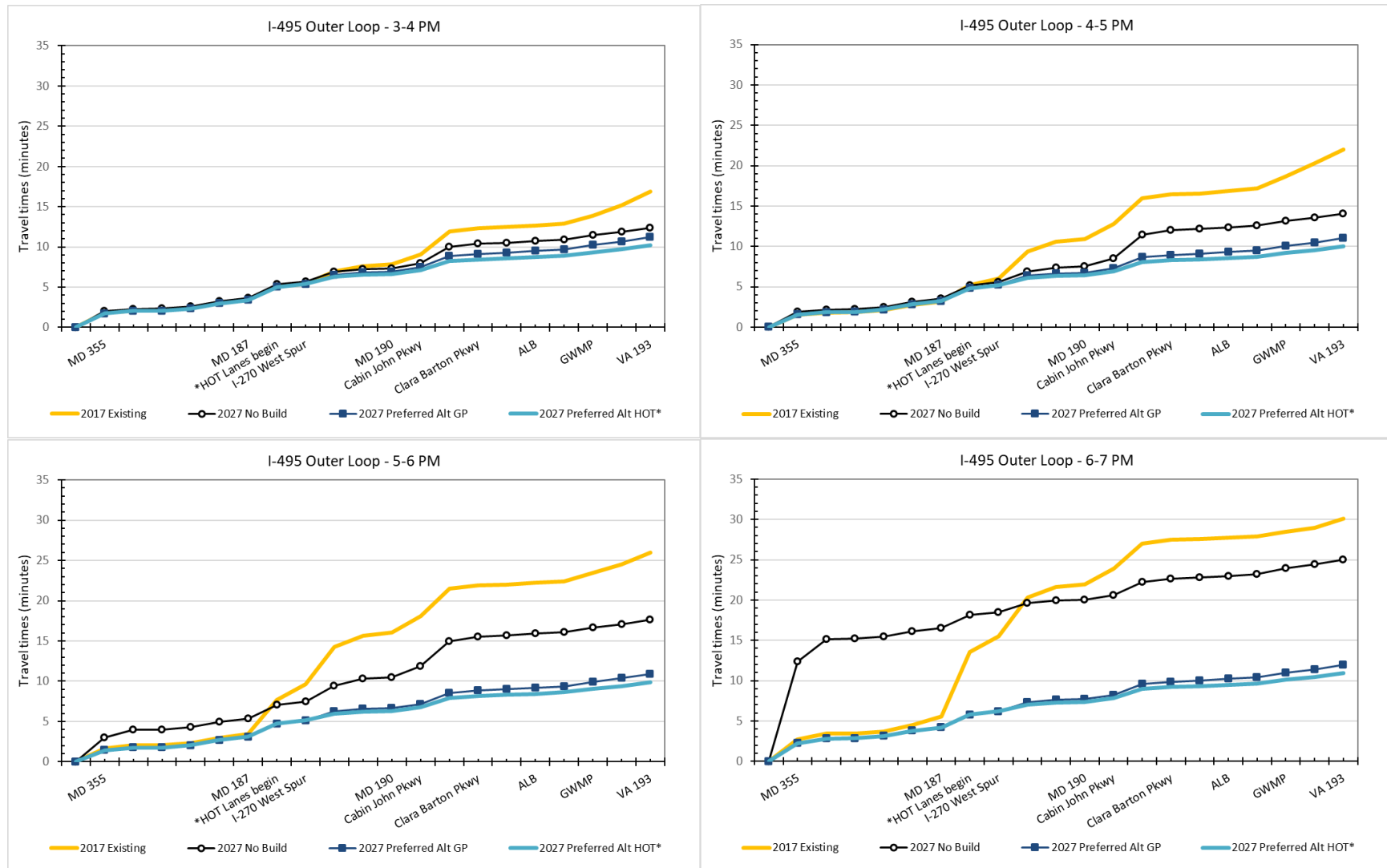




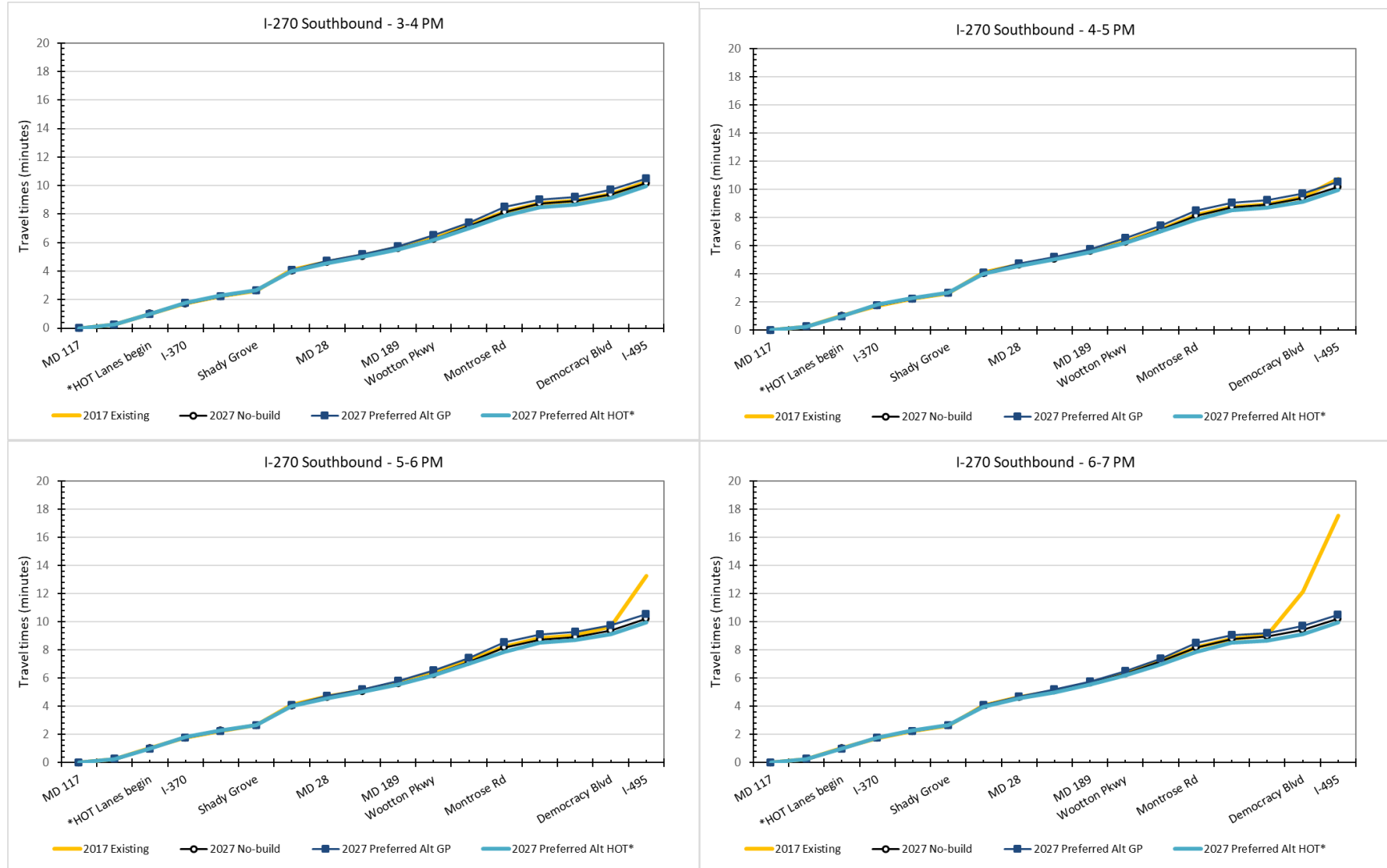
**Figure 6-26: I-495 Inner Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



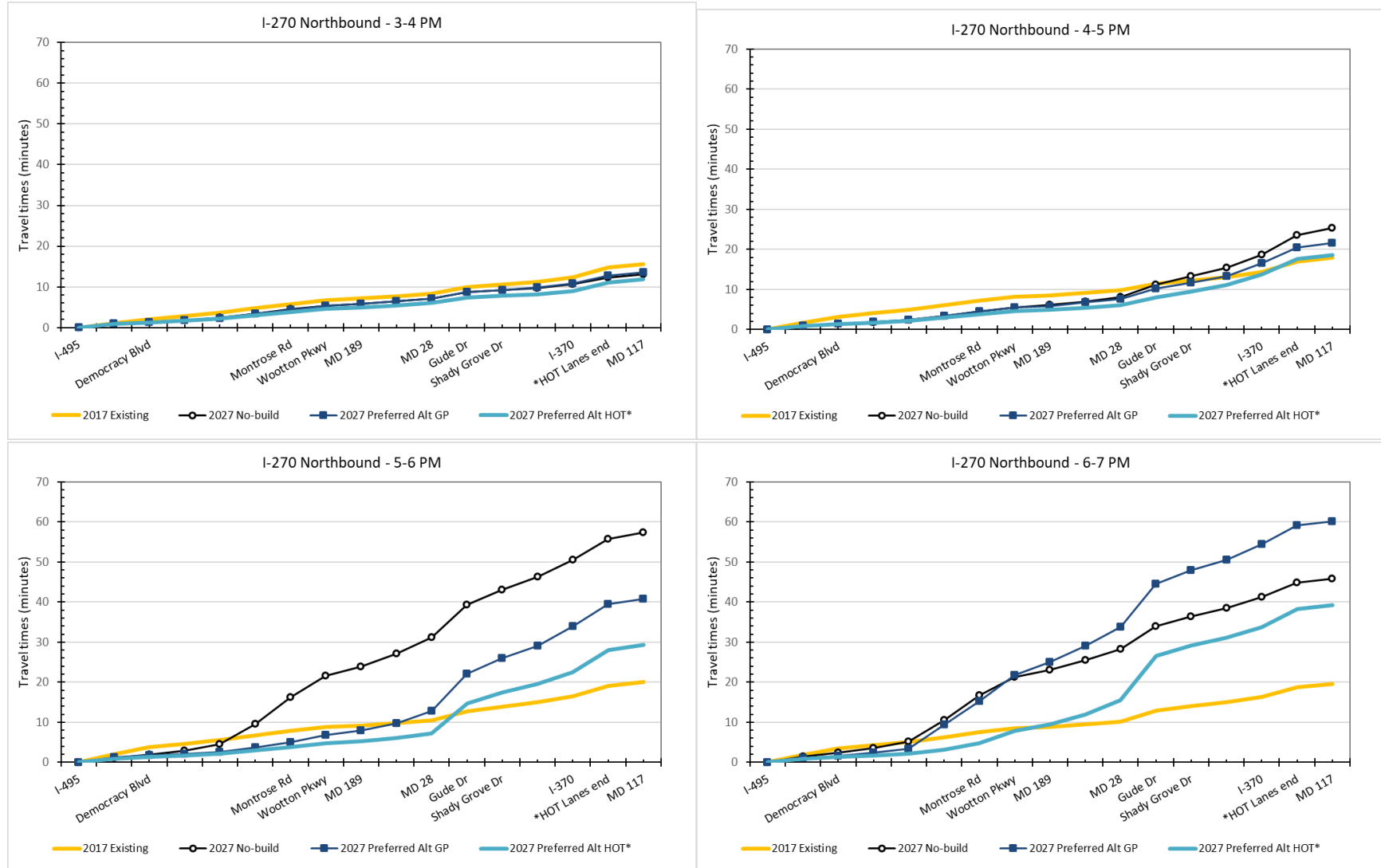
**Figure 6-27: I-495 Outer Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



**Figure 6-28: I-270 Southbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



**Figure 6-29: I-270 Northbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



#### 6.4.2.6 Ramp Queue Spillback

Queues along all on-ramps and off-ramps in the study area were compared between the No Build conditions and the Preferred Alternative to identify locations where ramp queue spillback occurs onto freeway or crossroad lanes. Table 6-13 and Table 6-14 summarize the simulated average and maximum queue lengths at each ramp location compared to the available storage length, indicating locations where the queue length exceeds the available ramp storage, which was measured from junction to gore point and excluding any associated acceleration and/or deceleration lane lengths. Simulated average queue length is defined as the arithmetic mean calculated for each hour within the peak period whereas the simulated maximum queue length is defined as the longest distance measured, even if occurring just once, within each hour of the peak period. Figure 6-30 and Figure 6-31 summarize the percentage of ramp locations where maximum queue length exceeds available ramp storage and spills back onto the mainline or crossroad lanes, with comparison against Existing and No Build conditions. Appendix H summarizes average and maximum queue lengths under Existing conditions.

As shown in Table 6-13 and Figure 6-30, the Preferred Alternative eliminates queue spillback at all ramp locations during the AM peak period, resolving spillback issues that occur under Existing and No Build conditions at locations including MD 190 and George Washington Memorial Parkway. The Preferred Alternative improves queuing for 15 ramps compared to Existing and No Build conditions. As shown in Figure 6-30, No Build conditions produce ramp spillback at fewer locations than Existing conditions during the AM peak period. Due to bottlenecks on I-270 Southbound north of I-370, much of the volume to downstream I-270 is metered, allowing many ramps south of I-370 to operate without the spillback observed in Existing conditions.

During the PM peak period, ramp queue spillback improves at over 30 ramp locations under the Preferred Alternative compared to No Build conditions, with queue lengths either decreasing or eliminated in the Preferred Alternative. As shown in Table 6-14, there are 17 ramp locations where the average or maximum queue length exceeds available ramp storage under No Build conditions, compared to 10 locations for the Preferred Alternative. The Preferred Alternative has no ramp locations that spill back onto the mainline.

Under both the Preferred Alternative and No Build conditions, the following locations have queues that exceed available storage length and spill back onto crossroad lanes during the PM peak period due to congestion along I-270 Northbound and I-495 Inner Loop. The mainline congestion that causes spillback at these locations is caused by existing bottlenecks outside the study area that become exacerbated under future year conditions.

- *MD 28 WB On-Ramp to I-270 NB General Purpose Lanes:* Under No Build conditions, maximum queue lengths exceed available ramp storage during all four analysis hours, and average queue lengths exceed available ramp storage from 4-7 PM. The Preferred Alternative improves conditions at this location, exceeding available ramp storage only between 5-7 PM for the maximum queue and 6-7 PM for the average queue. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program.

Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.

- *MD 189 WB & EB On-Ramps to I-270 NB General Purpose Lanes:* Under both No Build and Preferred Alternative conditions, maximum queue lengths exceed available storage from 5-7 PM at this location. Spillback at these ramps occur due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *Montrose Road WB On-Ramp to I-270 NB General Purpose Lanes:* Maximum queue lengths exceed available ramp storage from 5-7 PM under No Build conditions and from 4-7 PM under the Preferred Alternative. Maximum queue lengths are comparable between the No Build and Preferred Alternative conditions. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *Rockledge Drive/MD 187 On-Ramp to I-270 NB East Spur:* Maximum queue lengths exceed available ramp storage from 5-7 PM under No Build conditions and from 6-7 PM under the Preferred Alternative. Maximum queue lengths are improved under the Preferred Alternative compared to No Build conditions. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *MD 355 NB On-Ramp to I-270 NB East Spur:* Under No Build conditions, average and maximum queue lengths exceed available ramp storage from 5-7 PM. The Preferred Alternative improves conditions at this location, exceeding available ramp storage between only 6-7 PM for the maximum queue. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *Cabin John Parkway On-Ramp to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, average and maximum queue lengths exceed available ramp storage during all four analysis hours. The Preferred Alternative improves conditions at this location, with maximum queues exceeding available ramp storage between only 5-7 PM. Spillback at this ramp occurs due to the existing bottleneck along I-495 Inner Loop east of MD 355.
- *MD 190 WB On-Ramp to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, maximum queue lengths exceed available ramp storage during all four analysis hours. The Preferred Alternative improves conditions at this location, with maximum queues exceeding available ramp storage between only 5-7 PM. Spillback at this ramp occurs due to the existing bottleneck along I-495 Inner Loop east of MD 355.
- *George Washington Parkway WB On-Ramp to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, maximum queue lengths exceed available ramp storage during all four analysis hours. The Preferred Alternative improves conditions at this location, with maximum queues

exceeding available ramp storage between only 5-7 PM. Spillback at this ramp occurs due to the existing bottleneck along I-495 Inner Loop east of MD 355.

- *VA 193 NB On-Ramp to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, average and maximum queue lengths exceed available ramp storage from 4-7 PM. The Preferred Alternative improves conditions at this location, exceeding ramp storage length from 6-7 PM for average queue length and 5-7 PM for maximum queue length. Spillback at this ramp occurs due to the existing bottleneck along I-495 Inner Loop east of MD 355.

Under the Preferred Alternative, one location, listed below, has a queue that exceeds available storage length and spills back onto crossroad lanes during the PM peak period due to congestion along I-270 Northbound. The mainline congestion that causes spillback at this location is caused by an existing bottleneck outside the study area that becomes exacerbated under future year conditions.

- *Montrose Road EB On-Ramp to I-270 NB General Purpose Lanes:* The Preferred Alternative experiences average and maximum queue lengths exceeding available storage and extending approximately 1,000 feet and 1,400 feet, respectively, during 6-7 PM (as shown in **Table 6-14**). The queue is not expected to block the I-270 Southbound to Montrose Road Eastbound off-ramp due to modeled realistic driver behavior, in which a courtesy gap is provided for the off-ramp vehicles to access Montrose Road Eastbound. Because the Preferred Alternative is expected to push through approximately 18% more vehicles between the I-270 Split and Montrose Road during the PM peak period with significantly more throughput in the 5-7 PM hours (i.e., approximately 47% more in 5-6 PM hour and 20% more in 6-7 PM hour), the queue spillback north of the study area is anticipated to significantly worsen, thereby unable to recover during the PM peak period; this queue spillback causes some on-ramps to also spill back as there is no available capacity in the I-270 Northbound General Purpose lanes. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program, and those determined improvements will address the congestion. However, in the interim as part of this Study, signing/ITS improvements as well as traffic signal and ramp meter monitoring and adjustments may be considered as potential mitigation strategies.

In summary, the Preferred Alternative maintains or improves ramp spillback compared to No Build conditions at ramps throughout the study area, improving and reducing queues at over 30 locations, eliminating all ramp spillback during the AM peak period, and removing 7 ramp spillback locations that occur under PM No Build conditions. The remaining spillback locations that occur under PM conditions are due to existing bottlenecks along I-270 Northbound and I-495 Inner Loop that occur outside the study area and become exacerbated under future conditions.



Table 6-13: AM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative

| Ramp Location                             | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|---|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|   |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|   |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 117                           |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 117 EB On-Ramp to I-270 SB             | 1,920                    | 29            | 624       | 657       | 1,653     | 457       | 1,433     | 8         | 484       | 1,920                    | 11                         | 436       | 202       | 1,147     | 107       | 1,037     | 1         | 227       |
| MD 117 WB On-Ramp to I-270 SB             | 1,490                    | 29            | 624       | 572       | 1,327     | 404       | 1,109     | 8         | 484       | 1,490                    | 11                         | 436       | 187       | 1,008     | 107       | 1,037     | 1         | 227       |
| I-270 NB GP Off-Ramp to MD 117            | 1,300                    | 25            | 162       | 42        | 222       | 304       | 1,326     | 168       | 1,038     | 1,300                    | 23                         | 170       | 51        | 301       | 241       | 918       | 204       | 799       |
| I-270 at I-370                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 370 EB On-Ramp to I-270 SB GP          | 2,340                    | 0             | 0         | 3         | 207       | 0         | 65        | 0         | 0         | 2,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB GP          | 3,000                    | 0             | 24        | 147       | 1,026     | 112       | 1,267     | 1         | 49        | 2,940                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB Off-Ramp to I-370 EB             | 6,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 6,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 EB          | 2,300                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,220                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 EB On-Ramp to I-270 NB GP           | 2,400                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 WB On-Ramp to I-270 NB GP           | 2,780                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB Off-Ramp to I-370 WB             | 2,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,900                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 WB          | 3,320                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 3,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 EB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 2,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to I-370 EB GP       | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 3,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 WB at I-270 NB ML off-ramp          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 5,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Shady Grove Road                 |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Shady Grove Rd EB On-Ramp to I-270 SB GP  | 1,120                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 920                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Shady Grove Rd EB On-Ramp to I-270 NB GP  | 1,650                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,650                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to Shady Grove Rd EB | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,850                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to Shady Grove Rd WB | 1,600                    | 36            | 183       | 63        | 250       | 127       | 434       | 99        | 409       | 1,700                    | 30                         | 153       | 60        | 249       | 143       | 509       | 101       | 416       |
| Shady Grove Rd WB On-Ramp to I-270 NB GP  | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Shady Grove Rd WB On-Ramp to I-270 SB     | 1,600                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to Shady Grove Rd    | 1,250                    | 61            | 237       | 100       | 406       | 101       | 433       | 95        | 388       | 1,250                    | 61                         | 259       | 98        | 398       | 103       | 420       | 99        | 411       |
| I-270 at Gude Drive                       |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,860                    | 33                         | 201       | 37        | 209       | 41        | 252       | 35        | 243       |
| I-270 NB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,400                    | 57                         | 299       | 57        | 296       | 74        | 384       | 76        | 404       |
| Gude Dr On-Ramp to I-270 ML NB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Gude Dr On-Ramp to I-270 ML SB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,780                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

Table 6-13: AM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)

| Ramp Location                          | Available Storage (feet) | 2027 No-Build |             |             |             |             |             |             |             | Available Storage (feet) | 2027 Preferred Alternative |             |             |             |             |             |             |             |
|--|--------------------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------------------|----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|  |                          | 6-7 AM        |             | 7-8 AM      |             | 8-9 AM      |             | 9-10 AM     |             |                          | 6-7 AM                     |             | 7-8 AM      |             | 8-9 AM      |             | 9-10 AM     |             |
|  |                          | Avg. (feet)   | Max. (feet) | Avg. (feet) | Max. (feet) | Avg. (feet) | Max. (feet) | Avg. (feet) | Max. (feet) |                          | Avg. (feet)                | Max. (feet) | Avg. (feet) | Max. (feet) | Avg. (feet) | Max. (feet) | Avg. (feet) | Max. (feet) |
| I-270 at MD 28                         |                          |               |             |             |             |             |             |             |             |                          |                            |             |             |             |             |             |             |             |
| MD 28 EB On-Ramp to I-270 SB GP        | 1,950                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,950                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| MD 28 EB On-Ramp to I-270 NB GP        | 1,050                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 950                      | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 NB GP Off-Ramp to MD 28          | 1,040                    | 1             | 45          | 20          | 145         | 25          | 207         | 26          | 173         | 900                      | 1                          | 44          | 16          | 126         | 28          | 152         | 22          | 155         |
| MD 28 WB On-Ramp to I-270 NB GP        | 1,370                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,370                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 NB GP Off-Ramp to MD 28 WB       | 1,150                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,000                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 82          |
| MD 28 WB On-Ramp to I-270 SB GP        | 1,000                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 950                      | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 SB GP Off-Ramp to MD 28          | 900                      | 18            | 174         | 16          | 156         | 21          | 176         | 36          | 223         | 1,400                    | 2                          | 87          | 3           | 119         | 6           | 127         | 9           | 145         |
| I-270 at MD 189                        |                          |               |             |             |             |             |             |             |             |                          |                            |             |             |             |             |             |             |             |
| MD 189 WB On-Ramp to I-270 NB          | 1,080                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,140                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| MD 189 EB On-Ramp to I-270 NB          | 910                      | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 910                      | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 NB GP Off-Ramp to MD 189 WB      | 720                      | 4             | 54          | 11          | 75          | 5           | 59          | 7           | 67          | 630                      | 1                          | 45          | 3           | 67          | 2           | 46          | 3           | 61          |
| I-270 NB GP Off-Ramp to MD 189 EB      | 920                      | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 760                      | 6                          | 82          | 13          | 130         | 23          | 280         | 20          | 251         |
| MD 189 WB On-Ramp to I-270 SB GP       | 1,910                    | 0             | 0           | 0           | 22          | 0           | 0           | 0           | 0           | 1,890                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| MD 189 EB On-Ramp to I-270 SB GP       | 2,060                    | 0             | 0           | 0           | 22          | 0           | 0           | 0           | 0           | 2,070                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 SB GP Off-Ramp to MD 189 EB      | 900                      | 35            | 206         | 47          | 267         | 47          | 239         | 46          | 251         | 870                      | 13                         | 82          | 15          | 91          | 14          | 87          | 14          | 94          |
| I-270 SB GP Off-Ramp to MD 189 WB      | 1,150                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,120                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 at Wootton Parkway               |                          |               |             |             |             |             |             |             |             |                          |                            |             |             |             |             |             |             |             |
| I-270 NB ML Off-Ramp to Wootton Pkwy   | -                        | -             | -           | -           | -           | -           | -           | -           | -           | 1,800                    | 4                          | 89          | 7           | 141         | 13          | 180         | 15          | 215         |
| I-270 SB ML Off-Ramp to Wootton Pkwy   | -                        | -             | -           | -           | -           | -           | -           | -           | -           | 1,570                    | 25                         | 195         | 21          | 198         | 19          | 163         | 20          | 156         |
| Wootton Pkwy On-Ramp to I-270 NB ML    | -                        | -             | -           | -           | -           | -           | -           | -           | -           | 3,000                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Wootton Pkwy On-Ramp to I-270 SB ML    | -                        | -             | -           | -           | -           | -           | -           | -           | -           | 1,700                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 at Montrose Road                 |                          |               |             |             |             |             |             |             |             |                          |                            |             |             |             |             |             |             |             |
| Montrose Rd EB On-Ramp to I-270 SB GP  | 1,960                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,910                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 SB GP Off-Ramp to Montrose Rd EB | 1,340                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,220                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Montrose Rd EB On-Ramp to I-270 NB GP  | 1,150                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,000                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| I-270 NB GP Off-Ramp Montrose Rd EB    | 1,980                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,870                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Montrose Rd WB On-Ramp to I-270 NB GP  | 1,950                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,870                    | 0                          | 0           | 0           | 0           | 2           | 239         | 1           | 183         |
| I-270 NB Off-Ramp to Montrose Rd WB    | 1,520                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,320                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Montrose Rd WB On-Ramp to I-270 SB GP  | 1,200                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 13          | 1,100                    | 0                          | 106         | 2           | 144         | 1           | 133         | 1           | 120         |
| I-270 SB GP Off-Ramp to Montrose Rd WB | 1,600                    | 0             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 1,500                    | 0                          | 0           | 0           | 0           | 0           | 0           | 0           | 0           |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Table 6-13: AM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)**

| Ramp Location  | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 187 / Rockledge Drive                    |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB East Spur Off-Ramp to Rockledge Dr / MD 187 | 1,700                    | 1             | 70        | 3         | 91        | 7         | 152       | 3         | 105       | 1,400                    | 1                          | 74        | 4         | 109       | 14        | 217       | 8         | 152       |
| I-270 NB East Spur Off-Ramp to MD 187 SB             | 915                      | 18            | 142       | 45        | 264       | 22        | 175       | 20        | 165       | 720                      | 6                          | 56        | 26        | 142       | 16        | 100       | 16        | 101       |
| I-270 NB East Spur Off-Ramp to MD 187 NB             | 1,050                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 900                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 East Spur NB Off-Ramp to Rockledge Dr          | 960                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 890                      | 0                          | 20        | 0         | 66        | 0         | 66        | 0         | 51        |
| MD 187 On-Ramp to I-270 East Spur SB                 | 780                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 580                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Rockledge Dr / MD 187 On-Ramp to I-270 NB East Spur  | 1,300                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,050                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Westlake Terrace                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Westlake Terrace             | 1,550                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,440                    | 15                         | 210       | 22        | 216       | 50        | 308       | 53        | 334       |
| Westlake Terrace On-Ramp to I-270 NB ML              | 1,350                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,470                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to Westlake Terrace             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,850                    | 3                          | 98        | 7         | 128       | 8         | 122       | 22        | 206       |
| Westlake Terrace On-Ramp to I-270 SB ML              | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Democracy Boulevard                         |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 NB GP Off-Ramp to Democracy Blvd WB            | 1,330                    | 8             | 62        | 15        | 108       | 16        | 101       | 19        | 128       | 1,270                    | 10                         | 72        | 19        | 117       | 18        | 113       | 22        | 132       |
| I-270 NB GP Off-Ramp to Democracy Blvd EB            | 1,550                    | 53            | 277       | 75        | 311       | 87        | 380       | 85        | 361       | 1,450                    | 52                         | 223       | 77        | 322       | 96        | 411       | 93        | 429       |
| Democracy Blvd EB On-Ramp to I-270 West Spur GP NB   | 1,215                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Democracy Blvd WB On-Ramp to I-270 West Spur GP NB   | 1,680                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 West Spur SB Off-Ramp to Democracy Blvd GP EB  | 1,300                    | 29            | 136       | 43        | 183       | 49        | 232       | 49        | 206       | 1,140                    | 27                         | 125       | 35        | 158       | 47        | 208       | 49        | 215       |
| I-270 West Spur GP SB Off-Ramp to Democracy Blvd WB  | 1,430                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Democracy Blvd On-Ramp to I-495 Outer Loop GP        | 1,130                    | 0             | 0         | 0         | 0         | 46        | 156       | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 355                                      |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 East Spur SB Off-Ramp to MD 355 SB             | 1,940                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,940                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop Off-Ramp to MD 355 SB               | 2,300                    | 31            | 183       | 34        | 194       | 30        | 170       | 26        | 149       | 2,300                    | 34                         | 182       | 34        | 208       | 31        | 174       | 29        | 160       |
| MD 355 NB On-Ramp to I-495 Inner Loop                | 875                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 875                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 SB On-Ramp to I-495 Inner Loop                | 2,160                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,160                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop Off-Ramp to MD 355 NB               | 1,360                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB On-Ramp to I-495 Outer Loop                | 1,360                    | 0             | 0         | 0         | 0         | 6         | 92        | 0         | 21        | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB ramp to I-270 East Spur NB                 | 1,450                    | 0             | 0         | 0         | 0         | 0         | 8         | 0         | 0         | 1,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

Table 6-13: AM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)

| Ramp Location  | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-495 at MD 187                                      |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to MD 187 NB            | 950                      | 3             | 49        | 5         | 103       | 12        | 130       | 7         | 71        | 950                      | 9                          | 77        | 9         | 150       | 20        | 366       | 10        | 146       |
| I-495 Inner Loop GP Off-Ramp to MD 187 SB            | 1,030                    | 6             | 231       | 23        | 377       | 38        | 487       | 9         | 210       | 1,030                    | 5                          | 235       | 26        | 393       | 37        | 498       | 5         | 185       |
| MD 187 On-Ramp to I-495 Inner Loop GP                | 1,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 13        | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 187               | 1,015                    | 50            | 322       | 204       | 783       | 207       | 770       | 106       | 621       | 1,015                    | 39                         | 277       | 57        | 376       | 49        | 362       | 35        | 326       |
| I-495 Outer Loop GP Off-Ramp to MD 187 NB            | 1,250                    | 5             | 167       | 190       | 911       | 243       | 976       | 131       | 790       | 1,250                    | 0                          | 22        | 1         | 80        | 3         | 142       | 2         | 114       |
| MD 187 On-Ramp to I-495 Outer Loop GP                | 1,000                    | 0             | 0         | 33        | 458       | 453       | 685       | 248       | 603       | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 190/Cabin John Parkway                   |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Cabin John Pkwy GP ramp to MD-190                    | 770                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,630                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop GP       | 1,230                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to Cabin John Pkwy      | 1,140                    | 0             | 0         | 0         | 0         | 6         | 268       | 7         | 240       | 850                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Outer Loop GP             | 1,180                    | 0             | 0         | 0         | 45        | 1,183     | 1,738     | 1,330     | 1,738     | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 WB On-Ramp to I-495 Outer Loop GP             | 990                      | 0             | 0         | 37        | 453       | 127       | 772       | 42        | 538       | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 190               | 850                      | 26            | 114       | 121       | 1,078     | 85        | 1,036     | 49        | 323       | 1,040                    | 31                         | 130       | 38        | 158       | 28        | 127       | 29        | 134       |
| I-495 Inner Loop GP Off-Ramp to MD 190               | 1,675                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 590                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Inner Loop GP             | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 72        | 1,100                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD-190 WB On-Ramp to I-495 Inner Loop GP             | 2,100                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 72        | 1,480                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML Off-Ramp to MD 190               | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,320                    | 12                         | 100       | 14        | 102       | 9         | 80        | 9         | 76        |
| I-495 Inner Loop ML Off-Ramp to MD 190               | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 1                          | 54        | 2         | 63        | 1         | 47        | 1         | 61        |
| MD-190 On-Ramp to I-495 Outer Loop ML                | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,230                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 On-Ramp to I-495 Inner Loop ML                | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,130                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML Off-Ramp to Cabin John Pkwy      | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop ML       | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 800                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at Clara Barton Parkway                        |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to Clara Barton Pkwy EB | 2,670                    | 0             | 0         | 0         | 32        | 0         | 32        | 0         | 0         | 2,350                    | 0                          | 0         | 0         | 46        | 0         | 38        | 0         | 0         |
| I-495 Inner Loop GP Off-Ramp to Clara Barton Pkwy WB | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,240                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton Pkwy EB On-Ramp to I-495 Inner Loop GP  | 2,950                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,870                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to Clara Barton Pkwy WB | 1,500                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton EB On-Ramp to I-495 Outer Loop GP       | 1,550                    | 0             | 0         | 0         | 0         | 0         | 42        | 0         | 0         | 1,600                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton WB On-Ramp to I-495 Outer Loop GP       | 2,160                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,110                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Table 6-13: AM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)**

| Ramp Location                                    | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-495 at George Washington Parkway               |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to GWMP             | 1,230                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,810                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Inner Loop GP           | 2,200                    | 0             | 0         | 926       | 2,635     | 2,799     | 4,551     | 4,196     | 4,553     | 2,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to GWMP             | 3,260                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,200                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop ML Off-Ramp to GWMP             | 1,740                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,510                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Outer Loop ML           | 2,400                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 750                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Outer Loop C-D          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,580                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML ramp to I-495 Outer Loop C-D | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop GP ramp to I-495 Inner Loop ML  | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 840                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Inner Loop ML           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 400                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at VA 193                                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to VA 193           | 1,130                    | 19            | 179       | 231       | 1,319     | 96        | 1,065     | 52        | 469       | 1,130                    | 15                         | 95        | 69        | 468       | 43        | 317       | 37        | 178       |
| VA 193 NB On-Ramp to I-495 Inner Loop GP         | 1,050                    | 0             | 98        | 5         | 279       | 101       | 590       | 21        | 374       | 1,050                    | 0                          | 46        | 0         | 64        | 1         | 176       | 0         | 67        |
| I-495 Outer Loop GP slip ramp to VA 193          | 700                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 1,170                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,170                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 900                      | 44            | 243       | 54        | 339       | 47        | 325       | 57        | 304       | 900                      | 45                         | 260       | 77        | 336       | 58        | 338       | 61        | 324       |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

Table 6-14: PM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative

| Ramp Location                             | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|---|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|   |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|   |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 117                           |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 117 EB On-Ramp to I-270 SB             | 1,920                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,920                    | 0                          | 0         | 0         | 0         | 0         | 15        | 0         | 0         |
| MD 117 WB On-Ramp to I-270 SB             | 1,490                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,490                    | 0                          | 0         | 0         | 0         | 0         | 15        | 0         | 0         |
| I-270 NB GP Off-Ramp to MD 117            | 1,300                    | 113           | 410       | 84        | 444       | 46        | 333       | 142       | 538       | 1,300                    | 120                        | 405       | 209       | 553       | 80        | 420       | 128       | 418       |
| I-270 at I-370                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 370 EB On-Ramp to I-270 SB GP          | 2,340                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB GP          | 3,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 2,940                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB Off-Ramp to I-370 EB             | 6,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 6,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 EB          | 2,300                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,220                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 EB On-Ramp to I-270 NB GP           | 2,400                    | 2             | 61        | 1,006     | 2,880     | 5,312     | 6,083     | 6,045     | 6,084     | 1,400                    | 0                          | 0         | 0         | 0         | 263       | 778       | 377       | 776       |
| I-370 WB On-Ramp to I-270 NB GP           | 2,780                    | 111           | 705       | 2,713     | 4,650     | 4,493     | 4,650     | 4,333     | 4,652     | 2,800                    | 0                          | 0         | 0         | 0         | 721       | 1,868     | 1,387     | 1,869     |
| I-270 SB Off-Ramp to I-370 WB             | 2,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,900                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 WB          | 3,320                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 3,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 EB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 2,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to I-370 EB GP       | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 3,700                    | 0                          | 0         | 0         | 0         | 174       | 1,113     | 2,344     | 3,396     |
| I-370 WB at I-270 NB ML off-ramp          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 5,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Shady Grove Road                 |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Shady Grove Rd EB On-Ramp to I-270 SB GP  | 1,120                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 920                      | 1                          | 139       | 5         | 216       | 5         | 241       | 1         | 138       |
| Shady Grove Rd EB On-Ramp to I-270 NB GP  | 1,650                    | 0             | 0         | 719       | 3,125     | 3,156     | 3,977     | 3,252     | 3,979     | 1,650                    | 0                          | 0         | 0         | 64        | 0         | 32        | 445       | 792       |
| I-270 NB GP Off-Ramp to Shady Grove Rd EB | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,850                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to Shady Grove Rd WB | 1,600                    | 63            | 214       | 54        | 202       | 35        | 189       | 25        | 164       | 1,700                    | 46                         | 164       | 37        | 163       | 32        | 145       | 15        | 120       |
| Shady Grove Rd WB On-Ramp to I-270 NB GP  | 1,150                    | 0             | 0         | 622       | 1,864     | 1,745     | 1,867     | 1,431     | 1,867     | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 25        | 284       |
| Shady Grove Rd WB On-Ramp to I-270 SB     | 1,600                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to Shady Grove Rd    | 1,250                    | 60            | 232       | 55        | 215       | 50        | 186       | 50        | 212       | 1,250                    | 60                         | 208       | 58        | 207       | 62        | 214       | 58        | 216       |
| I-270 at Gude Drive                       |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,860                    | 55                         | 288       | 52        | 272       | 47        | 219       | 53        | 265       |
| I-270 NB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,400                    | 104                        | 484       | 91        | 415       | 81        | 401       | 83        | 515       |
| Gude Dr On-Ramp to I-270 ML NB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Gude Dr On-Ramp to I-270 ML SB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,780                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

Table 6-14: PM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)

| Ramp Location                          | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 28                         |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 28 EB On-Ramp to I-270 SB GP        | 1,950                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,950                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 28 EB On-Ramp to I-270 NB GP        | 1,050                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 950                      | 0                          | 0         | 0         | 0         | 1         | 46        | 29        | 155       |
| I-270 NB GP Off-Ramp to MD 28          | 1,040                    | 58            | 276       | 60        | 297       | 56        | 335       | 84        | 372       | 900                      | 52                         | 252       | 46        | 244       | 49        | 255       | 40        | 242       |
| MD 28 WB On-Ramp to I-270 NB GP        | 1,370                    | 1,095         | 1,822     | 1,630     | 2,402     | 2,066     | 2,404     | 1,908     | 2,404     | 1,370                    | 0                          | 0         | 166       | 468       | 1,365     | 2,349     | 2,061     | 2,340     |
| I-270 NB GP Off-Ramp to MD 28 WB       | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 13        | 0         | 25        |
| MD 28 WB On-Ramp to I-270 SB GP        | 1,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 950                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to MD 28          | 900                      | 20            | 175       | 28        | 215       | 21        | 188       | 25        | 219       | 1,400                    | 17                         | 155       | 21        | 217       | 27        | 214       | 22        | 196       |
| I-270 at MD 189                        |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 189 WB On-Ramp to I-270 NB          | 1,080                    | 227           | 791       | 388       | 987       | 737       | 1,403     | 448       | 1,092     | 1,140                    | 6                          | 149       | 20        | 226       | 159       | 964       | 815       | 1,433     |
| MD 189 EB On-Ramp to I-270 NB          | 910                      | 222           | 724       | 361       | 906       | 629       | 1,561     | 422       | 1,080     | 910                      | 0                          | 29        | 2         | 84        | 135       | 950       | 778       | 1,806     |
| I-270 NB GP Off-Ramp to MD 189 WB      | 720                      | 22            | 125       | 24        | 115       | 21        | 132       | 19        | 122       | 630                      | 12                         | 77        | 13        | 81        | 13        | 84        | 9         | 110       |
| I-270 NB GP Off-Ramp to MD 189 EB      | 920                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 760                      | 9                          | 124       | 9         | 104       | 8         | 133       | 12        | 341       |
| MD 189 WB On-Ramp to I-270 SB GP       | 1,910                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,890                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 189 EB On-Ramp to I-270 SB GP       | 2,060                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,070                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to MD 189 EB      | 900                      | 55            | 271       | 56        | 304       | 64        | 349       | 73        | 381       | 870                      | 4                          | 74        | 4         | 67        | 5         | 91        | 8         | 165       |
| I-270 SB GP Off-Ramp to MD 189 WB      | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,120                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Wootton Parkway               |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 NB ML Off-Ramp to Wootton Pkwy   | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 23                         | 174       | 29        | 195       | 27        | 186       | 17        | 129       |
| I-270 SB ML Off-Ramp to Wootton Pkwy   | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,570                    | 23                         | 166       | 24        | 187       | 23        | 172       | 30        | 183       |
| Wootton Pkwy On-Ramp to I-270 NB ML    | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 3,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Wootton Pkwy On-Ramp to I-270 SB ML    | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Montrose Road                 |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Montrose Rd EB On-Ramp to I-270 SB GP  | 1,960                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,910                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to Montrose Rd EB | 1,340                    | 0             | 0         | 0         | 0         | 36        | 344       | 82        | 509       | 1,220                    | 0                          | 0         | 0         | 0         | 0         | 0         | 57        | 638       |
| Montrose Rd EB On-Ramp to I-270 NB GP  | 1,150                    | 0             | 0         | 0         | 0         | 71        | 327       | 222       | 321       | 1,000                    | 0                          | 0         | 0         | 0         | 44        | 413       | 1,058     | 1,352     |
| I-270 NB GP Off-Ramp Montrose Rd EB    | 1,980                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,870                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Montrose Rd WB On-Ramp to I-270 NB GP  | 1,950                    | 0             | 0         | 0         | 116       | 2,267     | 4,003     | 1,463     | 3,992     | 1,870                    | 57                         | 769       | 722       | 2,562     | 2,837     | 3,812     | 3,792     | 3,868     |
| I-270 NB Off-Ramp to Montrose Rd WB    | 1,520                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,320                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Montrose Rd WB On-Ramp to I-270 SB GP  | 1,200                    | 0             | 0         | 0         | 0         | 0         | 5         | 16        | 182       | 1,100                    | 0                          | 8         | 0         | 35        | 0         | 4         | 0         | 0         |
| I-270 SB GP Off-Ramp to Montrose Rd WB | 1,600                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

Highlighted cells indicate locations where average or maximum queue lengths exceed available storage



Table 6-14: PM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)

| Ramp Location  | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 187 / Rockledge Drive                    |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB East Spur Off-Ramp to Rockledge Dr / MD 187 | 1,700                    | 1             | 61        | 1         | 78        | 1         | 79        | 1         | 52        | 1,400                    | 1                          | 75        | 2         | 93        | 28        | 265       | 2         | 91        |
| I-270 NB East Spur Off-Ramp to MD 187 SB             | 915                      | 27            | 184       | 40        | 208       | 14        | 144       | 11        | 119       | 720                      | 34                         | 143       | 34        | 142       | 17        | 99        | 14        | 102       |
| I-270 NB East Spur Off-Ramp to MD 187 NB             | 1,050                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 900                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 East Spur NB Off-Ramp to Rockledge Dr          | 960                      | 0             | 0         | 0         | 0         | 212       | 536       | 289       | 526       | 890                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 187 On-Ramp to I-270 East Spur SB                 | 780                      | 0             | 0         | 0         | 0         | 17        | 119       | 1         | 59        | 580                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Rockledge Dr / MD 187 On-Ramp to I-270 NB East Spur  | 1,300                    | 0             | 35        | 1         | 142       | 724       | 1,651     | 1,502     | 1,804     | 1,050                    | 7                          | 383       | 13        | 465       | 13        | 504       | 616       | 1,386     |
| I-270 at Westlake Terrace                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Westlake Terrace             | 1,550                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,440                    | 18                         | 197       | 27        | 237       | 23        | 237       | 22        | 239       |
| Westlake Terrace On-Ramp to I-270 NB ML              | 1,350                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,470                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to Westlake Terrace             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,850                    | 5                          | 117       | 9         | 153       | 7         | 145       | 6         | 118       |
| Westlake Terrace On-Ramp to I-270 SB ML              | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Democracy Boulevard                         |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 NB GP Off-Ramp to Democracy Blvd WB            | 1,330                    | 19            | 108       | 19        | 121       | 10        | 93        | 12        | 92        | 1,270                    | 33                         | 151       | 25        | 127       | 17        | 116       | 25        | 132       |
| I-270 NB GP Off-Ramp to Democracy Blvd EB            | 1,550                    | 25            | 114       | 30        | 143       | 24        | 152       | 20        | 127       | 1,450                    | 32                         | 140       | 26        | 125       | 30        | 177       | 25        | 131       |
| Democracy Blvd EB On-Ramp to I-270 West Spur GP NB   | 1,215                    | 0             | 0         | 0         | 0         | 3         | 51        | 3         | 43        | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 8         | 105       |
| Democracy Blvd WB On-Ramp to I-270 West Spur GP NB   | 1,680                    | 0             | 0         | 0         | 0         | 382       | 1,015     | 797       | 1,017     | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 52        | 402       |
| I-270 West Spur SB Off-Ramp to Democracy Blvd GP EB  | 1,300                    | 28            | 140       | 36        | 165       | 49        | 199       | 33        | 157       | 1,140                    | 30                         | 129       | 38        | 159       | 55        | 230       | 35        | 163       |
| I-270 West Spur GP SB Off-Ramp to Democracy Blvd WB  | 1,430                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Democracy Blvd On-Ramp to I-495 Outer Loop GP        | 1,130                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 355                                      |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 East Spur SB Off-Ramp to MD 355 SB             | 1,940                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,940                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop Off-Ramp to MD 355 SB               | 2,300                    | 77            | 286       | 56        | 217       | 39        | 202       | 90        | 373       | 2,300                    | 92                         | 344       | 63        | 238       | 63        | 265       | 96        | 454       |
| MD 355 NB On-Ramp to I-495 Inner Loop                | 875                      | 0             | 0         | 0         | 5         | 0         | 0         | 0         | 0         | 875                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 SB On-Ramp to I-495 Inner Loop                | 2,160                    | 0             | 0         | 0         | 0         | 2         | 123       | 0         | 0         | 2,160                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop Off-Ramp to MD 355 NB               | 1,360                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB On-Ramp to I-495 Outer Loop                | 1,360                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB ramp to I-270 East Spur NB                 | 1,450                    | 0             | 0         | 2         | 140       | 2,471     | 4,322     | 4,225     | 4,328     | 1,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 1,146     | 3,361     |

Highlighted cells indicate locations where average or maximum queue lengths exceed available storage


Table 6-14: PM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)

| Ramp Location  | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-495 at MD 187                                      |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to MD 187 NB            | 950                      | 38            | 234       | 39        | 280       | 23        | 256       | 785       | 2,882     | 950                      | 33                         | 319       | 34        | 386       | 31        | 391       | 67        | 586       |
| I-495 Inner Loop GP Off-Ramp to MD 187 SB            | 1,030                    | 1             | 85        | 0         | 48        | 0         | 69        | 23        | 403       | 1,030                    | 1                          | 110       | 1         | 75        | 1         | 123       | 1         | 100       |
| MD 187 On-Ramp to I-495 Inner Loop GP                | 1,000                    | 0             | 0         | 1         | 32        | 58        | 426       | 1         | 39        | 1,000                    | 0                          | 0         | 0         | 0         | 4         | 165       | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 187               | 1,015                    | 53            | 423       | 54        | 398       | 68        | 443       | 21        | 190       | 1,015                    | 23                         | 237       | 20        | 251       | 26        | 276       | 30        | 306       |
| I-495 Outer Loop GP Off-Ramp to MD 187 NB            | 1,250                    | 39            | 433       | 121       | 610       | 98        | 617       | 3         | 101       | 1,250                    | 2                          | 85        | 8         | 200       | 8         | 184       | 3         | 159       |
| MD 187 On-Ramp to I-495 Outer Loop GP                | 1,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 190/Cabin John Parkway                   |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Cabin John Pkwy GP ramp to MD-190                    | 770                      | 0             | 0         | 1         | 139       | 250       | 553       | 483       | 894       | 1,630                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop GP       | 1,230                    | 2,169         | 2,515     | 2,232     | 2,516     | 2,338     | 2,517     | 2,381     | 2,520     | 1,000                    | 0                          | 0         | 18        | 447       | 490       | 1,611     | 400       | 1,555     |
| I-495 Outer Loop GP Off-Ramp to Cabin John Pkwy      | 1,140                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 850                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Outer Loop GP             | 1,180                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 WB On-Ramp to I-495 Outer Loop GP             | 990                      | 20            | 219       | 0         | 23        | 0         | 0         | 0         | 27        | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 190               | 850                      | 59            | 268       | 60        | 362       | 56        | 342       | 34        | 138       | 1,040                    | 30                         | 122       | 27        | 122       | 31        | 134       | 26        | 113       |
| I-495 Inner Loop GP Off-Ramp to MD 190               | 1,675                    | 0             | 0         | 0         | 60        | 1         | 143       | 0         | 42        | 590                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Inner Loop GP             | 1,750                    | 890           | 1,539     | 1,081     | 1,682     | 1,602     | 2,249     | 1,696     | 2,240     | 1,100                    | 0                          | 0         | 124       | 786       | 834       | 1,017     | 782       | 943       |
| MD-190 WB On-Ramp to I-495 Inner Loop GP             | 2,100                    | 1,561         | 2,902     | 2,090     | 2,916     | 2,718     | 2,988     | 2,729     | 2,988     | 1,480                    | 0                          | 0         | 227       | 1,676     | 1,967     | 2,140     | 1,903     | 2,140     |
| I-495 Outer Loop ML Off-Ramp to MD 190               | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,320                    | 25                         | 130       | 29        | 140       | 24        | 125       | 23        | 129       |
| I-495 Inner Loop ML Off-Ramp to MD 190               | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 25                         | 123       | 28        | 162       | 34        | 143       | 30        | 152       |
| MD-190 On-Ramp to I-495 Outer Loop ML                | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,230                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 On-Ramp to I-495 Inner Loop ML                | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,130                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML Off-Ramp to Cabin John Pkwy      | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop ML       | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 800                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at Clara Barton Parkway                        |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to Clara Barton Pkwy EB | 2,670                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,350                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop GP Off-Ramp to Clara Barton Pkwy WB | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,240                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton Pkwy EB On-Ramp to I-495 Inner Loop GP  | 2,950                    | 0             | 0         | 0         | 9         | 1         | 62        | 1         | 63        | 2,870                    | 0                          | 0         | 0         | 0         | 40        | 366       | 47        | 387       |
| I-495 Outer Loop GP Off-Ramp to Clara Barton Pkwy WB | 1,500                    | 0             | 0         | 0         | 0         | 0         | 6         | 0         | 0         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton EB On-Ramp to I-495 Outer Loop GP       | 1,550                    | 0             | 0         | 4         | 190       | 4         | 227       | 0         | 28        | 1,600                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton WB On-Ramp to I-495 Outer Loop GP       | 2,160                    | 0             | 30        | 1,257     | 3,632     | 2,652     | 3,902     | 818       | 2,465     | 2,110                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

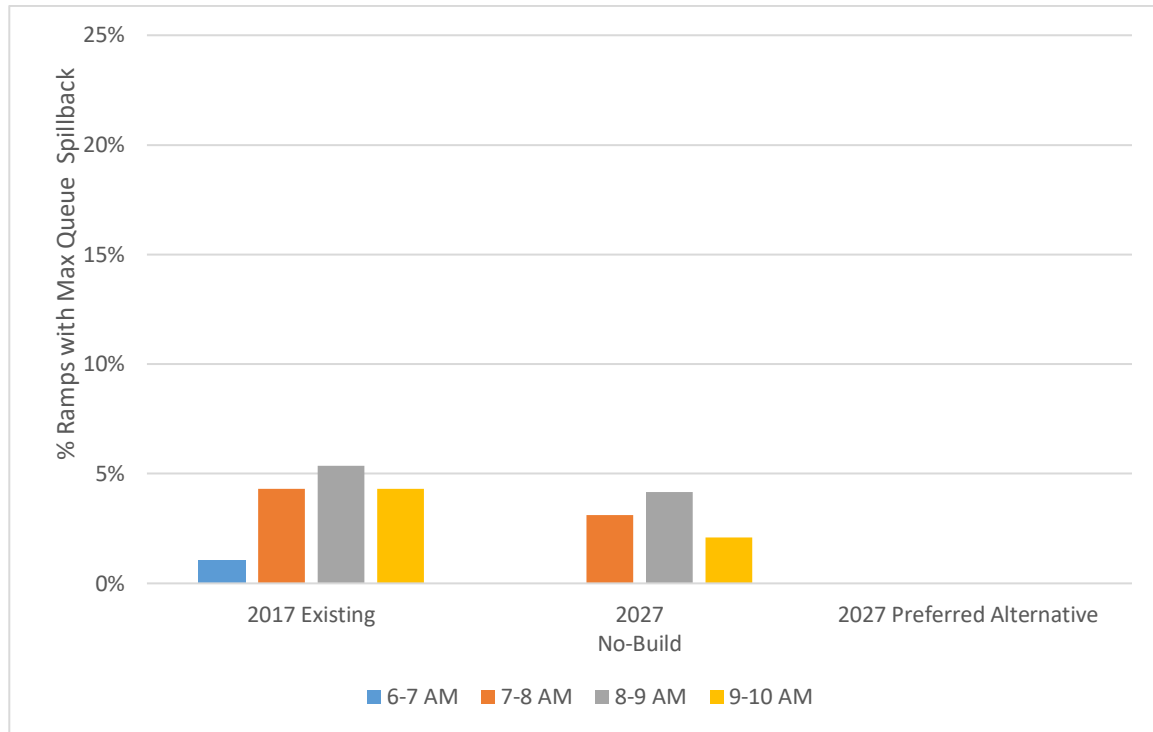
Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Table 6-14: PM Peak Period Ramp Queues – 2027 No Build and Preferred Alternative (Continued)**

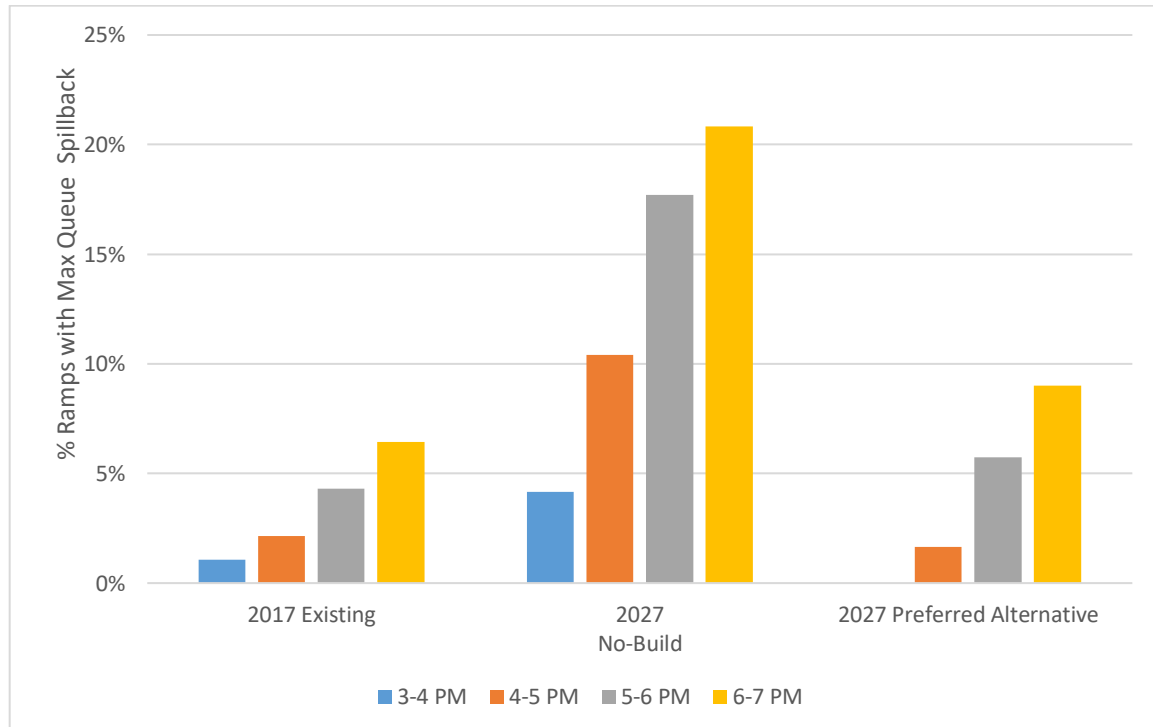
| Ramp Location                                    | Available Storage (feet) | 2027 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2027 Preferred Alternative |           |           |           |           |           |           |           |  |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--|
|  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |  |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |  |
| I-495 at George Washington Parkway               |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |  |
| I-495 Inner Loop GP Off-Ramp to GWMP             | 1,230                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,810                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| GWMP WB On-Ramp to I-495 Inner Loop GP           | 2,200                    | 1,020         | 3,633     | 2,526     | 4,549     | 3,210     | 4,554     | 4,304     | 4,555     | 2,000                    | 0                          | 0         | 0         | 0         | 1,753     | 4,332     | 3,699     | 4,341     |  |
| I-495 Outer Loop GP Off-Ramp to GWMP             | 3,260                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,200                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| I-495 Inner Loop ML Off-Ramp to GWMP             | 1,740                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,510                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| GWMP WB On-Ramp to I-495 Outer Loop ML           | 2,400                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| I-495 Outer Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 750                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| GWMP WB On-Ramp to I-495 Outer Loop C-D          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,580                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| I-495 Outer Loop ML ramp to I-495 Outer Loop C-D | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| I-495 Inner Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| I-495 Inner Loop GP ramp to I-495 Inner Loop ML  | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 840                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| GWMP WB On-Ramp to I-495 Inner Loop ML           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 400                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| I-495 at VA 193                                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |  |
| I-495 Inner Loop GP Off-Ramp to VA 193           | 1,130                    | 9             | 70        | 15        | 110       | 11        | 99        | 8         | 154       | 1,130                    | 8                          | 68        | 11        | 88        | 14        | 99        | 11        | 168       |  |
| VA 193 NB On-Ramp to I-495 Inner Loop GP         | 1,050                    | 14            | 251       | 1,581     | 2,101     | 2,264     | 2,649     | 2,630     | 2,664     | 1,050                    | 0                          | 6         | 0         | 0         | 209       | 1,718     | 2,111     | 2,650     |  |
| I-495 Outer Loop GP slip ramp to VA 193          | 700                      | 0             | 0         | 0         | 0         | 65        | 484       | 1,563     | 4,838     | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 1,170                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,170                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |  |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 900                      | 32            | 240       | 31        | 268       | 135       | 621       | 656       | 890       | 900                      | 38                         | 276       | 33        | 278       | 47        | 317       | 43        | 282       |  |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Figure 6-30: 2027 AM No Build vs Preferred Alternative Ramp Queue Spillback**



**Figure 6-31: 2027 PM No Build vs Preferred Alternative Ramp Queue Spillback**



#### 6.4.2.7 Summary of 2027 Operational Analysis Results

As shown, with the Preferred Alternative, speeds, densities, and LOS are improved throughout the network. The Preferred Alternative also serves more vehicles in the study area during the entire AM and PM peak periods. However, serving significantly more vehicles while experiencing congestion due to external constraints (i.e., bottlenecks outside of the study area that impact operations within the study area), may result in operational repercussions at vulnerable areas within the study area.

During the AM peak period, the most significant LOS improvements include: the I-495 Outer Loop lane-miles of LOS 'F' reduction from 33% (approximately 52 lane-miles) under No Build conditions to 3% (approximately 4 lane-miles) with the Preferred Alternative; and the I-270 Southbound lane-miles with LOS 'D' or better increasing from 79% (approximately 223 lane-miles) to 83% (approximately 263 lane-miles) while reducing those of LOS 'F' from 11% (approximately 30 lane-miles) to 8% (approximately 26 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively.

During the PM peak period, most significant LOS improvements include: the I-495 Outer Loop lane-miles of LOS 'F' reduction from 25% (approximately 40 lane-miles) under No Build conditions to 6% (approximately 10 lane-miles) with the Preferred Alternative; and the I-270 Northbound lane-miles with LOS 'D' or better increasing from 32% (approximately 98 lane-miles) to 47% (approximately 149 lane-miles) while reducing those of LOS 'F' from 59% (approximately 178 lane-miles) to 46% (approximately 146 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Under both No Build and Preferred Alternative PM peak period conditions, existing bottlenecks at locations outside of the study area become exacerbated, such as along I-270 Northbound from I-370 to MD 124; from MD 109 to MD 121; I-495 Inner Loop from MD 185 to MD 97; and from I-95 to MD 201. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

Overall travel times improve in the General Purpose Lanes under the Preferred Alternative conditions, with greater reductions in travel times along the HOT lanes. During both the AM and PM peak periods, the most significant travel time savings occur along the I-495 Outer Loop, particularly in the 8-10 AM and 5-7 PM peak hours for both the General Purpose and HOT lanes, respectively.

The AM and PM Preferred Alternative increases throughputs throughout the project limits when compared to the 2027 No Build conditions, with the highest increase along I-495 Inner Loop and I-270 Northbound between the I-270 West Spur and the MD 187 interchange. When compared to 2017 Existing conditions, the 2027 Preferred Alternative has increased total throughput at all key locations during the four-hour AM peak period. Like the AM, all key locations have increased total throughput during the four-hour PM peak period, except for the I-270 Northbound segment between the Shady Grove Road and I-370 interchanges; this degradation is caused by increased throughput more quickly reaching the existing bottleneck north of I-370 (outside the study area) in the first two hours of the PM peak period.

The Preferred Alternative improves queue spillback compared to No Build conditions at ramps throughout the study area, improving queue lengths at over 45 ramp locations over the AM/PM peak periods, eliminating all ramp spillback during the AM peak period, and removing 7 ramp spillback locations that occur under PM 2027 No Build conditions. The remaining spillback locations that occur under PM conditions are due to existing bottlenecks along I-270 Northbound and I-495 Inner Loop that occur outside the study area and become exacerbated under future conditions.

### 6.4.3 2045 No Build vs Preferred Alternative Conditions

The following subsections summarize and compare the 2045 No Build and the Preferred Alternative conditions with references to 2017 Existing conditions, at both the system-wide and segment levels. Like the previously discussed 2027 comparisons, the various VISSIM microsimulation performance metrics for the 2045 comparison purposes include:

- Network Performance and Latent Demand/Delay
- Throughput
- Freeway Density and LOS
- Freeway Speeds
- Freeway Travel Times
- Ramp Queue Spillback

#### 6.4.3.1 Network Performance Analysis

As previously discussed, latent demand is a critical metric when comparing heavily congested scenarios. Because these unserved vehicles are not quantified as part of network-based performance metrics, operational comparisons may be skewed for each analysis hour with many unserved vehicles. For example, travel times and speeds may appear better for one scenario but only because the number of vehicles contributing to these metrics is significantly lower than that of another scenario.

When comparing 2045 No Build and Preferred Alternative conditions, **Table 6-15** captures the significant differences in latent demand, particularly during the 5-7 PM hours. The No Build has between 40,000 and 65,000 unserved vehicles during these latter PM hours whereas the Preferred Alternative has approximately half of the No Build latent demand. One major vehicle input into the study area network is I-495 Inner Loop at the VA 193 interchange, which feeds both I-495 and I-270. At the end of the AM and PM peak periods under No Build conditions, this input has approximately 900 and 3,600 unserved vehicles, respectively. The Preferred Alternative has no unserved vehicles at the end of the AM peak period and only approximately 700 unserved vehicles at the end of the PM peak period.

As shown, the Preferred Alternative serves more vehicles in the study area during the entire AM and PM peak periods, except for the 6-7 AM hour. Serving significantly more vehicles while experiencing congestion due to external constraints (i.e., bottlenecks outside of the study area that impact operations within the study area), may result in operational repercussions at vulnerable areas within the study area.

**Table 6-15: 2045 Network Performance Metrics Comparison**

| Hour                  | Scenario                     | Latent Demand (vehicles) | Total Delay (hours) | Latent Delay (hours) | Total Delay + Latent Delay (hours) | Speed (mph) | Total Travel Time (hours) |
|-----------------------|------------------------------|--------------------------|---------------------|----------------------|------------------------------------|-------------|---------------------------|
| <b>AM Peak Period</b> |                              |                          |                     |                      |                                    |             |                           |
| <b>6-7 AM</b>         | <b>No Build</b>              | 6340                     | 12712               | 3192                 | 15904                              | 33          | 33136                     |
|                       | <b>Preferred Alternative</b> | 6752                     | 12039               | 3558                 | 15597                              | 35          | 32863                     |
|                       | <b>Network Benefit</b>       | <b>-412</b>              | <b>673</b>          | <b>-366</b>          | <b>307</b>                         | <b>2</b>    | <b>273</b>                |
| <b>7-8 AM</b>         | <b>No Build</b>              | 25373                    | 23288               | 15551                | 38839                              | 26          | 44700                     |
|                       | <b>Preferred Alternative</b> | 25050                    | 22802               | 15095                | 37897                              | 27          | 44745                     |
|                       | <b>Network Benefit</b>       | <b>323</b>               | <b>486</b>          | <b>456</b>           | <b>942</b>                         | <b>1</b>    | <b>-45</b>                |
| <b>8-9 AM</b>         | <b>No Build</b>              | 49704                    | 30904               | 37078                | 67982                              | 22          | 51891                     |
|                       | <b>Preferred Alternative</b> | 44647                    | 27587               | 34713                | 62300                              | 24          | 49838                     |
|                       | <b>Network Benefit</b>       | <b>5057</b>              | <b>3317</b>         | <b>2365</b>          | <b>5682</b>                        | <b>2</b>    | <b>2053</b>               |
| <b>9-10 AM</b>        | <b>No Build</b>              | 62789                    | 30367               | 55664                | 86031                              | 22          | 51244                     |
|                       | <b>Preferred Alternative</b> | 53972                    | 23398               | 48830                | 72228                              | 27          | 45611                     |
|                       | <b>Network Benefit</b>       | <b>8817</b>              | <b>6969</b>         | <b>6834</b>          | <b>13803</b>                       | <b>5</b>    | <b>5633</b>               |
| <b>PM Peak Period</b> |                              |                          |                     |                      |                                    |             |                           |
| <b>3-4 PM</b>         | <b>No Build</b>              | 5041                     | 12473               | 2840                 | 15313                              | 34          | 36416                     |
|                       | <b>Preferred Alternative</b> | 1691                     | 9651                | 861                  | 10512                              | 38          | 34685                     |
|                       | <b>Network Benefit</b>       | <b>3350</b>              | <b>2822</b>         | <b>1979</b>          | <b>4801</b>                        | <b>4</b>    | <b>1731</b>               |
| <b>4-5 PM</b>         | <b>No Build</b>              | 15715                    | 22733               | 9600                 | 32333                              | 27          | 46362                     |
|                       | <b>Preferred Alternative</b> | 7620                     | 16615               | 4269                 | 20884                              | 32          | 41779                     |
|                       | <b>Network Benefit</b>       | <b>8095</b>              | <b>6118</b>         | <b>5331</b>          | <b>11449</b>                       | <b>5</b>    | <b>4583</b>               |
| <b>5-6 PM</b>         | <b>No Build</b>              | 42028                    | 34847               | 27440                | 62287                              | 20          | 56886                     |
|                       | <b>Preferred Alternative</b> | 18770                    | 25166               | 12417                | 37583                              | 26          | 49683                     |
|                       | <b>Network Benefit</b>       | <b>23258</b>             | <b>9681</b>         | <b>15023</b>         | <b>24704</b>                       | <b>6</b>    | <b>7203</b>               |
| <b>6-7 PM</b>         | <b>No Build</b>              | 64860                    | 36865               | 53221                | 90086                              | 19          | 57619                     |
|                       | <b>Preferred Alternative</b> | 29749                    | 27445               | 24053                | 51498                              | 24          | 50665                     |
|                       | <b>Network Benefit</b>       | <b>35111</b>             | <b>9420</b>         | <b>29168</b>         | <b>38588</b>                       | <b>5</b>    | <b>6954</b>               |



### 6.4.3.2 Throughputs

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. Benefits of increased throughput on the highway include reduced peak spreading and reduced burden on the surrounding roadway network.

**Table 6-16 and Table 6-17** summarize freeway throughputs at key locations during the AM and PM peak periods, respectively, with a comparison to 2017 Existing and 2045 No Build conditions. **Figure 6-32 and Figure 6-33** provide graphical representations of the key locations to visually capture the differences between Existing, No Build, and Preferred Alternative conditions. **Appendix H** contains a summary of volumes by lane.

As shown in both summary tables and figures, the 2045 AM and PM Preferred Alternative increases throughputs throughout the project limits when compared to the 2045 No Build conditions. Also, as previously discussed, the Preferred Alternative serves approximately 10% and 55% more demand during the entire AM and PM peak periods, respectively, when compared to No Build conditions. The Preferred Alternative also has no unserved vehicles at the I-495 Inner Loop input in Virginia, which feeds both I-495 and I-270, at the end of the AM peak period and 80% less unserved vehicles at the end of the PM peak period.

For the AM peak period along I-495 Inner Loop and I-270 Northbound, throughput increases range from 11% to 19%, with the highest increase between the I-270 West Spur and the MD 187 interchange. Similarly, along I-495 Outer Loop and I-270 Southbound, the throughput increases also range from 11% to 19% along I-495 Outer Loop and I-270 Southbound, with highest increases between the I-270 West Spur and the MD 187 interchange as well as between the Clara Barton Parkway and George Washington Memorial Parkway interchanges.

For the PM peak period along I-495 Inner Loop and I-270 Northbound, throughput increases range from 14% to 27%, with the highest increase between the I-270 split and the Montrose Road interchange. The throughput increases range from 9% to 20% along I-495 Outer Loop and I-270 Southbound, with the highest increase between the MD 187 interchange and the I-270 West Spur, like the AM peak period.

When compared to 2017 Existing conditions, the 2045 Preferred Alternative has increased total throughput at all key locations during the four-hour AM peak period. Like the AM, all four I-495 Outer Loop and I-270 Southbound key locations have increased total throughput during the four-hour PM peak period. Two of the four I-495 Inner Loop and I-270 Northbound key locations have decreased throughput during the second or third hour within the PM peak period, which include: I-495 Inner Loop between the I-270 West Spur and MD 187 as well as I-270 Northbound between the Shady Grove Road and I-370 interchanges. This degradation is caused by increased throughput more quickly reaching the existing bottleneck north of I-370 (outside the study area) in the first two hours of the PM peak period. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of

congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

**Table 6-16: 2045 AM Throughput Comparison**

| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Inner Loop & I-270 Northbound Key Locations                 |          |          |                       |                       |       |                           |
| Between George Washington Memorial Parkway & Clara Barton Parkway |          |          |                       |                       |       |                           |
| 6-7 AM  | 7972     | 8705     | 2244                  | 7407                  | 9651  | 11%                       |
| 7-8 AM  | 8390     | 9141     | 2430                  | 8795                  | 11225 | 23%                       |
| 8-9 AM  | 8317     | 9157     | 2275                  | 8660                  | 10935 | 19%                       |
| 9-10 AM   | 8191     | 8952     | 2291                  | 8082                  | 10373 | 16%                       |
| AM Total  | 32870    | 35955    | 9240                  | 32944                 | 42184 | 17%                       |
| Between I-270 West Spur & MD 187                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 4286     | 4296     | 711                   | 4143                  | 4854  | 13%                       |
| 7-8 AM  | 4509     | 4498     | 829                   | 4631                  | 5460  | 21%                       |
| 8-9 AM  | 3930     | 3767     | 723                   | 3782                  | 4505  | 20%                       |
| 9-10 AM   | 3856     | 3603     | 816                   | 3615                  | 4431  | 23%                       |
| AM Total  | 16581    | 16164    | 3079                  | 16171                 | 19250 | 19%                       |
| Between I-270 Split & Montrose Road                               |          |          |                       |                       |       |                           |
| 6-7 AM  | 4475     | 5137     | 1419                  | 4203                  | 5622  | 9%                        |
| 7-8 AM  | 5588     | 6519     | 1544                  | 5564                  | 7108  | 9%                        |
| 8-9 AM  | 7874     | 8015     | 2001                  | 7374                  | 9375  | 17%                       |
| 9-10 AM   | 7496     | 7935     | 1900                  | 6879                  | 8779  | 11%                       |
| AM Total  | 25433    | 27606    | 6864                  | 24020                 | 30884 | 12%                       |
| Between Shady Grove Road & I-370                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 2588     | 3605     | 1016                  | 2916                  | 3932  | 9%                        |
| 7-8 AM  | 3535     | 4809     | 936                   | 4407                  | 5343  | 11%                       |
| 8-9 AM  | 4761     | 6090     | 1281                  | 5622                  | 6903  | 13%                       |
| 9-10 AM   | 4829     | 6082     | 1182                  | 5471                  | 6653  | 9%                        |
| AM Total  | 15713    | 20586    | 4415                  | 18416                 | 22831 | 11%                       |

**Table 6-16: 2045 AM Throughput Comparison (Continued)**

| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Outer Loop & I-270 Southbound Key Locations                 |          |          |                       |                       |       |                           |
| Between I-370 & Shady Grove Road                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 10566    | 10496    | 2330                  | 9134                  | 11464 | 9%                        |
| 7-8 AM  | 9787     | 9560     | 2348                  | 8219                  | 10567 | 11%                       |
| 8-9 AM  | 8862     | 8989     | 2561                  | 7498                  | 10059 | 12%                       |
| 9-10 AM   | 9506     | 9101     | 2626                  | 7465                  | 10091 | 11%                       |
| AM Total  | 38721    | 38146    | 9865                  | 32316                 | 42181 | 11%                       |
| Between Montrose Road & I-270 Split                               |          |          |                       |                       |       |                           |
| 6-7 AM  | 9707     | 10894    | 2700                  | 9643                  | 12343 | 13%                       |
| 7-8 AM  | 10203    | 11454    | 2743                  | 9938                  | 12681 | 11%                       |
| 8-9 AM  | 9818     | 10842    | 2859                  | 9398                  | 12257 | 13%                       |
| 9-10 AM   | 9639     | 9962     | 2867                  | 8407                  | 11274 | 13%                       |
| AM Total  | 39367    | 43152    | 11169                 | 37386                 | 48555 | 13%                       |
| Between MD 187 & I-270 West Spur                                  |          |          |                       |                       |       |                           |
| 6-7 AM  | 3830     | 3785     | 613                   | 3257                  | 3870  | 2%                        |
| 7-8 AM  | 4604     | 4027     | 728                   | 4116                  | 4844  | 20%                       |
| 8-9 AM  | 4073     | 3205     | 764                   | 3688                  | 4452  | 39%                       |
| 9-10 AM   | 4203     | 3639     | 549                   | 3661                  | 4210  | 16%                       |
| AM Total  | 16710    | 14656    | 2654                  | 14722                 | 17376 | 19%                       |
| Between Clara Barton Parkway & George Washington Memorial Parkway |          |          |                       |                       |       |                           |
| 6-7 AM  | 8202     | 8607     | 2684                  | 7159                  | 9843  | 14%                       |
| 7-8 AM  | 8873     | 8936     | 2602                  | 8397                  | 10999 | 23%                       |
| 8-9 AM  | 9254     | 8605     | 2812                  | 7915                  | 10727 | 25%                       |
| 9-10 AM   | 8693     | 8624     | 2840                  | 7077                  | 9917  | 15%                       |
| AM Total  | 35022    | 34772    | 10938                 | 30548                 | 41486 | 19%                       |

**Table 6-17: 2045 PM Throughput Comparison**

| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Inner Loop & I-270 Northbound Key Locations                 |          |          |                       |                       |       |                           |
| Between George Washington Memorial Parkway & Clara Barton Parkway |          |          |                       |                       |       |                           |
| 3-4 PM  | 8462     | 8487     | 3120                  | 6339                  | 9459  | 11%                       |
| 4-5 PM  | 7938     | 8667     | 3131                  | 6282                  | 9413  | 9%                        |
| 5-6 PM  | 7612     | 4640     | 2686                  | 3788                  | 6474  | 40%                       |
| 6-7 PM  | 8136     | 4780     | 2558                  | 4671                  | 7229  | 51%                       |
| PM Total  | 32148    | 26574    | 11495                 | 21080                 | 32575 | 23%                       |
| Between I-270 West Spur & MD 187                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 4172     | 4204     | 579                   | 4290                  | 4869  | 16%                       |
| 4-5 PM  | 3892     | 3075     | 550                   | 2553                  | 3103  | 1%                        |
| 5-6 PM  | 3449     | 1572     | 465                   | 2200                  | 2665  | 70%                       |
| 6-7 PM  | 3619     | 2988     | 491                   | 3610                  | 4101  | 37%                       |
| PM Total  | 15132    | 11839    | 2085                  | 12653                 | 14738 | 24%                       |
| Between I-270 Split & Montrose Road                               |          |          |                       |                       |       |                           |
| 3-4 PM  | 10824    | 11283    | 3519                  | 8888                  | 12407 | 10%                       |
| 4-5 PM  | 10770    | 11287    | 3599                  | 8553                  | 12152 | 8%                        |
| 5-6 PM  | 10862    | 7330     | 3352                  | 7614                  | 10966 | 50%                       |
| 6-7 PM  | 10603    | 4878     | 2950                  | 5717                  | 8667  | 78%                       |
| PM Total  | 43059    | 34778    | 13420                 | 30772                 | 44192 | 27%                       |
| Between Shady Grove Road & I-370                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 10653    | 10749    | 2913                  | 8536                  | 11449 | 7%                        |
| 4-5 PM  | 10469    | 8378     | 2847                  | 7874                  | 10721 | 28%                       |
| 5-6 PM  | 10112    | 6525     | 2394                  | 5446                  | 7840  | 20%                       |
| 6-7 PM  | 10021    | 8570     | 2461                  | 6478                  | 8939  | 4%                        |
| PM Total  | 41255    | 34222    | 10615                 | 28334                 | 38949 | 14%                       |

**Table 6-17: 2045 PM Throughput Comparison (Continued)**

| Time Interval   | Existing | No Build | Preferred Alternative |                       |       |                           |
|---|----------|----------|-----------------------|-----------------------|-------|---------------------------|
|   |          |          | HOT Lanes             | General Purpose Lanes | Total | Improvement from No Build |
| I-495 Outer Loop & I-270 Southbound Key Locations                 |          |          |                       |                       |       |                           |
| Between I-370 & Shady Grove Road                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 5578     | 7208     | 1714                  | 5751                  | 7465  | 4%                        |
| 4-5 PM  | 5806     | 7005     | 1847                  | 5944                  | 7791  | 11%                       |
| 5-6 PM  | 6307     | 6412     | 1960                  | 5974                  | 7934  | 24%                       |
| 6-7 PM  | 6102     | 7821     | 1878                  | 5844                  | 7722  | -1%                       |
| PM Total  | 23793    | 28446    | 7399                  | 23513                 | 30912 | 9%                        |
| Between Montrose Road & I-270 Split                               |          |          |                       |                       |       |                           |
| 3-4 PM  | 6721     | 7959     | 2513                  | 6660                  | 9173  | 15%                       |
| 4-5 PM  | 7215     | 8183     | 2771                  | 6957                  | 9728  | 19%                       |
| 5-6 PM  | 7487     | 6918     | 2767                  | 6673                  | 9440  | 36%                       |
| 6-7 PM  | 7277     | 8148     | 2602                  | 6166                  | 8768  | 8%                        |
| PM Total  | 28700    | 31208    | 10653                 | 26456                 | 37109 | 19%                       |
| Between MD 187 & I-270 West Spur                                  |          |          |                       |                       |       |                           |
| 3-4 PM  | 4469     | 4569     | 417                   | 4638                  | 5055  | 11%                       |
| 4-5 PM  | 4121     | 4226     | 429                   | 4307                  | 4736  | 12%                       |
| 5-6 PM  | 3898     | 3922     | 298                   | 4159                  | 4457  | 14%                       |
| 6-7 PM  | 3599     | 1748     | 277                   | 2790                  | 3067  | 75%                       |
| PM Total  | 16087    | 14465    | 1421                  | 15894                 | 17315 | 20%                       |
| Between Clara Barton Parkway & George Washington Memorial Parkway |          |          |                       |                       |       |                           |
| 3-4 PM  | 8034     | 9081     | 2281                  | 8229                  | 10510 | 16%                       |
| 4-5 PM  | 8107     | 8830     | 2155                  | 8345                  | 10500 | 19%                       |
| 5-6 PM  | 7742     | 8713     | 1950                  | 7903                  | 9853  | 13%                       |
| 6-7 PM  | 7865     | 7801     | 1881                  | 6771                  | 8652  | 11%                       |
| PM Total  | 31748    | 34425    | 8267                  | 31248                 | 39515 | 15%                       |

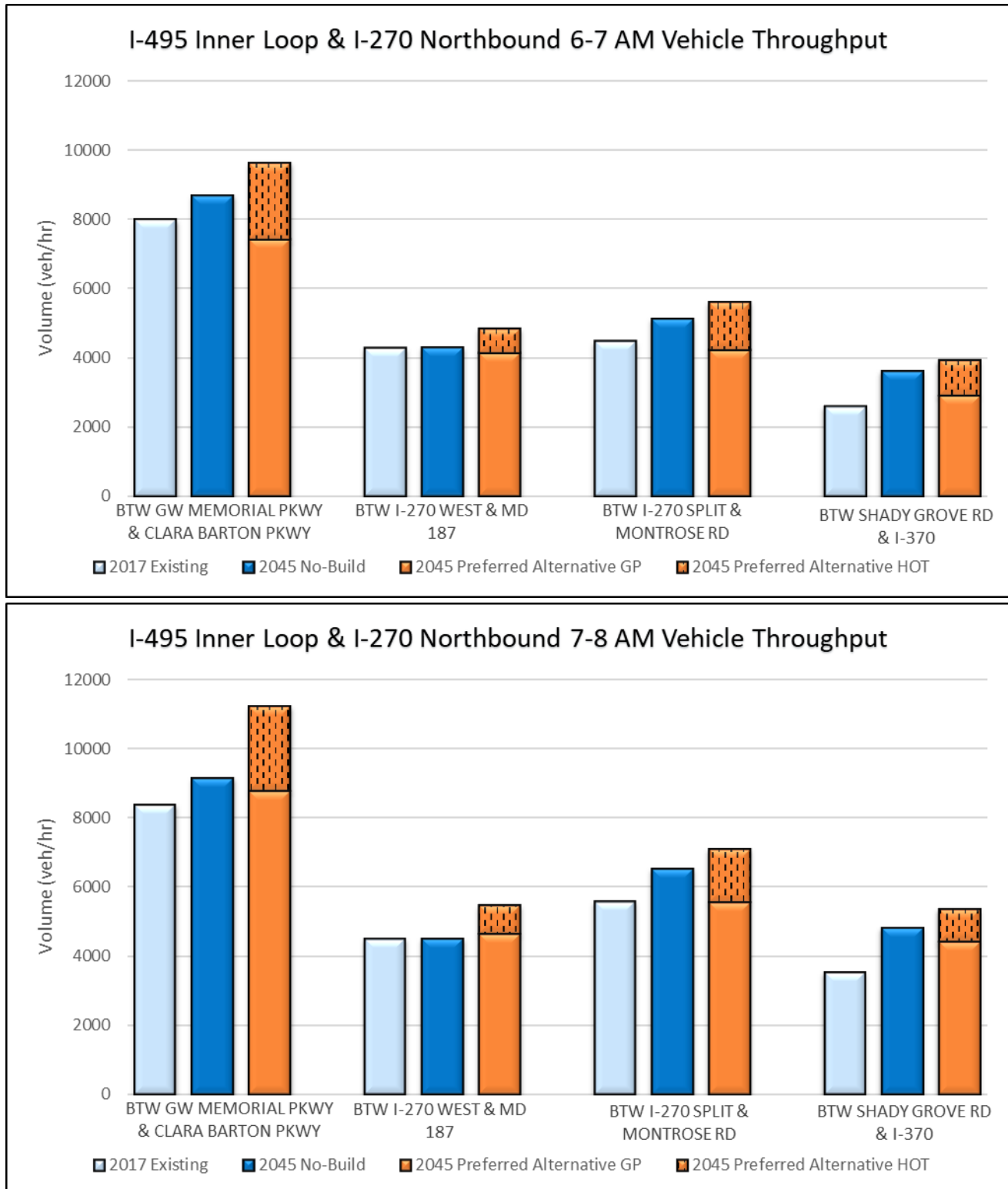
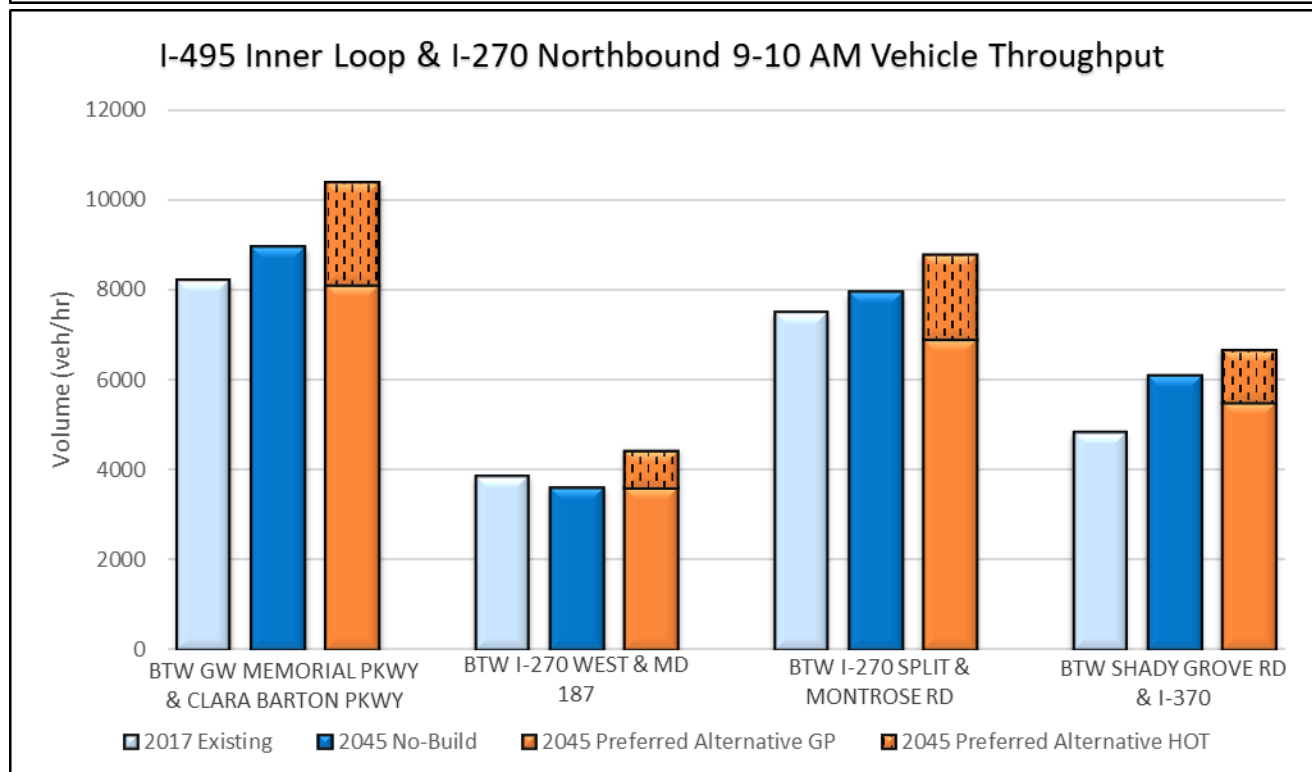
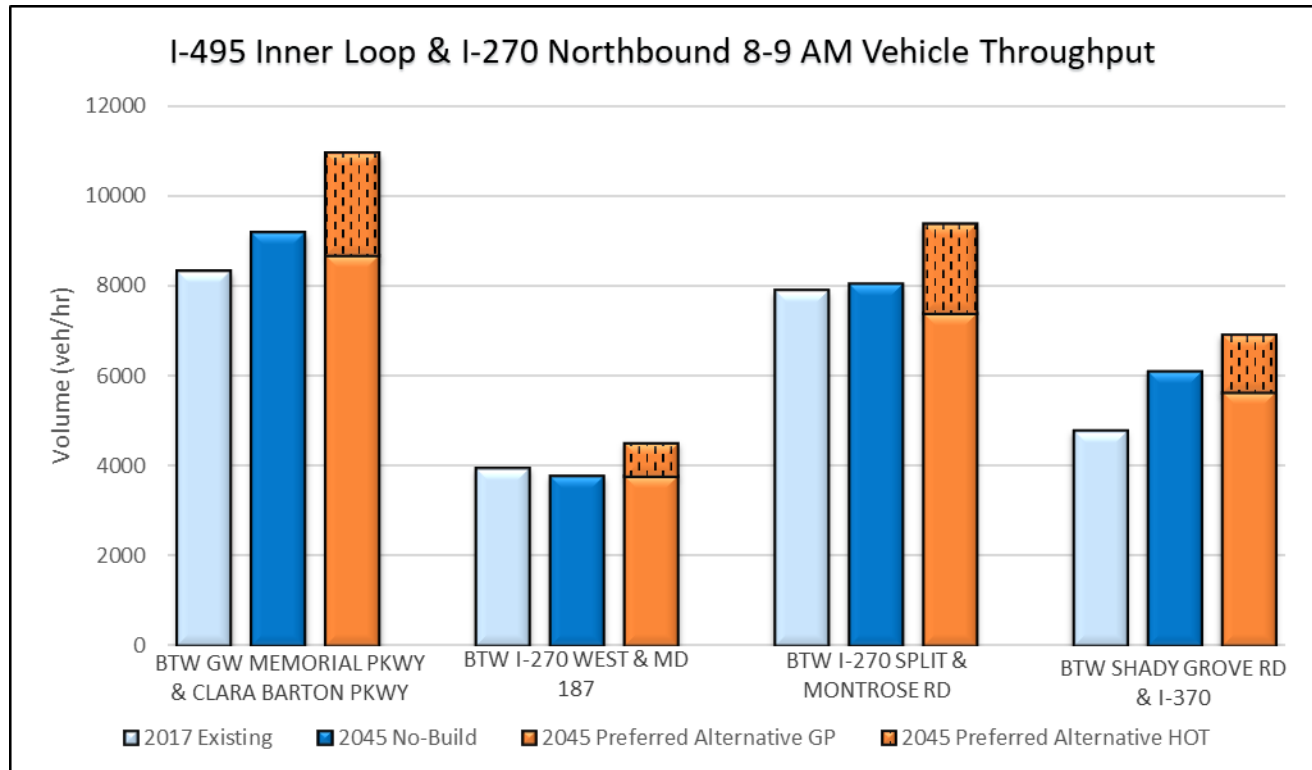
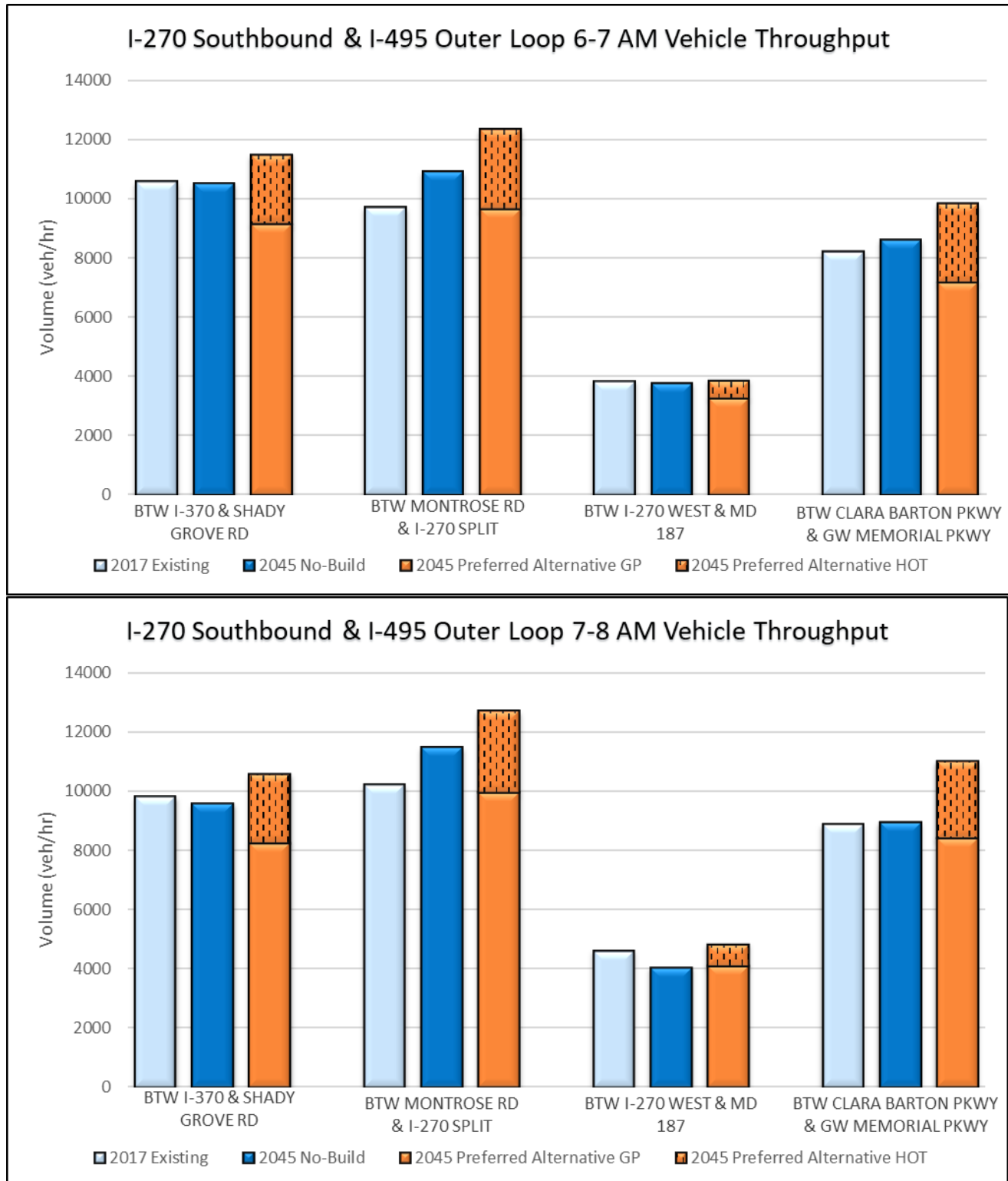
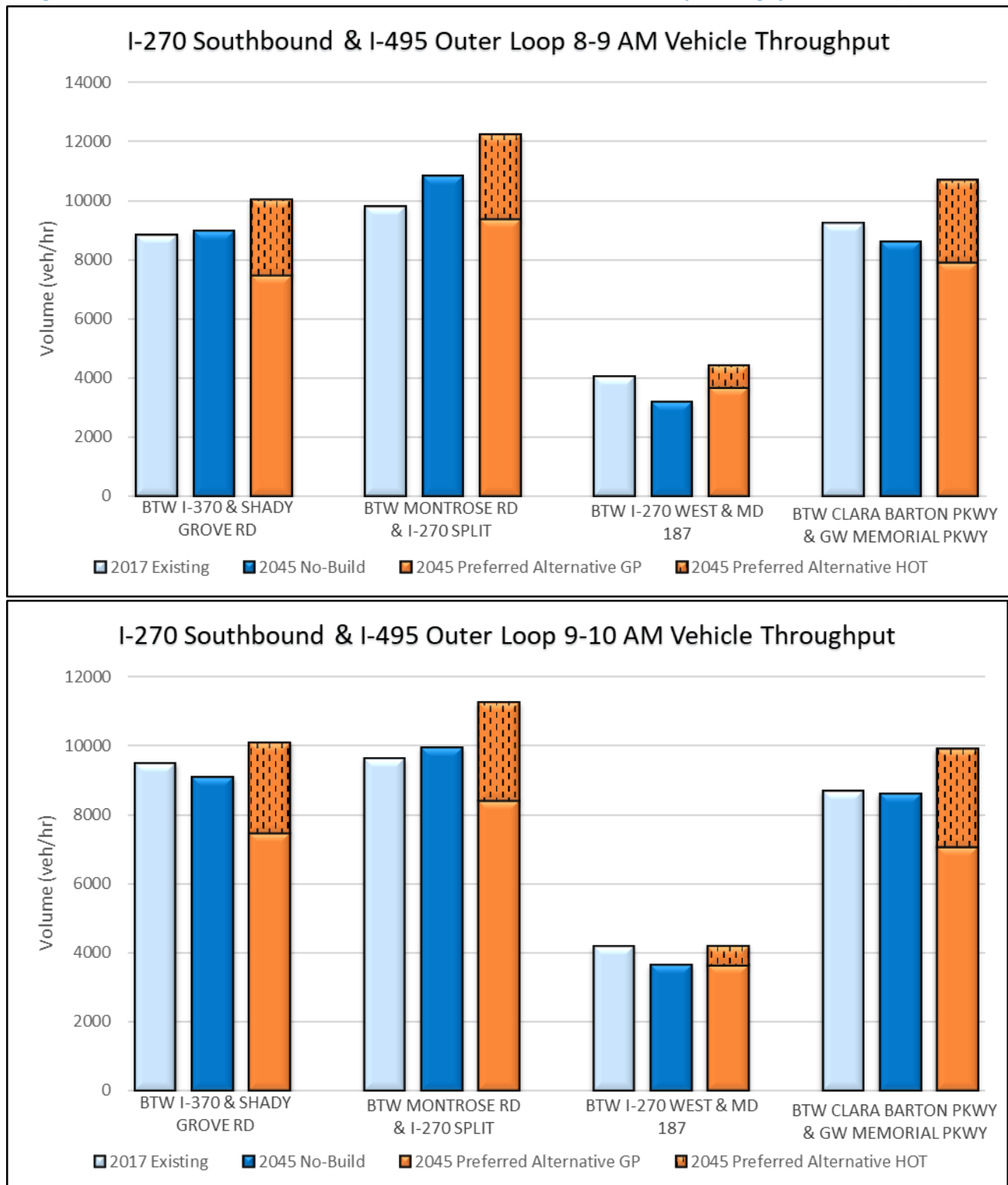
**Figure 6-32: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr)**


Figure 6-32: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)

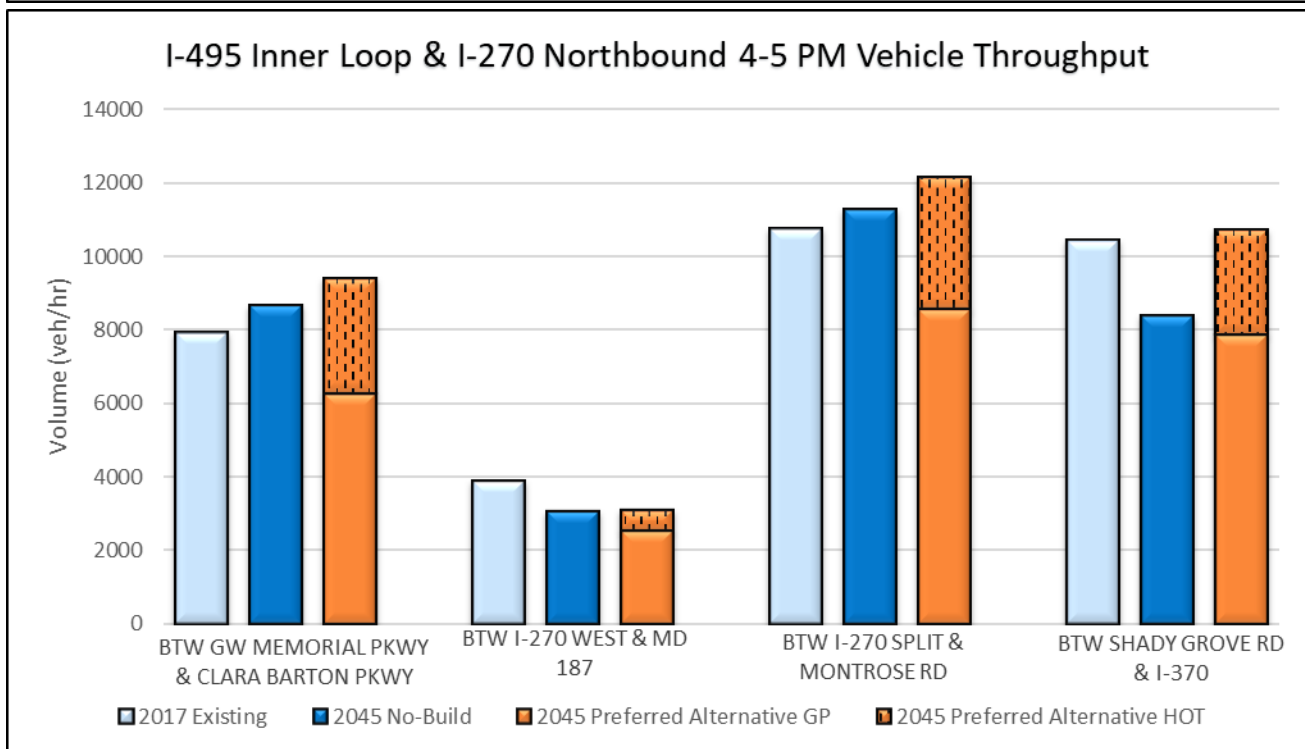
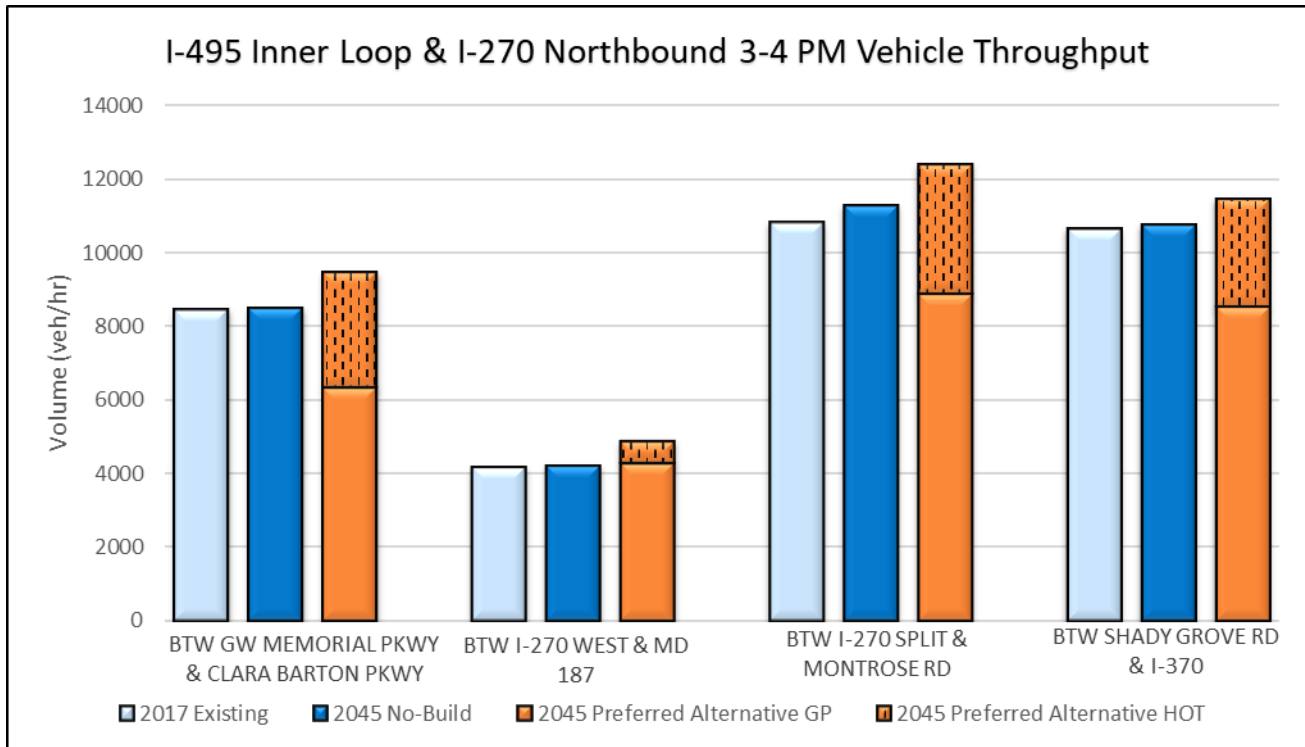




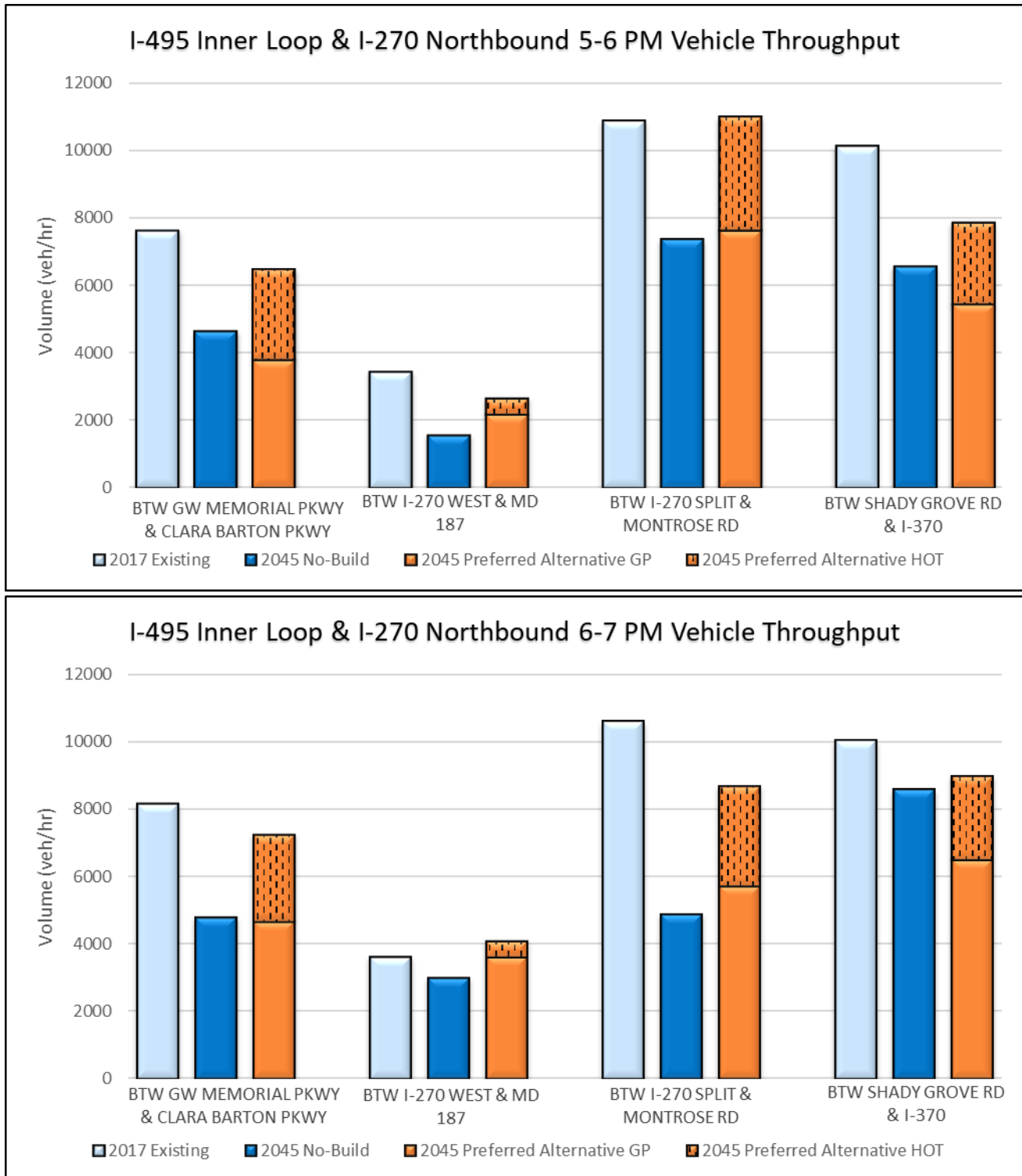
**Figure 6-32: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)**


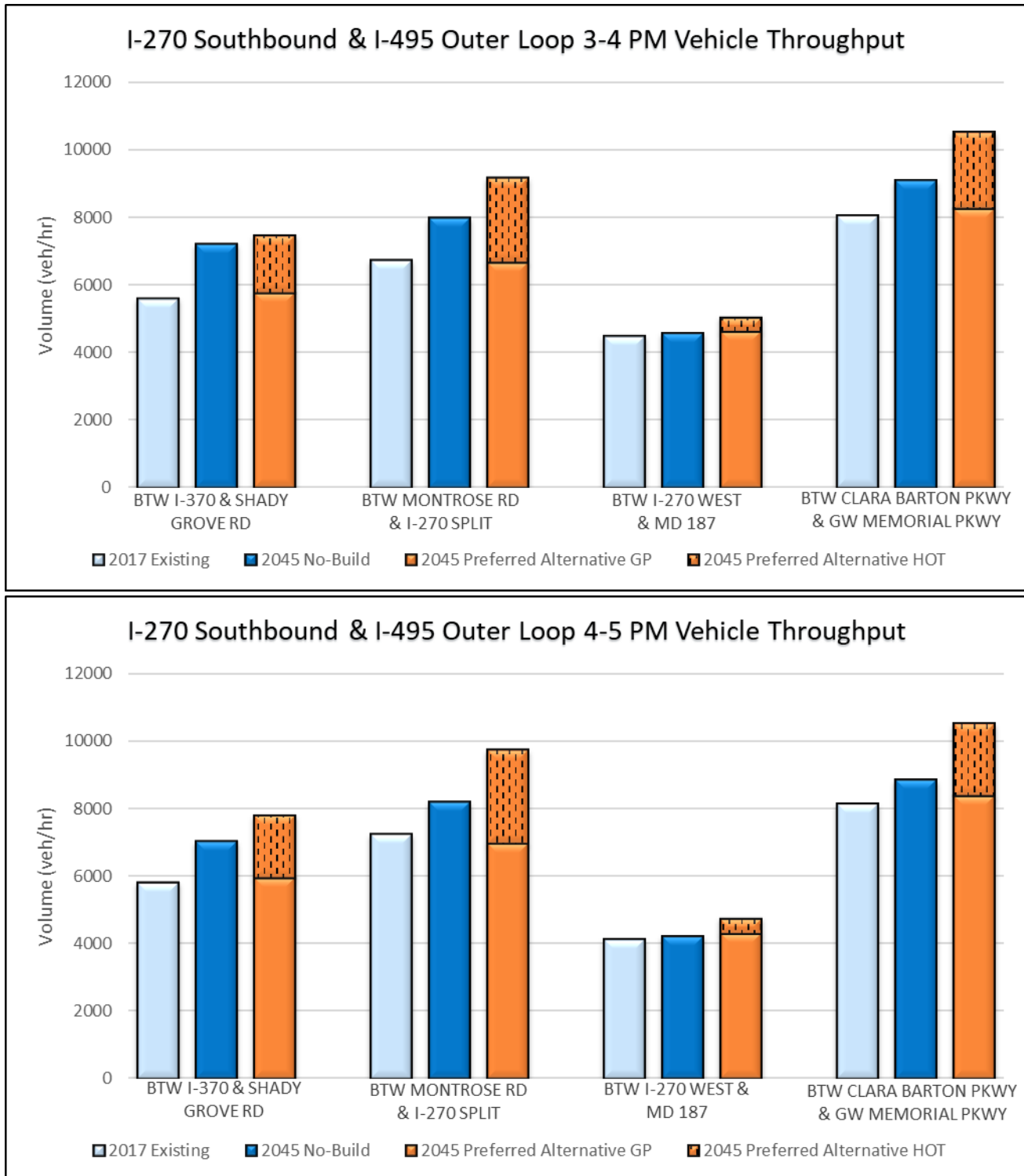
**Figure 6-32: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)**


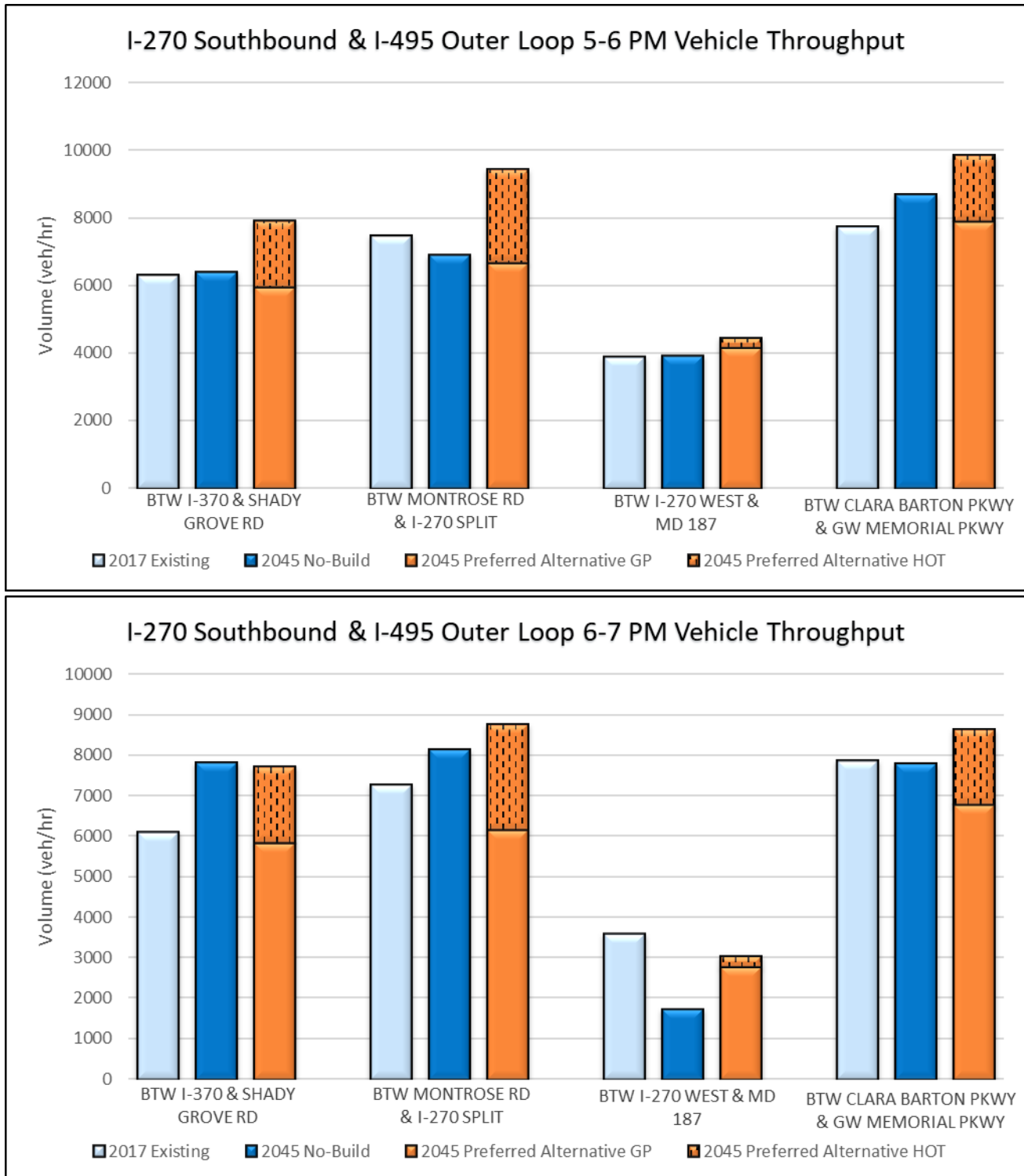
**Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr)**



**Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)**



**Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)**


**Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)**


### 6.4.3.3 Freeway Density and LOS Analysis

As summarized in **Section 2.5**, there are several background projects included in the No Build condition, including I-270 Innovative Congestion Management (ICM), that relieve bottlenecks and improve operations. While these projects will improve mobility and safety, they will not address the long-term roadway capacity needs for the I-270 corridor.

**Figure 6-34 and Figure 6-35** compare the percentage of lane-miles operating at each LOS between No Build and Preferred Alternative AM conditions along I-495 and I-270, respectively; the lane-mile percentages are based on density for the entire AM peak period. Because the overall I-270 roadway system is comprised of varying facility type operations, rather than comparing individually (i.e., Local lanes compared to HOT lanes), the overall roadway system was compared between No Build and Build (i.e., No Build General Purpose + Local lanes compared to Preferred Alternative General Purpose + HOT lanes).

Along the I-495 Inner Loop, the lane-miles operating with LOS 'D' or better increases from 52% (approximately 88 lane-miles) under No Build conditions to 62% (approximately 103 lane-miles) with the Preferred Alternative. Under 2045 AM No Build conditions, the existing bottlenecks at locations within the study area become exacerbated, specifically along the I-495 Inner Loop from American Legion Bridge to VA 193. These bottlenecks are mitigated under 2045 Preferred Alternative conditions, resulting in increased vehicle throughput on both I-495 Inner Loop and I-270 Northbound and decreased lane-miles operating at LOS 'F'. Along the I-495 Outer Loop, the lane-miles of LOS 'F' are reduced from 42% (approximately 67 lane-miles) under No Build conditions to 3% (approximately 4 lane-miles) with the Preferred Alternative.

During the AM peak period, the I-270 Northbound lane-miles with LOS 'D' or better increases from 98% (approximately 276 lane-miles) to 99% (approximately 317 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Similarly, the I-270 Southbound lane-miles with LOS 'D' or better increases from 73% (approximately 206 lane-miles) to 81% (approximately 255 lane-miles) while reducing those of LOS 'F' from 15% (approximately 43 lane-miles) to 9% (approximately 28 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Because of the I-270 ICM, the number of lane-miles operating at LOS 'F' is reduced along I-270 Southbound from the 2017 Existing conditions; and because of the Preferred Alternative, these LOS 'F' reductions are even more substantial. The overall I-270 roadway system operations are substantially better even though an uptick of LOS D, E, and/or F lane-miles is anticipated for the I-270 General Purpose lanes by themselves with the Preferred Alternative.



**Figure 6-34: 2045 AM I-495 Mainline Segment LOS – No Build vs Preferred Alternative**

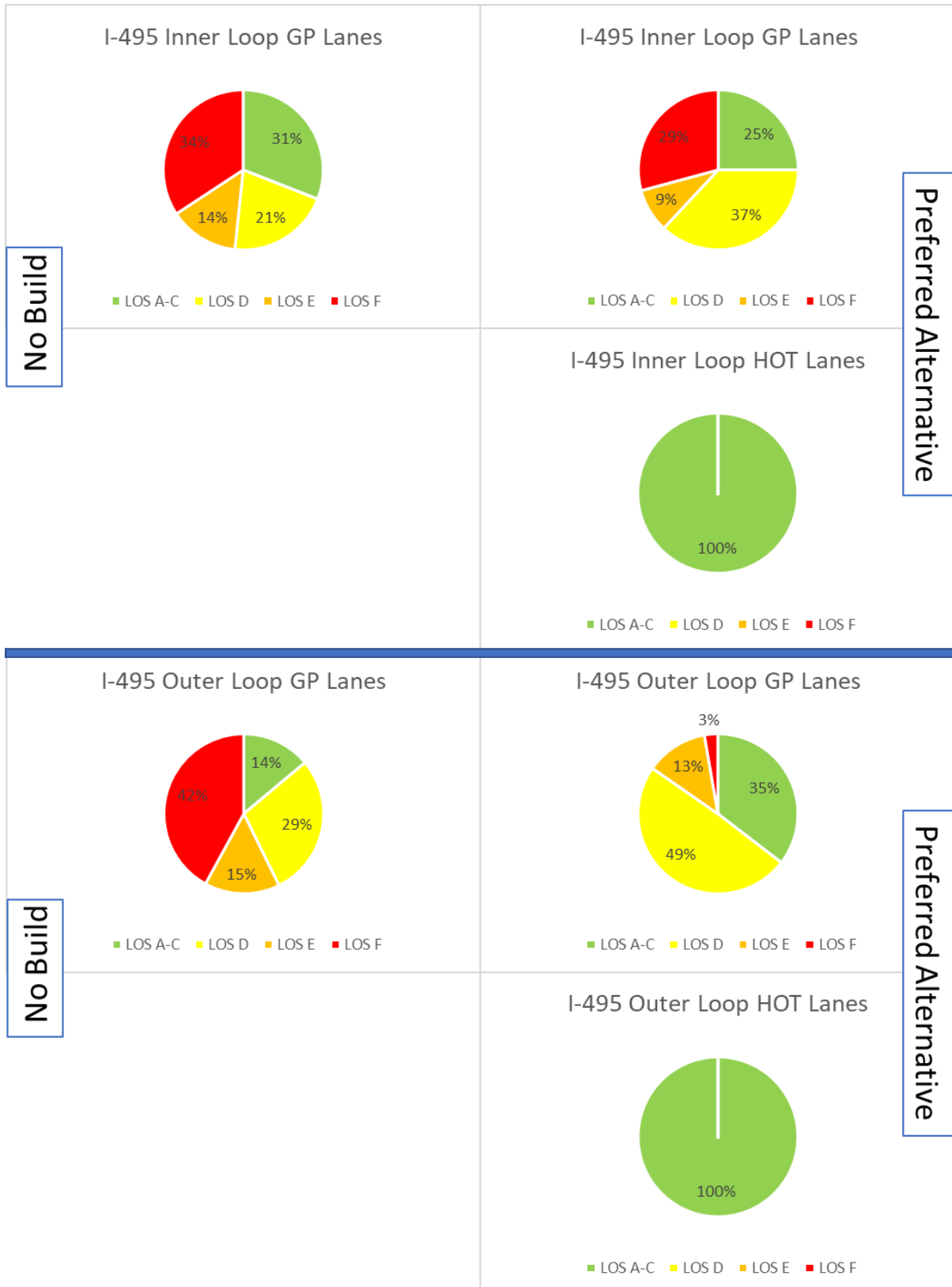
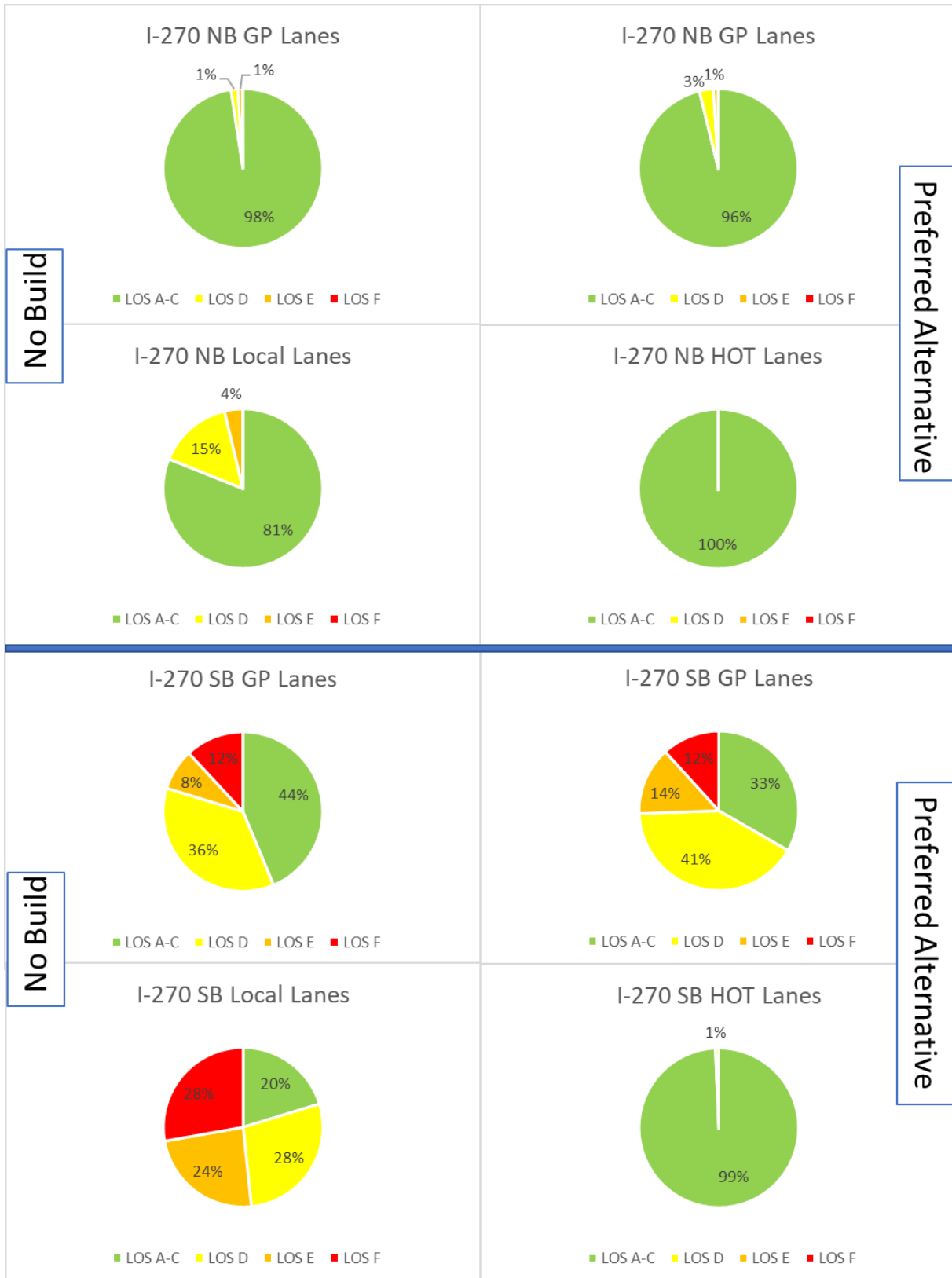


Figure 6-35: 2045 AM I-270 Mainline Segment LOS – No Build vs Preferred Alternative



**Figure 6-36 and Figure 6-37** compare the percentage of lane-miles operating at each LOS between No Build and Preferred Alternative PM conditions along I-495 and I-270, respectively; the lane-mile percentages are based on density for the entire PM peak period. Because the overall I-270 roadway system is comprised of varying facility type operations, rather than comparing individually (i.e., Local lanes compared to HOT lanes), the overall roadway system was compared between No Build and Build (i.e., No Build General Purpose + Local lanes compared to Preferred Alternative General Purpose + HOT lanes).

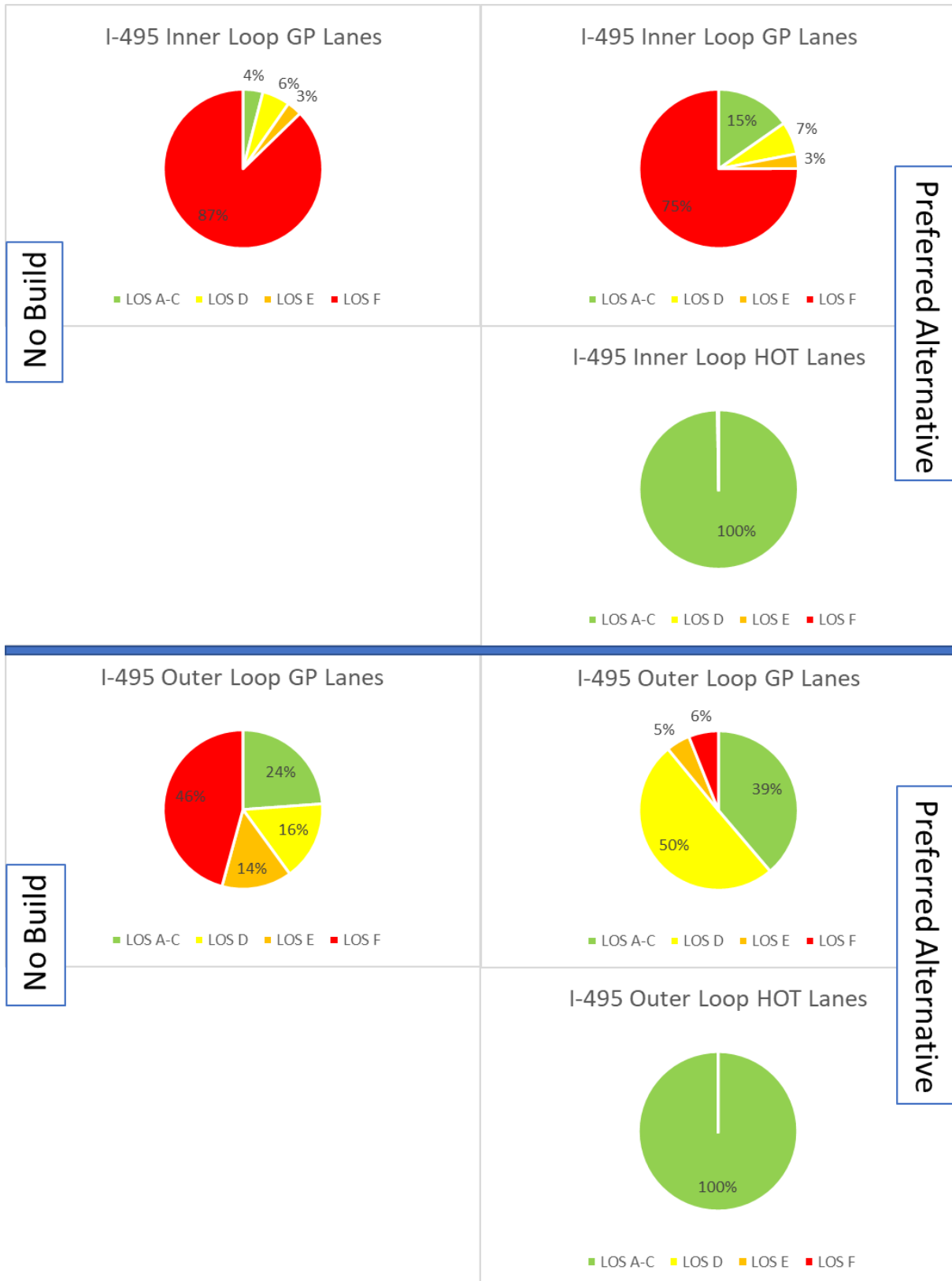
Under both 2045 No Build and Preferred Alternative PM peak period conditions, existing bottlenecks at locations outside of the study area become exacerbated, such as along I-270 Northbound from I-370 to MD 124; from MD 109 to MD 121; I-495 Inner Loop from MD 185 to MD 97; and from I-95 to MD 201. The resultant congestion impacts traffic operations within the project limits. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

Existing bottlenecks within the study area, that are exacerbated under No Build conditions, are mitigated with the Preferred Alternative, such as along the I-495 Inner Loop from the VA 193 interchange to I-270 West Spur. This mitigation results in increased vehicle throughput on both I-495 Inner Loop and I-270 Northbound but still produces higher percentages of lane-miles operating at LOS 'F'. Nevertheless, the Preferred Alternative serves approximately 55% more vehicles during the entire PM peak period, with 80% less unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

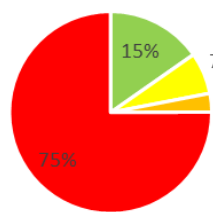
The lane-miles of LOS 'F' are reduced from 87% (approximately 148 lane-miles) to 75% (approximately 126 lane-miles) along the I-495 Inner Loop and from 46% (approximately 72 lane-miles) to 6% (approximately 10 lane-miles) along the I-495 Outer Loop between No Build and Preferred Alternative, respectively.

The PM peak period I-270 Northbound lane-miles with LOS 'D' or better increases from 34% (approximately 103 lane-miles) to 44% (approximately 140 lane-miles) while reducing those of LOS 'F' from 58% (approximately 176 lane-miles) to 50% (approximately 158 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Similarly, the I-270 Southbound lane-miles with LOS 'D' or better increases from 94% (approximately 264 lane-miles) to 99% (approximately 314 lane-miles) while reducing those of LOS 'F' from 5% (approximately 15 lane-miles) to 1% (approximately 1 lane-mile) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively.

**Figure 6-36: 2045 PM I-495 Mainline Segment LOS – No Build vs Preferred Alternative**



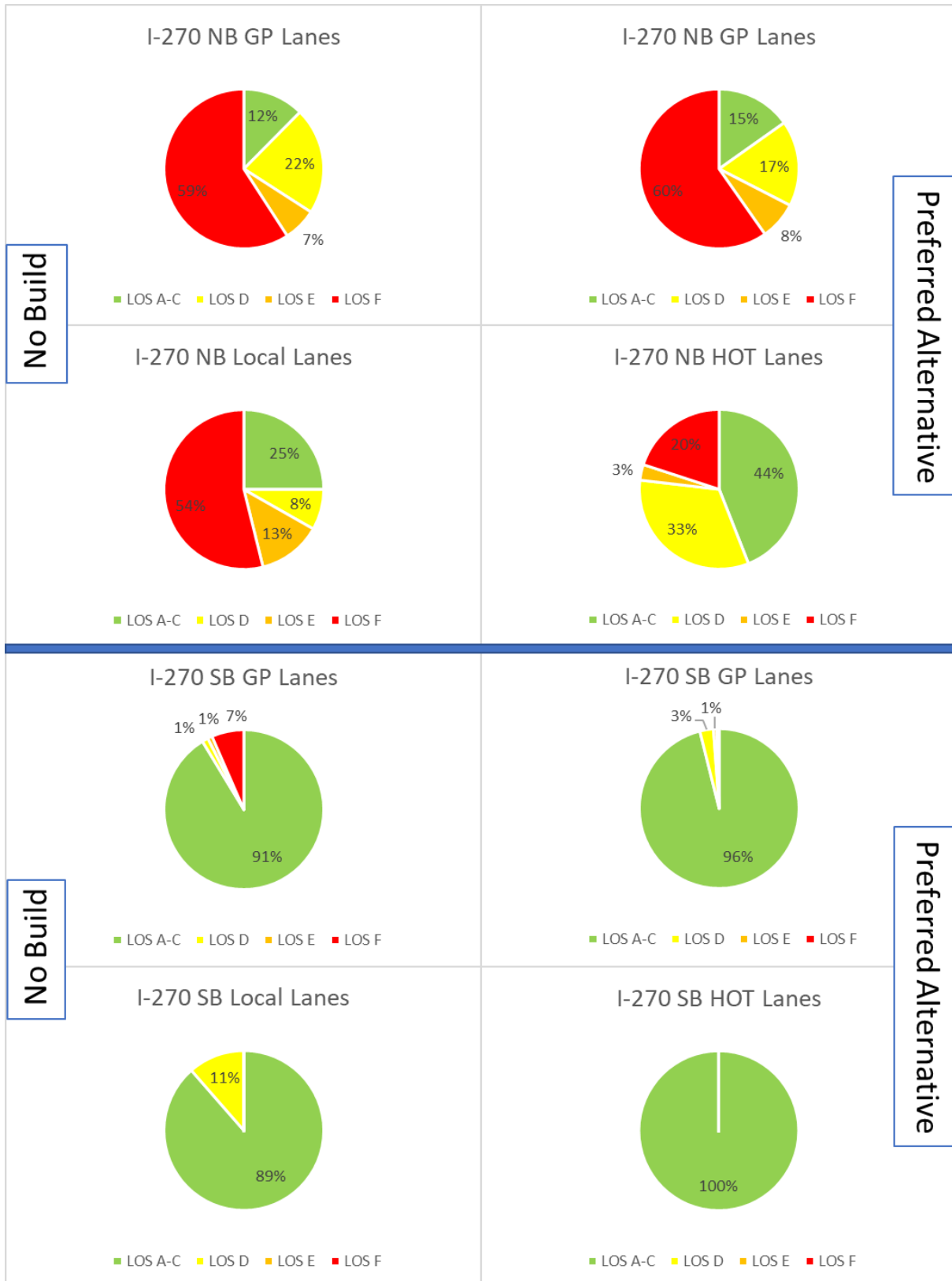
I-495 Inner Loop GP Lanes



■ LOS A-C   
 ■ LOS D   
 ■ LOS E   
 ■ LOS F

Preferred Alternative

Figure 6-37: 2045 PM I-270 Mainline Segment LOS – No Build vs Preferred Alternative



**Table 6-18 and Table 6-19** detail freeway density by segment for both No Build and Preferred Alternative conditions, during the AM and PM peak periods, respectively. Refer to **Table 6-1** for LOS thresholds for basic segments and for merge, diverge, and weave segments. **Appendix H** contains a summary of densities and speeds by lane as well as the number of lane changes through weave sections.

Under 2045 AM peak period No Build conditions like the 2027 No Build conditions, the existing bottlenecks at locations within the study area become exacerbated, specifically along the I-495 Inner Loop from the American Legion Bridge to VA 193. These bottlenecks are also mitigated under 2045 Preferred Alternative conditions, resulting in increased vehicle throughput on both I-495 Inner Loop and I-270 Northbound with consequential operational degradations at the higher throughput downstream areas, particularly east of the proposed Managed Lanes facility between the MD 355 and MD 185 interchanges. Even with these operational degradations, the Preferred Alternative serves approximately 10% more vehicles during the entire AM peak period, with no unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

The Preferred Alternative significantly improves density along the I-495 Outer Loop General Purpose lanes between the MD 185 and MD 190 interchanges, particularly in the latter hours of the AM peak period, as shown in **Table 6-18**, and like the 2027 Preferred Alternative conditions. Overall, I-270 Northbound and Southbound operate similarly with comparable density characteristics between No Build and Preferred Alternative conditions.

Operations at truncation points are similar or improved with the Preferred Alternative compared to No Build conditions. Slip ramps are located along I-270 West Spur Northbound and Southbound, serving vehicles traveling from the HOT Lanes to the General Purpose Lanes and from the General Purpose Lanes to the HOT lanes, in both directions of I-270 West Spur. In 2045, all General Purpose Lane segments and all HOT Lane along I-270 West Spur operate at LOS 'D' or better during all AM peak hours.

**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 26       | 26         | 39       | 29         | 118      | 25         | 117      | 23         |
|   | Diverge | 28       | 29         | 53       | 33         | 127      | 26         | 125      | 24         |
| VA 193 Interchange  | Basic   | 31       | 31         | 66       | 33         | 122      | 28         | 119      | 27         |
|   | Merge   | 19       | 19         | 54       | 22         | 128      | 26         | 100      | 22         |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 27       | 27         | 77       | 30         | 122      | 29         | 123      | 27         |
|   | Diverge | 27       | 28         | 73       | 31         | 106      | 30         | 108      | 28         |
| George Washington Memorial Parkway Interchange                    | Basic   | 28       | 26         | 88       | 32         | 105      | 31         | 107      | 29         |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 34       | 27         | 88       | 35         | 94       | 34         | 96       | 30         |
|   | Diverge | 46       | N/A        | 56       | N/A        | 54       | N/A        | 62       | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 39       | 30         | 43       | 38         | 43       | 36         | 53       | 33         |
| Between Clara Barton Parkway & MD 190                             | Merge   | 24       | 21         | 26       | 25         | 26       | 25         | 51       | 23         |
|   | Basic   | 36       | 31         | 38       | 37         | 38       | 37         | 73       | 34         |
|   | Diverge | 25       | 22         | 27       | 25         | 26       | 26         | 56       | 23         |
| MD 190 Interchange  | Basic   | 32       | 28         | 34       | 33         | 34       | 33         | 98       | 30         |
|   | Merge   | 20       | 19         | 22       | 24         | 28       | 26         | 118      | 29         |
|   | Basic   | 26       | N/A        | 28       | N/A        | 43       | N/A        | 127      | N/A        |
| Between MD 190 & I-270 West Spur                                  | Merge   | 13       | 21         | 17       | 25         | 39       | 32         | 95       | 41         |
|   | Basic   | 28       | 24         | 31       | 30         | 69       | 51         | 102      | 65         |
|   | Weave   | 23       | 25         | 25       | 31         | 55       | 64         | 69       | 85         |
| Between I-270 West Spur & MD 187                                  | Basic   | 26       | 27         | 27       | 32         | 22       | 88         | 21       | 109        |
|   | Merge   | N/A      | 21         | N/A      | 30         | N/A      | 138        | N/A      | 148        |
|   | Basic   |          | 29         |          | 48         | N/A      | 126        |          | 126        |
|   | Diverge | 23       | 20         | 25       | 41         | 19       | 93         | 17       | 90         |
| MD 187 Interchange  | Basic   | 23       | 25         | 24       | 64         | 19       | 142        | 19       | 136        |
| Between MD 187 & I-270 East Spur                                  | Merge   | 16       | 17         | 17       | 51         | 14       | 107        | 13       | 98         |
|   | Basic   | 24       | N/A        | 25       | N/A        | 20       | N/A        | 20       | N/A        |
|   | Diverge | 25       | 28         | 27       | 64         | 21       | 96         | 21       | 91         |
| I-270 East Spur Interchange                                       | Basic   | 35       | 41         | 37       | 75         | 30       | 102        | 30       | 93         |
|   | Weave   | 25       | 27         | 32       | 67         | 30       | 97         | 26       | 90         |
|   | Weave   | 18       | 19         | 30       | 57         | 27       | 78         | 20       | 75         |
|   | Basic   | 22       | N/A        | 40       | N/A        | 35       | N/A        | 25       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 18       | 19         | 39       | 59         | 34       | 77         | 22       | 71         |
|   | Basic   | 28       | 30         | 43       | 48         | 37       | 51         | 31       | 51         |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 10       | 15         | 11       | 15         | 9        | 14         | 9        | 14         |
| George Washington Memorial Parkway Interchange                    | Diverge | 7        | 10         | 7        | 10         | 6        | 9          | 6        | 9          |
|   | Merge   | 6        | N/A        | 9        | N/A        | 9        | N/A        | 9        | N/A        |
|   | Basic   | 13       | 12         | 19       | 14         | 19       | 13         | 19       | 13         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 12         | N/A      | 13         | N/A      | 12         | N/A      | 12         |
|   | Basic   |          | 18         |          | 20         |          | 18         |          | 18         |
|   | Diverge |          | 12         |          | 13         |          | 12         |          | 12         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |



**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 16         | N/A      | 18         | N/A      | 17         | N/A      | 17         |
|   | Merge   |          | 11         |          | 13         |          | 12         |          | 12         |
|   | Basic   |          | 11         |          | 13         |          | 12         |          | 12         |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 11         |          | 12         |          | 12         |          | 13         |
|   | Basic   |          | 11         |          | 13         |          | 13         |          | 14         |
|   | Diverge |          | 12         |          | 14         |          | 13         |          | 14         |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 12         |          | 15         |          | 15         |          | 20         |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 24       | 22         | 26       | 28         | 28       | 28         | 27       | 24         |
|   | Merge   | 10       | 10         | 13       | 14         | 15       | 15         | 13       | 12         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 19       | 18         | 20       | 22         | 22       | 23         | 21       | 20         |
|   | Basic   | 28       | 26         | 30       | 31         | 30       | 30         | 30       | 27         |
|   | Diverge | 20       | 20         | 23       | 24         | 24       | 24         | 23       | 23         |
|   | Basic   | 31       | 29         | 33       | 35         | 33       | 34         | 33       | 30         |
|   | Diverge | 21       | 30         | 21       | 37         | 20       | 36         | 20       | 32         |
|   | Basic   | 34       | N/A        | 38       | N/A        | 40       | N/A        | 38       | N/A        |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 33       |            | 35       |            | 34       |            | 32       |            |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Basic   | N/A      | 28         | N/A      | 33         | N/A      | 31         | N/A      | 27         |
|   | Merge   |          | 21         |          | 26         |          | 27         |          | 24         |
| Clara Barton Parkway Interchange                                    | Basic   | 39       | 33         | 38       | 37         | 34       | 32         | 35       | 29         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 25       | 25         | 24       | 28         | 22       | 25         | 22       | 23         |
|   | Basic   | 45       | 34         | 43       | 38         | 36       | 33         | 38       | 29         |
|   | Merge   | 54       | 22         | 56       | 27         | 30       | 24         | 35       | 23         |
| MD 190 Interchange  | Basic   | 44       | 33         | 42       | 34         | 30       | 29         | 31       | 27         |
|   | Diverge | 35       | 27         | 30       | 26         | 26       | 27         | 26       | 25         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 25       | 21         | 79       | 22         | 126      | 21         | 107      | 20         |
|   | Basic   | 52       | 35         | 63       | 37         | 76       | 32         | 69       | 28         |
|   | Weave   | 62       | 46         | 78       | 43         | 98       | 30         | 79       | 23         |
| Between I-270 West Spur & MD 187                                    | Basic   | 35       | 21         | 97       | 27         | 147      | 24         | 136      | 24         |
|   | Diverge | N/A      | 17         | N/A      | 22         | N/A      | 21         | N/A      | 19         |
|   | Basic   |          | 25         |          | 31         |          | 28         |          | 27         |
|   | Merge   |          | 17         |          | 17         |          | 64         |          | 22         |
| MD 187 Interchange  | Basic   | 20       | 20         | 53       | 25         | 127      | 22         | 149      | 21         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 15       | 15         | 32       | 18         | 79       | 16         | 99       | 15         |
|   | Basic   | 22       | 22         | 40       | 27         | 108      | 25         | 131      | 23         |
|   | Merge   | 17       | 17         | 28       | 23         | 91       | 23         | 89       | 19         |
| I-270 East Spur Interchange   | Basic   | 20       | 20         | 30       | 24         | 99       | 22         | 100      | 21         |
|   | Diverge | 27       | 26         | 36       | 32         | 96       | 36         | 90       | 30         |
| Between I-270 East Spur & MD 185                                    | Diverge | 26       | 25         | 31       | 29         | 64       | 35         | 55       | 29         |
|   | Basic   | 31       | 30         | 39       | 38         | 96       | 54         | 85       | 36         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic   | 6        | 18         | 6        | 15         | 6        | 20         | 6        | 20         |
| George Washington Memorial Parkway Interchange      | Merge   | 4        | 12         | 4        | 10         | 4        | 14         | 4        | 14         |
|   | Basic   | 5        | 16         | 6        | 13         | 5        | 18         | 5        | 18         |
|   | Diverge | N/A      | 15         | N/A      | 14         | N/A      | 15         | N/A      | 16         |
|   | Basic   | 12       | 22         | 12       | 21         | 11       | 23         | 12       | 23         |
|   | Merge   | N/A      | 14         | N/A      | 14         | N/A      | 15         | N/A      | 15         |
|   | Basic   |          | 19         |          | 19         |          | 20         |          | 18         |
|   | Diverge |          | 16         |          | 16         |          | 17         |          | 16         |
|   | Basic   |          | 16         |          | 16         |          | 17         |          | 16         |
| Diverge   | 13      |          | 14         |          | 14         |          | 14         |          |            |
| Between MD 190 & I-270 West Spur                    | Basic   |          | 17         |          | 18         |          | 18         |          | 18         |
| Merge   | 17      |          | 18         |          | 18         |          | 17         |          |            |
| Between I-270 West Spur & MD 187                    | Basic   | 11       | 13         | 13       | 10         |          |            |          |            |
| I-270 Northbound General Purpose Lanes              |         |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic   | 10       | 12         | 13       | 15         | 15       | 18         | 15       | 18         |
| Between MD 117 & I-370                              | Diverge | 13       | 14         | 19       | 20         | 22       | 25         | 20       | 22         |
|   | Basic   | 10       | 13         | 15       | 17         | 17       | 21         | 16       | 20         |
|   | Merge   | 11       | 11         | 16       | 16         | 19       | 19         | 16       | 18         |
| I-370 Interchange                                   | Basic   | 9        | 13         | 12       | 17         | 14       | 22         | 14       | 20         |
|   | Merge   | 8        | 13         | 11       | 15         | 12       | 20         | 12       | 18         |
|   | Basic   | N/A      | 14         | N/A      | 19         | N/A      | 24         | N/A      | 22         |
| Diverge   | 8       |          | 13         |          | 17         |          | 16         |          |            |
| Between I-370 & Shady Grove Road                    | Weave   |          | 8          |          | 13         |          | 16         |          | 16         |
| Shady Grove Road Interchange                        | Basic   | N/A      | 9          | N/A      | 15         | N/A      | 19         | N/A      | 18         |
|   | Merge   |          | 8          |          | 14         |          | 18         |          | 18         |
|   | Basic   |          | 9          |          | 9          |          | 12         |          | 13         |
| Between Shady Grove Road & MD 28                    | Weave   | 9        | N/A        | 12       | N/A        | 15       | N/A        | 15       | N/A        |
|   | Diverge | N/A      | 7          | N/A      | 12         | N/A      | 15         | N/A      | 15         |
|   | Basic   |          | 9          |          | 13         |          | 17         |          | 17         |
|   | Basic   |          | 11         |          | 16         |          | 21         |          | 20         |
|   | Merge   |          | 7          |          | 11         |          | 13         |          | 13         |
| MD 28 Interchange                                   | Basic   | 10       | 10         | 14       | 15         | 16       | 20         | 16       | 18         |
|   | Weave   | 10       | 11         | 13       | 17         | 16       | 29         | 16       | 22         |
|   | Basic   | N/A      | 13         | N/A      | 19         | N/A      | 26         | N/A      | 24         |
| Between MD 28 & MD 189                              | Basic   | 10       | 11         | 13       | 16         | 16       | 22         | 15       | 21         |
| MD 189 Interchange                                  | Basic   | N/A      | 12         | N/A      | 17         | N/A      | 23         | N/A      | 21         |
| Between MD 189 & Montrose Road                      | Diverge | 15       | 10         | 19       | 15         | 23       | 19         | 23       | 19         |
|   | Basic   | 12       | 12         | 15       | 18         | 19       | 26         | 19       | 24         |
|   | Merge   | N/A      | 10         | N/A      | 17         | N/A      | 30         | N/A      | 24         |
| Montrose Road Interchange                           | Diverge | 15       | N/A        | 18       | N/A        | 23       | N/A        | 23       | N/A        |
|   | Basic   | N/A      | 11         | N/A      | 15         | N/A      | 20         | N/A      | 19         |
|   | Weave   |          | 9          |          | 13         |          | 18         |          | 16         |
|   | Basic   |          | 11         |          | 11         |          | 14         |          | 14         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between Montrose Road & Spur Split                 | Weave   | 12       | 11         | 15       | 15         | 18       | 20         | 18       | 18         |
|  | Weave   | 13       | N/A        | 16       | N/A        | 20       | N/A        | 20       | N/A        |
| Between Spur Split & MD 187                        | Basic   | 14       | 9          | 21       | 13         | 27       | 20         | 26       | 17         |
|  | Merge   | 9        | 7          | 14       | 10         | 18       | 16         | 18       | 13         |
|  | Weave   | 7        | N/A        | 10       | N/A        | 13       | N/A        | 12       | N/A        |
| MD 187 Interchange                                 | Basic   | 10       | 12         | 13       | 15         | 16       | 24         | 16       | 21         |
|  | Diverge | 9        | 10         | 12       | 14         | 14       | 22         | 13       | 17         |
|  | Basic   | 12       | 15         | 17       | 20         | 20       | 32         | 19       | 25         |
| Between MD 187 & I-495                             | Diverge | 11       | 12         | 16       | 18         | 16       | 25         | 16       | 20         |
|  | Basic   | 14       | 17         | 21       | 26         | 23       | 40         | 22       | 30         |
|  | Diverge | N/A      | 13         | N/A      | 19         | N/A      | 37         | N/A      | 23         |
|  | Basic   |          | 13         |          | 19         |          | 36         |          | 24         |
|  | Merge   | 14       | 13         | 21       | 19         | 34       | 32         | 26       | 21         |
|  | Basic   | 12       | 11         | 17       | 15         | 25       | 23         | 21       | 16         |
|  | Basic   | 20       | 18         | 27       | 24         | 39       | 34         | 34       | 26         |
| I-270 West Spur Northbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Between Spur Split & Democracy Boulevard           | Basic   | 12       | 14         | 14       | 17         | 17       | 19         | 17       | 20         |
|  | Merge   | 10       | 12         | 12       | 15         | 14       | 16         | 15       | 17         |
|  | Basic   | 12       | 12         | 14       | 14         | 16       | 17         | 16       | 17         |
|  | Merge   | 14       | 7          | 15       | 8          | 17       | 10         | 17       | 10         |
| Democracy Boulevard Interchange                    | Basic   | 15       | 11         | 17       | 13         | 20       | 15         | 20       | 15         |
|  | Merge   | 13       | 11         | 15       | 13         | 16       | 15         | 15       | 16         |
|  | Basic   | 15       | 16         | 17       | 19         | 19       | 22         | 19       | 23         |
| Between Democracy Boulevard & I-495                | Diverge | 17       | 14         | 20       | 18         | 22       | 22         | 22       | 22         |
|  | Basic   | 19       | 13         | 23       | 18         | 34       | 22         | 35       | 22         |
|  | Diverge | N/A      | 14         | N/A      | 19         | N/A      | 23         | N/A      | 24         |
|  | Basic   |          | 15         |          | 19         |          | 27         |          | 27         |
| I-270 Northbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| Between MD 124 & MD 117                            | Diverge | 10       | N/A        | 16       | N/A        | 22       | N/A        | 22       | N/A        |
| Between MD 117 & I-370                             | Weave   | 11       |            | 18       |            | 28       |            | 26       |            |
|  | Basic   | 10       |            | 12       |            | 21       |            | 22       |            |
|  | Weave   | 14       |            | 20       |            | 28       |            | 26       |            |
| I-370 Interchange                                  | Basic   | 10       |            | 10       |            | 17       |            | 18       |            |
|  | Merge   | 7        |            | 7        |            | 11       |            | 12       |            |
|  | Basic   | 8        |            | 6        |            | 11       |            | 12       |            |
| Between I-370 & Shady Grove Road                   | Diverge | 10       |            | 13       |            | 19       |            | 20       |            |
|  | Basic   | 10       |            | 13       |            | 19       |            | 20       |            |
|  | Diverge | 10       |            | 13       |            | 19       |            | 20       |            |
|  | Merge   | 8        |            | 12       |            | 16       |            | 16       |            |
| Shady Grove Road Interchange                       | Basic   | 9        |            | 10       |            | 14       |            | 15       |            |
|  | Weave   | 6        |            | 7        |            | 11       |            | 11       |            |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 10       | N/A        | 13       | N/A        | 17       | N/A        | 18       | N/A        |
|  | Basic   | 15       |            | 20       |            | 27       |            | 28       |            |
|  | Diverge | 13       |            | 16       |            | 23       |            | 24       |            |
|  | Weave   | 10       |            | 12       |            | 17       |            | 18       |            |
|  | Merge   | 9        |            | 10       |            | 16       |            | 17       |            |
| MD 28 Interchange                                | Basic   | 12       |            | 12       |            | 19       |            | 21       |            |
|  | Weave   | 13       |            | 17       |            | 26       |            | 25       |            |
|  | Basic   | 19       |            | 22       |            | 34       |            | 34       |            |
| Between MD 28 & MD 189                           | Diverge | 14       |            | 18       |            | 34       |            | 30       |            |
|  | Basic   | 13       |            | 17       |            | 26       |            | 25       |            |
|  | Weave   | 13       |            | 19       |            | 25       |            | 25       |            |
|  | Basic   | 13       |            | 20       |            | 28       |            | 27       |            |
|  | Merge   | 13       |            | 20       |            | 28       |            | 27       |            |
| MD 189 Interchange                               | Basic   | 18       |            | 23       |            | 33       |            | 33       |            |
| Between MD 189 & Montrose Road                   | Diverge | 14       |            | 20       |            | 28       |            | 28       |            |
|  | Basic   | 21       |            | 30       |            | 42       |            | 41       |            |
|  | Merge   | 14       |            | 20       |            | 28       |            | 27       |            |
|  | Basic   | 16       |            | 25       |            | 34       |            | 32       |            |
|  | Merge   | 11       |            | 17       |            | 25       |            | 24       |            |
| Montrose Road Interchange                        | Basic   | 11       |            | 15       |            | 19       |            | 19       |            |
|  | Weave   | 8        |            | 11       |            | 15       |            | 14       |            |
|  | Basic   | 11       |            | 14       |            | 17       |            | 17       |            |
| Between Montrose Road & Spur Split               | Diverge | 14       |            | 19       |            | 25       |            | 23       |            |
|  | Basic   | 19       |            | 25       |            | 31       |            | 29       |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 10         | N/A      | 8          | N/A      | 12         | N/A      | 11         |
|  | Diverge |          | 8          |          | 7          |          | 10         |          | 10         |
|  | Basic   |          | 8          |          | 7          |          | 10         |          | 9          |
|  | Merge   |          | 5          |          | 5          |          | 7          |          | 6          |
| Gude Drive Interchange                           | Basic   |          | 7          |          | 6          |          | 9          |          | 8          |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 9          |          | 8          |          | 11         |          | 10         |
|  | Basic   |          | 12         |          | 11         |          | 15         |          | 14         |
|  | Merge   |          | 8          |          | 8          |          | 10         |          | 9          |
| Wootton Parkway Interchange                      | Basic   |          | 9          |          | 9          |          | 12         |          | 11         |
| Between Wootton Parkway & Spur Split             | Diverge |          | 8          |          | 9          |          | 11         |          | 11         |
|  | Basic   |          | 11         |          | 12         |          | 16         |          | 15         |
|  | Weave   |          | 7          |          | 8          |          | 11         |          | 10         |
| Spur Split through MD 187 Interchange            | Basic   |          | 4          |          | 5          |          | 6          |          | 5          |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 9          | N/A      | 10         | N/A      | 13         | N/A      | 12         |
|  | Merge   |          | 6          |          | 7          |          | 9          |          | 8          |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 8          |          | 9          |          | 11         |          | 10         |
|  | Weave   |          | 8          |          | 9          |          | 10         |          | 10         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 9          | N/A      | 11         | N/A      | 12         | N/A      | 12         |
|  | Diverge |          | 8          |          | 9          |          | 9          |          | 10         |
|  | Basic   |          | 12         |          | 13         |          | 14         |          | 15         |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |
| MD 117 Interchange                                       | Basic   | 99       | 91         | 103      | 97         | 106      | 98         | 101      | 92         |
| Between MD 117 & I-370                                   | Merge   | 59       | 79         | 60       | 84         | 59       | 86         | 60       | 82         |
|  | Basic   | 50       | 41         | 42       | 39         | 40       | 39         | 44       | 39         |
|  | Basic   | 48       | N/A        | 43       | N/A        | 44       | N/A        | 43       | N/A        |
|  | Diverge | 33       | 28         | 31       | 28         | 31       | 28         | 31       | 28         |
| I-370 Interchange  | Basic   | 45       | 40         | 35       | 36         | 32       | 34         | 36       | 35         |
|  | Diverge | 33       | 31         | 29       | 30         | 27       | 28         | 29       | 29         |
|  | Basic   | 28       | 34         | 23       | 29         | 20       | 26         | 21       | 27         |
|  | Basic   |          | 27         |          | 23         |          | 21         |          | 22         |
| Between I-370 & Shady Grove Road                         | Weave   | N/A      | 25         | N/A      | 23         | N/A      | 21         | N/A      | 20         |
|  | Diverge |          | 30         |          | 31         |          | 30         |          | 29         |
| Shady Grove Road Interchange                             | Merge   | 32       | N/A        | 28       | N/A        | 24       | N/A        | 22       | N/A        |
|  | Basic   | 40       | 32         | 33       | 26         | 29       | 23         | 26       | 23         |
|  | Diverge | 40       | 28         | 35       | 24         | 31       | 22         | 29       | 21         |
| Between Shady Grove Road & MD 28                         | Basic   | 29       | 36         | 24       | 29         | 22       | 25         | 20       | 25         |
|  | Merge   | 25       | 27         | 21       | 25         | 20       | 24         | 19       | 23         |
|  | Basic   | 34       | 36         | 28       | 30         | 26       | 27         | 25       | 26         |
| MD 28 Interchange  | Diverge | N/A      | 26         | N/A      | 23         | N/A      | 22         | N/A      | 22         |
|  | Basic   |          | 34         |          | 29         |          | 25         |          | 24         |
|  | Merge   | 28       | 25         | 26       | 23         | 25       | 21         | 23       | 21         |
|  | Basic   | 36       | 29         | 32       | 25         | 30       | 22         | 26       | 21         |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 17         | N/A      | 18         | N/A      | 16         | N/A      | 16         |
|  | Basic   |          | 32         |          | 29         |          | 25         |          | 25         |
|  | Diverge | 40       | 31         | 35       | 30         | 33       | 28         | 31       | 27         |
| MD 189 Interchange                                       | Basic   | 30       | 37         | 27       | 32         | 25       | 28         | 24       | 27         |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 35         | N/A      | 44         | N/A      | 34         | N/A      | 29         |
|  | Basic   |          | 43         |          | 40         |          | 35         |          | 33         |
| Montrose Road Interchange                                | Merge   | 32       | N/A        | 32       | N/A        | 30       | N/A        | 30       | N/A        |
|  | Diverge | N/A      | 28         | N/A      | 27         | N/A      | 28         | N/A      | 27         |
|  | Basic   |          | 37         |          | 35         |          | 32         |          | 30         |
|  | Weave   |          | 35         |          | 36         |          | 33         |          | 31         |
|  | Basic   |          | 37         |          | 38         |          | 33         |          | 30         |
| Between Montrose Road & Spur Split                       | Basic   | 30       | N/A        | 30       | N/A        | 28       | N/A        | 27       | N/A        |
|  | Weave   | 31       |            | 48       |            | 42       |            | 28       |            |
|  | Diverge | 18       |            | 21       |            | 21       |            | 20       |            |
|  | Weave   | 27       |            | 32       |            | 29       |            | 53       |            |
| Spur Split through MD 187 Interchange                    | Basic   | 19       | 21         | 24       | 27         | 24       | 28         | 22       | 25         |
|  | Diverge | 17       | 15         | 22       | 20         | 22       | 20         | 20       | 18         |
|  | Basic   | 17       | 22         | 21       | 27         | 20       | 26         | 19       | 24         |
|  | Merge   | 16       | 15         | 22       | 19         | 22       | 19         | 19       | 17         |
|  | Basic   | 17       | 22         | 23       | 29         | 22       | 29         | 20       | 26         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 16       | 16         | 24       | 21         | 27       | 22         | 23       | 20         |
|  | Basic   | 18       | 23         | 25       | 31         | 26       | 33         | 23       | 29         |
|  | Weave   | N/A      | 18         | N/A      | 23         | N/A      | 24         | N/A      | 22         |
|  | Diverge | 18       | N/A        | 23       | N/A        | 24       | N/A        | 22       | N/A        |
|  | Basic   | 17       | 17         | 25       | 35         | 24       | 35         | 24       | 27         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 27       | 28         | 24       | 24         | 40       | 21         | 20       | 19         |
|  | Weave   | 25       | N/A        | 23       | N/A        | 37       | N/A        | 18       | N/A        |
|  | Diverge | N/A      | 29         | N/A      | 27         | N/A      | 25         | N/A      | 20         |
| Democracy Boulevard                                | Merge   | N/A      | 24         | N/A      | 19         | N/A      | 15         | N/A      | 14         |
|  | Basic   | 29       | 37         | 28       | 32         | 39       | 26         | 20       | 22         |
|  | Diverge | N/A      | 38         | N/A      | 30         | N/A      | 23         | N/A      | 19         |
|  | Basic   | N/A      | 33         | N/A      | 28         | N/A      | 22         | N/A      | 17         |
| Democracy Boulevard to I-495                       | Merge   | 18       | 24         | 20       | 23         | 37       | 21         | 16       | 17         |
|  | Merge   | 32       | N/A        | 34       | N/A        | 42       | N/A        | 25       | N/A        |
|  | Basic   | 49       | 34         | 49       | 30         | 55       | 26         | 36       | 21         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 23       | N/A        | 27       | N/A        | 29       | N/A        | 31       | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 29       |            | 35       |            | 34       |            | 30       |            |
|  | Diverge | 27       |            | 27       |            | 27       |            | 29       |            |
| Shady Grove Road Interchange                       | Basic   | 32       |            | 24       |            | 21       |            | 24       |            |
|  | Merge   | 26       |            | 20       |            | 19       |            | 20       |            |
|  | Basic   | 40       |            | 30       |            | 28       |            | 31       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 28       |            | 23       |            | 22       |            | 24       |            |
|  | Basic   | 43       |            | 35       |            | 34       |            | 37       |            |
|  | Merge   | 37       |            | 34       |            | 32       |            | 34       |            |
|  | Diverge | 37       |            | 34       |            | 32       |            | 34       |            |
|  | Diverge | 45       |            | 41       |            | 38       |            | 39       |            |
|  | Basic   | 42       |            | 34       |            | 29       |            | 33       |            |
|  | Diverge | 28       |            | 22       |            | 20       |            | 22       |            |
| MD 28 Interchange                                  | Basic   | 37       |            | 30       |            | 24       |            | 26       |            |
|  | Merge   | 28       |            | 23       |            | 18       |            | 20       |            |
|  | Basic   | 45       |            | 37       |            | 27       |            | 30       |            |
| Between MD 28 & MD 189                             | Merge   | 53       |            | 42       |            | 27       |            | 28       |            |
|  | Basic   | 80       |            | 49       |            | 27       |            | 28       |            |
|  | Merge   | 78       |            | 50       |            | 29       |            | 28       |            |
|  | Basic   | 44       |            | 41       |            | 35       |            | 34       |            |
|  | Diverge | 40       |            | 39       |            | 34       |            | 33       |            |
| MD 189 Interchange                                 | Basic   | 58       |            | 53       |            | 45       |            | 46       |            |
| Between MD 189 & Montrose Road                     | Merge   | 45       |            | 48       |            | 44       |            | 41       |            |
|  | Diverge | 46       |            | 50       |            | 45       |            | 42       |            |
|  | Basic   | 44       |            | 43       |            | 38       |            | 35       |            |
|  | Diverge | 30       |            | 29       |            | 26       |            | 23       |            |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-18: 2045 AM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Montrose Road Interchange                        | Basic   | 41       | N/A        | 41       | N/A        | 36       | N/A        | 32       | N/A        |
|  | Weave   | 35       |            | 39       |            | 35       |            | 31       |            |
|  | Basic   | 38       |            | 44       |            | 36       |            | 27       |            |
|  | Merge   | 26       |            | 38       |            | 34       |            | 25       |            |
|  | Basic   | 39       |            | 56       |            | 51       |            | 38       |            |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                | Basic   | N/A      | 20         | N/A      | 26         | N/A      | 27         | N/A      | 26         |
| Between I-370 & Gude Drive                       | Merge   |          | 19         |          | 19         |          | 21         |          | 22         |
|  | Basic   |          | 19         |          | 19         |          | 21         |          | 21         |
|  | Diverge |          | 13         |          | 13         |          | 14         |          | 14         |
| Gude Drive Interchange                           | Basic   |          | 17         |          | 17         |          | 18         |          | 19         |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 15         |          | 16         |          | 17         |          | 17         |
|  | Basic   |          | 21         |          | 21         |          | 23         |          | 23         |
|  | Diverge |          | 14         |          | 15         |          | 16         |          | 16         |
| Wootton Parkway Interchange                      | Basic   |          | 18         |          | 18         |          | 20         |          | 20         |
| Between Wootton Parkway and Spur Split           | Merge   |          | 15         |          | 15         |          | 15         |          | 15         |
|  | Basic   |          | 22         |          | 22         |          | 23         |          | 23         |
|  | Diverge |          | 14         |          | 15         |          | 15         |          | 15         |
| Spur Split through MD 187 Interchange            | Basic   |          | 7          |          | 8          |          | 8          |          | 8          |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 18         | N/A      | 18         | N/A      | 19         | N/A      | 19         |
|  | Diverge |          | 12         |          | 12         |          | 13         |          | 13         |
| Westlake Terrace/Fernwood Road Interchange       | Basic   |          | 14         |          | 15         |          | 15         |          | 15         |
|  | Diverge |          | 10         |          | 10         |          | 10         |          | 10         |
|  | Basic   |          | 13         |          | 13         |          | 14         |          | 14         |
| Westlake Terrace/Fernwood Road to I-495          | Merge   |          | 10         |          | 11         |          | 11         |          | 10         |
|  | Basic   |          | 14         |          | 16         |          | 16         |          | 15         |
|  | Merge   |          | 14         |          | 15         |          | 14         |          | 15         |
|  | Basic   |          | 20         |          | 22         |          | 21         |          | 22         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |



Under both 2045 No Build and Preferred Alternative PM peak period conditions, existing bottlenecks at locations outside of the study area become exacerbated, such as along I-270 Northbound from I-370 to MD 124; from MD 109 to MD 121; I-495 Inner Loop from MD 185 to MD 97; and from I-95 to MD 201. The resultant congestion impacts traffic operations within the project limits, as shown in **Table 6-19**, and like the 2027 No Build and Preferred Alternative conditions. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed **Chapter 8** to address both operational and safety concerns.

Like the AM, the existing bottlenecks at locations within the study area become exacerbated under 2045 PM No Build conditions, specifically along the I-495 Inner Loop from the VA 193 interchange to I-270 West Spur. These bottlenecks are mitigated under 2045 Preferred Alternative conditions, resulting in increased vehicle throughput on both I-495 Inner Loop and I-270 Northbound with consequential operational degradations at the higher throughput downstream areas. Even with these operational degradations, the Preferred Alternative serves approximately 55% more vehicles during the entire PM peak period, with 80% less unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

The Preferred Alternative significantly improves density along the I-495 Outer Loop General Purpose lanes between I-270 East Spur and the MD 185 interchange during the latter PM hours as well as between I-270 West Spur and the Clara Barton interchange during the entire PM peak period. The Preferred Alternative also provides benefit along I-270 Southbound between the I-270 Spur split and I-495 during the 5-7 PM hours.

Operations at truncation points are similar or improved with the Preferred Alternative compared to No Build conditions. Slip ramps are located along I-270 West Spur Northbound and Southbound, serving vehicles traveling from the HOT Lanes to the General Purpose Lanes and from the General Purpose Lanes to the HOT lanes, in both directions of I-270 West Spur. In 2027, all General Purpose Lane segments along I-270 West Spur operate at LOS 'D' or better during all PM peak hours, except during the 6-7 PM hour when some segments operate at LOS 'E' or 'F' due to spillback from the downstream bottleneck, though with significantly improved operations compared to the No Build condition. All HOT Lane segments along I-270 West Spur operate at LOS 'D' or better during all PM peak hours.

**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 17       | 14         | 41       | 15         | 148      | 56         | 171      | 120        |
|   | Diverge | 18       | 15         | 63       | 16         | 151      | 79         | 171      | 130        |
| VA 193 Interchange  | Basic   | 23       | 16         | 119      | 17         | 169      | 119        | 178      | 143        |
|   | Merge   | 29       | 14         | 167      | 15         | 203      | 167        | 206      | 182        |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 46       | 18         | 144      | 19         | 184      | 154        | 189      | 160        |
|   | Diverge | 69       | 19         | 142      | 21         | 198      | 167        | 199      | 163        |
| George Washington Memorial Parkway Interchange                    | Basic   | 82       | 22         | 106      | 28         | 158      | 138        | 157      | 128        |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 83       | 23         | 98       | 41         | 155      | 163        | 149      | 137        |
|   | Diverge | 68       | N/A        | 78       | N/A        | 141      | N/A        | 136      | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 92       | 26         | 102      | 53         | 163      | 185        | 162      | 151        |
| Between Clara Barton Parkway & MD 190                             | Merge   | 109      | 21         | 118      | 58         | 182      | 175        | 179      | 144        |
|   | Basic   | 96       | 27         | 98       | 89         | 166      | 187        | 159      | 149        |
|   | Diverge | 70       | 19         | 72       | 82         | 122      | 136        | 113      | 115        |
| MD 190 Interchange  | Basic   | 112      | 25         | 116      | 121        | 178      | 191        | 169      | 156        |
|   | Merge   | 125      | 25         | 128      | 142        | 192      | 203        | 175      | 170        |
|   | Basic   | 117      | 24         | 121      | 140        | 183      | 189        | 170      | 157        |
| Between MD 190 & I-270 West Spur                                  | Merge   | 126      | 26         | 130      | 139        | 183      | 176        | 163      | 156        |
|   | Basic   | 52       | 30         | 62       | 136        | 153      | 162        | 130      | 126        |
|   | Weave   | 29       | 33         | 46       | 137        | 132      | 154        | 110      | 115        |
| Between I-270 West Spur & MD 187                                  | Basic   | 26       | 45         | 103      | 172        | 198      | 185        | 136      | 145        |
|   | Merge   | N/A      | 39         | N/A      | 121        | 132      | N/A        | 98       |            |
|   | Basic   |          | 70         |          | 157        | 172      |            | 133      |            |
|   | Diverge | 22       | 55         | 94       | 110        | 138      | 121        | 96       | 95         |
| MD 187 Interchange  | Basic   | 24       | 89         | 151      | 169        | 201      | 181        | 141      | 148        |
| Between MD 187 & I-270 East Spur                                  | Merge   | 18       | 66         | 114      | 117        | 163      | 138        | 101      | 104        |
|   | Basic   | 28       | N/A        | 150      | N/A        | 181      | N/A        | 131      | N/A        |
|   | Diverge | 32       | 88         | 134      | 134        | 167      | 143        | 109      | 115        |
| I-270 East Spur Interchange                                       | Basic   | 45       | 92         | 148      | 132        | 174      | 141        | 114      | 106        |
|   | Weave   | 46       | 88         | 138      | 120        | 156      | 130        | 105      | 108        |
|   | Weave   | 42       | 73         | 101      | 91         | 116      | 104        | 78       | 86         |
|   | Basic   | 53       | N/A        | 111      | N/A        | 135      | N/A        | 88       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 47       | 77         | 100      | 93         | 133      | 106        | 80       | 94         |
|   | Basic   | 69       | 89         | 119      | 99         | 134      | 110        | 97       | 102        |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 13       | 22         | 13       | 22         | 27       | 21         | 154      | 18         |
| George Washington Memorial Parkway Interchange                    | Diverge | 8        | 14         | 8        | 15         | 84       | 14         | 195      | 12         |
|   | Merge   | 12       | N/A        | 12       | N/A        | 126      | N/A        | 187      | N/A        |
|   | Basic   | 35       | 21         | 40       | 21         | 147      | 20         | 147      | 17         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 17         | N/A      | 17         | N/A      | 14         | N/A      | 14         |
|   | Basic   |          | 25         |          | 25         |          | 22         |          | 21         |
|   | Diverge |          | 17         |          | 17         |          | 14         |          | 14         |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 21         | N/A      | 22         | N/A      | 18         | N/A      | 16         |
|   | Merge   |          | 21         |          | 21         |          | 18         |          | 18         |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 14         |          | 14         |          | 12         |          | 12         |
|   | Basic   |          | 22         |          | 23         |          | 20         |          | 19         |
|   | Diverge |          | 22         |          | 22         |          | 20         |          | 19         |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 10         |          | 9          |          | 16         |          | 8          |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 28       | 29         | 26       | 30         | 22       | 26         | 20       | 22         |
|   | Merge   | 19       | 19         | 18       | 19         | 13       | 15         | 11       | 13         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 24       | 25         | 23       | 26         | 19       | 22         | 18       | 20         |
|   | Basic   | 26       | 29         | 25       | 29         | 24       | 27         | 23       | 24         |
|   | Diverge | 21       | 24         | 20       | 24         | 20       | 24         | 20       | 22         |
|   | Basic   | 29       | 33         | 28       | 33         | 28       | 32         | 26       | 27         |
|   | Diverge | 34       | 38         | 32       | 39         | 32       | 37         | 31       | 32         |
|   | Basic   | 36       | N/A        | 35       | N/A        | 35       | N/A        | 32       | N/A        |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 42       |            | 42       |            | 42       |            | 34       |            |
|   | Basic   | N/A      | 32         | N/A      | 33         | N/A      | 31         | N/A      | 26         |
|   | Merge   |          | 25         |          | 28         |          | 26         |          | 22         |
| Clara Barton Parkway Interchange                                    | Basic   | 59       | 36         | 64       | 34         | 66       | 32         | 39       | 27         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 45       | 28         | 50       | 27         | 51       | 25         | 27       | 21         |
|   | Basic   | 71       | 34         | 79       | 33         | 81       | 31         | 39       | 26         |
|   | Merge   | 63       | 25         | 77       | 24         | 77       | 22         | 31       | 20         |
| MD 190 Interchange  | Basic   | 70       | 31         | 91       | 30         | 93       | 29         | 32       | 23         |
|   | Diverge | 45       | 22         | 63       | 23         | 64       | 22         | 22       | 18         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 28       | 17         | 37       | 16         | 37       | 16         | 15       | 13         |
|   | Basic   | 44       | 28         | 67       | 28         | 66       | 27         | 24       | 21         |
|   | Weave   | 34       | 23         | 62       | 23         | 52       | 22         | 18       | 17         |
| Between I-270 West Spur & MD 187                                    | Basic   | 36       | 30         | 70       | 28         | 73       | 27         | 16       | 18         |
|   | Diverge | N/A      | 23         | N/A      | 21         | N/A      | 20         | N/A      | 13         |
|   | Basic   |          | 32         |          | 30         |          | 29         |          | 19         |
|   | Merge   | 20       | 21         | 46       | 20         | 43       | 20         | 13       | 13         |
| MD 187 Interchange  | Basic   | 25       | 28         | 47       | 26         | 45       | 24         | 10       | 14         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 18       | 20         | 29       | 18         | 31       | 17         | 6        | 10         |
|   | Basic   | 27       | 30         | 40       | 28         | 44       | 26         | 8        | 16         |
|   | Merge   | 25       | 27         | 31       | 24         | 32       | 22         | 6        | 14         |
| I-270 East Spur Interchange   | Basic   | 24       | 27         | 32       | 25         | 32       | 24         | 6        | 14         |
|   | Diverge | 33       | 35         | 37       | 34         | 70       | 32         | 195      | 95         |
| Between I-270 East Spur & MD 185                                    | Diverge | 30       | 32         | 31       | 31         | 54       | 31         | 133      | 101        |
|   | Basic   | 51       | 55         | 48       | 47         | 60       | 42         | 164      | 110        |
|   |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location  | Type                                   | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|--|----------|------------|----------|------------|----------|------------|----------|------------|
|   |  | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |  |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic                                  | 12       | 14         | 12       | 14         | 11       | 10         | 8        | 10         |
| George Washington Memorial Parkway Interchange      | Merge                                  | 8        | 10         | 8        | 10         | 7        | 7          | 6        | 7          |
|   | Basic                                  | 10       | 9          | 10       | 9          | 10       | 8          | 8        | 8          |
|   | Diverge                                | N/A      | 12         | N/A      | 11         | N/A      | 10         | N/A      | 10         |
|   | Basic                                  | 22       | 18         | 22       | 17         | 21       | 16         | 17       | 15         |
|   | Merge                                  | N/A      | 12         | N/A      | 12         | N/A      | 10         | N/A      | 10         |
|   | Basic                                  |          | 14         |          | 14         |          | 13         |          | 12         |
|   | Diverge                                |          | 11         |          | 12         |          | 10         |          | 9          |
|   | Basic                                  |          | 11         |          | 12         |          | 10         |          | 9          |
|   | Diverge                                |          | 10         |          | 10         |          | 9          |          | 9          |
| Basic   | 13                                     |          | 14         |          | 12         |          | 11         |          |            |
| Between MD 190 & I-270 West Spur                    | Merge                                  | 13       | 14         | 14       | 12         | 12       | 11         |          |            |
|   | Basic                                  | 7        | 7          | 5        | 5          |          |            |          |            |
|   | I-270 Northbound General Purpose Lanes |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic                                  | 87       | 76         | 113      | 92         | 111      | 112        | 81       | 103        |
| Between MD 117 & I-370                              | Diverge                                | 69       | 63         | 109      | 96         | 115      | 116        | 51       | 108        |
|   | Basic                                  | 58       | 59         | 96       | 100        | 96       | 120        | 36       | 113        |
|   | Merge                                  | 63       | 53         | 138      | 95         | 143      | 120        | 38       | 100        |
| I-370 Interchange                                   | Basic                                  | 50       | 56         | 110      | 113        | 108      | 139        | 26       | 128        |
|   | Merge                                  | 28       | 46         | 101      | 112        | 92       | 133        | 15       | 121        |
|   | Basic                                  | N/A      | 40         | N/A      | 111        | N/A      | 146        | N/A      | 126        |
| Diverge   | 31                                     |          | 75         |          | 103        |          | 83         |          |            |
| Between I-370 & Shady Grove Road                    | Weave                                  |          | 30         |          | 79         |          | 116        |          | 98         |
| Shady Grove Road Interchange                        | Basic                                  |          | 32         |          | 94         |          | 153        |          | 132        |
|   | Merge                                  |          | 25         |          | 44         |          | 83         |          | 55         |
|   | Basic                                  |          | 35         |          | 28         |          | 107        |          | 75         |
| Between Shady Grove Road & MD 28                    | Weave                                  | 32       | N/A        | 78       | N/A        | 111      | N/A        | 31       | N/A        |
|   | Diverge                                | N/A      | 17         | N/A      | 52         | N/A      | 92         | N/A      | 84         |
|   | Basic                                  |          | 26         |          | 65         |          | 149        |          | 133        |
|   | Basic                                  |          | 32         |          | 49         |          | 146        |          | 137        |
|   | Merge                                  |          | 17         |          | 23         |          | 155        |          | 162        |
| MD 28 Interchange                                   | Basic                                  | 35       | 31         | 56       | 33         | 77       | 148        | 25       | 153        |
|   | Weave                                  | 31       | 34         | 49       | 36         | 109      | 134        | 62       | 133        |
|   | Basic                                  | N/A      | 40         | N/A      | 41         | N/A      | 133        | N/A      | 124        |
| Between MD 28 & MD 189                              | Basic                                  | 32       | N/A        | 44       | N/A        | 69       | N/A        | 25       | N/A        |
|   | Weave                                  | N/A      | 48         | N/A      | 46         | N/A      | 123        | N/A      | 138        |
| MD 189 Interchange                                  | Basic                                  | N/A      | 34         | N/A      | 35         | N/A      | 129        | N/A      | 162        |
| Between MD 189 & Montrose Road                      | Diverge                                | 55       | 29         | 73       | 28         | 158      | 104        | 145      | 144        |
|   | Basic                                  | 37       | 36         | 45       | 36         | 139      | 111        | 141      | 144        |
|   | Merge                                  | N/A      | 37         | N/A      | 41         | N/A      | 127        | N/A      | 198        |
| Montrose Road Interchange                           | Diverge                                | 36       | N/A        | 41       | N/A        | 154      | N/A        | 179      | N/A        |
|   | Basic                                  | N/A      | 31         | N/A      | 30         | N/A      | 97         | N/A      | 158        |
|   | Weave                                  |          | 27         |          | 26         |          | 88         |          | 156        |
|   | Basic                                  | 33       | 30         | 34       | 29         | 123      | 81         | 151      | 139        |
|   |  | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type   | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |    |
|--|--|----------|------------|----------|------------|----------|------------|----------|------------|----|
|  |  | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |    |
| I-270 Northbound General Purpose Lanes (Continued) |  |          |            |          |            |          |            |          |            |    |
| Between Montrose Road & Spur Split                 | Weave  | 32       | 29         | 32       | 27         | 99       | 56         | 151      | 150        |    |
|  | Weave  | 34       | N/A        | 35       | N/A        | 81       | N/A        | 143      | N/A        |    |
| Between Spur Split & MD 187                        | Basic  | 50       | 26         | 54       | 28         | 102      | 36         | 179      | 193        |    |
|  | Merge  | 40       | 19         | 62       | 22         | 112      | 24         | 191      | 165        |    |
|  | Weave  | 23       | N/A        | 54       | N/A        | 100      | N/A        | 166      | N/A        |    |
| MD 187 Interchange                                 | Basic  | 22       | 28         | 56       | 28         | 104      | 30         | 139      | 181        |    |
|  | Diverge  | 16       | 19         | 42       | 19         | 105      | 20         | 143      | 121        |    |
|  | Basic  | 23       | 29         | 38       | 30         | 98       | 31         | 137      | 172        |    |
| Between MD 187 & I-495                             | Diverge  | 19       | 22         | 31       | 22         | 92       | 22         | 134      | 113        |    |
|  | Basic  | 26       | 33         | 31       | 34         | 80       | 33         | 134      | 159        |    |
|  | Diverge  | N/A      | 25         | N/A      | 26         | N/A      | 25         | N/A      | 139        |    |
|  | Basic  |          | 26         |          | 26         |          | 25         |          | 147        |    |
|  | Merge  | 21       | 25         | 24       | 25         | 100      | 25         | 209      | 156        |    |
|  | Basic  | 18       | 18         | 18       | 18         | 65       | 17         | 141      | 148        |    |
|  | Basic  | 28       | 28         | 29       | 28         | 86       | 27         | 206      | 148        |    |
|  | I-270 West Spur Northbound General Purpose Lanes |          |            |          |            |          |            |          |            |    |
|  | Between Spur Split & Democracy Boulevard         | Basic    | 29         | 29       | 30         | 24       | 52         | 29       | 126        | 89 |
| Merge  |  | 22       | 23         | 23       | 19         | 27       | 19         | 57       | 67         |    |
| Basic  |  | 26       | 21         | 26       | 16         | 28       | 15         | 116      | 62         |    |
| Merge  |  | 28       | 15         | 29       | 12         | 25       | 11         | 137      | 38         |    |
| Democracy Boulevard Interchange                    | Basic  | 30       | 15         | 29       | 9          | 17       | 8          | 83       | 42         |    |
|  | Merge  | 23       | 15         | 22       | 9          | 17       | 8          | 115      | 38         |    |
|  | Basic  | 28       | 21         | 27       | 13         | 14       | 11         | 75       | 37         |    |
| Between Democracy Boulevard & I-495                | Diverge  | 24       | 19         | 24       | 11         | 11       | 10         | 68       | 27         |    |
|  | Basic  | 33       | N/A        | 31       | N/A        | 14       | N/A        | 58       | N/A        |    |
|  | Diverge  | N/A      | 20         | N/A      | 12         | N/A      | 10         | N/A      | 25         |    |
|  | Basic  |          | 20         |          | 13         |          | 11         |          | 25         |    |
| I-270 Northbound Local Lanes                       |  |          |            |          |            |          |            |          |            |    |
| Between MD 124 & MD 117                            | Diverge  | 27       | N/A        | 18       | N/A        | 19       | N/A        | 31       | N/A        |    |
| Between MD 117 & I-370                             | Weave  | 34       |            | 23       |            | 21       |            | 42       |            |    |
|  | Basic  | 22       |            | 18       |            | 16       |            | 35       |            |    |
|  | Weave  | 56       |            | 129      |            | 133      |            | 74       |            |    |
| I-370 Interchange                                  | Basic  | 52       |            | 158      |            | 165      |            | 107      |            |    |
|  | Merge  | 37       |            | 172      |            | 183      |            | 134      |            |    |
|  | Basic  | 29       |            | 168      |            | 183      |            | 130      |            |    |
| Between I-370 & Shady Grove Road                   | Diverge  | 30       |            | 131      |            | 149      |            | 92       |            |    |
|  | Basic  | 28       |            | 129      |            | 155      |            | 83       |            |    |
|  | Diverge  | 29       |            | 122      |            | 152      |            | 85       |            |    |
|  | Merge  | 22       |            | 133      |            | 172      |            | 101      |            |    |
| Shady Grove Road Interchange                       | Basic  | 23       |            | 132      |            | 183      |            | 92       |            |    |
|  | Weave  | 17       |            | 125      |            | 189      |            | 74       |            |    |
|  |  | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |    |

**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 16       | N/A        | 54       | N/A        | 108      | N/A        | 50       | N/A        |
|  | Basic   | 24       |            | 67       |            | 172      |            | 83       |            |
|  | Diverge | 24       |            | 38       |            | 171      |            | 94       |            |
|  | Weave   | 19       |            | 22       |            | 154      |            | 99       |            |
|  | Merge   | 20       |            | 21       |            | 147      |            | 98       |            |
| MD 28 Interchange                                | Basic   | 22       |            | 22       |            | 147      |            | 103      |            |
|  | Weave   | 33       |            | 41       |            | 104      |            | 93       |            |
|  | Basic   | 37       |            | 38       |            | 94       |            | 71       |            |
| Between MD 28 & MD 189                           | Diverge | 32       |            | 50       |            | 80       |            | 71       |            |
|  | Basic   | 27       |            | 45       |            | 72       |            | 70       |            |
|  | Weave   | 28       |            | 49       |            | 149      |            | 128      |            |
|  | Basic   | 30       |            | 43       |            | 162      |            | 138      |            |
|  | Merge   | 30       |            | 38       |            | 164      |            | 143      |            |
| MD 189 Interchange                               | Basic   | 34       |            | 38       |            | 182      |            | 158      |            |
| Between MD 189 & Montrose Road                   | Diverge | 28       |            | 29       |            | 115      |            | 104      |            |
|  | Basic   | 43       |            | 43       |            | 157      |            | 153      |            |
|  | Merge   | 38       |            | 49       |            | 137      |            | 164      |            |
|  | Basic   | 39       | 38         | 151      | 174        |          |            |          |            |
|  | Merge   | 27       | 24         | 145      | 179        |          |            |          |            |
| Montrose Road Interchange                        | Basic   | 19       | 16         | 114      | 155        |          |            |          |            |
|  | Weave   | 16       | 14         | 75       | 123        |          |            |          |            |
|  | Basic   | 18       | 15         | 47       | 97         |          |            |          |            |
| Between Montrose Road & Spur Split               | Diverge | 19       | 18         | 19       | 41         |          |            |          |            |
|  | Basic   | 28       | 25         | 17       | 32         |          |            |          |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 30         | N/A      | 89         | N/A      | 127        | N/A      | 125        |
|  | Diverge |          | 24         |          | 44         |          | 77         |          | 76         |
|  | Basic   |          | 24         |          | 47         |          | 107        |          | 114        |
|  | Merge   |          | 16         |          | 32         |          | 90         |          | 105        |
| Gude Drive Interchange                           | Basic   |          | 21         |          | 28         |          | 103        |          | 146        |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 19         |          | 19         |          | 55         |          | 92         |
|  | Basic   |          | 27         |          | 27         |          | 48         |          | 103        |
|  | Merge   |          | 18         |          | 18         |          | 20         |          | 55         |
| Wootton Parkway Interchange                      | Basic   |          | 24         |          | 24         |          | 24         |          | 56         |
| Between Wootton Parkway & Spur Split             | Diverge |          | 19         |          | 20         |          | 18         |          | 24         |
|  | Basic   | 28       | 29         | 27       | 27         |          |            |          |            |
|  | Weave   | 19       | 19         | 18       | 16         |          |            |          |            |
| Spur Split through MD 187 Interchange            | Basic   | 8        | 8          | 8        | 4          |          |            |          |            |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 25         | N/A      | 25         | N/A      | 23         | N/A      | 22         |
|  | Merge   |          | 17         |          | 17         |          | 16         |          | 15         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 19         |          | 19         |          | 16         |          | 16         |
|  | Weave   |          | 19         |          | 19         |          | 17         |          | 22         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 27         | N/A      | 28         | N/A      | 25         | N/A      | 23         |
|  | Diverge |          | 19         |          | 20         |          | 18         |          | 17         |
|  | Basic   |          | 28         |          | 29         |          | 26         |          | 24         |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |
| MD 117 Interchange                                       | Basic   | 21       | 22         | 22       | 24         | 23       | 25         | 23       | 24         |
| Between MD 117 & I-370                                   | Merge   | 27       | 24         | 29       | 27         | 31       | 28         | 27       | 24         |
|  | Basic   | 22       | 19         | 23       | 21         | 25       | 21         | 23       | 19         |
|  | Diverge | 20       | 18         | 21       | 21         | 22       | 21         | 20       | 19         |
| I-370 Interchange  | Basic   | 18       | 19         | 19       | 20         | 20       | 21         | 20       | 21         |
|  | Diverge | 15       | 15         | 15       | 17         | 16       | 18         | 16       | 17         |
|  | Basic   | 15       | 16         | 16       | 17         | 15       | 17         | 16       | 17         |
|  | Basic   |          | 13         |          | 13         |          | 14         |          | 14         |
| Between I-370 & Shady Grove Road                         | Weave   | N/A      | 14         | N/A      | 14         | N/A      | 14         | N/A      | 13         |
|  | Diverge |          | 20         |          | 20         |          | 20         |          | 19         |
| Shady Grove Road Interchange                             | Merge   | 18       | N/A        | 18       | N/A        | 17       | N/A        | 21       | N/A        |
|  | Basic   | 20       | 17         | 21       | 17         | 19       | 18         | 23       | 18         |
|  | Diverge | 22       | 17         | 23       | 18         | 21       | 19         | 25       | 18         |
| Between Shady Grove Road & MD 28                         | Basic   | 18       | 19         | 17       | 20         | 16       | 21         | 20       | 20         |
|  | Merge   | 16       | 19         | 15       | 21         | 14       | 23         | 18       | 20         |
|  | Basic   | 21       | 21         | 20       | 23         | 19       | 24         | 24       | 22         |
| MD 28 Interchange  | Diverge | N/A      | 17         | N/A      | 18         | N/A      | 19         | N/A      | 18         |
|  | Basic   |          | 19         |          | 20         |          | 21         |          | 20         |
|  | Merge   | 18       | 15         | 17       | 15         | 17       | 16         | 20       | 15         |
|  | Basic   | 23       | 17         | 21       | 17         | 20       | 18         | 25       | 17         |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 13         | N/A      | 14         | N/A      | 15         | N/A      | 14         |
|  | Basic   |          | 20         |          | 21         |          | 22         |          | 21         |
|  | Diverge | 25       | 22         | 23       | 23         | 22       | 26         | 26       | 23         |
| MD 189 Interchange                                       | Basic   | 19       | 21         | 19       | 22         | 16       | 23         | 21       | 22         |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 21         | N/A      | 21         | N/A      | 22         | N/A      | 21         |
|  | Basic   |          | 24         |          | 25         |          | 26         |          | 25         |
| Montrose Road Interchange                                | Merge   | 18       | N/A        | 17       | N/A        | 16       | N/A        | 20       | N/A        |
|  | Diverge | N/A      | 24         | N/A      | 25         | N/A      | 27         | N/A      | 25         |
|  | Basic   |          | 23         |          | 24         |          | 25         |          | 23         |
|  | Weave   |          | 23         |          | 24         |          | 23         |          | 22         |
|  | Basic   |          | 23         |          | 24         |          | 23         |          | 21         |
| Between Montrose Road & Spur Split                       | Basic   | 20       | N/A        | 20       | N/A        | 17       | N/A        | 22       | N/A        |
|  | Weave   | 19       |            | 20       |            | 17       |            | 20       |            |
|  | Diverge | 13       |            | 13       |            | 10       |            | 14       |            |
|  | Weave   | 18       |            | 20       |            | 19       |            | 21       |            |
| Spur Split through MD 187 Interchange                    | Basic   | 17       | 21         | 17       | 21         | 14       | 21         | 17       | 19         |
|  | Diverge | 17       | 13         | 17       | 13         | 20       | 14         | 19       | 12         |
|  | Basic   | 18       | 24         | 17       | 23         | 45       | 25         | 35       | 21         |
|  | Merge   | 17       | 19         | 19       | 19         | 83       | 22         | 38       | 16         |
|  | Basic   | 20       | 28         | 24       | 28         | 95       | 33         | 51       | 24         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |



**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 16       | 21         | 29       | 21         | 136      | 25         | 68       | 16         |
|  | Basic   | 21       | 29         | 61       | 30         | 124      | 37         | 71       | 24         |
|  | Merge   | N/A      | 22         | N/A      | 22         | N/A      | 34         | N/A      | 18         |
|  | Diverge | 21       | 23         | 83       | 26         | 120      | 38         | 72       | 18         |
|  | Basic   | 27       | 33         | 104      | 51         | 128      | 54         | 80       | 25         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 16       | 13         | 17       | 14         | 15       | 14         | 16       | 12         |
|  | Weave   | 14       | N/A        | 15       | N/A        | 13       | N/A        | 14       | N/A        |
|  | Diverge | N/A      | 13         | N/A      | 15         | N/A      | 15         | N/A      | 13         |
| Democracy Boulevard                                | Merge   | N/A      | 14         | N/A      | 14         | N/A      | 14         | N/A      | 14         |
|  | Basic   | 14       | 18         | 15       | 19         | 12       | 18         | 14       | 18         |
|  | Diverge | N/A      | 14         | N/A      | 14         | N/A      | 14         | N/A      | 14         |
|  | Basic   | N/A      | 13         | N/A      | 14         | N/A      | 14         | N/A      | 13         |
| Democracy Boulevard to I-495                       | Merge   | 12       | 12         | 12       | 13         | 10       | 12         | 10       | 11         |
|  | Merge   | 19       | N/A        | 20       | N/A        | 16       | N/A        | 17       | N/A        |
|  | Basic   | 23       | 16         | 26       | 18         | 20       | 17         | 21       | 16         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 8        | N/A        | 7        | N/A        | 11       | N/A        | 9        | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 18       |            | 15       |            | 14       |            | 21       |            |
|  | Diverge | 16       |            | 14       |            | 12       |            | 16       |            |
| Shady Grove Road Interchange                       | Basic   | 16       |            | 13       |            | 11       |            | 16       |            |
|  | Merge   | 15       |            | 13       |            | 11       |            | 16       |            |
|  | Basic   | 22       |            | 19       |            | 16       |            | 24       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 18       |            | 17       |            | 13       |            | 22       |            |
|  | Basic   | 27       |            | 25       |            | 19       |            | 33       |            |
|  | Merge   | 20       |            | 21       |            | 16       |            | 24       |            |
|  | Diverge | 20       |            | 21       |            | 16       |            | 24       |            |
|  | Diverge | 24       |            | 25       |            | 20       |            | 29       |            |
|  | Basic   | 21       |            | 23       |            | 18       |            | 26       |            |
|  | Diverge | 15       |            | 16       |            | 12       |            | 18       |            |
| MD 28 Interchange                                  | Basic   | 15       |            | 17       |            | 13       |            | 19       |            |
|  | Merge   | 13       |            | 13       |            | 10       |            | 15       |            |
|  | Basic   | 18       |            | 19       |            | 14       |            | 22       |            |
| Between MD 28 & MD 189                             | Merge   | 19       |            | 20       |            | 18       |            | 22       |            |
|  | Basic   | 19       |            | 20       |            | 18       |            | 22       |            |
|  | Merge   | 21       |            | 20       |            | 20       |            | 23       |            |
|  | Basic   | 25       |            | 25       |            | 24       |            | 28       |            |
|  | Diverge | 25       |            | 25       |            | 24       |            | 28       |            |
| MD 189 Interchange                                 | Basic   | 29       |            | 29       |            | 28       |            | 32       |            |
| Between MD 189 & Montrose Road                     | Merge   | 23       |            | 23       |            | 22       |            | 26       |            |
|  | Diverge | 23       |            | 24       |            | 22       |            | 26       |            |
|  | Basic   | 20       |            | 21       |            | 20       |            | 23       |            |
|  | Diverge | 14       |            | 14       |            | 13       |            | 16       |            |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

**Table 6-19: 2045 PM VISSIM Freeway Density (pc/hr/ln) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Montrose Road Interchange                        | Basic   | 17       | N/A        | 17       | N/A        | 16       | N/A        | 19       | N/A        |
|  | Weave   | 21       |            | 22       |            | 16       |            | 17       |            |
|  | Basic   | 16       |            | 17       |            | 11       |            | 13       |            |
|  | Merge   | 13       |            | 15       |            | 11       |            | 11       |            |
|  | Basic   | 20       |            | 22       |            | 17       |            | 16       |            |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                | Basic   | N/A      | 12         | N/A      | 15         | N/A      | 15         | N/A      | 14         |
| Between I-370 & Gude Drive                       | Merge   |          | 14         |          | 15         |          | 16         |          | 15         |
|  | Basic   |          | 14         |          | 15         |          | 16         |          | 15         |
|  | Diverge |          | 9          |          | 10         |          | 11         |          | 10         |
| Gude Drive Interchange                           | Basic   |          | 11         |          | 12         |          | 13         |          | 13         |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 12         |          | 13         |          | 13         |          | 13         |
|  | Basic   |          | 17         |          | 19         |          | 20         |          | 19         |
|  | Diverge |          | 12         |          | 13         |          | 13         |          | 13         |
| Wootton Parkway Interchange                      | Basic   |          | 14         |          | 16         |          | 17         |          | 16         |
| Between Wootton Parkway and Spur Split           | Merge   |          | 14         |          | 15         |          | 15         |          | 14         |
|  | Basic   |          | 20         |          | 23         |          | 22         |          | 21         |
|  | Diverge |          | 13         |          | 15         |          | 15         |          | 14         |
| Spur Split through MD 187 Interchange            | Basic   |          | 8          |          | 9          |          | 8          |          | 9          |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 16         | N/A      | 18         | N/A      | 18         | N/A      | 17         |
|  | Diverge |          | 11         |          | 12         |          | 12         |          | 11         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 13         |          | 15         |          | 16         |          | 14         |
|  | Diverge |          | 10         |          | 11         |          | 12         |          | 10         |
|  | Basic   |          | 8          |          | 9          |          | 9          |          | 7          |
| Westlake Terrace/Fernwood Road to I-<br>495      | Merge   |          | 6          |          | 8          |          | 7          |          | 6          |
|  | Basic   |          | 10         |          | 12         |          | 11         |          | 9          |
|  | Merge   |          | 11         |          | 12         |          | 11         |          | 10         |
|  | Basic   |          | 16         |          | 18         |          | 16         |          | 15         |
|  |         | LOS A-C  | LOS D      | LOS E    | LOS F      |          |            |          |            |

#### 6.4.3.4 Freeway Speed Analysis

**Table 6-20 and Table 6-21** compare freeway speed by segment between No Build and Preferred Alternative conditions during the AM and PM peak periods, respectively. **Figure 6-38 to Figure 6-45** summarize and compare freeway speed along I-495 and I-270 during the AM and PM peak periods between 2017 Existing, No Build, and Preferred Alternative conditions.

Along the I-495 Inner Loop during the AM peak period, speeds improve approaching the American Legion Bridge and the I-270 West Spur but decrease east of the I-270 West Spur as throughput increases from the Preferred Alternative mitigation of the existing bottleneck near the American Legion Bridge. The Preferred Alternative serves all vehicles at the I-495 Inner Loop input in this area south of VA 193, unlike the No Build conditions.

Along the I-495 Outer Loop, speeds significantly improve at all congested segments, particularly between the MD 185 and MD 190 interchanges, as shown in **Table 6-20**, and like the 2027 Preferred Alternative trends. During all AM peak period hours, speeds in the HOT lanes are at or near free-flow conditions.

Along I-270 Northbound and Southbound, speeds are generally at or near free-flow during the AM peak period under both No Build and Preferred Alternative conditions. However, small pockets of congestion shown in the No Build conditions are mitigated with the Preferred Alternative, particularly around the Watkins Mill Road and MD 117 interchanges.

**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 58       | 58         | 42       | 57         | 12       | 58         | 12       | 58         |
|   | Diverge | 56       | 54         | 31       | 52         | 11       | 56         | 11       | 58         |
| VA 193 Interchange  | Basic   | 56       | 55         | 26       | 55         | 12       | 57         | 13       | 58         |
|   | Merge   | 52       | 53         | 19       | 49         | 9        | 46         | 10       | 49         |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 56       | 56         | 20       | 55         | 12       | 54         | 12       | 55         |
|   | Diverge | 57       | 57         | 22       | 56         | 14       | 56         | 14       | 57         |
| George Washington Memorial Parkway Interchange                    | Basic   | 56       | 57         | 18       | 55         | 15       | 55         | 15       | 56         |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 45       | 56         | 18       | 51         | 17       | 52         | 16       | 54         |
|   | Diverge | 38       | N/A        | 33       | N/A        | 34       | N/A        | 29       | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 51       | 57         | 50       | 54         | 50       | 55         | 39       | 56         |
| Between Clara Barton Parkway & MD 190                             | Merge   | 56       | 57         | 55       | 56         | 55       | 56         | 31       | 56         |
|   | Basic   | 56       | 57         | 56       | 56         | 56       | 56         | 28       | 56         |
|   | Diverge | 56       | 57         | 56       | 56         | 55       | 56         | 26       | 56         |
| MD 190 Interchange  | Basic   | 57       | 57         | 57       | 56         | 56       | 55         | 18       | 56         |
|   | Merge   | 58       | 58         | 58       | 58         | 48       | 53         | 12       | 47         |
|   | Basic   | 58       | N/A        | 58       | N/A        | 38       | N/A        | 12       | N/A        |
| Between MD 190 & I-270 West Spur                                  | Merge   | 58       | 58         | 58       | 57         | 32       | 50         | 14       | 43         |
|   | Basic   | 57       | 58         | 56       | 57         | 27       | 42         | 18       | 33         |
|   | Weave   | 58       | 57         | 58       | 54         | 34       | 34         | 28       | 25         |
| Between I-270 West Spur & MD 187                                  | Basic   | 56       | 52         | 56       | 49         | 57       | 20         | 57       | 12         |
|   | Merge   | N/A      | 58         | N/A      | 48         | N/A      | 9          | N/A      | 8          |
|   | Basic   |          | 57         |          | 39         |          | 12         |          | 12         |
|   | Diverge | 46       | 54         | 44       | 33         | 48       | 16         | 50       | 16         |
| MD 187 Interchange  | Basic   | 56       | 57         | 56       | 24         | 57       | 9          | 57       | 10         |
| Between MD 187 & I-270 East Spur                                  | Merge   | 55       | 55         | 54       | 20         | 56       | 9          | 56       | 11         |
|   | Basic   | 57       | N/A        | 57       | N/A        | 57       | N/A        | 57       | N/A        |
|   | Diverge | 55       | 54         | 55       | 25         | 57       | 16         | 57       | 18         |
| I-270 East Spur Interchange                                       | Basic   | 51       | 49         | 51       | 27         | 52       | 18         | 52       | 22         |
|   | Weave   | 59       | 59         | 55       | 26         | 53       | 18         | 60       | 20         |
|   | Weave   | 59       | 59         | 50       | 29         | 50       | 23         | 59       | 25         |
|   | Basic   | 60       | N/A        | 44       | N/A        | 47       | N/A        | 59       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 60       | 60         | 38       | 26         | 42       | 21         | 60       | 22         |
|   | Basic   | 59       | 58         | 48       | 42         | 53       | 41         | 59       | 41         |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 64       | 64         | 64       | 64         | 64       | 64         | 64       | 64         |
| George Washington Memorial Parkway Interchange                    | Diverge | 63       | 63         | 63       | 63         | 64       | 63         | 64       | 63         |
|   | Merge   | 64       | N/A        | 63       | N/A        | 63       | N/A        | 63       | N/A        |
|   | Basic   | 59       | 64         | 57       | 63         | 57       | 64         | 57       | 64         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|   | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |
|   | Merge   |          | 64         |          | 64         |          | 64         |          |            |
|   | Basic   |          | 65         |          | 64         |          | 64         |          |            |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 64         |          | 63         |          | 63         |          | 62         |
|   | Basic   |          | 64         |          | 64         |          | 64         |          |            |
|   | Diverge |          | 63         |          | 63         |          | 63         |          |            |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 59         |          | 58         |          | 53         |          | 50         |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 53       | 53         | 53       | 53         | 52       | 52         | 53       | 53         |
|   | Merge   | 54       | 54         | 53       | 53         | 53       | 53         | 53       | 54         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 54       | 54         | 53       | 53         | 53       | 53         | 53       | 54         |
|   | Basic   | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|   | Diverge | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |
|   | Basic   | 53       | 52         | 53       | 51         | 53       | 52         | 53       | 52         |
|   | Diverge | 52       | 51         | 52       | 51         | 51       | 51         | 51       | 51         |
|   | Basic   | 52       | N/A        | 51       | N/A        | 48       | N/A        | 50       | N/A        |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 53       |            | 52       |            | 51       |            | 52       |            |
|   | Basic   | N/A      | 53         | N/A      | 52         | N/A      | 52         | N/A      | 53         |
|   | Merge   |          | 50         |          | 49         |          | 48         |          | 49         |
| Clara Barton Parkway Interchange                                    | Basic   | 53       | 52         | 53       | 52         | 53       | 52         | 53       | 53         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 53       | 52         | 53       | 52         | 53       | 53         | 53       | 53         |
|   | Basic   | 47       | 52         | 48       | 52         | 51       | 52         | 50       | 53         |
|   | Merge   | 34       | 54         | 31       | 53         | 46       | 53         | 45       | 53         |
| MD 190 Interchange  | Basic   | 47       | 53         | 43       | 53         | 52       | 53         | 52       | 53         |
|   | Diverge | 50       | 52         | 51       | 52         | 51       | 53         | 51       | 53         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 53       | 53         | 33       | 53         | 26       | 53         | 29       | 54         |
|   | Basic   | 42       | 49         | 34       | 49         | 27       | 50         | 31       | 52         |
|   | Weave   | 31       | 39         | 22       | 41         | 17       | 46         | 21       | 53         |
| Between I-270 West Spur & MD 187                                    | Basic   | 41       | 52         | 16       | 52         | 8        | 52         | 10       | 52         |
|   | Diverge | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
|   | Basic   |          | 53         |          | 53         |          | 53         |          |            |
|   | Merge   |          | 53         |          | 52         |          | 22         |          | 52         |
| MD 187 Interchange  | Basic   | 53       | 53         | 33       | 53         | 12       | 54         | 7        | 53         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 53       | 53         | 40       | 53         | 27       | 53         | 14       | 53         |
|   | Basic   | 53       | 53         | 40       | 53         | 25       | 53         | 10       | 53         |
|   | Merge   | 49       | 49         | 39       | 49         | 23       | 49         | 16       | 49         |
| I-270 East Spur Interchange   | Basic   | 53       | 53         | 43       | 53         | 25       | 53         | 18       | 53         |
|   | Diverge | 53       | 53         | 48       | 53         | 26       | 53         | 25       | 53         |
| Between I-270 East Spur & MD 185                                    | Diverge | 53       | 53         | 51       | 53         | 29       | 51         | 31       | 53         |
|   | Basic   | 53       | 53         | 50       | 51         | 24       | 42         | 27       | 50         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic   | 65       | 63         | 65       | 63         | 64       | 63         | 65       | 63         |
| George Washington Memorial Parkway Interchange      | Merge   | 59       | 58         | 59       | 58         | 58       | 57         | 59       | 57         |
|   | Basic   | 65       | 64         | 65       | 64         | 65       | 64         | 65       | 64         |
|   | Diverge | N/A      | 62         | N/A      | 63         | N/A      | 62         | N/A      | 61         |
|   | Basic   | 58       | 63         | 58       | 63         | 58       | 63         | 58       | 62         |
|   | Merge   | N/A      | 62         | N/A      | 63         | N/A      | 62         | N/A      | 61         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          |            |
|   | Diverge |          | 63         |          | 63         |          | 63         |          |            |
|   | Basic   |          | 63         |          | 63         |          | 63         |          |            |
| Between MD 190 & I-270 West Spur                    | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|   | Merge   |          | 63         |          | 63         |          | 63         |          | 63         |
| Between I-270 West Spur & MD 187                    | Basic   |          | 58         |          | 58         |          | 58         |          | 58         |
| I-270 Northbound General Purpose Lanes              |         |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic   | 65       | 59         | 64       | 59         | 64       | 58         | 64       | 58         |
| Between MD 117 & I-370                              | Diverge | 64       | 59         | 63       | 58         | 62       | 56         | 63       | 57         |
|   | Basic   | 64       | 59         | 63       | 58         | 62       | 57         | 63       | 58         |
|   | Merge   | 62       | 59         | 60       | 57         | 60       | 56         | 60       | 57         |
| I-370 Interchange                                   | Basic   | 65       | 59         | 64       | 57         | 64       | 56         | 64       | 57         |
|   | Merge   | 52       | 59         | 51       | 58         | 51       | 57         | 51       | 57         |
|   | Basic   | N/A      | 61         | N/A      | 59         | N/A      | 57         | N/A      | 58         |
|   | Diverge |          | 58         |          | 56         |          | 53         |          | 55         |
| Between I-370 & Shady Grove Road                    | Weave   | N/A      | 61         | N/A      | 59         | N/A      | 58         | N/A      | 59         |
| Shady Grove Road Interchange                        | Basic   |          | 61         |          | 59         |          | 58         |          | 59         |
|   | Merge   |          | 60         |          | 58         |          | 57         |          | 58         |
|   | Basic   | 65       | 62         | 64       | 60         | 64       | 59         | 64       | 60         |
| Between Shady Grove Road & MD 28                    | Weave   | 64       | N/A        | 64       | N/A        | 63       | N/A        | 63       | N/A        |
|   | Diverge | N/A      | 61         | N/A      | 60         | N/A      | 59         | N/A      | 59         |
|   | Basic   |          | 61         |          | 59         |          | 59         |          | 59         |
|   | Basic   |          | 62         |          | 60         |          | 59         |          | 59         |
|   | Merge   |          | 59         |          | 57         |          | 56         |          | 57         |
| MD 28 Interchange                                   | Basic   | 64       | 62         | 64       | 60         | 64       | 58         | 64       | 59         |
|   | Weave   | 64       | 59         | 63       | 56         | 62       | 48         | 63       | 54         |
|   | Basic   | N/A      | 62         | N/A      | 60         | N/A      | 58         | N/A      | 59         |
| Between MD 28 & MD 189                              | Basic   | 64       | 62         | 64       | 60         | 63       | 58         | 63       | 59         |
| MD 189 Interchange                                  | Basic   | N/A      | 62         | N/A      | 61         | N/A      | 60         | N/A      | 61         |
| Between MD 189 & Montrose Road                      | Diverge | 64       | 62         | 64       | 60         | 62       | 59         | 62       | 59         |
|   | Basic   | 64       | 63         | 64       | 61         | 64       | 59         | 64       | 60         |
|   | Merge   | N/A      | 61         | N/A      | 59         | N/A      | 52         | N/A      | 56         |
| Montrose Road Interchange                           | Diverge | 64       | N/A        | 64       | N/A        | 62       | N/A        | 63       | N/A        |
|   | Basic   | N/A      | 64         | N/A      | 63         | N/A      | 62         | N/A      | 63         |
|   | Weave   |          | 62         |          | 61         |          | 60         |          | 60         |
|   | Basic   | 64       | 64         | 64       | 64         | 64       | 63         | 64       | 63         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between Montrose Road & Spur Split                 | Weave   | 64       | 64         | 64       | 64         | 63       | 63         | 63       | 63         |
|  | Weave   | 64       | N/A        | 64       | N/A        | 63       | N/A        | 63       | N/A        |
| Between Spur Split & MD 187                        | Basic   | 64       | 64         | 63       | 64         | 62       | 63         | 62       | 63         |
|  | Merge   | 63       | 62         | 60       | 58         | 57       | 55         | 59       | 57         |
|  | Weave   | 50       | N/A        | 58       | N/A        | 59       | N/A        | 60       | N/A        |
| MD 187 Interchange                                 | Basic   | 64       | 64         | 64       | 63         | 63       | 63         | 63       | 63         |
|  | Diverge | 64       | 59         | 63       | 58         | 63       | 57         | 63       | 58         |
|  | Basic   | 64       | 63         | 64       | 62         | 63       | 61         | 63       | 62         |
| Between MD 187 & I-495                             | Diverge | 64       | 63         | 63       | 61         | 63       | 59         | 63       | 60         |
|  | Basic   | 64       | 63         | 63       | 62         | 61       | 56         | 62       | 61         |
|  | Diverge | N/A      | 63         | N/A      | 62         | N/A      | 47         | N/A      | 57         |
|  | Basic   |          | 63         |          | 62         |          | 50         |          | 56         |
|  | Merge   | 60       | 60         | 59       | 59         | 47       | 51         | 53       | 55         |
|  | Basic   | 64       | 64         | 63       | 63         | 50       | 58         | 54       | 63         |
|  | Basic   | 59       | 59         | 58       | 59         | 45       | 58         | 49       | 58         |
| I-270 West Spur Northbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Between Spur Split & Democracy Boulevard           | Basic   | 64       | 64         | 64       | 64         | 64       | 63         | 64       | 63         |
|  | Merge   | 63       | 62         | 63       | 61         | 62       | 60         | 62       | 60         |
|  | Basic   | 65       | 64         | 64       | 64         | 64       | 63         | 64       | 63         |
|  | Merge   | 63       | 56         | 63       | 56         | 62       | 56         | 62       | 56         |
| Democracy Boulevard Interchange                    | Basic   | 64       | 65         | 64       | 64         | 63       | 64         | 63       | 63         |
|  | Merge   | 62       | 63         | 60       | 62         | 60       | 61         | 59       | 61         |
|  | Basic   | 64       | 63         | 64       | 63         | 63       | 62         | 62       | 61         |
| Between Democracy Boulevard & I-495                | Diverge | 63       | 62         | 62       | 62         | 60       | 60         | 59       | 58         |
|  | Basic   | 61       | 63         | 59       | 62         | 50       | 60         | 49       | 59         |
|  | Diverge | N/A      | 62         | N/A      | 60         | N/A      | 57         | N/A      | 56         |
|  | Basic   |          | 62         |          | 61         |          | 54         |          | 50         |
| I-270 Northbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| Between MD 124 & MD 117                            | Diverge | 43       | N/A        | 43       | N/A        | 42       | N/A        | 42       | N/A        |
| Between MD 117 & I-370                             | Weave   | 42       |            | 42       |            | 39       |            | 40       |            |
|  | Basic   | 42       |            | 42       |            | 42       |            | 42       |            |
|  | Weave   | 43       |            | 42       |            | 42       |            | 42       |            |
| I-370 Interchange                                  | Basic   | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Merge   | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Basic   | 44       |            | 44       |            | 44       |            | 44       |            |
| Between I-370 & Shady Grove Road                   | Diverge | 49       |            | 47       |            | 45       |            | 45       |            |
|  | Basic   | 49       |            | 47       |            | 46       |            | 46       |            |
|  | Diverge | 50       |            | 48       |            | 47       |            | 47       |            |
|  | Merge   | 47       |            | 46       |            | 45       |            | 45       |            |
| Shady Grove Road Interchange                       | Basic   | 52       |            | 52       |            | 51       |            | 51       |            |
|  | Weave   | 51       |            | 51       |            | 50       |            | 51       |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph



**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 43       | N/A        | 43       | N/A        | 43       | N/A        | 43       | N/A        |
|  | Basic   | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Diverge | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Weave   | 41       |            | 41       |            | 40       |            | 40       |            |
|  | Merge   | 43       |            | 43       |            | 42       |            | 42       |            |
| MD 28 Interchange                                | Basic   | 43       |            | 43       |            | 43       |            | 43       |            |
|  | Weave   | 42       |            | 40       |            | 38       |            | 38       |            |
|  | Basic   | 43       |            | 42       |            | 41       |            | 41       |            |
| Between MD 28 & MD 189                           | Diverge | 41       |            | 39       |            | 31       |            | 34       |            |
|  | Basic   | 43       |            | 43       |            | 41       |            | 42       |            |
|  | Weave   | 43       |            | 42       |            | 42       |            | 42       |            |
|  | Basic   | 43       |            | 42       |            | 42       |            | 42       |            |
|  | Merge   | 43       |            | 42       |            | 42       |            | 42       |            |
| MD 189 Interchange                               | Basic   | 42       |            | 42       |            | 42       |            | 42       |            |
| Between MD 189 & Montrose Road                   | Diverge | 42       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 42       |            | 42       |            | 41       |            | 41       |            |
|  | Merge   | 43       |            | 42       |            | 41       |            | 42       |            |
|  | Basic   | 42       |            | 42       |            | 41       |            | 41       |            |
|  | Merge   | 41       |            | 40       |            | 36       |            | 37       |            |
| Montrose Road Interchange                        | Basic   | 43       |            | 43       |            | 42       |            | 42       |            |
|  | Weave   | 42       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 43       |            | 43       |            | 42       |            | 42       |            |
| Between Montrose Road & Spur Split               | Diverge | 41       |            | 39       |            | 37       |            | 39       |            |
|  | Basic   | 45       |            | 45       |            | 44       |            | 44       |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 63         | N/A      | 64         | N/A      | 63         | N/A      | 63         |
|  | Diverge |          | 63         |          | 64         |          | 63         |          | 63         |
|  | Basic   |          | 64         |          | 64         |          | 63         |          | 63         |
|  | Merge   |          | 63         |          | 63         |          | 62         |          | 63         |
| Gude Drive Interchange                           | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 57         |          | 57         |          | 56         |          | 56         |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|  | Merge   |          | 62         |          | 62         |          | 61         |          | 62         |
| Wootton Parkway Interchange                      | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |
| Between Wootton Parkway & Spur Split             | Diverge |          | 59         |          | 58         |          | 57         |          | 57         |
|  | Basic   |          | 64         |          | 64         |          | 63         |          | 63         |
|  | Weave   |          | 64         |          | 64         |          | 64         |          | 64         |
| Spur Split through MD 187 Interchange            | Basic   |          | 64         |          | 64         |          | 63         |          | 64         |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 64         | N/A      | 64         | N/A      | 64         | N/A      | 64         |
|  | Merge   |          | 64         |          | 64         |          | 63         |          | 64         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 63         |          | 62         |          | 61         |          | 62         |
|  | Weave   |          | 62         |          | 61         |          | 60         |          | 61         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |    |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|----|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |    |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |    |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 64         | N/A      | 64         | N/A      | 64         | N/A      | 64         |    |
|  | Diverge |          | 64         |          | 63         |          | 64         |          | 63         |    |
|  | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |    |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |    |
| MD 117 Interchange                                       | Basic   | 20       | 22         | 18       | 20         | 17       | 20         | 19       | 22         |    |
| Between MD 117 & I-370                                   | Merge   | 32       | 26         | 32       | 24         | 32       | 23         | 32       | 24         |    |
|  | Basic   | 40       | 43         | 45       | 44         | 47       | 43         | 44       | 43         |    |
|  | Basic   | 40       | N/A        | 44       | N/A        | 43       | N/A        | 44       | N/A        |    |
|  | Diverge | 49       | 50         | 52       | 51         | 52       | 50         | 52       | 50         |    |
| I-370 Interchange  | Basic   | 46       | 52         | 50       | 52         | 51       | 52         | 50       | 52         |    |
|  | Diverge | 52       | 49         | 52       | 48         | 52       | 48         | 52       | 48         |    |
|  | Basic   | 53       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |    |
|  | Basic   | N/A      | 54         | N/A      | 54         | N/A      | 55         | N/A      | 54         |    |
| Between I-370 & Shady Grove Road                         | Weave   |          | 53         |          | 53         |          | 53         |          | 53         |    |
| Diverge  | 52      |          | 52         |          | 52         |          | 52         |          | 53         |    |
| Shady Grove Road Interchange                             | Merge   | 48       | N/A        | 50       | N/A        | 53       | N/A        | 53       | N/A        |    |
|  | Basic   | 46       | 53         | 49       | 53         | 51       | 53         | 52       | 53         |    |
|  | Diverge | 51       | 49         | 51       | 50         | 52       | 50         | 52       | 50         |    |
| Between Shady Grove Road & MD 28                         | Basic   | 53       | 52         | 53       | 53         | 53       | 53         | 53       | 53         |    |
|  | Merge   | 52       | 50         | 53       | 50         | 53       | 50         | 53       | 50         |    |
|  | Basic   | 52       | 52         | 52       | 53         | 53       | 53         | 53       | 53         |    |
| MD 28 Interchange  | Diverge | N/A      | 54         | N/A      | 54         | N/A      | 54         | N/A      | 54         |    |
|  | Basic   |          | 53         |          | 53         |          | 53         |          | 53         | 53 |
|  | Merge   | 52       | 53         | 53       | 53         | 53       | 53         | 53       | 53         |    |
|  | Basic   | 51       | 53         | 52       | 53         | 52       | 53         | 52       | 53         |    |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 52         | N/A      | 52         | N/A      | 52         | N/A      | 52         |    |
|  | Basic   |          | 52         |          | 52         |          | 53         |          | 53         | 53 |
|  | Diverge | 51       | 52         | 52       | 52         | 52       | 53         | 52       | 53         |    |
| MD 189 Interchange                                       | Basic   | 53       | 52         | 53       | 52         | 53       | 53         | 53       | 53         |    |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 47         | N/A      | 43         | N/A      | 50         | N/A      | 52         |    |
|  | Basic   |          | 48         |          | 49         |          | 50         |          | 51         |    |
| Montrose Road Interchange                                | Merge   | 53       | N/A        | 53       | N/A        | 53       | N/A        | 53       | N/A        |    |
|  | Diverge | N/A      | 51         | N/A      | 51         | N/A      | 51         | N/A      | 51         |    |
|  | Basic   |          | 53         |          | 53         |          | 53         |          | 53         |    |
|  | Weave   |          | 50         |          | 48         |          | 49         |          | 49         |    |
|  | Basic   |          | 52         |          | 51         |          | 52         |          | 52         |    |
| Between Montrose Road & Spur Split                       | Basic   | N/A      | 53         | N/A      | 52         | N/A      | 53         | N/A      | N/A        |    |
|  | Weave   |          | 52         |          | 39         |          | 41         |          |            | 51 |
|  | Diverge |          | 53         |          | 52         |          | 49         |          |            | 53 |
|  | Weave   | 53       | 51         | 53       | 38         | 48       | 41         | 53       | 51         |    |
| Spur Split through MD 187 Interchange                    | Basic   | 57       | 61         | 56       | 60         | 56       | 59         | 57       | 61         |    |
|  | Diverge | 63       | 63         | 62       | 62         | 61       | 62         | 63       | 63         |    |
|  | Basic   | 63       | 63         | 63       | 63         | 63       | 63         | 63       | 63         |    |
|  | Merge   | 59       | 56         | 56       | 52         | 55       | 52         | 58       | 53         |    |
|  | Basic   | 63       | 63         | 62       | 61         | 61       | 61         | 63       | 62         |    |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 62       | 61         | 59       | 57         | 53       | 57         | 57       | 58         |
|  | Basic   | 63       | 63         | 60       | 61         | 59       | 60         | 61       | 61         |
|  | Weave   | N/A      | 63         | N/A      | 62         | N/A      | 62         | N/A      | 63         |
|  | Diverge | 63       | N/A        | 63       | N/A        | 62       | N/A        | 63       | N/A        |
|  | Basic   | 63       | 63         | 63       | 46         | 63       | 44         | 63       | 56         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 53       | 53         | 53       | 53         | 45       | 54         | 54       | 54         |
|  | Weave   | 53       | N/A        | 53       | N/A        | 46       | N/A        | 53       | N/A        |
|  | Diverge | N/A      | 52         | N/A      | 53         | N/A      | 53         | N/A      | 53         |
| Democracy Boulevard                                | Merge   |          | 54         |          | 54         |          | 55         |          | 55         |
|  | Basic   | 53       | 52         | 50       | 52         | 46       | 53         | 52       | 53         |
|  | Diverge | N/A      | 47         | N/A      | 50         | N/A      | 53         | N/A      | 52         |
|  | Basic   |          | 51         |          | 52         |          | 53         |          | 53         |
| Democracy Boulevard to I-495                       | Merge   | 51       | 52         | 46       | 53         | 43       | 53         | 49       | 54         |
|  | Merge   | 50       | N/A        | 46       | N/A        | 44       | N/A        | 49       | N/A        |
|  | Basic   | 45       | 52         | 42       | 53         | 38       | 53         | 45       | 54         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 45       | N/A        | 43       | N/A        | 41       | N/A        | 41       | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 40       |            | 35       |            | 35       |            | 40       |            |
|  | Diverge | 41       |            | 41       |            | 41       |            | 41       |            |
| Shady Grove Road Interchange                       | Basic   | 42       |            | 42       |            | 42       |            | 42       |            |
|  | Merge   | 41       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 41       |            | 42       |            | 42       |            | 42       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 41       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 41       |            | 41       |            | 41       |            | 41       |            |
|  | Merge   | 41       |            | 41       |            | 41       |            | 41       |            |
|  | Diverge | 41       |            | 41       |            | 42       |            | 42       |            |
|  | Diverge | 41       |            | 41       |            | 41       |            | 41       |            |
|  | Basic   | 41       |            | 41       |            | 42       |            | 42       |            |
|  | Diverge | 42       |            | 42       |            | 42       |            | 42       |            |
| MD 28 Interchange                                  | Basic   | 41       |            | 41       |            | 42       |            | 42       |            |
|  | Merge   | 36       |            | 37       |            | 39       |            | 38       |            |
|  | Basic   | 37       |            | 38       |            | 42       |            | 42       |            |
| Between MD 28 & MD 189                             | Merge   | 30       |            | 34       |            | 42       |            | 42       |            |
|  | Basic   | 20       |            | 30       |            | 42       |            | 42       |            |
|  | Merge   | 18       |            | 27       |            | 41       |            | 41       |            |
|  | Basic   | 38       |            | 39       |            | 41       |            | 41       |            |
|  | Diverge | 41       |            | 41       |            | 41       |            | 42       |            |
| MD 189 Interchange                                 | Basic   | 38       |            | 38       |            | 38       |            | 38       |            |
| Between MD 189 & Montrose Road                     | Merge   | 36       |            | 36       |            | 36       |            | 36       |            |
|  | Diverge | 36       |            | 35       |            | 35       |            | 35       |            |
|  | Basic   | 36       |            | 36       |            | 37       |            | 37       |            |
|  | Diverge | 37       |            | 37       |            | 37       |            | 37       |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-20: 2045 AM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 6-7 AM   |            | 7-8 AM   |            | 8-9 AM   |            | 9-10 AM  |            |    |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|----|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |    |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |    |
| Montrose Road Interchange                        | Basic   | 36       | N/A        | 36       | N/A        | 37       | N/A        | 37       | N/A        |    |
|  | Weave   | 37       |            | 35       |            | 36       |            | 36       |            |    |
|  | Basic   | 38       |            | 37       |            | 38       |            | 39       |            |    |
|  | Merge   | 38       |            | 35       |            | 37       |            | 39       |            |    |
|  | Basic   | 38       |            | 36       |            | 37       |            | 39       |            |    |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |    |
| I-370 Interchange                                | Basic   | N/A      | 57         | N/A      | 55         | N/A      | 55         | N/A      | 55         |    |
| Between I-370 & Gude Drive                       | Merge   |          | 61         |          | 61         |          | 61         |          | 61         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 61         |          | 62         |          | 61         |          | 62         |    |
| Gude Drive Interchange                           | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 53         |          | 51         |          | 50         |          | 50         |    |
|  | Basic   |          | 63         |          | 63         |          | 62         |          | 62         |    |
|  | Diverge |          | 59         |          | 58         |          | 58         |          | 58         |    |
| Wootton Parkway Interchange                      | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
| Between Wootton Parkway and Spur Split           | Merge   |          | 62         |          | 62         |          | 62         |          | 62         | 62 |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
| Spur Split through MD 187 Interchange            | Basic   |          | 64         |          | 64         |          | 64         |          | 64         | 63 |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |    |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |    |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Westlake Terrace/Fernwood Road Interchange       | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 59         |          | 59         |          | 59         |          | 59         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Westlake Terrace/Fernwood Road to I-495          | Merge   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |
|  | Merge   |          | 61         |          | 61         |          | 61         |          | 61         | 61 |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         | 63 |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

As shown in **Table 6-21**, speeds improve along the I-495 Inner Loop General Purpose lanes from VA 193 to MD 190 during the 3-4 PM hour and to Clara Barton Parkway during 4-5 PM hour, with smaller speed increases during the 5-6 PM and 6-7 PM hours as throughput increases across the PM peak period. Along the I-495 Outer Loop, speeds increase at all congested segments during the PM peak period with the Preferred Alternative, particularly between the Clara Barton Parkway interchange and the I-270 West Spur.

Along I-270 Northbound during the first three hours of the PM peak period, speeds improve between the I-270 Spur split and the MD 189 interchange with the Preferred Alternative; and during the first two hours, speeds also improve from MD 189 to Watkins Mill Road, the northern study area limit on I-270. The speeds then decrease during the last one to two hours of the PM peak period; this degradation is caused by increased throughput more quickly reaching the existing bottleneck north of I-370 (outside the study area) throughout the entire PM peak period. Speeds in the I-270 Northbound HOT lanes are at or near free-flow conditions, except the area in which the HOT lanes tie into the General Purpose lanes (i.e., just north of the bridge over I-370). The slower speeds at this tie-in point and south through the Wootton Parkway interchange are also attributed to the existing bottleneck north of I-370; the queue first formed outside of the study area, due to the increased throughput reaching this point more quickly, spills back to the I-270 Northbound General Purpose and HOT lanes within the study area. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

Nevertheless, the Preferred Alternative serves approximately 55% more vehicles during the entire PM peak period, with 80% less unserved vehicles at the I-495 Inner Loop input in Virginia when compared to the No Build conditions.

With the Preferred Alternative, speeds improve along I-270 Southbound General Purpose lanes, particularly between the I-270 Spur split and I-495. Speeds in the HOT lanes are at or near free-flow conditions throughout the entire PM peak period. These 2045 speed trends are comparable to those under the 2027 conditions.

**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop General Purpose Lanes                            |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 59       | 59         | 34       | 59         | 5        | 22         | 3        | 16         |
|   | Diverge | 58       | 58         | 22       | 58         | 4        | 19         | 3        | 15         |
| VA 193 Interchange  | Basic   | 52       | 59         | 10       | 59         | 4        | 11         | 3        | 9          |
|   | Merge   | 36       | 53         | 6        | 54         | 3        | 5          | 3        | 5          |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 27       | 56         | 8        | 56         | 4        | 5          | 3        | 6          |
|   | Diverge | 17       | 57         | 10       | 56         | 4        | 5          | 4        | 6          |
| George Washington Memorial Parkway Interchange                    | Basic   | 17       | 57         | 14       | 48         | 5        | 8          | 5        | 9          |
| Between George Washington Memorial Parkway & Clara Barton Parkway | Weave   | 17       | 56         | 15       | 34         | 5        | 5          | 6        | 8          |
|   | Diverge | 26       | N/A        | 23       | N/A        | 7        | N/A        | 8        | N/A        |
| Clara Barton Parkway Interchange                                  | Basic   | 21       | 56         | 18       | 27         | 6        | 4          | 6        | 7          |
| Between Clara Barton Parkway & MD 190                             | Merge   | 16       | 55         | 14       | 17         | 5        | 4          | 5        | 6          |
|   | Basic   | 20       | 55         | 19       | 14         | 6        | 4          | 7        | 8          |
|   | Diverge | 22       | 55         | 21       | 18         | 10       | 12         | 11       | 15         |
| MD 190 Interchange  | Basic   | 15       | 55         | 14       | 8          | 5        | 4          | 5        | 8          |
|   | Merge   | 14       | 55         | 13       | 7          | 4        | 4          | 5        | 8          |
|   | Basic   | 14       | 55         | 13       | 7          | 4        | 4          | 5        | 8          |
| Between MD 190 & I-270 West Spur                                  | Merge   | 14       | 54         | 13       | 7          | 4        | 4          | 5        | 8          |
|   | Basic   | 39       | 53         | 31       | 8          | 6        | 6          | 9        | 12         |
|   | Weave   | 53       | 49         | 36       | 10         | 15       | 8          | 16       | 15         |
| Between I-270 West Spur & MD 187                                  | Basic   | 54       | 36         | 11       | 5          | 3        | 4          | 7        | 8          |
|   | Merge   | N/A      | 33         | N/A      | 9          | N/A      | 7          | N/A      | 14         |
|   | Basic   |          | 23         |          | 7          |          | 5          |          | 11         |
|   | Diverge | 46       | 24         | 13       | 13         | 8        | 12         | 12       | 16         |
| MD 187 Interchange  | Basic   | 54       | 15         | 6        | 6          | 2        | 5          | 7        | 8          |
| Between MD 187 & I-270 East Spur                                  | Merge   | 52       | 16         | 7        | 8          | 3        | 5          | 9        | 10         |
|   | Basic   | 49       | N/A        | 6        | N/A        | 3        | N/A        | 9        | N/A        |
|   | Diverge | 46       | 16         | 7        | 8          | 4        | 7          | 11       | 12         |
| I-270 East Spur Interchange                                       | Basic   | 43       | 19         | 8        | 11         | 5        | 9          | 14       | 16         |
|   | Weave   | 39       | 20         | 9        | 13         | 7        | 11         | 16       | 16         |
|   | Weave   | 34       | 22         | 15       | 18         | 11       | 15         | 20       | 19         |
|   | Basic   | 30       | N/A        | 13       | N/A        | 8        | N/A        | 18       | N/A        |
| Between I-270 East Spur & MD 185                                  | Merge   | 26       | 21         | 11       | 17         | 8        | 14         | 16       | 17         |
|   | Basic   | 28       | 22         | 13       | 18         | 10       | 15         | 19       | 17         |
| I-495 Inner Loop HOT Managed Lanes                                |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway               | Basic   | 64       | 63         | 64       | 63         | 43       | 64         | 8        | 64         |
| George Washington Memorial Parkway Interchange                    | Diverge | 63       | 63         | 63       | 63         | 6        | 63         | 2        | 63         |
|   | Merge   | 62       | N/A        | 61       | N/A        | 4        | N/A        | 3        | N/A        |
|   | Basic   | 42       | 63         | 38       | 63         | 7        | 63         | 8        | 63         |
| Between George Washington Memorial Parkway & MD 190               | Merge   | N/A      | 62         | N/A      | 62         | N/A      | 62         | N/A      | 62         |
|   | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
|   | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Inner Loop HOT Managed Lanes (Continued)                      |         |          |            |          |            |          |            |          |            |
| MD 190 Interchange  | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |
|   | Merge   |          | 63         |          | 63         |          | 63         |          |            |
| Between MD 190 & I-270 West Spur                                    | Merge   |          | 61         |          | 61         |          | 61         |          |            |
|   | Basic   |          | 63         |          | 63         |          | 63         |          |            |
|   | Diverge |          | 62         |          | 63         |          | 63         |          |            |
| Between I-270 West Spur & MD 187                                    | Basic   |          | 59         |          | 59         |          | 47         |          | 59         |
| I-495 Outer Loop General Purpose Lanes                              |         |          |            |          |            |          |            |          |            |
| Between VA 267 & VA 193   | Basic   | 53       | 53         | 53       | 53         | 54       | 53         | 54       | 54         |
|   | Merge   | 53       | 53         | 53       | 53         | 54       | 53         | 54       | 54         |
| VA 193 Interchange & George Washington Memorial Parkway Interchange | Merge   | 54       | 54         | 54       | 54         | 54       | 54         | 55       | 54         |
|   | Basic   | 54       | 53         | 54       | 53         | 54       | 53         | 54       | 54         |
|   | Diverge | 54       | 53         | 54       | 53         | 54       | 54         | 54       | 54         |
|   | Basic   | 54       | 52         | 54       | 52         | 54       | 53         | 54       | 53         |
|   | Diverge | 53       | 51         | 53       | 51         | 53       | 51         | 54       | 52         |
|   | Basic   | 52       | N/A        | 52       | N/A        | 52       | N/A        | 53       | N/A        |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Weave   | 44       |            | 43       |            | 42       |            | 47       |            |
| Between George Washington Memorial Parkway and Clara Barton Parkway | Basic   | N/A      | 53         | N/A      | 52         | N/A      | 53         | N/A      | 53         |
|   | Merge   |          | 49         |          | 48         |          | 49         |          | 50         |
| Clara Barton Parkway Interchange                                    | Basic   | 35       | 51         | 31       | 51         | 30       | 51         | 40       | 53         |
| Between Clara Barton Parkway & MD 190                               | Diverge | 36       | 52         | 32       | 53         | 32       | 53         | 42       | 53         |
|   | Basic   | 27       | 53         | 24       | 53         | 22       | 53         | 39       | 53         |
|   | Merge   | 24       | 52         | 19       | 53         | 18       | 53         | 37       | 53         |
| MD 190 Interchange  | Basic   | 26       | 53         | 18       | 53         | 18       | 53         | 44       | 54         |
|   | Diverge | 37       | 53         | 27       | 53         | 26       | 54         | 50       | 54         |
| Between MD 190 & I-270 West Spur                                    | Diverge | 41       | 53         | 32       | 53         | 31       | 53         | 51       | 54         |
|   | Basic   | 43       | 53         | 28       | 53         | 28       | 53         | 51       | 54         |
|   | Weave   | 46       | 54         | 26       | 54         | 29       | 54         | 51       | 55         |
| Between I-270 West Spur & MD 187                                    | Basic   | 46       | 52         | 28       | 52         | 25       | 52         | 47       | 52         |
|   | Diverge | N/A      | 53         | N/A      | 53         | N/A      | 53         | N/A      | 54         |
|   | Basic   |          | 53         |          | 53         |          | 53         |          |            |
|   | Merge   |          | 52         |          | 52         |          | 38         |          | 52         |
| MD 187 Interchange  | Basic   | 53       | 53         | 43       | 53         | 43       | 53         | 47       | 54         |
| Between MD 187 & I-270 East Spur                                    | Diverge | 53       | 53         | 46       | 53         | 45       | 53         | 48       | 53         |
|   | Basic   | 53       | 53         | 45       | 53         | 45       | 53         | 50       | 54         |
|   | Merge   | 49       | 49         | 42       | 49         | 42       | 49         | 49       | 49         |
| I-270 East Spur Interchange   | Basic   | 53       | 53         | 46       | 53         | 43       | 53         | 45       | 52         |
|   | Diverge | 53       | 53         | 49       | 53         | 29       | 53         | 7        | 20         |
| Between I-270 East Spur & MD 185                                    | Diverge | 52       | 52         | 50       | 52         | 36       | 53         | 10       | 23         |
|   | Basic   | 43       | 42         | 43       | 46         | 34       | 49         | 4        | 14         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph



**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location  | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|---|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|   |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-495 Outer Loop HOT Managed Lanes                  |         |          |            |          |            |          |            |          |            |
| Between VA 193 & George Washington Memorial Parkway | Basic   | 64       | 63         | 64       | 63         | 64       | 63         | 65       | 64         |
| George Washington Memorial Parkway Interchange      | Merge   | 58       | 56         | 58       | 56         | 59       | 57         | 59       | 58         |
|   | Basic   | 65       | 64         | 65       | 64         | 65       | 64         | 65       | 64         |
|   | Diverge | N/A      | 63         | N/A      | 64         | N/A      | 64         | N/A      | 64         |
|   | Basic   | 59       | 63         | 59       | 63         | 59       | 63         | 60       | 63         |
|   | Merge   | N/A      | 61         | N/A      | 61         | N/A      | 62         | N/A      | 61         |
|   | Basic   |          | 64         |          | 64         |          | 64         |          |            |
|   | Diverge |          | 64         |          | 64         |          | 64         |          |            |
|   | Basic   |          | 64         |          | 64         |          | 64         |          |            |
| Between MD 190 & I-270 West Spur                    | Diverge |          | 64         |          | 64         |          | 64         |          | 64         |
|   | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |
|   | Merge   |          | 64         |          | 64         |          | 64         |          | 64         |
| Between I-270 West Spur & MD 187                    | Basic   |          | 59         |          | 59         |          | 59         |          | 59         |
| I-270 Northbound General Purpose Lanes              |         |          |            |          |            |          |            |          |            |
| Between Watkins Mill Rd & MD 117                    | Basic   | 22       | 25         | 16       | 21         | 17       | 14         | 23       | 17         |
| Between MD 117 & I-370                              | Diverge | 28       | 30         | 18       | 20         | 18       | 14         | 32       | 16         |
|   | Basic   | 29       | 28         | 17       | 16         | 16       | 12         | 37       | 13         |
|   | Merge   | 25       | 27         | 12       | 15         | 13       | 10         | 34       | 13         |
| I-370 Interchange                                   | Basic   | 35       | 31         | 16       | 17         | 15       | 11         | 43       | 12         |
|   | Merge   | 33       | 36         | 8        | 13         | 8        | 9          | 39       | 11         |
|   | Basic   | N/A      | 41         | N/A      | 13         | N/A      | 7          | N/A      | 10         |
|   | Diverge |          | 47         |          | 24         |          | 14         |          | 20         |
| Between I-370 & Shady Grove Road                    | Weave   | N/A      | 50         | N/A      | 27         | N/A      | 16         | N/A      | 22         |
| Shady Grove Road Interchange                        | Basic   |          | 51         |          | 20         |          | 8          |          | 12         |
|   | Merge   |          | 51         |          | 23         |          | 9          |          | 15         |
|   | Basic   | 47       | 52         | 13       | 22         | 13       | 6          | 49       | 9          |
| Between Shady Grove Road & MD 28                    | Weave   | 53       | N/A        | 21       | N/A        | 15       | N/A        | 42       | N/A        |
|   | Diverge | N/A      | 53         | N/A      | 31         | N/A      | 19         | N/A      | 20         |
|   | Basic   |          | 54         |          | 30         |          | 12         |          | 14         |
|   | Basic   |          | 52         |          | 39         |          | 7          |          | 8          |
|   | Merge   |          | 50         |          | 44         |          | 6          |          | 6          |
| MD 28 Interchange                                   | Basic   | 52       | 53         | 32       | 49         | 18       | 7          | 47       | 7          |
|   | Weave   | 53       | 47         | 32       | 44         | 11       | 7          | 31       | 8          |
|   | Basic   | N/A      | 47         | N/A      | 46         | N/A      | 9          | N/A      | 10         |
| Between MD 28 & MD 189                              | Basic   | 52       | N/A        | 37       | N/A        | 15       | N/A        | 45       | N/A        |
|   | Weave   | N/A      | 40         | N/A      | 41         | N/A      | 10         | N/A      | 10         |
| MD 189 Interchange                                  | Basic   | N/A      | 51         | N/A      | 50         | N/A      | 10         | N/A      | 9          |
| Between MD 189 & Montrose Road                      | Diverge | 40       | 53         | 31       | 53         | 11       | 16         | 16       | 12         |
|   | Basic   | 52       | 52         | 46       | 52         | 10       | 13         | 10       | 10         |
|   | Merge   | N/A      | 47         | N/A      | 46         | N/A      | 12         | N/A      | 8          |
| Montrose Road Interchange                           | Diverge | 51       | N/A        | 49       | N/A        | 7        | N/A        | 6        | N/A        |
|   | Basic   | N/A      | 53         | N/A      | 53         | N/A      | 14         | N/A      | 9          |
|   | Weave   |          | 52         |          | 52         |          | 13         |          | 8          |
|   | Basic   | 52       | 53         | 52       | 53         | 9        | 16         | 6        | 10         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between Montrose Road & Spur Split                 | Weave   | 52       | 53         | 52       | 53         | 12       | 25         | 6        | 8          |
|  | Weave   | 51       | N/A        | 50       | N/A        | 16       | N/A        | 10       | N/A        |
| Between Spur Split & MD 187                        | Basic   | 41       | 57         | 39       | 56         | 16       | 44         | 4        | 3          |
|  | Merge   | 36       | 47         | 24       | 45         | 9        | 40         | 2        | 3          |
|  | Weave   | 45       | N/A        | 27       | N/A        | 17       | N/A        | 13       | N/A        |
| MD 187 Interchange                                 | Basic   | 57       | 58         | 32       | 58         | 24       | 54         | 21       | 4          |
|  | Diverge | 58       | 59         | 41       | 59         | 27       | 58         | 24       | 17         |
|  | Basic   | 57       | 57         | 43       | 56         | 24       | 56         | 21       | 5          |
| Between MD 187 & I-495                             | Diverge | 58       | 58         | 50       | 58         | 30       | 58         | 25       | 19         |
|  | Basic   | 57       | 57         | 52       | 57         | 28       | 57         | 21       | 6          |
|  | Diverge | N/A      | 57         | N/A      | 56         | N/A      | 56         | N/A      | 5          |
|  | Basic   |          | 57         |          | 56         |          | 57         |          | 5          |
|  | Merge   | 56       | 56         | 53       | 56         | 27       | 56         | 14       | 4          |
|  | Basic   | 59       | 60         | 58       | 60         | 29       | 60         | 12       | 4          |
|  | Basic   | 56       | 56         | 55       | 56         | 22       | 56         | 2        | 7          |
| I-270 West Spur Northbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Between Spur Split & Democracy Boulevard           | Basic   | 53       | 53         | 53       | 53         | 26       | 45         | 15       | 18         |
|  | Merge   | 51       | 54         | 50       | 55         | 39       | 53         | 20       | 23         |
|  | Basic   | 54       | 54         | 54       | 54         | 42       | 54         | 17       | 28         |
|  | Merge   | 53       | 48         | 52       | 48         | 46       | 47         | 18       | 28         |
| Democracy Boulevard Interchange                    | Basic   | 52       | 55         | 53       | 56         | 50       | 56         | 24       | 37         |
|  | Merge   | 53       | 55         | 53       | 55         | 47       | 54         | 18       | 37         |
|  | Basic   | 54       | 54         | 54       | 55         | 51       | 55         | 24       | 41         |
| Between Democracy Boulevard & I-495                | Diverge | 54       | 54         | 54       | 55         | 54       | 54         | 31       | 46         |
|  | Basic   | 52       | N/A        | 52       | N/A        | 53       | N/A        | 28       | N/A        |
|  | Diverge | N/A      | 54         | N/A      | 54         | N/A      | 54         | N/A      | 48         |
|  | Basic   |          | 54         |          | 53         |          | 53         |          | 46         |
| I-270 Northbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| Between MD 124 & MD 117                            | Diverge | 46       | N/A        | 48       | N/A        | 48       | N/A        | 47       | N/A        |
| Between MD 117 & I-370                             | Weave   | 38       |            | 42       |            | 43       |            | 35       |            |
|  | Basic   | 52       |            | 51       |            | 51       |            | 48       |            |
|  | Weave   | 27       |            | 9        |            | 8        |            | 25       |            |
| I-370 Interchange                                  | Basic   | 30       |            | 6        |            | 6        |            | 17       |            |
|  | Merge   | 31       |            | 4        |            | 4        |            | 9        |            |
|  | Basic   | 40       |            | 5        |            | 4        |            | 10       |            |
| Between I-370 & Shady Grove Road                   | Diverge | 49       |            | 12       |            | 8        |            | 20       |            |
|  | Basic   | 52       |            | 9        |            | 6        |            | 20       |            |
|  | Diverge | 51       |            | 10       |            | 6        |            | 20       |            |
|  | Merge   | 50       |            | 7        |            | 4        |            | 14       |            |
| Shady Grove Road Interchange                       | Basic   | 53       |            | 7        |            | 4        |            | 16       |            |
|  | Weave   | 52       |            | 6        |            | 3        |            | 16       |            |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Northbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |
| Between Shady Grove Road & MD 28                 | Diverge | 53       | N/A        | 26       | N/A        | 9        | N/A        | 25       | N/A        |
|  | Basic   | 53       |            | 18       |            | 3        |            | 16       |            |
|  | Diverge | 53       |            | 32       |            | 3        |            | 12       |            |
|  | Weave   | 47       |            | 38       |            | 3        |            | 7        |            |
|  | Merge   | 47       |            | 41       |            | 3        |            | 7        |            |
| MD 28 Interchange                                | Basic   | 52       |            | 48       |            | 3        |            | 7        |            |
|  | Weave   | 37       |            | 31       |            | 7        |            | 9        |            |
|  | Basic   | 49       |            | 45       |            | 13       |            | 17       |            |
| Between MD 28 & MD 189                           | Diverge | 42       |            | 29       |            | 9        |            | 13       |            |
|  | Basic   | 50       |            | 33       |            | 10       |            | 14       |            |
|  | Weave   | 50       |            | 29       |            | 5        |            | 7        |            |
|  | Basic   | 51       |            | 37       |            | 5        |            | 7        |            |
|  | Merge   | 48       |            | 40       |            | 5        |            | 7        |            |
| MD 189 Interchange                               | Basic   | 53       |            | 48       |            | 4        |            | 6        |            |
| Between MD 189 & Montrose Road                   | Diverge | 49       |            | 47       |            | 13       |            | 15       |            |
|  | Basic   | 50       |            | 49       |            | 7        |            | 7        |            |
|  | Merge   | 37       |            | 30       |            | 5        |            | 4        |            |
|  | Basic   | 45       |            | 43       |            | 6        |            | 5        |            |
|  | Merge   | 44       |            | 45       |            | 5        |            | 3        |            |
| Montrose Road Interchange                        | Basic   | 53       |            | 53       |            | 7        |            | 3        |            |
|  | Weave   | 48       |            | 48       |            | 14       |            | 5        |            |
|  | Basic   | 53       |            | 53       |            | 23       |            | 11       |            |
| Between Montrose Road & Spur Split               | Diverge | 49       |            | 49       |            | 42       |            | 30       |            |
|  | Basic   | 53       |            | 53       |            | 48       |            | 29       |            |
| I-270 Northbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |
| Between I-370 & Gude Drive                       | Basic   | N/A      | 56         | N/A      | 20         | N/A      | 11         | N/A      | 12         |
|  | Diverge |          | 62         |          | 46         |          | 26         |          | 27         |
|  | Basic   |          | 62         |          | 44         |          | 14         |          | 13         |
|  | Merge   |          | 62         |          | 45         |          | 12         |          | 11         |
| Gude Drive Interchange                           | Basic   |          | 63         |          | 53         |          | 14         |          | 8          |
| Between Gude Drive & Wootton Parkway             | Diverge |          | 60         |          | 60         |          | 32         |          | 19         |
|  | Basic   |          | 63         |          | 63         |          | 43         |          | 18         |
|  | Merge   |          | 62         |          | 61         |          | 54         |          | 32         |
| Wootton Parkway Interchange                      | Basic   |          | 63         |          | 63         |          | 61         |          | 37         |
| Between Wootton Parkway & Spur Split             | Diverge |          | 62         |          | 62         |          | 62         |          | 54         |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 59         |
|  | Weave   |          | 63         |          | 62         |          | 63         |          | 63         |
| Spur Split through MD 187 Interchange            | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |
| I-270 West Spur Northbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 62         | N/A      | 62         | N/A      | 62         | N/A      | 62         |
|  | Merge   |          | 59         |          | 60         |          | 60         |          | 58         |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 63         |          | 63         |          | 63         |          | 62         |
|  | Weave   |          | 63         |          | 63         |          | 63         |          | 54         |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |    |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|----|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |    |
| I-270 West Spur Northbound HOT Managed Lanes (Continued) |         |          |            |          |            |          |            |          |            |    |
| Westlake Terrace/Fernwood Road to I-495                  | Basic   | N/A      | 62         | N/A      | 62         | N/A      | 62         | N/A      | 62         |    |
|  | Diverge |          | 63         |          | 62         |          | 63         |          | 62         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
| I-270 Southbound General Purpose Lanes                   |         |          |            |          |            |          |            |          |            |    |
| MD 117 Interchange                                       | Basic   | 63       | 63         | 63       | 63         | 63       | 63         | 63       | 63         |    |
| Between MD 117 & I-370                                   | Merge   | 61       | 61         | 59       | 60         | 59       | 60         | 60       | 61         |    |
|  | Basic   | 63       | 63         | 62       | 62         | 62       | 62         | 62       | 63         |    |
|  | Diverge | 63       | 63         | 63       | 62         | 63       | 62         | 63       | 62         |    |
| I-370 Interchange  | Basic   | 63       | 63         | 63       | 63         | 63       | 63         | 63       | 63         |    |
|  | Diverge | 64       | 57         | 64       | 57         | 63       | 56         | 63       | 56         |    |
|  | Basic   | 64       | 63         | 64       | 63         | 64       | 63         | 64       | 63         |    |
|  | Basic   | N/A      | 65         | N/A      | 65         | N/A      | 65         | N/A      | 64         |    |
| Between I-370 & Shady Grove Road                         | Weave   |          | 60         |          | 60         |          | 60         |          | 60         | 60 |
| Diverge  | 60      |          | 60         |          | 60         |          | 60         |          | 60         |    |
| Shady Grove Road Interchange                             | Merge   | 60       | N/A        | 60       | N/A        | 60       | N/A        | 59       | N/A        |    |
|  | Basic   | 61       | 60         | 61       | 60         | 61       | 60         | 60       | 60         |    |
|  | Diverge | 61       | 57         | 61       | 57         | 61       | 56         | 60       | 57         |    |
| Between Shady Grove Road & MD 28                         | Basic   | 60       | 60         | 61       | 60         | 61       | 59         | 60       | 60         |    |
|  | Merge   | 60       | 56         | 60       | 56         | 60       | 55         | 59       | 56         |    |
|  | Basic   | 60       | 59         | 60       | 59         | 61       | 58         | 59       | 59         |    |
| MD 28 Interchange  | Diverge | N/A      | 59         | N/A      | 59         | N/A      | 58         | N/A      | 59         |    |
|  | Basic   |          | 59         |          | 58         |          | 58         |          | 59         |    |
|  | Merge   | 60       | 58         | 61       | 58         | 61       | 57         | 60       | 58         |    |
|  | Basic   | 60       | 58         | 60       | 58         | 60       | 58         | 58       | 58         |    |
| Between MD 28 & MD 189                                   | Merge   | N/A      | 57         | N/A      | 56         | N/A      | 56         | N/A      | 57         |    |
|  | Basic   |          | 58         |          | 57         |          | 57         |          | 57         | 58 |
|  | Diverge | 59       | 57         | 60       | 57         | 60       | 57         | 58       | 57         |    |
| MD 189 Interchange                                       | Basic   | 59       | 58         | 59       | 58         | 59       | 57         | 58       | 58         |    |
| Between MD 189 & Montrose Road                           | Merge   | N/A      | 57         | N/A      | 57         | N/A      | 57         | N/A      | 57         |    |
|  | Basic   |          | 57         |          | 57         |          | 56         |          | 57         |    |
| Montrose Road Interchange                                | Merge   | 60       | N/A        | 60       | N/A        | 61       | N/A        | 59       | N/A        |    |
|  | Diverge | N/A      | 53         | N/A      | 53         | N/A      | 52         | N/A      | 53         |    |
|  | Basic   |          | 57         |          | 57         |          | 57         |          | 57         |    |
|  | Weave   |          | 54         |          | 53         |          | 54         |          | 54         |    |
|  | Basic   |          | 57         |          | 56         |          | 56         |          | 57         |    |
| Between Montrose Road & Spur Split                       | Basic   | 60       | N/A        | 60       | N/A        | 61       | N/A        | 59       | N/A        |    |
|  | Weave   | 59       |            | 59       |            | 60       |            | 59       |            |    |
|  | Diverge | 60       |            | 60       |            | 60       |            | 59       |            |    |
|  | Weave   | 60       | 57         | 60       | 57         | 61       | 57         | 60       | 57         |    |
| Spur Split through MD 187 Interchange                    | Basic   | 59       | 58         | 59       | 58         | 58       | 58         | 59       | 58         |    |
|  | Diverge | 59       | 59         | 59       | 59         | 52       | 57         | 55       | 59         |    |
|  | Basic   | 59       | 58         | 59       | 58         | 38       | 52         | 49       | 58         |    |
|  | Merge   | 54       | 51         | 50       | 50         | 25       | 45         | 45       | 54         |    |
|  | Basic   | 58       | 57         | 53       | 56         | 21       | 50         | 41       | 58         |    |

<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |
| I-270 Southbound General Purpose Lanes (Continued) |         |          |            |          |            |          |            |          |            |
| Between MD 187 & I-495                             | Merge   | 59       | 54         | 41       | 54         | 16       | 48         | 36       | 55         |
|  | Basic   | 63       | 61         | 25       | 61         | 12       | 54         | 29       | 63         |
|  | Merge   | N/A      | 63         | N/A      | 63         | N/A      | 53         | N/A      | 63         |
|  | Diverge | 63       | 62         | 20       | 55         | 11       | 48         | 25       | 63         |
|  | Basic   | 59       | 49         | 14       | 34         | 9        | 30         | 21       | 54         |
| I-270 West Spur Southbound General Purpose Lanes   |         |          |            |          |            |          |            |          |            |
| Spur Split to Democracy Boulevard                  | Basic   | 59       | 59         | 59       | 59         | 59       | 59         | 59       | 59         |
|  | Weave   | 59       | N/A        | 59       | N/A        | 59       | N/A        | 58       | N/A        |
|  | Diverge | N/A      | 58         | N/A      | 58         | N/A      | 58         | N/A      | 58         |
| Democracy Boulevard                                | Merge   |          | 57         |          | 57         |          | 57         |          | 57         |
| Democracy Boulevard                                | Basic   | 59       | 58         | 59       | 58         | 59       | 58         | 59       | 58         |
|  | Diverge | N/A      | 57         | N/A      | 57         | N/A      | 57         | N/A      | 57         |
|  | Basic   |          | 57         |          | 57         |          | 57         |          | 57         |
| Democracy Boulevard to I-495                       | Merge   | 56       | 56         | 55       | 56         | 56       | 56         | 56       | 56         |
|  | Merge   | 57       | N/A        | 56       | N/A        | 57       | N/A        | 58       | N/A        |
|  | Basic   | 57       | 56         | 52       | 56         | 56       | 56         | 58       | 56         |
| I-270 Southbound Local Lanes                       |         |          |            |          |            |          |            |          |            |
| I-370 Interchange                                  | Basic   | 57       | N/A        | 56       | N/A        | 56       | N/A        | 57       | N/A        |
| Between I-370 & Shady Grove Road                   | Weave   | 51       |            | 52       |            | 50       |            | 46       |            |
|  | Diverge | 52       |            | 53       |            | 52       |            | 52       |            |
| Shady Grove Road Interchange                       | Basic   | 53       |            | 54       |            | 54       |            | 53       |            |
|  | Merge   | 51       |            | 51       |            | 52       |            | 50       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 52       |            |
| Between Shady Grove Road & MD 28                   | Merge   | 51       |            | 51       |            | 52       |            | 49       |            |
|  | Basic   | 52       |            | 52       |            | 53       |            | 50       |            |
|  | Merge   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 51       |            | 51       |            | 51       |            | 51       |            |
| MD 28 Interchange                                  | Basic   | 54       |            | 54       |            | 54       |            | 53       |            |
|  | Merge   | 44       |            | 45       |            | 46       |            | 44       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 52       |            |
| Between MD 28 & MD 189                             | Merge   | 52       |            | 52       |            | 52       |            | 52       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Merge   | 53       |            | 53       |            | 53       |            | 52       |            |
|  | Basic   | 52       |            | 52       |            | 52       |            | 52       |            |
|  | Diverge | 52       |            | 53       |            | 52       |            | 52       |            |
| MD 189 Interchange                                 | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
| Between MD 189 & Montrose Road                     | Merge   | 53       |            | 53       |            | 53       |            | 52       |            |
|  | Diverge | 52       |            | 52       |            | 52       |            | 52       |            |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |
|  | Diverge | 51       |            | 51       |            | 51       |            | 51       |            |

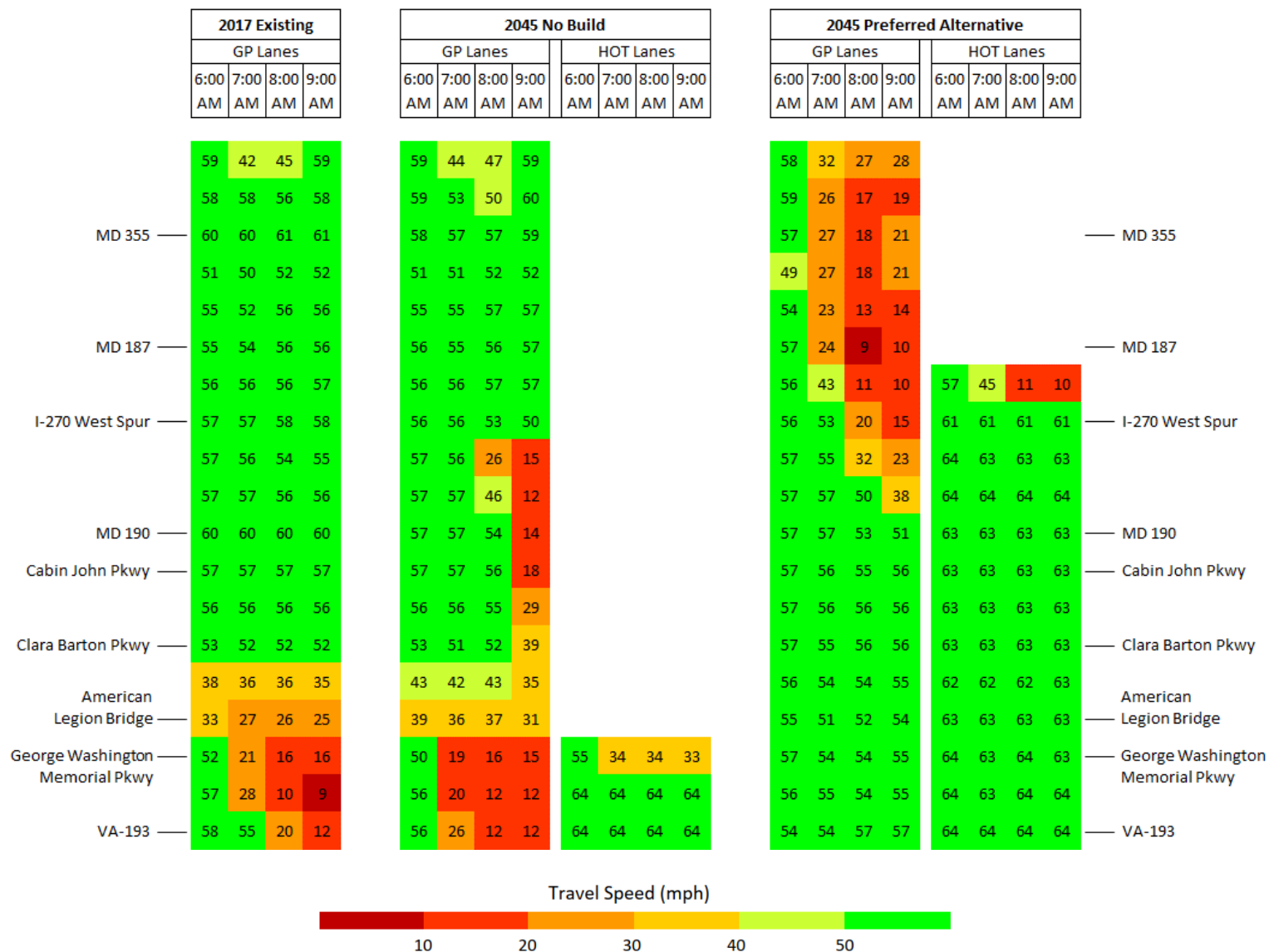
<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Table 6-21: 2045 PM VISSIM Freeway Speeds (mph) by Segment (Continued)**

| Location   | Type    | 3-4 PM   |            | 4-5 PM   |            | 5-6 PM   |            | 6-7 PM   |            |    |
|--|---------|----------|------------|----------|------------|----------|------------|----------|------------|----|
|  |         | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. | No Build | Pref. Alt. |    |
| I-270 Southbound Local Lanes (Continued)         |         |          |            |          |            |          |            |          |            |    |
| Montrose Road Interchange                        | Basic   | 54       | N/A        | 53       | N/A        | 53       | N/A        | 53       | N/A        |    |
|  | Weave   | 43       |            | 42       |            | 47       |            | 47       |            |    |
|  | Basic   | 52       |            | 51       |            | 52       |            | 53       |            | 53 |
|  | Merge   | 52       |            | 52       |            | 53       |            | 52       |            |    |
|  | Basic   | 53       |            | 53       |            | 53       |            | 53       |            |    |
| I-270 Southbound HOT Managed Lanes               |         |          |            |          |            |          |            |          |            |    |
| I-370 Interchange                                | Basic   | N/A      | 60         | N/A      | 59         | N/A      | 58         | N/A      | 59         |    |
| Between I-370 & Gude Drive                       | Merge   |          | 63         |          | 63         |          | 62         |          | 62         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 58         |          | 58         |          | 58         |          | 58         |    |
| Gude Drive Interchange                           | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |    |
| Between Gude Drive and Wootton Parkway           | Merge   |          | 61         |          | 61         |          | 61         |          | 61         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 62         |          | 62         |          | 62         |          | 62         |    |
| Wootton Parkway Interchange                      | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Between Wootton Parkway and Spur Split           | Merge   |          | 61         |          | 61         |          | 61         |          | 61         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Diverge |          | 63         |          | 63         |          | 63         |          | 63         |    |
| Spur Split through MD 187 Interchange            | Basic   |          | 64         |          | 63         |          | 63         |          | 64         |    |
| I-270 West Spur Southbound HOT Managed Lanes     |         |          |            |          |            |          |            |          |            |    |
| Spur Split to Westlake Terrace/<br>Fernwood Road | Basic   | N/A      | 63         | N/A      | 63         | N/A      | 63         | N/A      | 63         |    |
|  | Diverge |          | 63         |          | 63         |          | 62         |          | 63         |    |
| Westlake Terrace/Fernwood Road<br>Interchange    | Basic   |          | 63         |          | 63         |          | 62         |          | 63         |    |
|  | Diverge |          | 57         |          | 57         |          | 55         |          | 55         |    |
|  | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |    |
| Westlake Terrace/Fernwood Road to I-<br>495      | Merge   |          | 63         |          | 63         |          | 63         |          | 63         |    |
|  | Basic   |          | 64         |          | 64         |          | 64         |          | 64         |    |
|  | Merge   |          | 62         |          | 62         |          | 62         |          | 62         |    |
|  | Basic   |          | 63         |          | 63         |          | 63         |          | 63         |    |

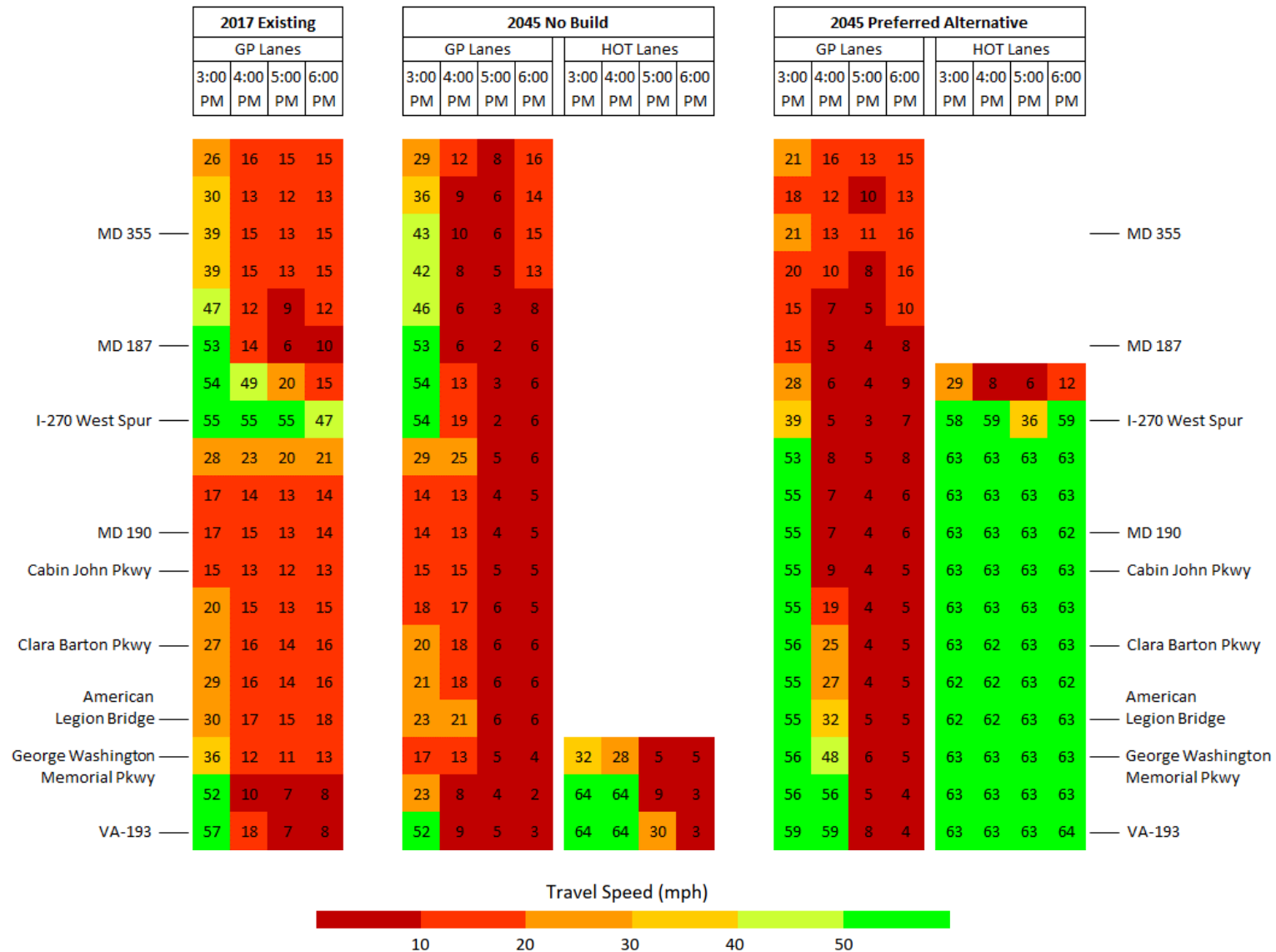
<10 mph
10-20 mph
20-30 mph
30-40 mph
40-50 mph
>50 mph

**Figure 6-38: I-495 Inner Loop 2045 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**

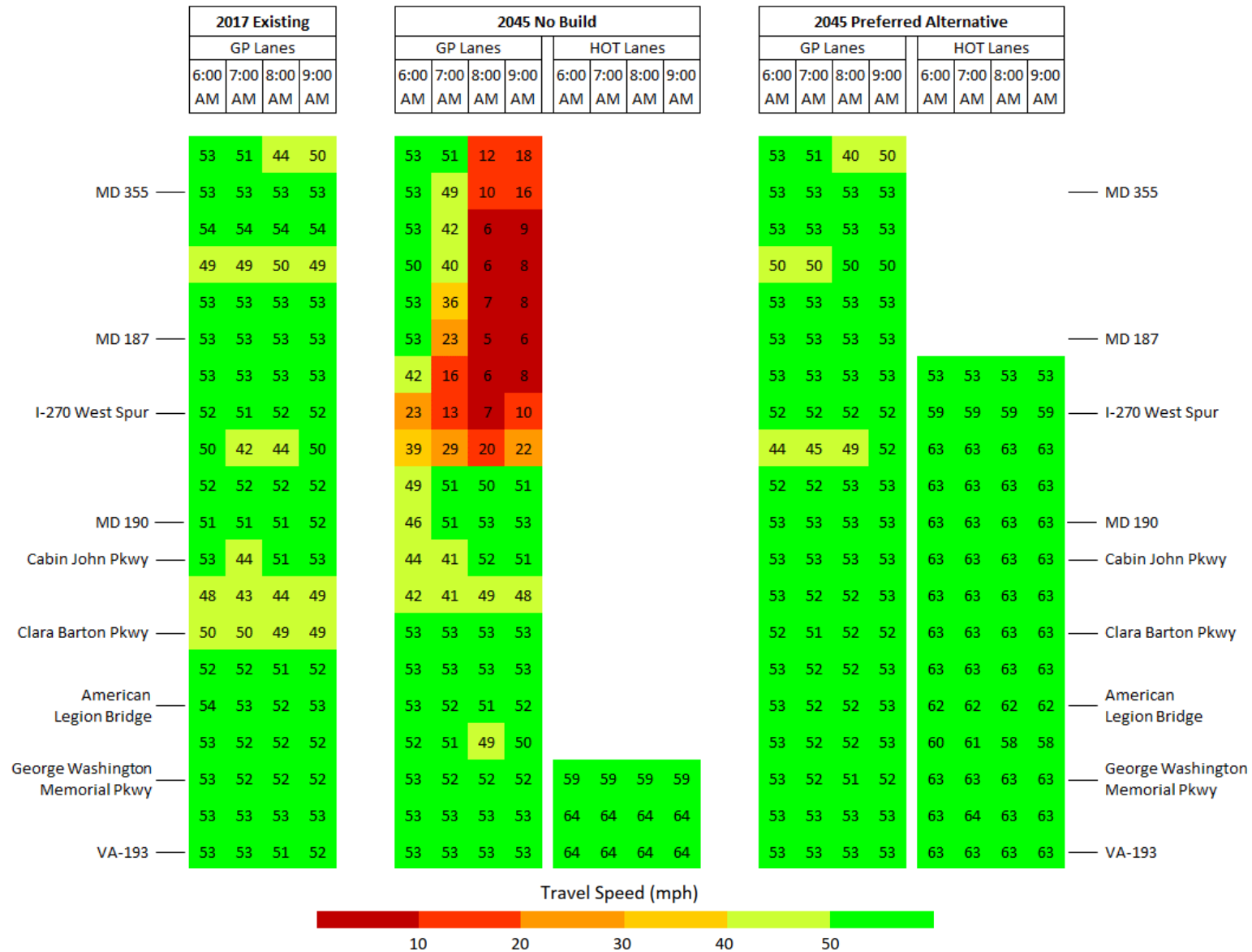




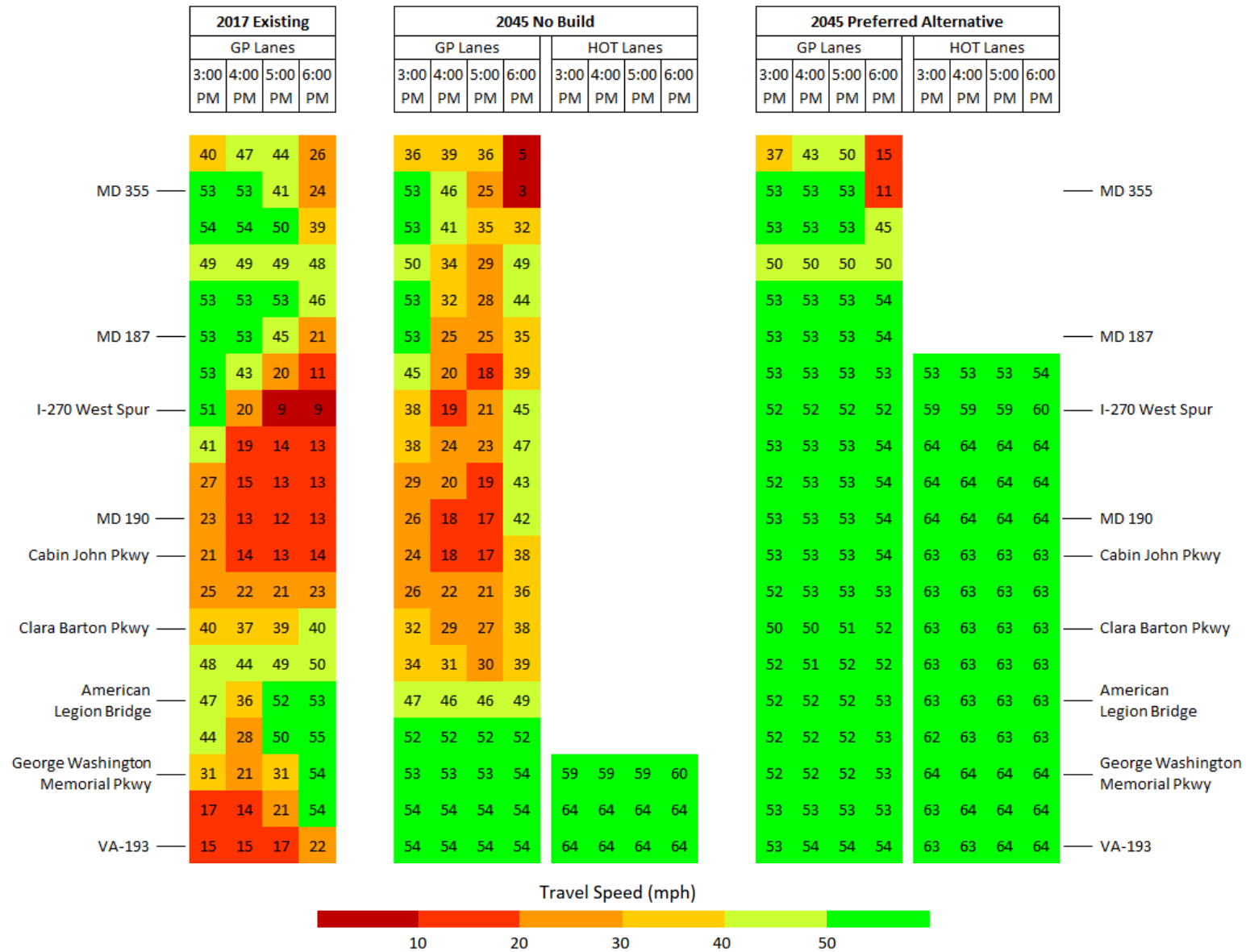
**Figure 6-39: I-495 Inner Loop 2045 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**



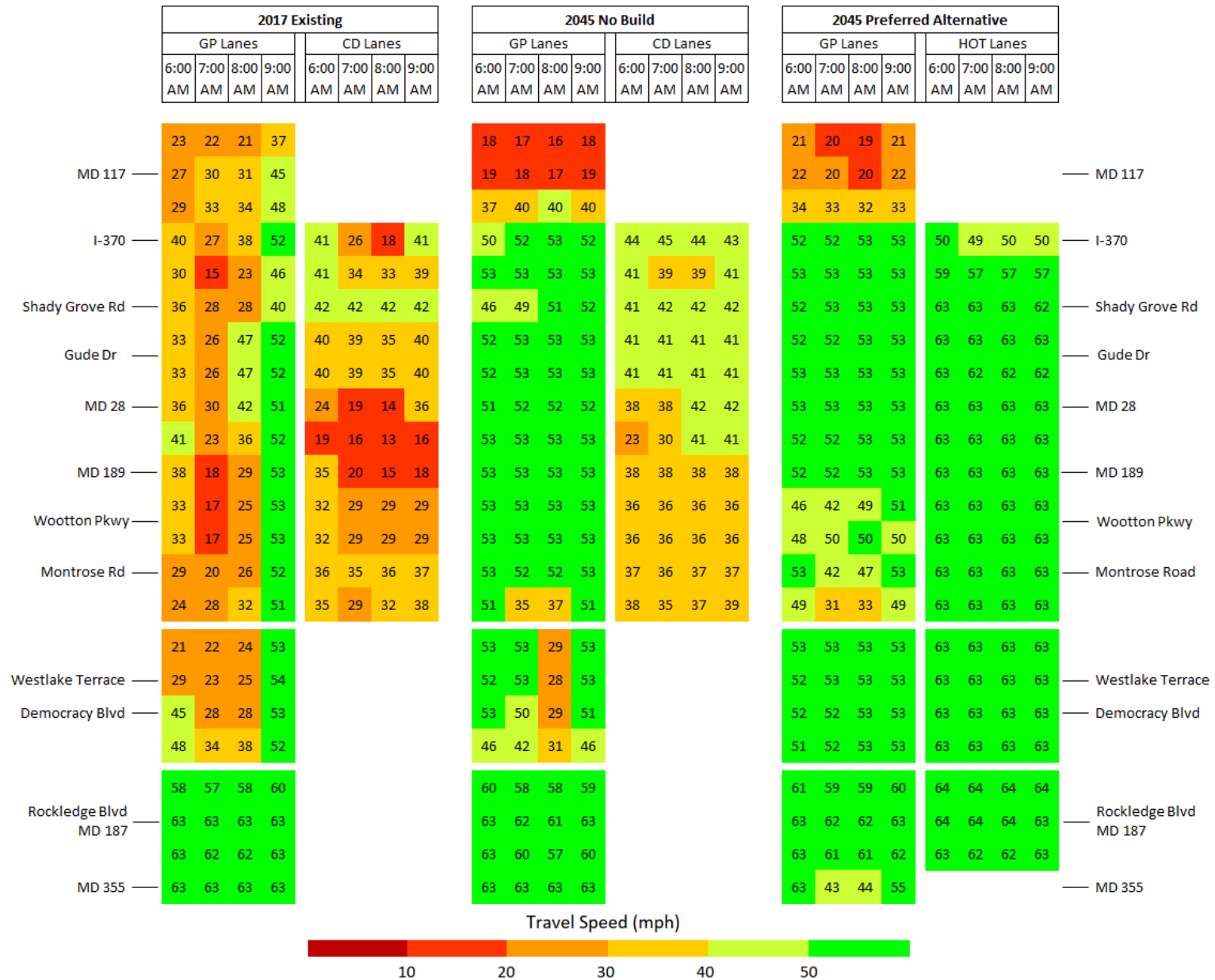
**Figure 6-40: I-495 Outer Loop 2045 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**



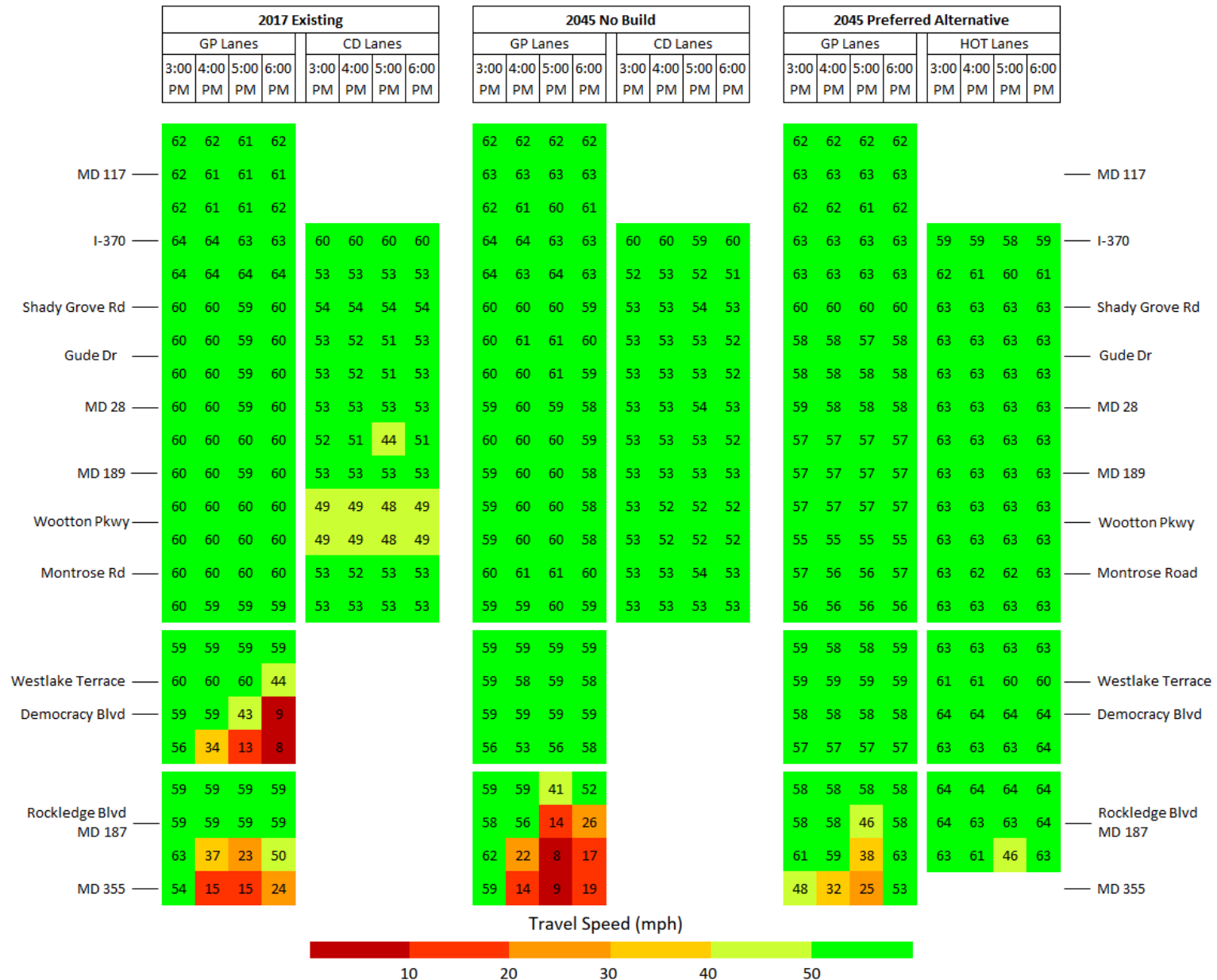
**Figure 6-41: I-495 Outer Loop 2045 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**



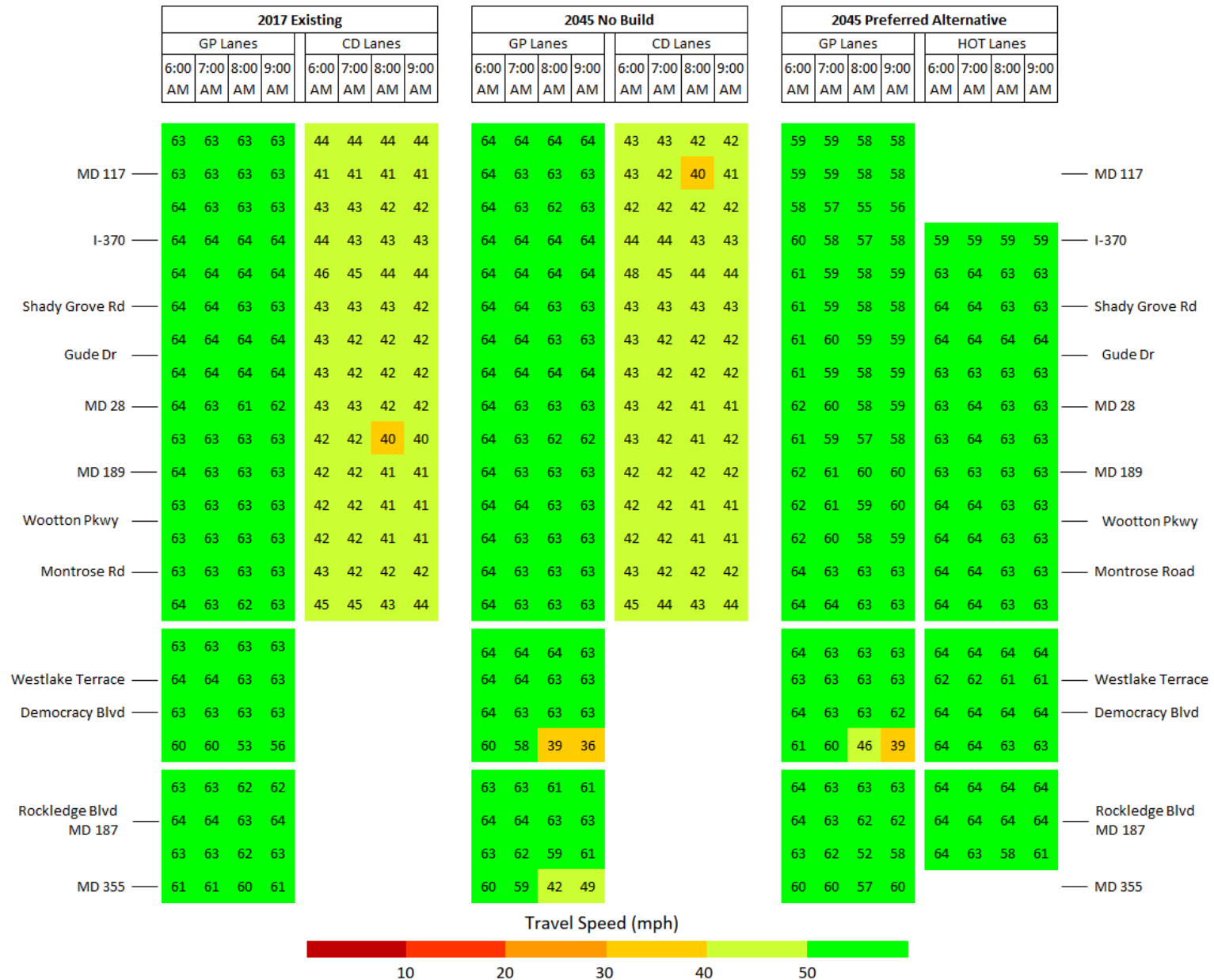
**Figure 6-42: I-270 Southbound 2045 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**



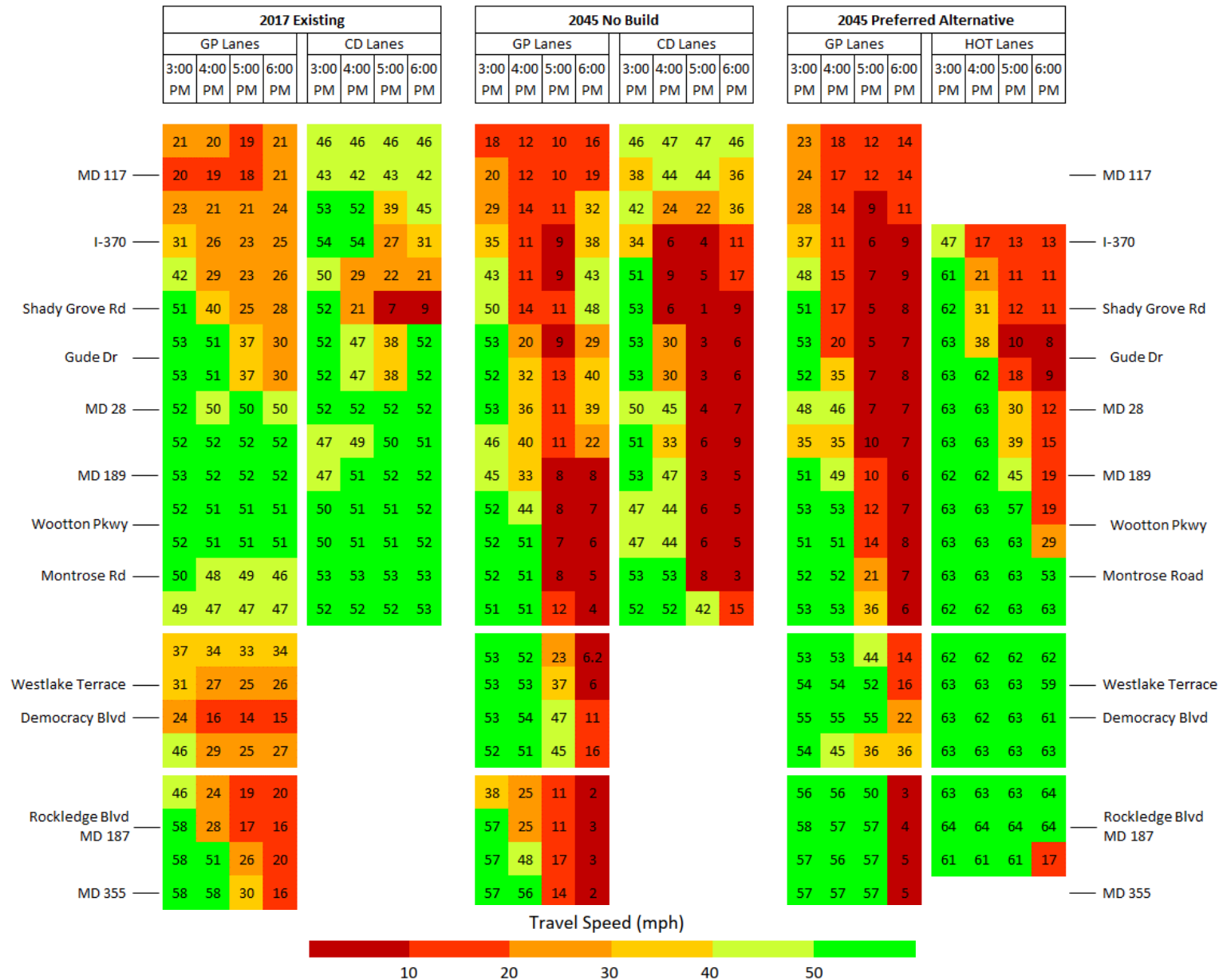
**Figure 6-43: I-270 Southbound 2045 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**



**Figure 6-44: I-270 Northbound 2045 No Build vs Preferred Alternative Speed by Segment – AM Peak Period**



**Figure 6-45: I-270 Northbound 2045 No Build vs Preferred Alternative Speed by Segment – PM Peak Period**





### 6.4.3.5 Freeway Travel Time Analysis

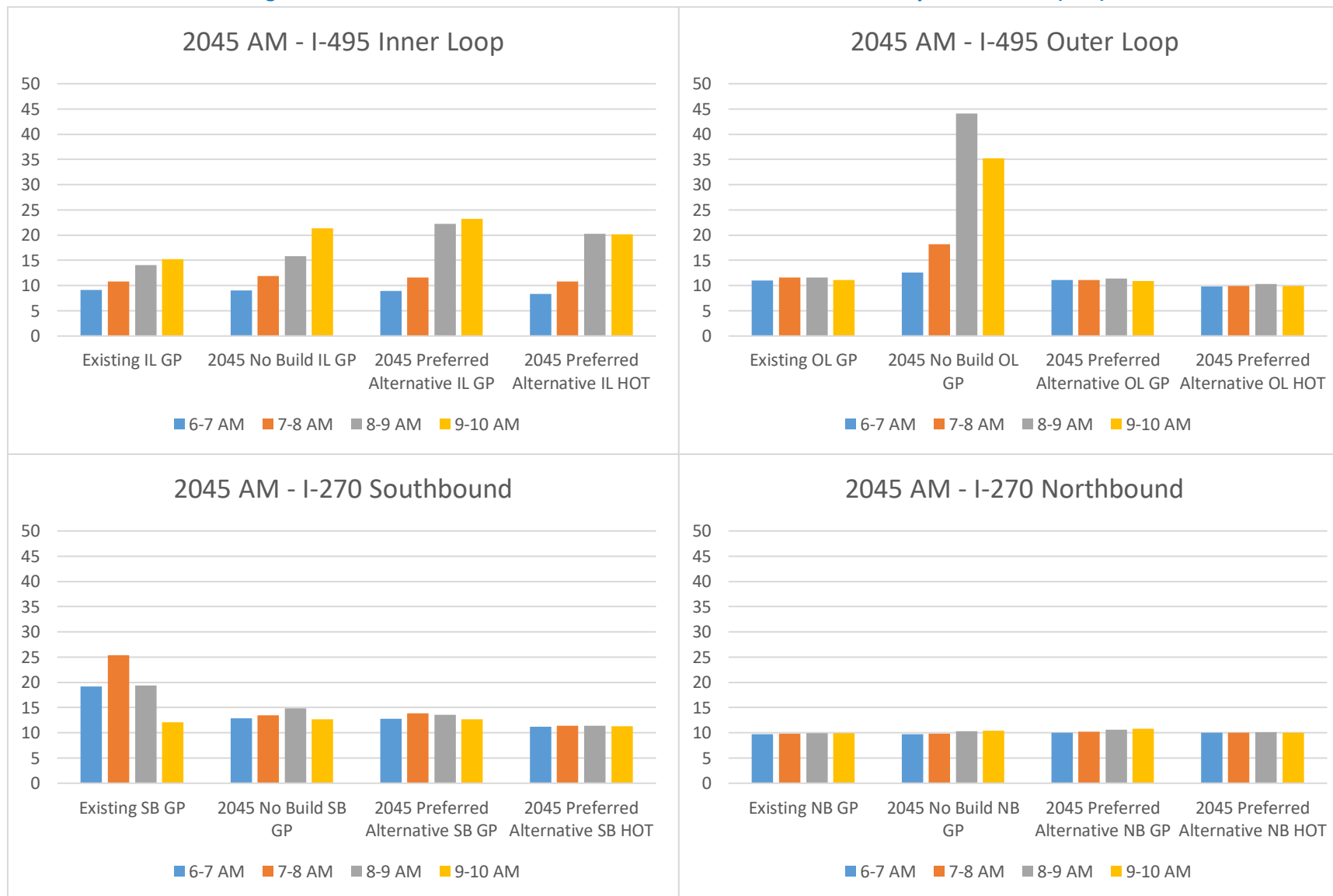
A comparison of overall corridor travel times for 2045 AM conditions is summarized in **Figure 6-46** while **Figure 6-47 to Figure 6-50** display cumulative travel times of the General Purpose lanes and HOT lanes for each of the analysis hours between interchanges along the corridors. Travel times are summarized for the 9.5-mile section of I-495 from VA 193 to MD 185; this segmentation includes the 4.0-mile segment from I-270 West Spur and MD 185, east of the HOT lanes termination. Along I-270, travel times are summarized along the 1.5-mile section of I-270 West Spur as well as the 12.0-mile section of I-270 (including the I-270 East Spur but excluding the I-270 local lanes) from I-495 to MD 124; this segmentation includes the 1.6-mile section from I-370 to MD 124, north of the HOT lanes termination.

Overall, travel times improve in the General Purpose lanes, with greater improvement in the HOT lanes. All travel times for No Build conditions along I-270 are a weighted average of travel times along the General Purpose and HOV lanes.

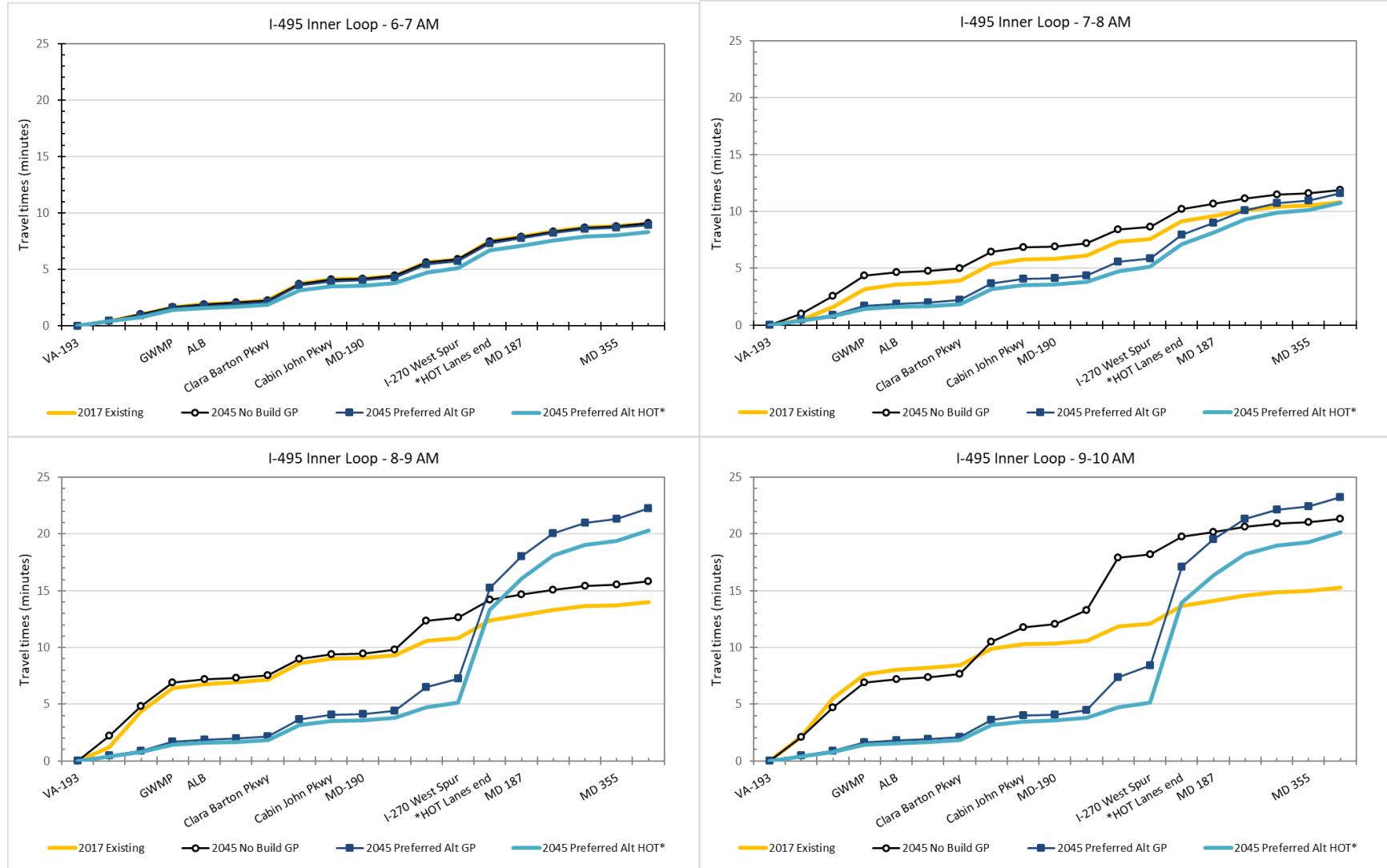
Like the 2027 AM peak period travel time trends, the 2045 Preferred Alternative shows similar or improved travel times along both the I-495 Inner Loop General Purpose and HOT lanes between the VA 193 interchange and I-270 West Spur (as shown in **Figure 6-47**). Travel times east of the I-270 West Spur do, however, increase during the 8-9 AM hour due to increased throughput and congestion, east of the proposed Managed Lanes facility. Nevertheless, in two of the four AM peak hours, the Preferred Alternative General Purpose lanes have the same cumulative travel times with increased throughput when compared to the No Build conditions; furthermore, the cumulative travel times are the same or similar with increased throughput when compared to Existing conditions. Along the I-495 Outer Loop, travel times greatly improve along both the General Purpose and HOT lanes during all four AM peak hours, with significant reductions in the 8-10 AM hours, more so following the 2017 Existing travel time trends (as shown in **Figure 6-48**).

No Build and Preferred Alternative travel times are comparable along the I-270 Southbound General Purpose lanes, with greater travel time savings along the Preferred Alternative HOT lanes (as shown in **Figure 6-49**). Because of the I-270 ICM, both No Build and Preferred Alternative southbound travel times are significantly less than 2017 Existing conditions, particularly in the 7-8 AM hour. Like the southbound direction, No Build and Preferred Alternative travel times are comparable for the I-270 Northbound General Purpose lanes but also for the HOT lanes, as this off-peak direction experiences minimal congestion during the AM peak period (as shown in **Figure 6-50**). Both No Build and Preferred Alternative experience similar northbound travel time trends when compared to the 2017 Existing conditions.

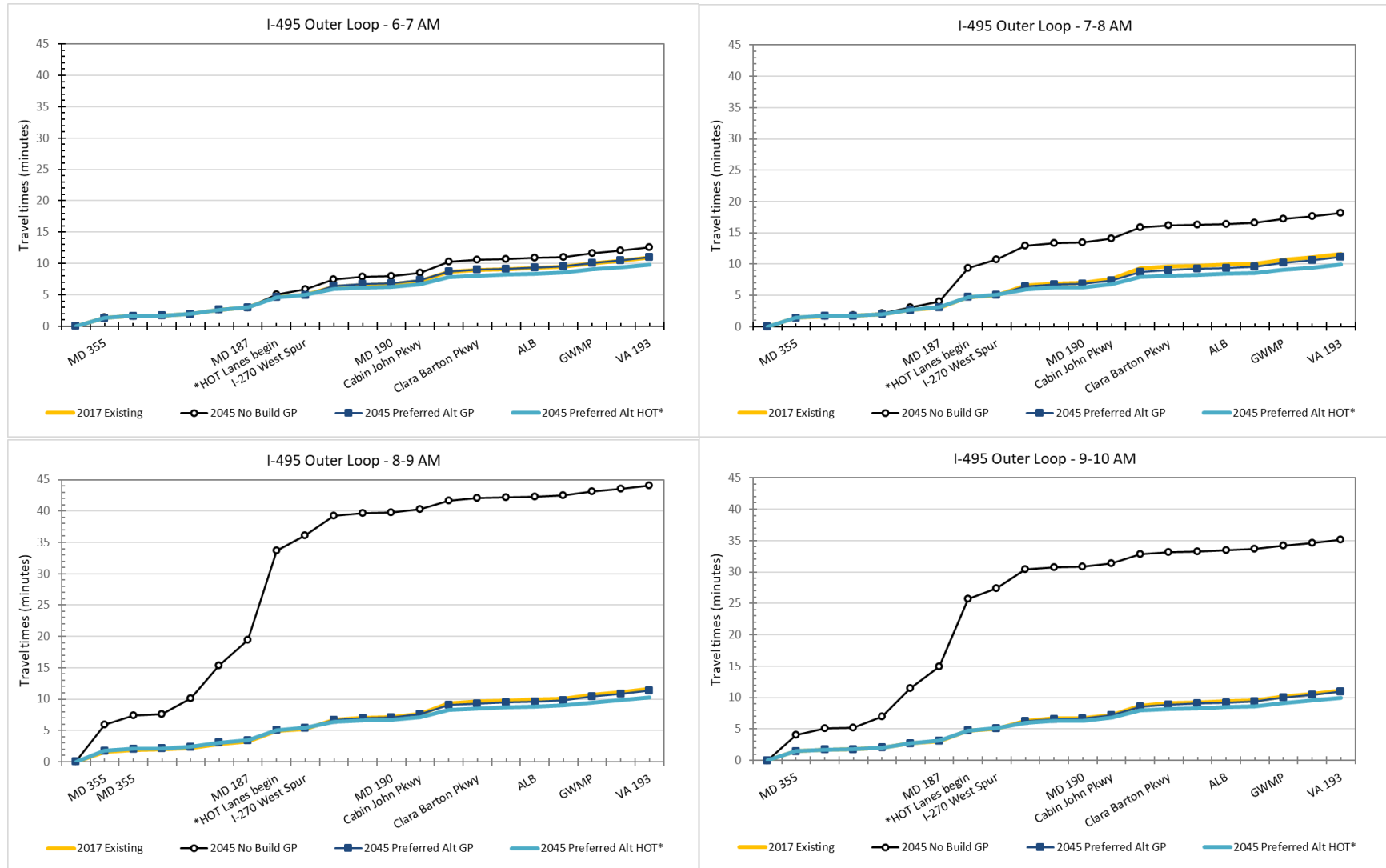
**Figure 6-46: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Travel Times (min)**



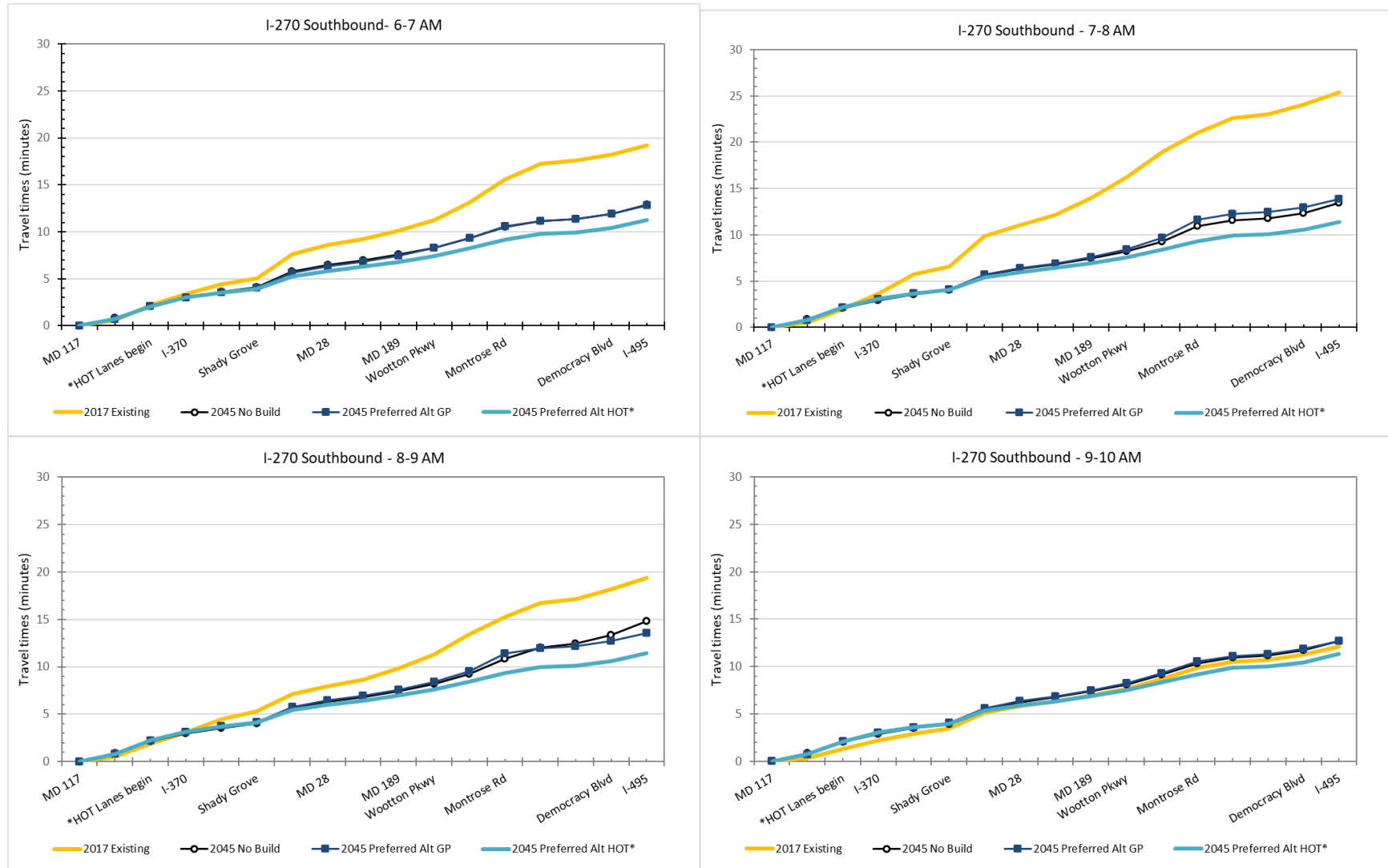
**Figure 6-47: I-495 Inner Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**



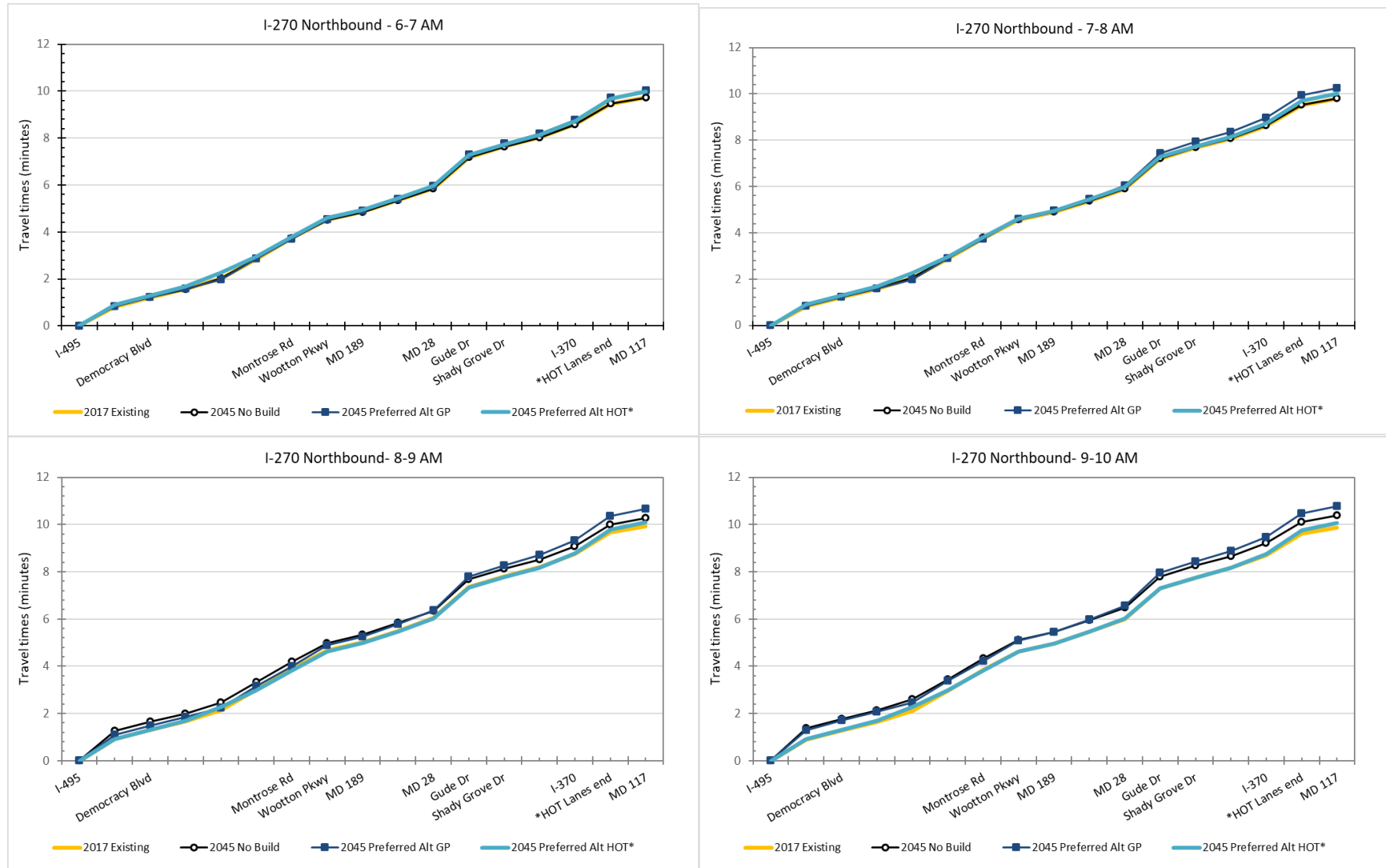
**Figure 6-48: I-495 Outer Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**



**Figure 6-49: I-270 Southbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**



**Figure 6-50: I-270 Northbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period**



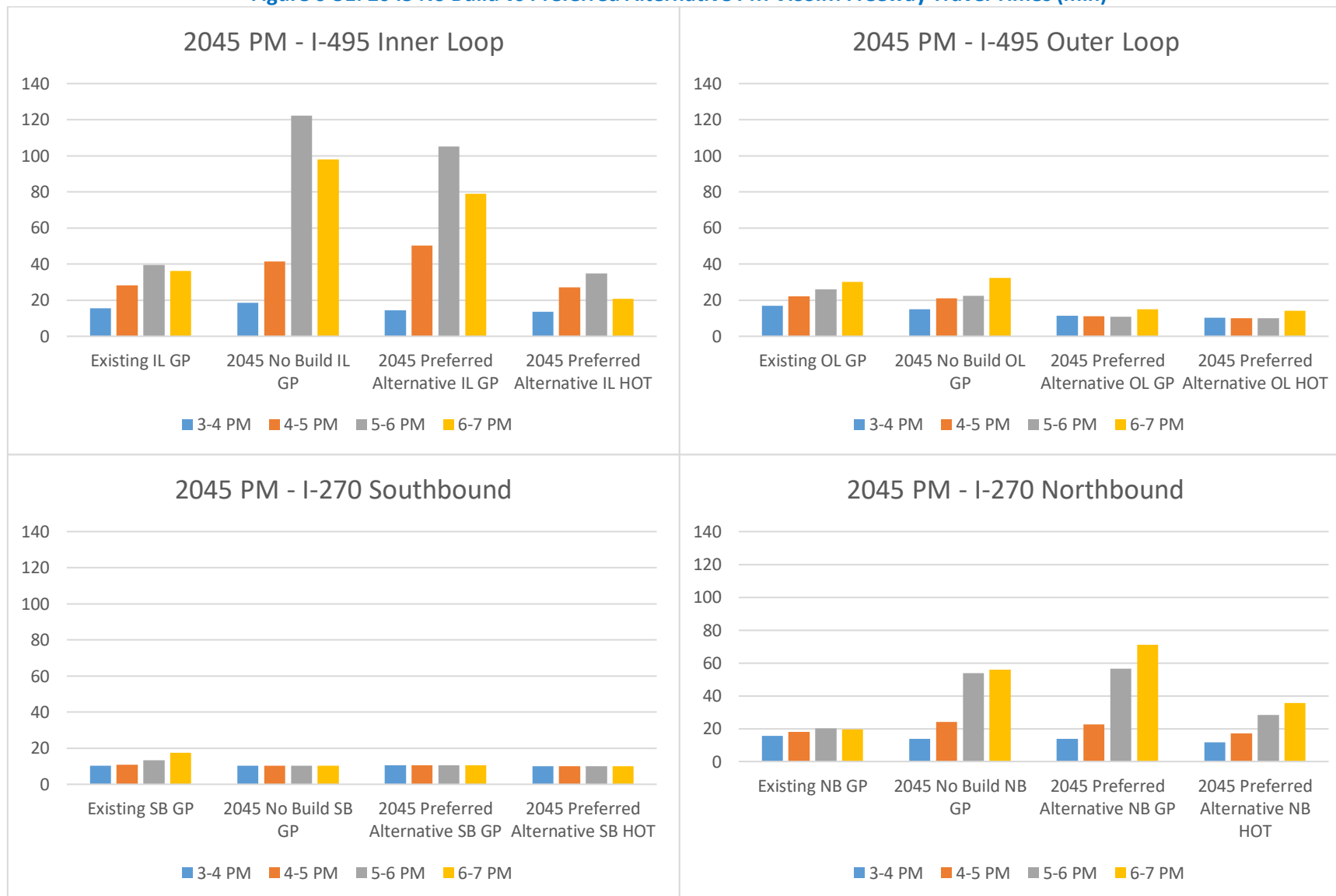
Like the AM, a comparison of overall corridor travel times for 2045 PM conditions is summarized in **Figure 6-51** while **Figure 6-52 to Figure 6-55** display cumulative travel times of the General Purpose mainline and HOT lanes for each of the analysis hours between interchanges along the corridors. Overall, travel times improve in the General Purpose lanes, with greater improvement in the HOT lanes. As previously stated, all travel times for No Build conditions along I-270 are a weighted average of travel times along the General Purpose and HOV lanes.

During the PM peak period along the I-495 Inner Loop, the 2045 No Build and Preferred Alternative General Purpose lanes experience similar travel time trends while the Preferred Alternative HOT lanes experience travel time improvement during all four PM peak hours, with substantial improvement between 5-7 PM hours (as shown in **Figure 6-52**). Travel times along the I-495 Outer Loop General Purpose and HOT lanes improve during all four PM peak hours, with greatest improvement between 5-7 PM hours for both roadway facilities with the Preferred Alternative (as shown in **Figure 6-53**).

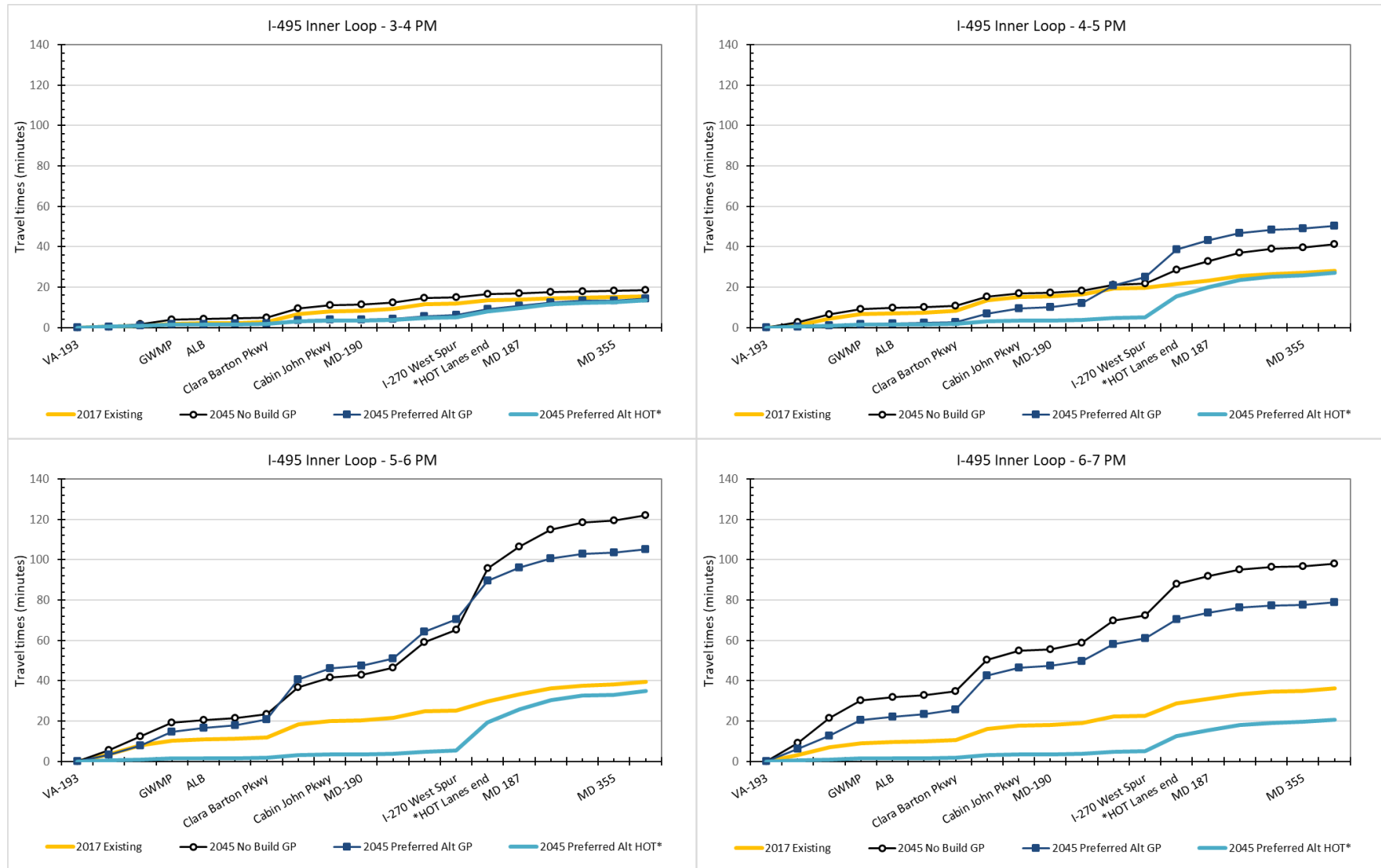
No Build and Preferred Alternative travel times are comparable in both the I-270 Southbound General Purpose and HOT lanes, as this off-peak direction experiences minimal congestion during the PM peak period (as shown in **Figure 6-54**). Both No Build and Preferred Alternative experience similar southbound travel time trends when compared to the 2017 Existing conditions. Travel times along the I-270 Northbound General Purpose lanes portray the high variability experienced along the corridor with an increase during the 6-7 PM hour due to the queue spillback first formed north of the study area. Travel times within the HOT lanes decrease during all PM peak hours, with great reduction during the 5-7 PM hours (as shown in **Figure 6-55**).



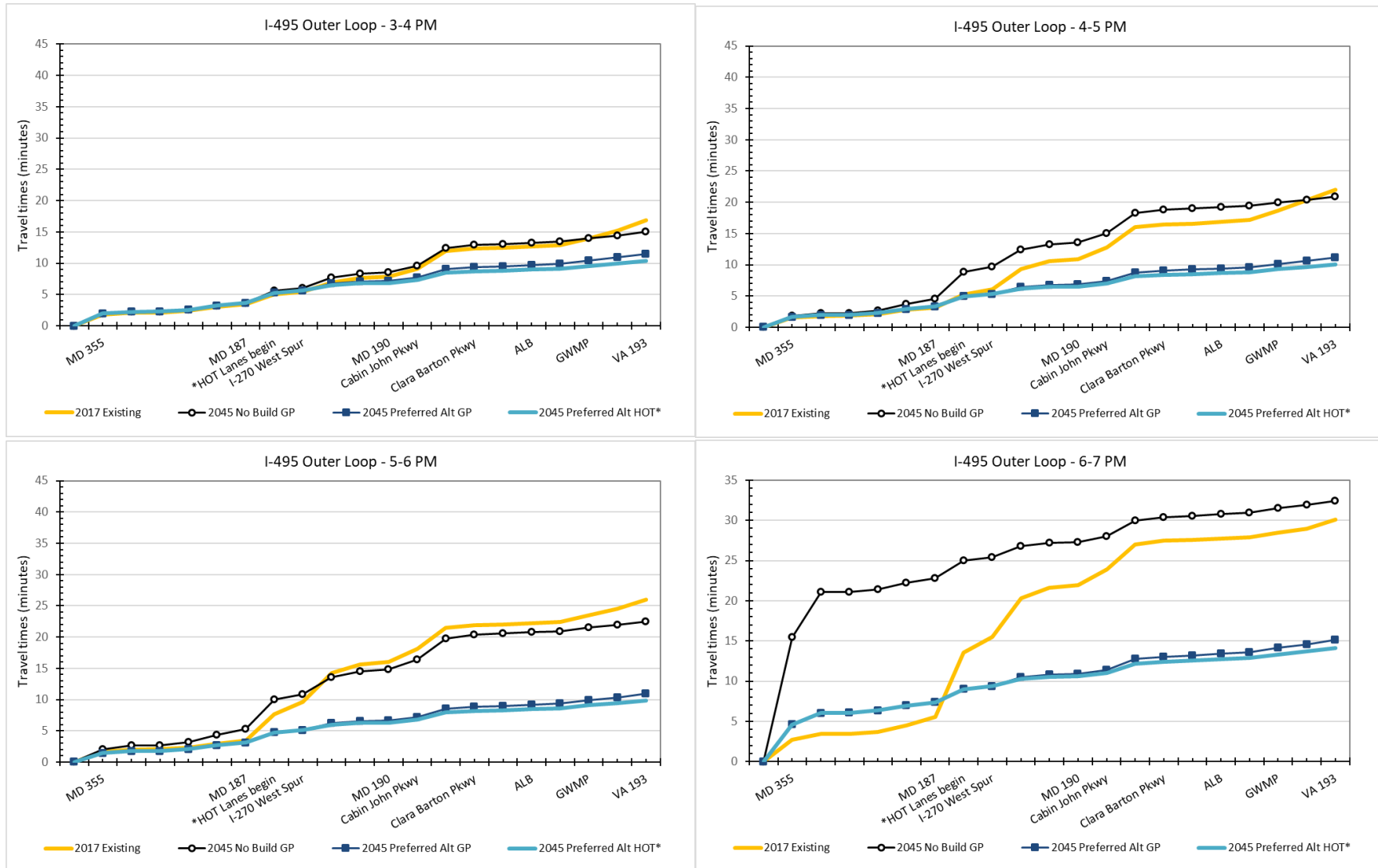
**Figure 6-51: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Travel Times (min)**



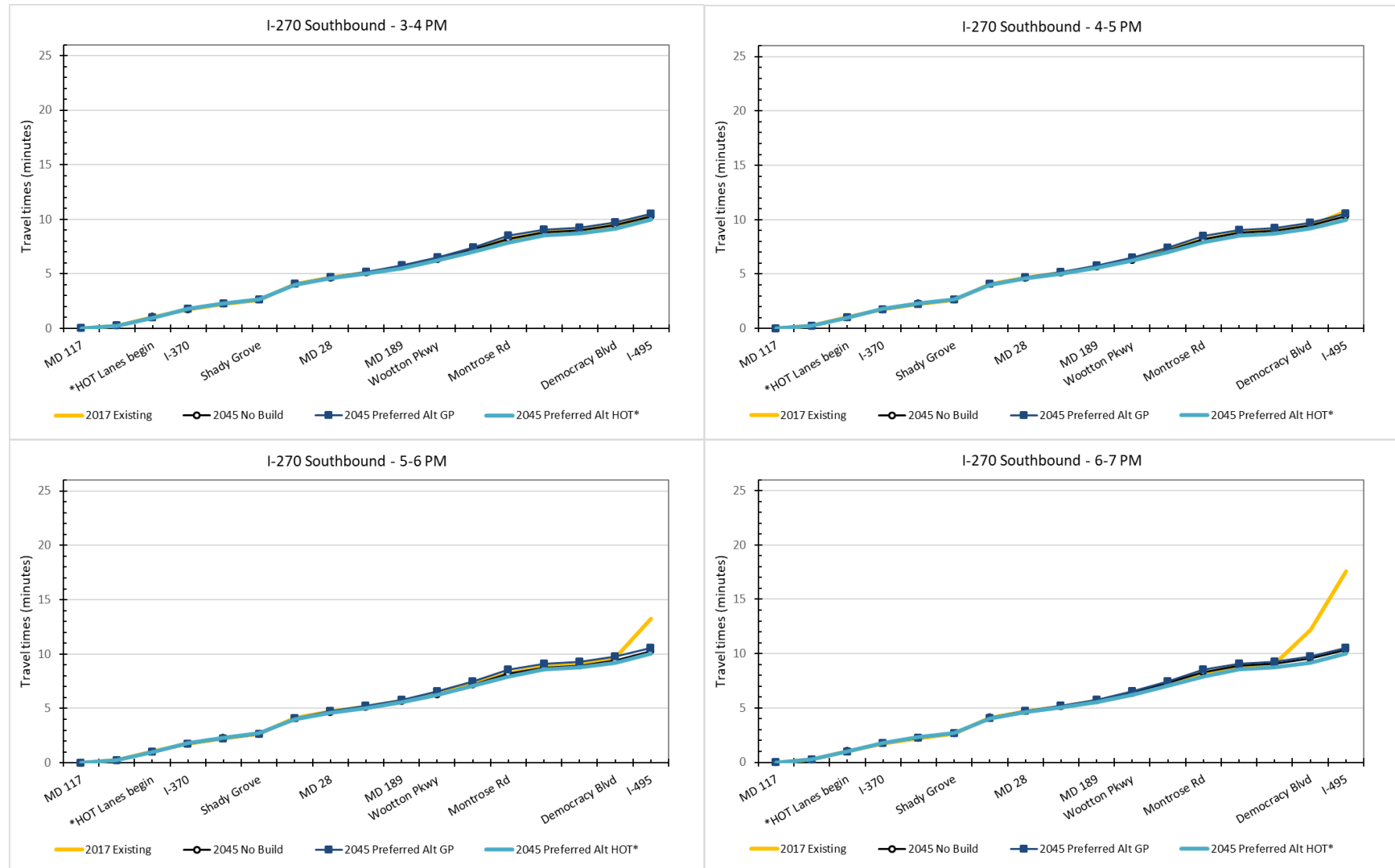
**Figure 6-52: I-495 Inner Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



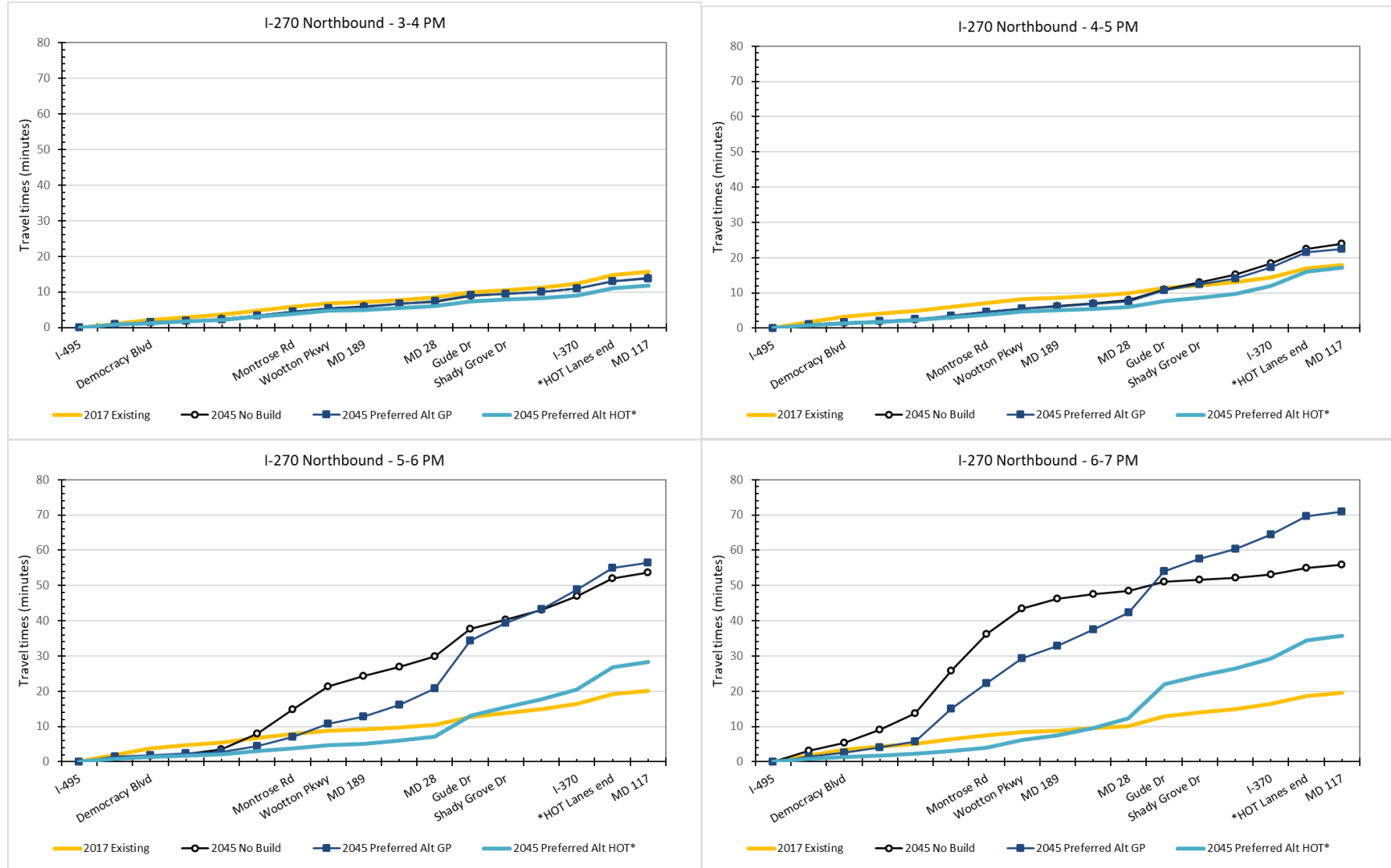
**Figure 6-53: I-495 Outer Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



**Figure 6-54: I-270 Southbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



**Figure 6-55: I-270 Northbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period**



#### 6.4.3.6 Ramp Queue Spillback

Queues along all on-ramps and off-ramps in the study area were compared between the No Build conditions and the Preferred Alternative to identify locations where ramp queue spillback occurs onto freeway or crossroad lanes. Table 6-22 and Table 6-23 summarize the simulated average and maximum queue lengths at each ramp location compared to the available storage length, indicating locations where the queue length exceeds the available ramp storage, which was measured from junction to gore point and excluding any associated acceleration and/or deceleration lane lengths. Simulated average queue length is defined as the arithmetic mean calculated for each hour within the peak period whereas the simulated maximum queue length is defined as the longest distance measured, even if occurring just once, within each hour of the peak period. Figure 6-56 and Figure 6-57 summarize the percentage of ramp locations where maximum queue length exceeds available ramp storage and spills back onto the mainline or crossroad lanes, with comparison against Existing and No Build conditions. Appendix H summarizes average and maximum queue lengths under Existing conditions.

As shown in Table 6-22 and Figure 6-56, the Preferred Alternative eliminates AM peak period queue spillback at all ramp locations in the study area but one, resolving spillback issues that occur under Existing and No Build conditions at locations including MD 190 and George Washington Memorial Parkway. The Preferred Alternative improves queuing for over 15 ramps compared to Existing and No Build conditions. As shown in Figure 6-56, No Build conditions produce ramp spillback at fewer locations than Existing conditions during the AM peak period. Due to bottlenecks on I-270 Southbound north of I-370, much of the volume to downstream I-270 is metered, allowing many ramps south of I-370 to operate without the spillback observed in Existing conditions.

During the AM peak period, the following location has queues exceeding the available ramp storage length for both the No Build and Preferred Alternative:

- *MD 117 EB On-Ramp to I-270 SB:* Under No Build conditions, maximum queue lengths exceed the available ramp storage from 7-10 AM. The Preferred Alternative improves conditions, with maximum queue length exceeding ramp storage from only 7-9 AM. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.

During the PM peak period, ramp queue spillback improves at over 25 ramp locations under the Preferred Alternative compared to No Build conditions, with queue lengths either decreasing or eliminated in the Preferred Alternative. As shown in Table 6-23, there are 18 ramp locations where the average or maximum queue length exceeds available ramp storage under No Build conditions, compared to 10 locations for the Preferred Alternative. The Preferred Alternative has no ramp locations that spill back onto the mainline.

Under both the Preferred Alternative and No Build conditions, the following locations have queues that exceed available storage length and spill back onto crossroad lanes during the PM peak period due to congestion along I-270 Northbound and I-495 Inner Loop. The mainline congestion that causes spillback

at these locations is caused by existing bottlenecks outside the study area that become exacerbated under future year conditions.

- *MD 28 WB On-Ramp to I-270 NB General Purpose Lanes:* Under No Build conditions, maximum queue lengths exceed available ramp storage during all four analysis hours. The Preferred Alternative improves conditions at this location with the maximum queue exceeding available ramp storage only between 5-7 PM. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *MD 189 WB & EB On-Ramps to I-270 NB General Purpose Lanes:* Under No Build conditions, maximum queue length exceeds the ramp storage length from 4-7 PM. Under the Preferred Alternative, maximum queue lengths exceed available storage from only 5-7 PM. Spillback at these ramps occur due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *Montrose Road WB On-Ramp to I-270 NB General Purpose Lanes:* Maximum queue lengths exceed available ramp storage from 5-7 PM under No Build conditions and from 4-7 PM under the Preferred Alternative. Maximum queue lengths are comparable between the No Build and Preferred Alternative conditions. Because the Preferred Alternative is expected to push through approximately 27% more vehicles between the I-270 Split and Montrose Road during the PM peak period with significantly more throughput in the 5-7 PM hours (i.e., approximately 50% more in 5-6 PM hour and 78% more in 6-7 PM hour), the queue spillback causes the on-ramp to spill back more quickly as there is no available capacity in the I-270 Northbound General Purpose lanes. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *Montrose Road EB On-Ramp to I-270 NB General Purpose Lanes:* The No Build maximum queue length exceeds the ramp storage from 6-7 PM. The Preferred Alternative queue lengths exceed available storage from 5-7 PM. Maximum queue lengths are comparable between the No Build and Preferred Alternative conditions. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *Rockledge Drive/MD 187 On-Ramp to I-270 NB East Spur:* Maximum queue lengths exceed available ramp storage from 5-7 PM under No Build conditions and from 6-7 PM under the Preferred Alternative. Queue lengths are comparable under the Preferred Alternative compared to No Build conditions. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent



planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.

- *MD 355 NB On-Ramp to I-270 NB East Spur:* Under No Build conditions, average and maximum queue lengths exceed available ramp storage from 5-7 PM. The Preferred Alternative improves conditions at this location, exceeding available ramp storage between only 6-7 PM. Spillback at this ramp occurs due to the existing bottleneck along I-270 north of I-370. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study.
- *Cabin John Parkway On-Ramp to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, average and maximum queue lengths exceed available ramp storage during all four analysis hours. The Preferred Alternative improves conditions at this location, with maximum queues exceeding available ramp storage between only 4-7 PM. Spillback at this ramp occurs due to the existing bottleneck outside the study area along I-495 Inner Loop east of MD 355.
- *MD 190 EB & WB On-Ramps to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, maximum queue lengths exceed available ramp storage during all four analysis hours. The Preferred Alternative improves conditions at this location, with queues exceeding available ramp storage between only 4-7 PM. Spillback at these ramps occur due to the existing bottleneck along I-495 Inner Loop east of MD 355.
- *George Washington Parkway WB On-Ramp to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, maximum queue lengths exceed available ramp storage during all four analysis hours. The Preferred Alternative improves conditions at this location, with maximum queues exceeding available ramp storage between only 4-7 PM. Spillback at this ramp occurs due to the existing bottleneck along I-495 Inner Loop east of MD 355.
- *VA 193 NB On-Ramp to I-495 Inner Loop General Purpose Lanes:* Under No Build conditions, average and maximum queue lengths exceed available ramp storage from 4-7 PM. The Preferred Alternative improves conditions at this location, exceeding ramp storage length from 5-7 PM. Spillback at this ramp occurs due to the existing bottleneck along I-495 Inner Loop east of MD 355.

In summary, the Preferred Alternative maintains or improves ramp spillback compared to No Build conditions throughout the study area, improving and reducing queues at over 30 locations, eliminating almost all ramp spillback during the AM peak period, and removing 8 ramp spillback locations that occur under PM No Build conditions. The remaining spillback locations that occur under PM conditions are due to existing bottlenecks along I-270 Northbound and I-495 Inner Loop that occur outside the study area and become exacerbated under future conditions.

**Table 6-22: AM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative**

| Ramp Location                             | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|---|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|   |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|   |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 117                           |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 117 EB On-Ramp to I-270 SB             | 1,920                    | 88            | 752       | 1,238     | 2,152     | 1,745     | 2,397     | 477       | 1,997     | 1,920                    | 69                         | 734       | 816       | 1,994     | 866       | 1,954     | 52        | 911       |
| MD 117 WB On-Ramp to I-270 SB             | 1,490                    | 88            | 752       | 1,006     | 1,472     | 1,243     | 1,472     | 393       | 1,314     | 1,490                    | 69                         | 721       | 698       | 1,379     | 824       | 1,423     | 52        | 911       |
| I-270 NB GP Off-Ramp to MD 117            | 1,300                    | 25            | 184       | 38        | 254       | 251       | 715       | 106       | 486       | 1,300                    | 29                         | 189       | 61        | 297       | 155       | 571       | 126       | 529       |
| I-270 at I-370                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 370 EB On-Ramp to I-270 SB GP          | 2,340                    | 0             | 0         | 0         | 119       | 0         | 40        | 0         | 0         | 2,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB GP          | 3,000                    | 3             | 134       | 241       | 1,920     | 133       | 1,298     | 0         | 0         | 2,940                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB Off-Ramp to I-370 EB             | 6,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 6,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 EB          | 2,300                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,220                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 EB On-Ramp to I-270 NB GP           | 2,400                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 WB On-Ramp to I-270 NB GP           | 2,780                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB Off-Ramp to I-370 WB             | 2,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,900                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 WB          | 3,320                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 3,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 EB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 2,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to I-370 EB GP       | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 3,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 WB at I-270 NB ML off-ramp          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 5,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Shady Grove Road                 |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Shady Grove Rd EB On-Ramp to I-270 SB GP  | 1,120                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 920                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Shady Grove Rd EB On-Ramp to I-270 NB GP  | 1,650                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,650                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to Shady Grove Rd EB | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,850                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to Shady Grove Rd WB | 1,600                    | 39            | 197       | 66        | 273       | 118       | 411       | 95        | 380       | 1,700                    | 28                         | 156       | 56        | 248       | 109       | 404       | 79        | 309       |
| Shady Grove Rd WB On-Ramp to I-270 NB GP  | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Shady Grove Rd WB On-Ramp to I-270 SB     | 1,600                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to Shady Grove Rd    | 1,250                    | 64            | 240       | 98        | 424       | 103       | 465       | 99        | 426       | 1,250                    | 60                         | 232       | 99        | 419       | 100       | 427       | 95        | 408       |
| I-270 at Gude Drive                       |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,860                    | 31                         | 228       | 33        | 210       | 34        | 211       | 33        | 195       |
| I-270 NB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,400                    | 65                         | 350       | 70        | 366       | 87        | 404       | 88        | 401       |
| Gude Dr On-Ramp to I-270 ML NB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Gude Dr On-Ramp to I-270 ML SB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,780                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |


 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage


Table 6-22: AM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)

| Ramp Location                          | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 28                         |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 28 EB On-Ramp to I-270 SB GP        | 1,950                    | 1             | 92        | 4         | 182       | 0         | 0         | 0         | 0         | 1,950                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 28 EB On-Ramp to I-270 NB GP        | 1,050                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 950                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to MD 28          | 1,040                    | 2             | 59        | 22        | 169       | 34        | 204       | 28        | 201       | 900                      | 1                          | 53        | 15        | 130       | 21        | 162       | 21        | 136       |
| MD 28 WB On-Ramp to I-270 NB GP        | 1,370                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,370                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to MD 28 WB       | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,000                    | 0                          | 0         | 0         | 0         | 2         | 263       | 1         | 194       |
| MD 28 WB On-Ramp to I-270 SB GP        | 1,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 950                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to MD 28          | 900                      | 10            | 151       | 10        | 132       | 12        | 124       | 26        | 198       | 1,400                    | 0                          | 31        | 0         | 51        | 1         | 64        | 2         | 74        |
| I-270 at MD 189                        |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 189 WB On-Ramp to I-270 NB          | 1,080                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,140                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 189 EB On-Ramp to I-270 NB          | 910                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 910                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to MD 189 WB      | 720                      | 5             | 60        | 21        | 109       | 5         | 78        | 7         | 63        | 630                      | 1                          | 50        | 3         | 61        | 5         | 61        | 4         | 58        |
| I-270 NB GP Off-Ramp to MD 189 EB      | 920                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 760                      | 2                          | 70        | 9         | 130       | 18        | 221       | 15        | 210       |
| MD 189 WB On-Ramp to I-270 SB GP       | 1,910                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,890                    | 0                          | 0         | 1         | 145       | 0         | 8         | 0         | 0         |
| MD 189 EB On-Ramp to I-270 SB GP       | 2,060                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,070                    | 0                          | 0         | 1         | 119       | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to MD 189 EB      | 900                      | 33            | 191       | 43        | 204       | 43        | 211       | 38        | 231       | 870                      | 6                          | 91        | 10        | 92        | 9         | 86        | 9         | 81        |
| I-270 SB GP Off-Ramp to MD 189 WB      | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,120                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Wootton Parkway               |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 NB ML Off-Ramp to Wootton Pkwy   | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 4                          | 96        | 8         | 151       | 17        | 194       | 17        | 213       |
| I-270 SB ML Off-Ramp to Wootton Pkwy   | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,570                    | 28                         | 220       | 23        | 177       | 18        | 164       | 23        | 201       |
| Wootton Pkwy On-Ramp to I-270 NB ML    | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 3,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Wootton Pkwy On-Ramp to I-270 SB ML    | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Montrose Road                 |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Montrose Rd EB On-Ramp to I-270 SB GP  | 1,960                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,910                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to Montrose Rd EB | 1,340                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,220                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Montrose Rd EB On-Ramp to I-270 NB GP  | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp Montrose Rd EB    | 1,980                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,870                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Montrose Rd WB On-Ramp to I-270 NB GP  | 1,950                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,870                    | 0                          | 0         | 0         | 0         | 6         | 456       | 2         | 261       |
| I-270 NB Off-Ramp to Montrose Rd WB    | 1,520                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,320                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Montrose Rd WB On-Ramp to I-270 SB GP  | 1,200                    | 0             | 0         | 0         | 32        | 0         | 0         | 0         | 0         | 1,100                    | 0                          | 117       | 2         | 164       | 1         | 144       | 2         | 161       |
| I-270 SB GP Off-Ramp to Montrose Rd WB | 1,600                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage


**Table 6-22: AM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)**

| Ramp Location  | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 187 / Rockledge Drive                    |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB East Spur Off-Ramp to Rockledge Dr / MD 187 | 1,700                    | 2             | 83        | 4         | 114       | 12        | 248       | 6         | 141       | 1,400                    | 1                          | 84        | 10        | 164       | 21        | 256       | 12        | 208       |
| I-270 NB East Spur Off-Ramp to MD 187 SB             | 915                      | 28            | 206       | 58        | 334       | 28        | 209       | 43        | 296       | 720                      | 5                          | 70        | 48        | 227       | 37        | 181       | 36        | 177       |
| I-270 NB East Spur Off-Ramp to MD 187 NB             | 1,050                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 900                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 East Spur NB Off-Ramp to Rockledge Dr          | 960                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 890                      | 0                          | 16        | 0         | 75        | 0         | 85        | 0         | 60        |
| MD 187 On-Ramp to I-270 East Spur SB                 | 780                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 580                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Rockledge Dr / MD 187 On-Ramp to I-270 NB East Spur  | 1,300                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,050                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Westlake Terrace                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Westlake Terrace             | 1,550                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,440                    | 30                         | 292       | 36        | 299       | 72        | 432       | 121       | 572       |
| Westlake Terrace On-Ramp to I-270 NB ML              | 1,350                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,470                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to Westlake Terrace             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,850                    | 8                          | 168       | 13        | 181       | 12        | 163       | 23        | 226       |
| Westlake Terrace On-Ramp to I-270 SB ML              | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Democracy Boulevard                         |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 NB GP Off-Ramp to Democracy Blvd WB            | 1,330                    | 8             | 76        | 15        | 97        | 15        | 112       | 18        | 127       | 1,270                    | 11                         | 91        | 22        | 133       | 20        | 141       | 25        | 160       |
| I-270 NB GP Off-Ramp to Democracy Blvd EB            | 1,550                    | 57            | 245       | 74        | 299       | 90        | 385       | 86        | 361       | 1,450                    | 46                         | 219       | 74        | 304       | 103       | 583       | 89        | 370       |
| Democracy Blvd EB On-Ramp to I-270 West Spur GP NB   | 1,215                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Democracy Blvd WB On-Ramp to I-270 West Spur GP NB   | 1,680                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 West Spur SB Off-Ramp to Democracy Blvd GP EB  | 1,300                    | 29            | 138       | 53        | 221       | 57        | 236       | 50        | 196       | 1,140                    | 26                         | 131       | 34        | 150       | 57        | 241       | 49        | 208       |
| I-270 West Spur GP SB Off-Ramp to Democracy Blvd WB  | 1,430                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Democracy Blvd On-Ramp to I-495 Outer Loop GP        | 1,130                    | 0             | 0         | 0         | 0         | 45        | 159       | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 355                                      |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 East Spur SB Off-Ramp to MD 355 SB             | 1,940                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,940                    | 0                          | 0         | 0         | 0         | 0         | 12        | 0         | 0         |
| I-495 Inner Loop Off-Ramp to MD 355 SB               | 2,300                    | 31            | 178       | 33        | 179       | 26        | 148       | 25        | 131       | 2,300                    | 32                         | 180       | 32        | 186       | 27        | 163       | 26        | 168       |
| MD 355 NB On-Ramp to I-495 Inner Loop                | 875                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 875                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 SB On-Ramp to I-495 Inner Loop                | 2,160                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,160                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop Off-Ramp to MD 355 NB               | 1,360                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB On-Ramp to I-495 Outer Loop                | 1,360                    | 0             | 0         | 0         | 0         | 278       | 731       | 1         | 68        | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB ramp to I-270 East Spur NB                 | 1,450                    | 0             | 0         | 0         | 0         | 1         | 68        | 0         | 0         | 1,450                    | 0                          | 0         | 0         | 0         | 2         | 81        | 0         | 0         |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Table 6-22: AM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)**

| Ramp Location                                   | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|---|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|   |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|   |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-495 at MD 187                                 |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to MD 187 NB       | 950                      | 7             | 62        | 10        | 158       | 14        | 145       | 13        | 103       | 950                      | 9                          | 91        | 14        | 189       | 11        | 288       | 6         | 75        |
| I-495 Inner Loop GP Off-Ramp to MD 187 SB       | 1,030                    | 4             | 151       | 28        | 347       | 24        | 347       | 8         | 275       | 1,030                    | 6                          | 232       | 34        | 514       | 61        | 564       | 9         | 323       |
| MD 187 On-Ramp to I-495 Inner Loop GP           | 1,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 187          | 1,015                    | 58            | 366       | 77        | 439       | 171       | 1,199     | 2,117     | 3,429     | 1,015                    | 26                         | 232       | 41        | 291       | 74        | 513       | 28        | 269       |
| I-495 Outer Loop GP Off-Ramp to MD 187 NB       | 1,250                    | 7             | 180       | 20        | 355       | 131       | 813       | 66        | 552       | 1,250                    | 0                          | 11        | 0         | 68        | 3         | 158       | 3         | 140       |
| MD 187 On-Ramp to I-495 Outer Loop GP           | 1,000                    | 0             | 0         | 135       | 785       | 629       | 970       | 588       | 967       | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 190/Cabin John Parkway              |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Cabin John Pkwy GP ramp to MD-190               | 770                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,630                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop GP  | 1,230                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to Cabin John Pkwy | 1,140                    | 0             | 0         | 1         | 66        | 3         | 155       | 8         | 191       | 850                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Outer Loop GP        | 1,180                    | 0             | 0         | 102       | 1,166     | 1,342     | 1,737     | 1,462     | 1,736     | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 WB On-Ramp to I-495 Outer Loop GP        | 990                      | 0             | 0         | 160       | 885       | 280       | 1,369     | 165       | 958       | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 190          | 850                      | 31            | 109       | 131       | 1,049     | 81        | 918       | 59        | 741       | 1,040                    | 29                         | 131       | 38        | 191       | 28        | 125       | 29        | 130       |
| I-495 Inner Loop GP Off-Ramp to MD 190          | 1,675                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 590                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Inner Loop GP        | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,100                    | 0                          | 0         | 0         | 0         | 0         | 0         | 3         | 96        |
| MD-190 WB On-Ramp to I-495 Inner Loop GP        | 2,100                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,480                    | 0                          | 0         | 0         | 0         | 0         | 0         | 4         | 175       |
| I-495 Outer Loop ML Off-Ramp to MD 190          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,320                    | 13                         | 85        | 15        | 106       | 8         | 85        | 8         | 79        |
| I-495 Inner Loop ML Off-Ramp to MD 190          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 2                          | 66        | 3         | 68        | 1         | 47        | 1         | 50        |
| MD-190 On-Ramp to I-495 Outer Loop ML           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,230                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 On-Ramp to I-495 Inner Loop ML           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,130                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML Off-Ramp to Cabin John Pkwy | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop ML  | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 800                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at Clara Barton Parkway                   |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 ILGP Off-Ramp to Clara Barton Pkwy EB     | 2,670                    | 0             | 0         | 0         | 35        | 0         | 15        | 0         | 9         | 2,350                    | 0                          | 0         | 0         | 42        | 0         | 53        | 0         | 0         |
| I-495 IL GP Off-Ramp to Clara Barton Pkwy WB    | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,240                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton Pkwy EB On-Ramp to I-495 IL GP     | 2,950                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,870                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 OL GP Off-Ramp to Clara Barton Pkwy WB    | 1,500                    | 0             | 5         | 0         | 5         | 0         | 0         | 0         | 0         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton EB On-Ramp to I-495 OL GP          | 1,550                    | 0             | 0         | 0         | 0         | 1         | 120       | 0         | 0         | 1,600                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton WB On-Ramp to I-495 OL GP          | 2,160                    | 0             | 0         | 0         | 0         | 0         | 9         | 0         | 0         | 2,110                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage



**Table 6-22: AM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)**

| Ramp Location                                    | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 6-7 AM        |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |                          | 6-7 AM                     |           | 7-8 AM    |           | 8-9 AM    |           | 9-10 AM   |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-495 at George Washington Parkway               |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to GWMP             | 1,230                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,810                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Inner Loop GP           | 2,200                    | 0             | 118       | 2,433     | 4,041     | 2,883     | 4,555     | 4,049     | 4,556     | 2,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to GWMP             | 3,260                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,200                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop ML Off-Ramp to GWMP             | 1,740                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,510                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Outer Loop ML           | 2,400                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 750                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Outer Loop C-D          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,580                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML ramp to I-495 Outer Loop C-D | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop GP ramp to I-495 Inner Loop ML  | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 840                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| GWMP WB On-Ramp to I-495 Inner Loop ML           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 400                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at VA 193                                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to VA 193           | 1,130                    | 17            | 154       | 202       | 868       | 65        | 571       | 50        | 429       | 1,130                    | 10                         | 128       | 72        | 521       | 35        | 285       | 32        | 178       |
| VA 193 NB On-Ramp to I-495 Inner Loop GP         | 1,050                    | 0             | 57        | 6         | 236       | 124       | 620       | 28        | 433       | 1,050                    | 0                          | 15        | 0         | 83        | 2         | 181       | 0         | 48        |
| I-495 Outer Loop GP slip ramp to VA 193          | 700                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 1,170                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,170                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 900                      | 46            | 315       | 60        | 337       | 46        | 311       | 57        | 295       | 900                      | 45                         | 277       | 77        | 381       | 57        | 337       | 56        | 324       |


 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

Table 6-23: PM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative

| Ramp Location                             | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|---|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|   |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|   |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 117                           |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 117 EB On-Ramp to I-270 SB             | 1,920                    | 0             | 0         | 0         | 0         | 0         | 16        | 0         | 49        | 1,920                    | 0                          | 0         | 0         | 31        | 0         | 0         | 0         | 0         |
| MD 117 WB On-Ramp to I-270 SB             | 1,490                    | 0             | 0         | 0         | 0         | 0         | 16        | 0         | 49        | 1,490                    | 0                          | 0         | 0         | 31        | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to MD 117            | 1,300                    | 111           | 408       | 97        | 427       | 48        | 314       | 163       | 502       | 1,300                    | 128                        | 427       | 195       | 536       | 77        | 386       | 96        | 397       |
| I-270 at I-370                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 370 EB On-Ramp to I-270 SB GP          | 2,340                    | 0             | 0         | 0         | 0         | 0         | 0         | 21        | 473       | 2,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB GP          | 3,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 13        | 238       | 2,940                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB Off-Ramp to I-370 EB             | 6,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 6,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 EB          | 2,300                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,220                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 EB On-Ramp to I-270 NB GP           | 2,400                    | 29            | 411       | 1,950     | 5,064     | 6,007     | 6,084     | 5,801     | 6,084     | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-370 WB On-Ramp to I-270 NB GP           | 2,780                    | 313           | 1,915     | 3,347     | 4,651     | 4,395     | 4,652     | 2,213     | 4,598     | 2,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB Off-Ramp to I-370 WB             | 2,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,900                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to I-370 WB          | 3,320                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 3,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 EB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 2,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 370 WB On-Ramp to I-270 SB ML          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to I-370 EB GP       | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 3,700                    | 0                          | 0         | 0         | 0         | 69        | 752       | 5         | 253       |
| I-370 WB at I-270 NB ML off-ramp          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 5,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Shady Grove Road                 |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Shady Grove Rd EB On-Ramp to I-270 SB GP  | 1,120                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 920                      | 2                          | 158       | 4         | 191       | 7         | 284       | 2         | 161       |
| Shady Grove Rd EB On-Ramp to I-270 NB GP  | 1,650                    | 0             | 0         | 1,402     | 3,974     | 3,929     | 3,979     | 1,512     | 3,971     | 1,650                    | 0                          | 0         | 0         | 0         | 31        | 392       | 0         | 0         |
| I-270 NB GP Off-Ramp to Shady Grove Rd EB | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,850                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB GP Off-Ramp to Shady Grove Rd WB | 1,600                    | 64            | 212       | 48        | 208       | 16        | 140       | 33        | 181       | 1,700                    | 39                         | 161       | 29        | 138       | 23        | 126       | 13        | 99        |
| Shady Grove Rd WB On-Ramp to I-270 NB GP  | 1,150                    | 0             | 0         | 1,013     | 1,867     | 1,764     | 1,868     | 941       | 1,864     | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Shady Grove Rd WB On-Ramp to I-270 SB     | 1,600                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to Shady Grove Rd    | 1,250                    | 69            | 261       | 63        | 281       | 50        | 192       | 65        | 256       | 1,250                    | 66                         | 223       | 63        | 210       | 66        | 229       | 56        | 190       |
| I-270 at Gude Drive                       |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,860                    | 63                         | 291       | 54        | 312       | 54        | 293       | 58        | 293       |
| I-270 NB ML Off-Ramp to Gude Dr           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,400                    | 95                         | 420       | 90        | 448       | 77        | 392       | 71        | 377       |
| Gude Dr On-Ramp to I-270 ML NB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Gude Dr On-Ramp to I-270 ML SB            | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,780                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

Highlighted cells indicate locations where average or maximum queue lengths exceed available storage



**Table 6-23: PM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)**

| Ramp Location                          | NB Queue counter | BD Queue counter | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|--|------------------|------------------|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                  |                  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|  |                  |                  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 28                         |                  |                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 28 EB On-Ramp to I-270 SB GP        | 28               | 28               | 1,950                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,950                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 28 EB On-Ramp to I-270 NB GP        | 72               | 72               | 1,050                    | 0             | 0         | 0         | 0         | 8         | 136       | 4         | 103       | 950                      | 0                          | 0         | 0         | 0         | 6         | 123       | 0         | 15        |
| I-270 NB GP Off-Ramp to MD 28          | 158              | 158              | 1,040                    | 86            | 354       | 76        | 323       | 36        | 264       | 85        | 458       | 900                      | 59                         | 291       | 51        | 228       | 36        | 239       | 39        | 241       |
| MD 28 WB On-Ramp to I-270 NB GP        | 73               | 73               | 1,370                    | 1,124         | 1,869     | 1,687     | 2,405     | 2,125     | 2,404     | 1,222     | 2,397     | 1,370                    | 0                          | 0         | 0         | 5         | 1,392     | 2,253     | 1,355     | 2,166     |
| I-270 NB GP Off-Ramp to MD 28 WB       | 159              | 159              | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 101       | 856       | 1,000                    | 0                          | 0         | 0         | 7         | 0         | 0         | 894       | 219       |
| MD 28 WB On-Ramp to I-270 SB GP        | 27               | 27               | 1,000                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 950                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to MD 28          | 117              | 117              | 900                      | 27            | 186       | 29        | 215       | 14        | 159       | 42        | 266       | 1,400                    | 16                         | 170       | 15        | 146       | 24        | 214       | 17        | 185       |
| I-270 at MD 189                        |                  |                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| MD 189 WB On-Ramp to I-270 NB          | 418              | 418              | 1,080                    | 226           | 753       | 468       | 1,103     | 1,026     | 1,481     | 787       | 1,460     | 1,140                    | 6                          | 144       | 39        | 308       | 560       | 1,522     | 1,231     | 1,532     |
| MD 189 EB On-Ramp to I-270 NB          | 417              | 417              | 910                      | 220           | 663       | 420       | 1,064     | 935       | 1,823     | 934       | 2,111     | 910                      | 0                          | 17        | 4         | 151       | 649       | 2,506     | 1,409     | 2,399     |
| I-270 NB GP Off-Ramp to MD 189 WB      | 156              | 156              | 720                      | 23            | 126       | 24        | 117       | 16        | 131       | 13        | 118       | 630                      | 8                          | 67        | 12        | 75        | 10        | 122       | 15        | 178       |
| I-270 NB GP Off-Ramp to MD 189 EB      | 157              | 157              | 920                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 760                      | 10                         | 157       | 10        | 133       | 7         | 181       | 12        | 313       |
| MD 189 WB On-Ramp to I-270 SB GP       | 415              | 415              | 1,910                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,890                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 189 EB On-Ramp to I-270 SB GP       | 416              | 416              | 2,060                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,070                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to MD 189 EB      | 118              | 118              | 900                      | 58            | 286       | 56        | 310       | 63        | 315       | 85        | 375       | 870                      | 3                          | 72        | 4         | 81        | 12        | 226       | 26        | 407       |
| I-270 SB GP Off-Ramp to MD 189 WB      | 119              | 119              | 1,150                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,120                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Wootton Parkway               |                  |                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 NB ML Off-Ramp to Wootton Pkwy   | 1023             | 1023             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 26                         | 197       | 37        | 253       | 31        | 210       | 16        | 133       |
| I-270 SB ML Off-Ramp to Wootton Pkwy   | 1024             | 1024             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,570                    | 23                         | 172       | 26        | 166       | 27        | 202       | 30        | 201       |
| Wootton Pkwy On-Ramp to I-270 NB ML    | 1025             | 1025             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 3,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Wootton Pkwy On-Ramp to I-270 SB ML    | 1026             | 1026             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Montrose Road                 |                  |                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Montrose Rd EB On-Ramp to I-270 SB GP  | 32               | 32               | 1,960                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,910                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 SB GP Off-Ramp to Montrose Rd EB | 121              | 121              | 1,340                    | 0             | 0         | 0         | 0         | 0         | 0         | 7         | 304       | 1,220                    | 0                          | 0         | 0         | 0         | 0         | 0         | 69        | 569       |
| Montrose Rd EB On-Ramp to I-270 NB GP  | 67               | 67               | 1,150                    | 0             | 0         | 0         | 0         | 423       | 1,007     | 830       | 1,277     | 1,000                    | 0                          | 0         | 0         | 0         | 307       | 1,219     | 1,186     | 1,350     |
| I-270 NB GP Off-Ramp Montrose Rd EB    | 154              | 154              | 1,980                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,870                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Montrose Rd WB On-Ramp to I-270 NB GP  | 414              | 414              | 1,950                    | 14            | 179       | 61        | 595       | 2,548     | 3,605     | 3,387     | 3,606     | 1,870                    | 32                         | 643       | 628       | 2,515     | 3,115     | 3,868     | 3,811     | 3,916     |
| I-270 NB Off-Ramp to Montrose Rd WB    | 155              | 155              | 1,520                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,320                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Montrose Rd WB On-Ramp to I-270 SB GP  | 31               | 31               | 1,200                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,100                    | 0                          | 20        | 0         | 38        | 0         | 4         | 0         | 8         |
| I-270 SB GP Off-Ramp to Montrose Rd WB | 131              | 131              | 1,600                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Table 6-23: PM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)**

| Ramp Location  | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-270 at MD 187 / Rockledge Drive                    |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB East Spur Off-Ramp to Rockledge Dr / MD 187 | 1,700                    | 3             | 127       | 2         | 110       | 5         | 157       | 4         | 139       | 1,400                    | 2                          | 101       | 2         | 110       | 69        | 387       | 3         | 109       |
| I-270 NB East Spur Off-Ramp to MD 187 SB             | 915                      | 63            | 312       | 115       | 400       | 31        | 247       | 8         | 144       | 720                      | 42                         | 188       | 39        | 161       | 24        | 121       | 10        | 77        |
| I-270 NB East Spur Off-Ramp to MD 187 NB             | 1,050                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 900                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 East Spur NB Off-Ramp to Rockledge Dr          | 960                      | 0             | 0         | 0         | 0         | 416       | 667       | 547       | 556       | 890                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 187 On-Ramp to I-270 East Spur SB                 | 780                      | 0             | 0         | 1         | 54        | 118       | 488       | 2         | 79        | 580                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Rockledge Dr / MD 187 On-Ramp to I-270 NB East Spur  | 1,300                    | 0             | 44        | 4         | 306       | 471       | 1,793     | 1,864     | 1,945     | 1,050                    | 8                          | 398       | 14        | 488       | 25        | 734       | 1,416     | 1,713     |
| I-270 at Westlake Terrace                            |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 SB ML Off-Ramp to Westlake Terrace             | 1,550                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,440                    | 31                         | 297       | 37        | 311       | 24        | 236       | 34        | 265       |
| Westlake Terrace On-Ramp to I-270 NB ML              | 1,350                    | 0             | 0         | 0         | 0         | 9         | 299       | 292       | 305       | 1,470                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 NB ML Off-Ramp to Westlake Terrace             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,850                    | 8                          | 148       | 12        | 170       | 8         | 139       | 8         | 160       |
| Westlake Terrace On-Ramp to I-270 SB ML              | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,800                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 at Democracy Boulevard                         |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 NB GP Off-Ramp to Democracy Blvd WB            | 1,330                    | 19            | 116       | 18        | 112       | 6         | 76        | 7         | 74        | 1,270                    | 45                         | 221       | 29        | 155       | 25        | 169       | 41        | 221       |
| I-270 NB GP Off-Ramp to Democracy Blvd EB            | 1,550                    | 39            | 155       | 39        | 191       | 22        | 137       | 22        | 167       | 1,450                    | 44                         | 195       | 23        | 143       | 32        | 223       | 43        | 234       |
| Democracy Blvd EB On-Ramp to I-270 West Spur GP NB   | 1,215                    | 0             | 0         | 0         | 0         | 1         | 39        | 248       | 884       | 1,150                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Democracy Blvd WB On-Ramp to I-270 West Spur GP NB   | 1,680                    | 0             | 0         | 0         | 0         | 78        | 509       | 1,590     | 2,544     | 1,400                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-270 West Spur SB Off-Ramp to Democracy Blvd GP EB  | 1,300                    | 33            | 138       | 43        | 171       | 49        | 207       | 36        | 161       | 1,140                    | 39                         | 167       | 51        | 232       | 58        | 223       | 44        | 189       |
| I-270 West Spur GP SB Off-Ramp to Democracy Blvd WB  | 1,430                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,280                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Democracy Blvd On-Ramp to I-495 Outer Loop GP        | 1,130                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 355                                      |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-270 East Spur SB Off-Ramp to MD 355 SB             | 1,940                    | 0             | 0         | 0         | 0         | 0         | 8         | 0         | 0         | 1,940                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop Off-Ramp to MD 355 SB               | 2,300                    | 73            | 249       | 47        | 202       | 30        | 169       | 75        | 402       | 2,300                    | 94                         | 395       | 69        | 266       | 62        | 273       | 117       | 526       |
| MD 355 NB On-Ramp to I-495 Inner Loop                | 875                      | 0             | 0         | 0         | 0         | 0         | 10        | 0         | 0         | 875                      | 0                          | 4         | 1         | 47        | 9         | 213       | 0         | 0         |
| MD 355 SB On-Ramp to I-495 Inner Loop                | 2,160                    | 0             | 0         | 0         | 0         | 5         | 201       | 0         | 0         | 2,160                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop Off-Ramp to MD 355 NB               | 1,360                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB On-Ramp to I-495 Outer Loop                | 1,360                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,360                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 355 NB ramp to I-270 East Spur NB                 | 1,450                    | 0             | 0         | 0         | 86        | 1,621     | 3,458     | 4,207     | 4,327     | 1,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 2,614     | 4,325     |

Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Table 6-23: PM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)**

| Ramp Location  | NB Queue counter | BD Queue counter | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |
|--|------------------|------------------|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  |                  |                  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |
|  |                  |                  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |
| I-495 at MD 187                                      |                  |                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to MD 187 NB            | 521              | 521              | 950                      | 28            | 210       | 18        | 118       | 12        | 170       | 197       | 1,701     | 950                      | 29                         | 244       | 24        | 225       | 30        | 349       | 668       | 784       |
| I-495 Inner Loop GP Off-Ramp to MD 187 SB            | 522              | 522              | 1,030                    | 1             | 113       | 1         | 80        | 0         | 79        | 1         | 94        | 1,030                    | 1                          | 86        | 1         | 59        | 1         | 87        | 2         | 164       |
| MD 187 On-Ramp to I-495 Inner Loop GP                | 304              | 304              | 1,000                    | 0             | 0         | 0         | 0         | 28        | 392       | 0         | 27        | 1,000                    | 0                          | 0         | 0         | 0         | 46        | 441       | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 187               | 523              | 523              | 1,015                    | 32            | 273       | 26        | 245       | 36        | 334       | 15        | 174       | 1,015                    | 22                         | 253       | 16        | 175       | 22        | 243       | 19        | 196       |
| I-495 Outer Loop GP Off-Ramp to MD 187 NB            | 524              | 524              | 1,250                    | 38            | 373       | 35        | 321       | 32        | 334       | 2         | 131       | 1,250                    | 3                          | 105       | 5         | 119       | 5         | 151       | 1         | 111       |
| MD 187 On-Ramp to I-495 Outer Loop GP                | 387              | 387              | 1,000                    | 0             | 0         | 22        | 197       | 4         | 103       | 0         | 32        | 1,000                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at MD 190/Cabin John Parkway                   |                  |                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| Cabin John Pkwy GP ramp to MD-190                    | 512              | 1005             | 770                      | 0             | 16        | 8         | 575       | 1         | 143       | 0         | 52        | 1,630                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop GP       | 65               | 1008             | 1,230                    | 2,261         | 2,517     | 2,177     | 2,516     | 2,423     | 2,518     | 2,429     | 2,519     | 1,000                    | 0                          | 0         | 102       | 1,220     | 386       | 1,926     | 413       | 1,802     |
| I-495 Outer Loop GP Off-Ramp to Cabin John Pkwy      | 390              | 1002             | 1,140                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 850                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Outer Loop GP             | 389              | 1003             | 1,180                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 WB On-Ramp to I-495 Outer Loop GP             | 388              | 1003             | 990                      | 0             | 51        | 0         | 23        | 0         | 0         | 0         | 0         | 2,450                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop GP Off-Ramp to MD 190               | 516              | 1000             | 850                      | 59            | 457       | 55        | 314       | 63        | 460       | 34        | 212       | 1,040                    | 30                         | 123       | 29        | 125       | 31        | 131       | 23        | 108       |
| I-495 Inner Loop GP Off-Ramp to MD 190               | 513              | 1007             | 1,675                    | 0             | 13        | 3         | 294       | 0         | 51        | 0         | 60        | 590                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 EB On-Ramp to I-495 Inner Loop GP             | 1009             | 1009             | 1,750                    | 1,175         | 1,521     | 1,321     | 1,863     | 1,754     | 2,299     | 2,004     | 2,378     | 1,100                    | 0                          | 0         | 687       | 1,212     | 922       | 1,443     | 795       | 1,157     |
| MD-190 WB On-Ramp to I-495 Inner Loop GP             | 1010             | 1010             | 2,100                    | 2,611         | 2,987     | 2,755     | 2,984     | 2,890     | 2,988     | 2,887     | 2,988     | 1,480                    | 0                          | 0         | 1,422     | 2,140     | 2,031     | 2,140     | 1,933     | 2,140     |
| I-495 Outer Loop ML Off-Ramp to MD 190               | 1011             | 1011             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,320                    | 25                         | 133       | 28        | 152       | 26        | 145       | 22        | 122       |
| I-495 Inner Loop ML Off-Ramp to MD 190               | 1014             | 1014             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 28                         | 149       | 33        | 155       | 33        | 161       | 33        | 154       |
| MD-190 On-Ramp to I-495 Outer Loop ML                | 1004             | 1004             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,230                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| MD 190 On-Ramp to I-495 Inner Loop ML                | 1013             | 1013             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,130                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Outer Loop ML Off-Ramp to Cabin John Pkwy      | 1012             | 1012             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Cabin John Pkwy On-Ramp to I-495 Inner Loop ML       | 1006             | 1006             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 800                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 at Clara Barton Parkway                        |                  |                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |
| I-495 Inner Loop GP Off-Ramp to Clara Barton Pkwy EB | 504              | 504              | 2,670                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,350                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| I-495 Inner Loop GP Off-Ramp to Clara Barton Pkwy WB | 506              | 506              | 1,750                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,240                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton Pkwy EB On-Ramp to I-495 Inner Loop GP  | 302              | 302              | 2,950                    | 0             | 5         | 0         | 6         | 2         | 66        | 3         | 76        | 2,870                    | 0                          | 0         | 4         | 153       | 59        | 367       | 117       | 593       |
| I-495 Outer Loop GP Off-Ramp to Clara Barton Pkwy WB | 508              | 508              | 1,500                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 8         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 10        | 0         | 15        |
| Clara Barton EB On-Ramp to I-495 Outer Loop GP       | 510              | 510              | 1,550                    | 62            | 586       | 695       | 2,103     | 1,087     | 1,964     | 123       | 1,056     | 1,600                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Clara Barton WB On-Ramp to I-495 Outer Loop GP       | 511              | 511              | 2,160                    | 798           | 2,449     | 3,862     | 4,495     | 4,444     | 4,495     | 4,408     | 4,494     | 2,110                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

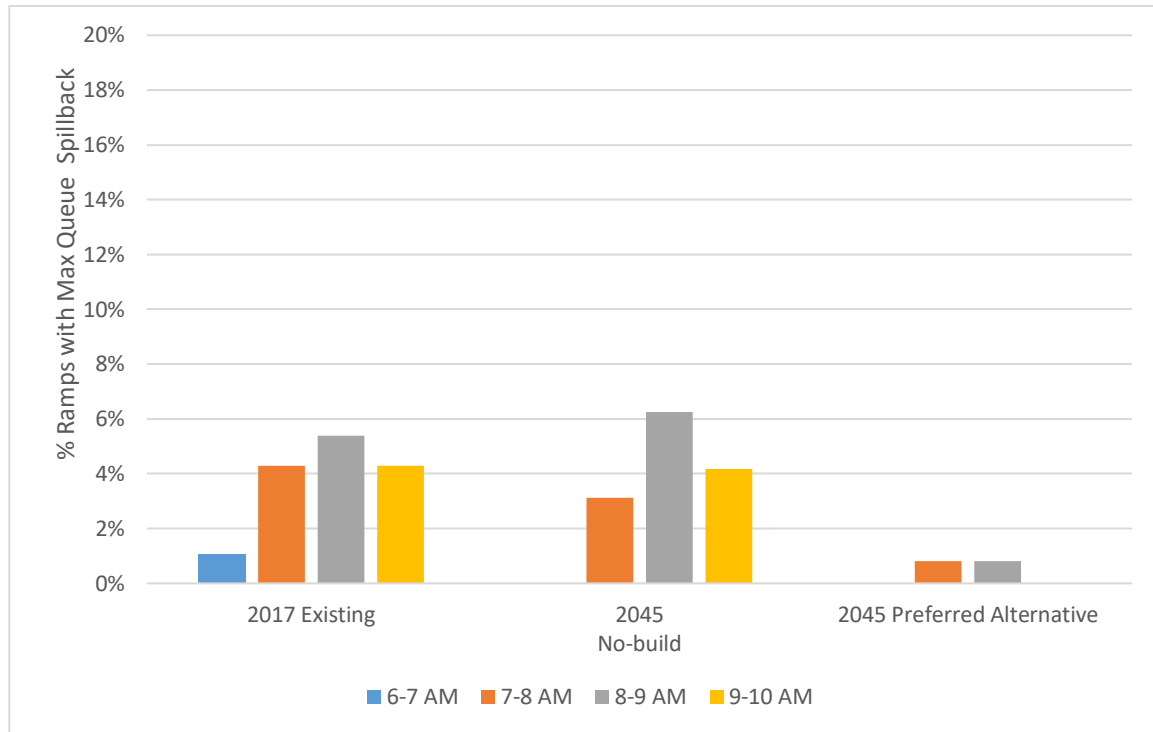
Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Table 6-23: PM Peak Period Ramp Queues – 2045 No Build and Preferred Alternative (Continued)**

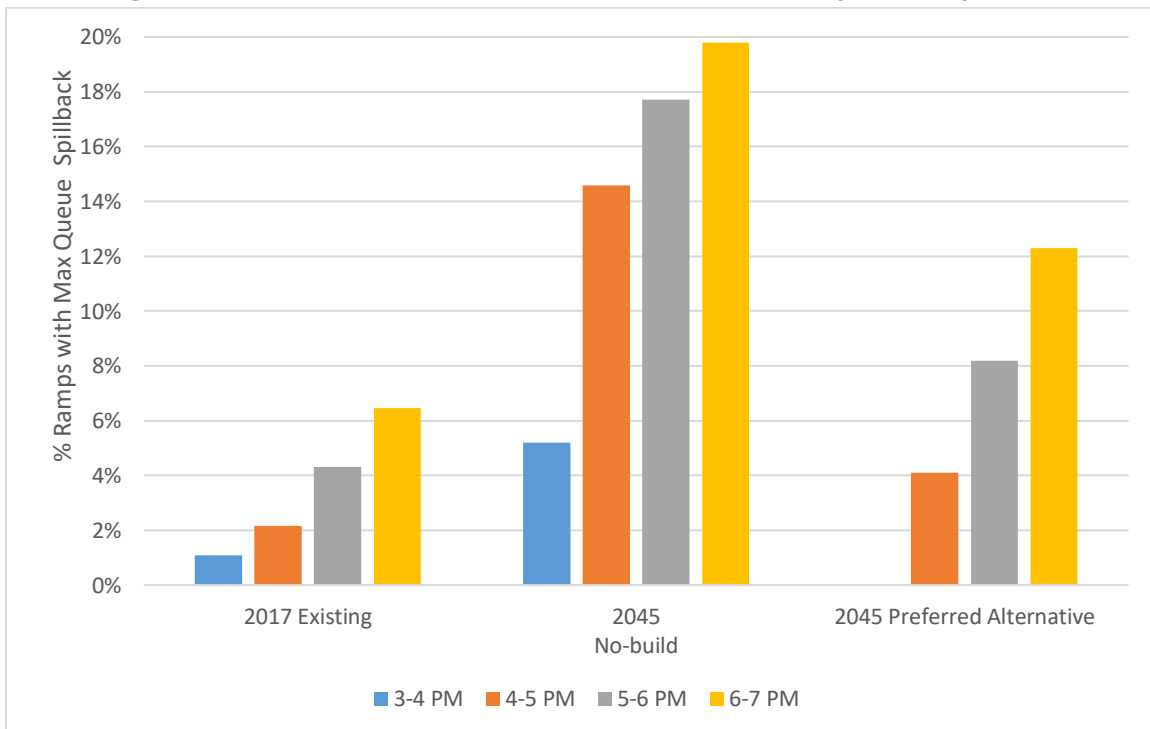
| Ramp Location                                    | Available Storage (feet) | 2045 No-Build |           |           |           |           |           |           |           | Available Storage (feet) | 2045 Preferred Alternative |           |           |           |           |           |           |           |   |
|--|--------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---|
|  |                          | 3-4 PM        |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |                          | 3-4 PM                     |           | 4-5 PM    |           | 5-6 PM    |           | 6-7 PM    |           |   |
|  |                          | Avg. (ft)     | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |                          | Avg. (ft)                  | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) | Avg. (ft) | Max. (ft) |   |
| I-495 at George Washington Parkway               |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |   |
| I-495 Inner Loop GP Off-Ramp to GWMP             | 1,230                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,810                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| GWMP WB On-Ramp to I-495 Inner Loop GP           | 2,200                    | 1,377         | 4,545     | 2,682     | 4,551     | 3,906     | 4,556     | 4,376     | 4,556     | 2,000                    | 0                          | 0         | 147       | 2,451     | 4,066     | 4,339     | 3,878     | 4,339     | 0 |
| I-495 Outer Loop GP Off-Ramp to GWMP             | 3,260                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,200                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| I-495 Inner Loop ML Off-Ramp to GWMP             | 1,740                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,510                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| GWMP WB On-Ramp to I-495 Outer Loop ML           | 2,400                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2,700                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| I-495 Outer Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 750                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| GWMP WB On-Ramp to I-495 Outer Loop C-D          | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,580                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| I-495 Outer Loop ML ramp to I-495 Outer Loop C-D | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| I-495 Inner Loop ML Off-Ramp to GWMP             | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 1,500                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| I-495 Inner Loop GP ramp to I-495 Inner Loop ML  | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 840                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| GWMP WB On-Ramp to I-495 Inner Loop ML           | -                        | -             | -         | -         | -         | -         | -         | -         | -         | 400                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| I-495 at VA 193                                  |                          |               |           |           |           |           |           |           |           |                          |                            |           |           |           |           |           |           |           |   |
| I-495 Inner Loop GP Off-Ramp to VA 193           | 1,130                    | 9             | 100       | 12        | 94        | 7         | 92        | 7         | 127       | 1,130                    | 10                         | 90        | 11        | 93        | 12        | 108       | 9         | 142       | 0 |
| VA 193 NB On-Ramp to I-495 Inner Loop GP         | 1,050                    | 11            | 211       | 1,928     | 2,624     | 2,617     | 2,658     | 2,630     | 2,657     | 1,050                    | 0                          | 0         | 0         | 0         | 1,676     | 2,637     | 2,608     | 2,656     | 0 |
| I-495 Outer Loop GP slip ramp to VA 193          | 700                      | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 700                      | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 1,170                    | 0             | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1,170                    | 0                          | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0 |
| VA 193 On-Ramp to I-495 Outer Loop GP            | 900                      | 26            | 203       | 33        | 263       | 44        | 312       | 29        | 270       | 900                      | 38                         | 277       | 36        | 267       | 44        | 283       | 40        | 300       | 0 |

 Highlighted cells indicate locations where average or maximum queue lengths exceed available storage

**Figure 6-56: 2045 AM No Build vs Preferred Alternative Ramp Queue Spillback**



**Figure 6-57: 2045 PM No Build vs Preferred Alternative Ramp Queue Spillback**



#### 6.4.3.7 Summary of 2045 Operational Analysis Results

As shown, with the Preferred Alternative, speeds, densities, and LOS are improved throughout the network. The Preferred Alternative also serves more vehicles in the study area during the entire AM and PM peak periods, except for the 6-7 AM hour. However, the Preferred Alternative serves significantly more vehicles while experiencing congestion due to external constraints (i.e., bottlenecks outside of the study area that impact operations within the study area), which may result in operational repercussions at vulnerable areas within the study area.

During the AM peak period, the most significant LOS improvements include: the I-495 Outer Loop lane-miles of LOS 'F' reduction from 42% (approximately 67 lane-miles) under No Build conditions to 3% (approximately 4 lane-miles) with the Preferred Alternative; and the I-270 Southbound lane-miles with LOS 'D' or better increasing from 73% (approximately 206 lane-miles) to 81% (approximately 255 lane-miles) while reducing those of LOS 'F' from 15% (approximately 43 lane-miles) to 9% (approximately 28 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively.

During the PM peak period, most significant LOS improvements include: the I-495 Outer Loop lane-miles of LOS 'F' reduction from 46% (approximately 72 lane-miles) under No Build conditions to 6% (approximately 10 lane-miles) with the Preferred Alternative; and the I-270 Northbound lane-miles with LOS 'D' or better increasing from 34% (approximately 103 lane-miles) to 44% (approximately 140 lane-miles) while reducing those of LOS 'F' from 58% (approximately 176 lane-miles) to 50% (approximately 158 lane-miles) between No Build General Purpose/Local lanes and Preferred Alternative General Purpose/HOT lanes, respectively. Under both No Build and Preferred Alternative PM peak period conditions, existing bottlenecks at locations outside of the study area become exacerbated, such as along I-270 Northbound from I-370 to MD 124; from MD 109 to MD 121; I-495 Inner Loop from MD 185 to MD 97; and from I-95 to MD 201. The northern section of I-270 from I-370 to I-70 is part of a separate, independent planning study under the I-495 and I-270 P3 Program. Improvements are needed in the northern section of I-270 with or without the improvements being considered under the Study. For the interim, signal timing improvements and an active warning system with messaging signs may be put in place to alert motorists at the onset of congestion in both the General Purpose and HOT lanes. Potential mitigation considerations are listed in **Chapter 8** to address both operational and safety concerns.

Overall travel times improve in the General Purpose Lanes under the Preferred Alternative conditions, with greater reductions in travel times along the HOT lanes. During both the AM and PM peak periods, the most significant travel time savings occur along the I-495 Outer Loop, particularly in the 8-10 AM and 5-7 PM peak hours for both the General Purpose and HOT lanes, respectively.

The AM and PM Preferred Alternative increases throughputs throughout the project limits when compared to the 2045 No Build conditions, with the highest increases along I-495 Inner Loop and I-270 Northbound between the I-270 West Spur and the MD 187 interchange as well as between the I-270 split and the Montrose Road interchange, respectively. When compared to 2017 Existing conditions, the 2045 Preferred Alternative has increased total throughput at all key locations during the four-hour AM peak period. Like the AM, all four I-495 Outer Loop and I-270 Southbound key locations have increased total throughput during the four-hour PM peak period. Two of the four I-495 Inner Loop and I-270 Northbound

key locations have decreased throughput during the second or third hour within the PM peak period, which include: I-495 Inner Loop between the I-270 West Spur and MD 187 as well as I-270 Northbound between the Shady Grove Road and I-370 interchanges. This degradation is caused by increased throughput more quickly reaching the existing bottleneck north of I-370 (outside the study area) in the first two hours of the PM peak period.

The Preferred Alternative improves queue spillback compared to No Build conditions at ramps throughout the study area, improving queue lengths at over 45 locations during the AM/PM peak periods, eliminating almost all ramp spillback during the AM peak period, and removing 8 ramp spillback locations that occur under 2027 PM No Build conditions. The remaining spillback locations that occur under PM conditions are due to existing bottlenecks along I-270 Northbound and I-495 Inner Loop that occur outside the study area and become exacerbated under future conditions.

## 6.5 SYNCHRO RESULTS

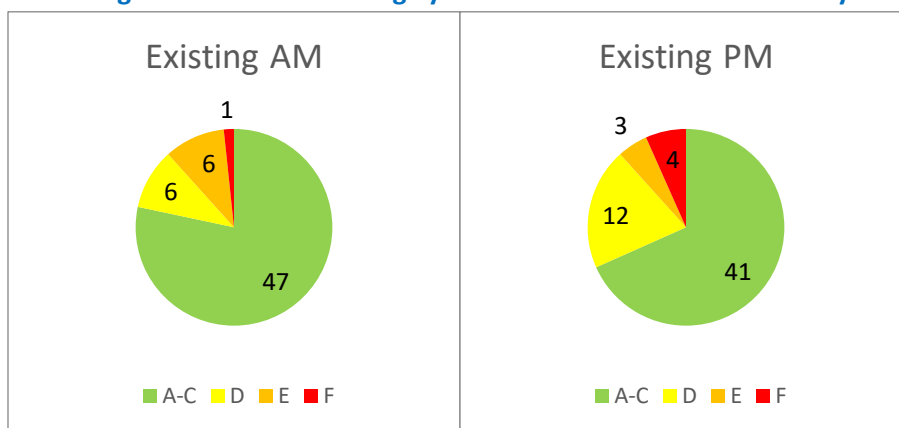
Synchro analysis was used to analyze the crossroads along the network. The results of the Synchro analysis are included in **Appendix I** and are summarized on the following pages.

Measures of effectiveness (MOEs) from the Synchro outputs were used to document operations at the signalized and unsignalized ramp junction intersections. Average control delay by movement, average control delay by approach, and overall intersection control delay (seconds/vehicle) was reported for each intersection. 50<sup>th</sup> and 95<sup>th</sup> percentile queue lengths by movement in feet were also reported. Overall average control delay values reflect various congestion levels based on delay thresholds established in the *Highway Capacity Manual 6<sup>th</sup> Edition* as shown in **Table 6-2** and **Table 6-3**. **Appendix H** also contains a summary of travel speeds and density by link for the crossroads throughout the study area.

### 6.5.1 Existing Conditions

**Figure 6-58** summarizes the number of intersections operating at LOS 'A' through 'F' with 2017 existing conditions. **Table 6-24** summarizes 2017 existing delay and LOS at study intersections, based on Synchro. As shown, 1 intersection operates at LOS 'F' during the AM peak hour and 4 intersections operate at LOS 'F' during the PM peak hour. Additionally, 6 intersections operate at LOS 'E' during the AM peak hour and 3 intersections operate at LOS 'E' during the PM peak hour.

**Figure 6-58: 2017 Existing Synchro Number of Intersections by LOS**





**Table 6-24: 2017 Existing Synchro Intersection Delay and LOS Results**

| Intersection  | 2017 Existing  |                |
|---|----------------|----------------|
|   | AM Delay (LOS) | PM Delay (LOS) |
| <b>I-270 at I-370 (Sam Eig Hwy)</b>                         |                |                |
| Sam Eig Hwy at Fields Rd                                    | 24.6 (C)       | 30.2 (C)       |
| Washingtonian Blvd at I-370 WB Ramps                        | 17.9 (B)       | 19.1 (B)       |
| Washingtonian Blvd at I-370 EB Ramps                        | 12.3 (B)       | 21.7 (C)       |
| Sam Eig Hwy SBR at MD 119 (Great Seneca Hwy)                | 3.1 (A)        | 21.1 (C)       |
| Sam Eig Hwy at MD 119 (Great Seneca Hwy)                    | 28.6 (C)       | 38.7 (D)       |
| Sam Eig Hwy at Diamondback Dr                               | 31.3 (C)       | 36.6 (D)       |
| <b>I-270 at Shady Grove Rd</b>                              |                |                |
| Omega Dr at MD 28 (Key West Ave)                            | 33.6 (C)       | 36.4 (D)       |
| Omega Dr at I-270 SB Off-Ramp (Unsignalized)*               | 21.7 (C)       | 37.1 (E)       |
| Omega Dr/Fields Rd at Washingtonian Blvd                    | 7.5 (A)        | 11.7 (B)       |
| Shady Grove Rd at Corporate Blvd                            | 31.2 (C)       | 39.2 (D)       |
| Shady Grove Rd at I-270 SB Off-Ramp                         | 20.4 (C)       | 16.8 (B)       |
| Shady Grove Rd at I-270 NB Off-Ramp                         | 28.5 (C)       | 13.0 (B)       |
| Shady Grove Rd at Choke Cherry Rd                           | 21.1 (C)       | 31.0 (C)       |
| Redland Blvd at Piccard Dr                                  | 12.4 (B)       | 14.7 (B)       |
| <b>I-270 at Gude Dr</b>                                     |                |                |
| Gude Dr at Research Blvd                                    | 61.1 (E)       | 93.0 (F)       |
| Gude Dr at Piccard Dr                                       | 8.9 (A)        | 18.3 (B)       |
| <b>I-270 at MD 28 (Montgomery Ave)</b>                      |                |                |
| MD 28 at Hurley Ave   | 42.3 (D)       | 135.0 (F)      |
| MD 28 at I-270 SB Ramps                                     | 12.4 (B)       | 14.0 (B)       |
| MD 28 at I-270 NB Off-Ramp/Nelson St                        | 24.4 (C)       | 31.9 (C)       |
| MD 28 at Laird St/Bullard Cir                               | 14.5 (B)       | 16.6 (B)       |
| <b>I-270 at MD 189 (Falls Rd)</b>                           |                |                |
| MD 189 at Wootton Pkwy                                      | 59.6 (E)       | 47.1 (D)       |
| MD 189 at I-270 Ramps (SPUI)                                | 64.9 (E)       | 63.8 (E)       |
| MD 189 at Great Falls Rd/Potomac Valley Rd                  | 24.7 (C)       | 14.7 (B)       |
| <b>I-270 at Wootton Pkwy</b>                                |                |                |
| Wootton Pkwy at Seven Locks Rd                              | 49.6 (D)       | 31.3 (C)       |
| Wootton Pkwy at Tower Oaks Rd                               | 21.3 (C)       | 15.2 (B)       |
| <b>I-270 at Montrose Rd</b>                                 |                |                |
| Montrose Rd at Seven Locks Rd                               | 32.7 (C)       | 38.0 (D)       |
| Montrose Rd at Potomac Ave (Unsignalized)*                  | 37.7 (E)       | 77.7 (F)       |
| Montrose Rd at Tower Oaks Blvd                              | 42.0 (D)       | 12.4 (B)       |
| Montrose Rd at Farm Ln                                      | 1.6 (A)        | 3.5 (A)        |
| Montrose Rd at Hitching Post Ln/Farm Haven Dr               | 8.2 (A)        | 9.1 (A)        |
| Tower Oaks Blvd at I-270 NB Ramps/GEICO Entrance            | 19.8 (B)       | 17.7 (B)       |
| Tower Oaks Blvd at Commercial Dr                            | 3.4 (A)        | 4.9 (A)        |
| <b>I-270 West Spur at Westlake Terrace</b>                  |                |                |
| Westlake Terrace at Westfield Montgomery Mall/Motor City Dr | 13.5 (B)       | 21.5 (C)       |
| Westlake Terrace at I-270 West Spur Ramps                   | 8.8 (A)        | 12.6 (B)       |
| Westlake Terrace at Rockledge Dr                            | 25.2 (C)       | 42.2 (D)       |

**Table 6-24: 2017 Existing Synchro Intersection Delay and LOS Results (Continued)**

| <b>I-270 West Spur at Democracy Blvd</b>                          |           |           |
|---|-----------|-----------|
| Democracy Blvd at Taveshire Way                                   | 10.3 (B)  | 12.1 (B)  |
| Democracy Blvd at I-270 SB On-Ramp/I-270 SB Off-Ramp              | 28.6 (C)  | 105.5 (F) |
| Democracy Blvd at I-270 SB On-Ramp                                | 9.0 (A)   | 9.3 (A)   |
| Democracy Blvd at I-270 NB Ramps                                  | 10.6 (B)  | 9.9 (A)   |
| Democracy Blvd at I-270 NB Off-Ramp                               | 33.1 (C)  | 10.2 (B)  |
| Democracy Blvd at Fernwood Rd                                     | 63.1 (E)  | 30.9 (C)  |
| <b>I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)</b> |           |           |
| Rockledge Dr at Rock Forest Dr                                    | 23.1 (C)  | 33.8 (C)  |
| Rockledge Dr at I-270 SB Ramps                                    | 24.8 (C)  | 40.4 (D)  |
| Rockledge Dr at I-270 NB Ramps                                    | 25.9 (C)  | 18.5 (B)  |
| MD 187 at Rock Spring Dr  | 64.2 (E)  | 50.8 (D)  |
| MD 187 at I-270 SB Ramps  | 41.7 (D)  | 46.2 (D)  |
| MD 187 at I-270 NB Ramps  | 11.9 (B)  | 14.5 (B)  |
| MD 187 at Tuckerman Ln  | 133.8 (F) | 70.4 (E)  |
| <b>I-495 at MD 190 (River Rd)</b>                                 |           |           |
| MD 190 at Seven Locks Rd  | 36.1 (D)  | 39.1 (D)  |
| MD 190 at I-495 Outer Loop Off-Ramp                               | 11.5 (B)  | 12.0 (B)  |
| MD 190 at I-495 Inner Loop On-Ramp                                | 1.9 (A)   | 7.8 (A)   |
| MD 190 at Burdette Rd   | 16.9 (B)  | 31.7 (C)  |
| <b>I-495 at MD 187 (Old Georgetown Rd)</b>                        |           |           |
| MD 187 at Lone Oak Dr/Manor Oak Way                               | 14.6 (B)  | 12.5 (B)  |
| MD 187 at I-495 Outer Loop Off-Ramp                               | 29.1 (C)  | 32.8 (C)  |
| MD 187 at I-495 Inner Loop Off-Ramp                               | 6.9 (A)   | 30.0 (C)  |
| MD 187 at Ryland Dr/Church Driveway                               | 16.2 (B)  | 12.0 (B)  |
| <b>I-495 at MD 355 (Rockville Pk)/I-270 East Spur</b>             |           |           |
| MD 355 at Grosvenor Ln  | 44.6 (D)  | 36.0 (D)  |
| MD 355 at I-495 Inner Loop Off-Ramp                               | 25.2 (C)  | 17.6 (B)  |
| MD 355 at Pooks Hill Rd   | 31.2 (C)  | 18.3 (B)  |
| MD 355 at Alta Vista Rd/Bellevue Dr                               | 13.6 (B)  | 23.9 (C)  |

\*Unsignalized (stop-controlled) intersection; delay and LOS for worst approach shown

## 6.5.2 Proposed Improvements

Based on the Synchro analysis of 2045 Preferred Alternative volumes, two improvements were identified at crossroad intersections within the study area. There are ongoing discussions with the City of Rockville and other stakeholders regarding these improvements. As such, these improvements are subject to change, pending those discussions with stakeholders.

- Wootton Parkway at Seven Locks Road
  - o At this intersection, 565 westbound left-turning vehicles are projected during the AM peak hour with No Build conditions. With completion of the Preferred Alternative, this volume is projected to increase by 12% to 635 vehicles. During the PM peak hour, this volume is projected to be much lower with both No Build and Build conditions.
  - o This intersection currently consists of a single westbound left-turn lane with exclusive/permissive phasing separated from the through lanes by a 10-foot wide

hatched area. To accommodate this increase in volume during the AM peak hour, the roadway will be restriped within the existing pavement to provide a second westbound left-turn lane along Wootton Parkway.

- o To accommodate the double left-turn movement, this left-turn movement will be converted from exclusive/permissive left-turn phasing to exclusive left-turn phasing. Additionally, the opposing eastbound left-turn movement will be converted from permissive left-turn phasing to exclusive left-turning phasing to prevent sight distance issues between these vehicles and opposing through vehicles. This improvement has the potential for providing a safety benefit by eliminating left-turn crashes associated with permissive left-turning movements.
- o This improvement is projected to reduce westbound left-turn delay from 122 seconds to 45 seconds and reduce the 95th percentile queue length from approximately 700 feet to approximately 400 feet. Delay for the eastbound through movement is projected to decrease from 36 seconds to 32 seconds, improving this movement's level of service (LOS) from LOS 'D' to LOS 'C', with no change in the 95th percentile queue length. The overall intersection delay is projected to decrease from 44 seconds to 26 seconds, improving intersection LOS from LOS 'D' to LOS 'C'.
- Gude Drive at Research Boulevard
  - o At this intersection, with No Build conditions, 460 westbound left-turning vehicles are projected during the AM peak hour. With completion of the Preferred Alternative, this volume is projected to increase slightly to 485 vehicles, while the opposing eastbound through volume is projected to increase by 12% from 790 vehicles to 885 vehicles. During the PM peak hour, the westbound left-turn movement is projected to decrease from 435 vehicles to 355 vehicles, while the opposing eastbound through volume is projected to increase by 22% from 710 vehicles to 865 vehicles.
  - o This intersection currently consists of a single westbound left-turn lane with exclusive/permissive phasing. Along the eastbound approach, there are two dedicated through lanes. Widening to include a third eastbound through lane is not geometrically feasible due to right-of-way and environmental impacts both east and west of the intersection. Therefore, the Preferred Alternative will include widening to install a second westbound left-turn lane along Gude Drive, which would have fewer impacts.
  - o To accommodate the double left-turn movement, this left-turn movement will be converted from exclusive/permissive left-turn phasing to exclusive left-turn phasing. Additionally, the opposing eastbound left-turn movement will be converted from permissive left-turn phasing to exclusive left-turning phasing to prevent sight distance issues between these vehicles and opposing through vehicles. This improvement has the potential for providing a safety benefit by eliminating left-turn crashes associated with permissive left-turning movements.
  - o During the AM peak hour, this improvement is projected to decrease the westbound left-turn delay from 59 seconds to 23 seconds, improving from LOS 'E' to LOS 'C', and reduce its 95th percentile queue length from approximately 450 feet to approximately 200 feet. Eastbound through delay is projected to decrease from 72 seconds to 57 seconds with a small decrease in its 95th percentile queue length. Overall intersection delay is projected

to decrease from 38 seconds to 29 seconds, improving intersection LOS from LOS 'D' to LOS 'C'.

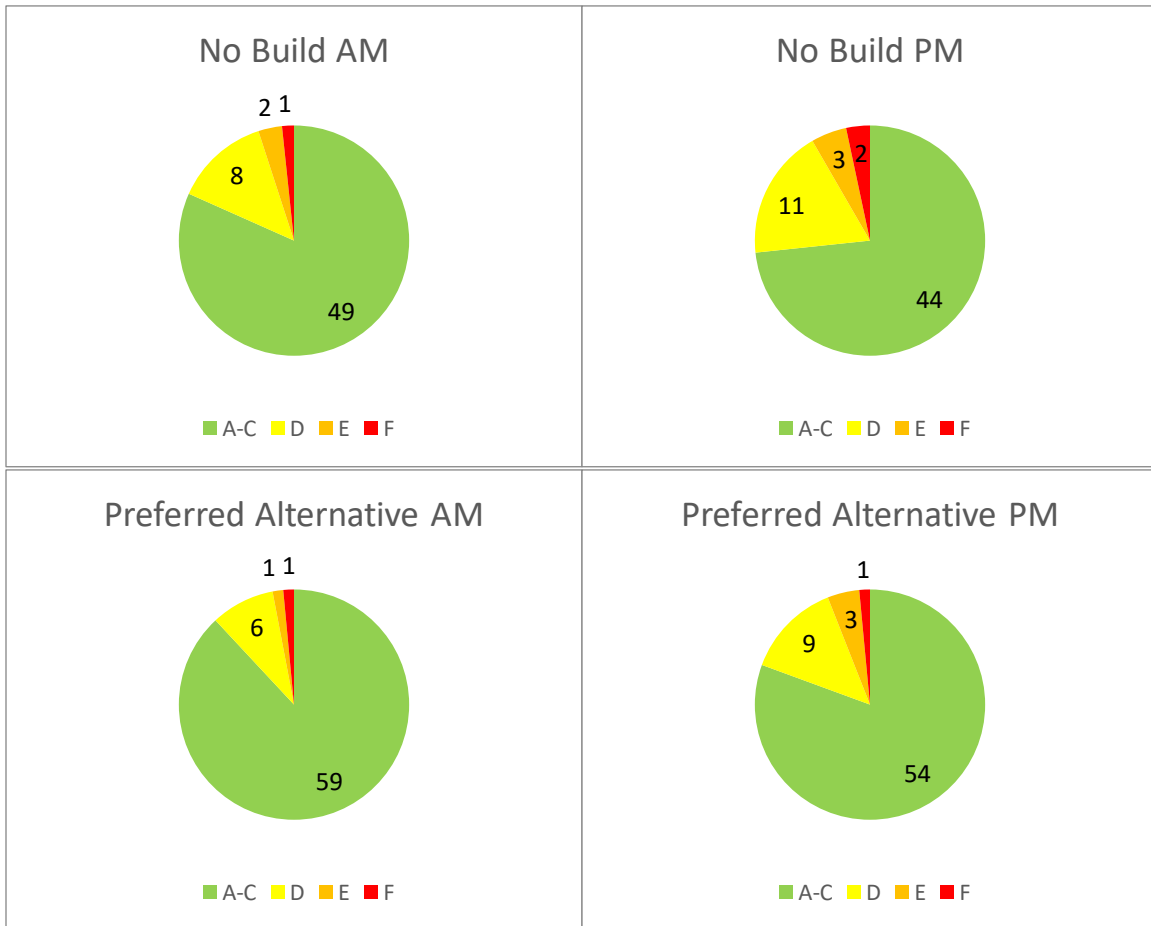
- o During the PM peak hour, this improvement is projected to decrease the westbound left-turn delay from 33 seconds to 28 seconds and reduce its 95th percentile queue length from approximately 250 feet to approximately 125 feet. Eastbound through delay and the 95th percentile queue length are projected to decrease slightly. Overall intersection delay is projected to remain approximately the same.

### 6.5.3 2027 Conditions

**Figure 6-59** summarizes the number of intersections operating at LOS 'A' through 'F' with No Build conditions and the Preferred Alternative. **Table 6-25** summarizes 2027 delay and LOS at study intersections, based on Synchro under No Build conditions and the Preferred Alternative. As shown, 1 intersection is projected to operate at LOS 'F' during the AM peak hour and 2 intersections are projected to operate at LOS 'F' during the PM peak hour with No Build conditions. Additionally, 2 intersections are projected to operate at LOS 'E' during the AM peak hour and 3 intersections are projected to operate at LOS 'E' during the PM peak hour with No Build conditions. With the Preferred Alternative, 1 intersection is projected to operate at LOS 'F' during each peak hour. Additionally, 1 intersection is projected to operate at LOS 'E' during the AM peak hour and 3 intersections are projected to operate at LOS 'E' during the PM peak hour with the Preferred Alternative. While there are more intersections with the Preferred Alternative (67 intersections) than with No Build conditions (60 intersections), fewer intersections operate at LOS 'E'/'F' with the Preferred Alternative.

**Table 6-26** summarizes queuing at ramp junction intersections. As shown, no queues spill back onto the freeways.

**Figure 6-59: 2027 No Build vs Preferred Alternative Synchro Number of Intersections by LOS**



**Table 6-25: 2027 No Build and Preferred Alternative Synchro Intersection Delay and LOS Results**

| Intersection                                  | No Build          |                   | Preferred Alternative |                   |
|---|-------------------|-------------------|-----------------------|-------------------|
|   | AM<br>Delay (LOS) | PM<br>Delay (LOS) | AM<br>Delay (LOS)     | PM<br>Delay (LOS) |
| <b>I-270 at I-370 (Sam Eig Hwy)</b>           |                   |                   |                       |                   |
| Sam Eig Hwy at Fields Rd                      | 22.2 (C)          | 28.4 (C)          | 22.2 (C)              | 28.2 (C)          |
| Washingtonian Blvd at I-370 WB Ramps          | 20.5 (C)          | 20.4 (C)          | 20.0 (C)              | 22.9 (C)          |
| Washingtonian Blvd at I-370 EB Ramps          | 10.7 (B)          | 21.7 (C)          | 14.3 (B)              | 26.4 (C)          |
| Sam Eig Hwy SBR at MD 119 (Great Seneca Hwy)  | 4.7 (A)           | 10.9 (B)          | 5.4 (A)               | 10.6 (B)          |
| Sam Eig Hwy at MD 119 (Great Seneca Hwy)      | 33.5 (C)          | 44.9 (D)          | 33.8 (C)              | 44.6 (D)          |
| Sam Eig Hwy at Diamondback Dr                 | 29.4 (C)          | 38.5 (D)          | 29.3 (C)              | 38.7 (D)          |
| <b>I-270 at Shady Grove Rd</b>                |                   |                   |                       |                   |
| Omega Dr at MD 28 (Key West Ave)              | 35.2 (D)          | 37.8 (D)          | 35.2 (D)              | 37.8 (D)          |
| Omega Dr at I-270 SB Off-Ramp (Unsignalized)* | 24.9 (C)          | 46.8 (E)          | 24.2 (C)              | 46.8 (E)          |
| Omega Dr/Fields Rd at Washingtonian Blvd      | 7.6 (A)           | 12.7 (B)          | 7.6 (A)               | 12.7 (B)          |
| Shady Grove Rd at Corporate Blvd              | 22.0 (C)          | 32.3 (C)          | 20.1 (C)              | 31.0 (C)          |
| Shady Grove Rd at I-270 SB Off-Ramp           | 25.3 (C)          | 17.7 (B)          | 24.8 (C)              | 17.0 (B)          |
| Shady Grove Rd at I-270 NB Off-Ramp           | 24.4 (C)          | 12.7 (B)          | 24.2 (C)              | 9.9 (A)           |
| Shady Grove Rd at Choke Cherry Rd             | 19.8 (B)          | 38.7 (D)          | 19.3 (B)              | 37.0 (D)          |
| Redland Blvd at Piccard Dr                    | 10.7 (B)          | 13.1 (B)          | 12.5 (B)              | 13.5 (B)          |
| <b>I-270 at Gude Dr</b>                       |                   |                   |                       |                   |
| Gude Dr at Research Blvd                      | 62.2 (E)          | 104.2 (F)         | 27.2 (C)              | 22.9 (C)          |
| Gude Dr at I-270 HOT Lanes Access             | N/A               | N/A               | 29.5 (C)              | 27.4 (C)          |
| Gude Dr at Piccard Dr                         | 9.5 (A)           | 18.4 (B)          | 8.2 (A)               | 18.7 (B)          |
| <b>I-270 at MD 28 (Montgomery Ave)</b>        |                   |                   |                       |                   |
| MD 28 at Hurley Ave                           | 16.5 (B)          | 22.5 (C)          | 16.4 (B)              | 22.2 (C)          |
| MD 28 at I-270 SB Ramps                       | 14.9 (B)          | 17.3 (B)          | 14.1 (B)              | 19.3 (B)          |
| MD 28 at I-270 NB Off-Ramp/Nelson St          | 21.9 (C)          | 25.1 (C)          | 21.7 (C)              | 24.8 (C)          |
| MD 28 at Laird St/Bullard Cir                 | 13.7 (B)          | 13.7 (B)          | 12.7 (B)              | 13.9 (B)          |
| <b>I-270 at MD 189 (Falls Rd)</b>             |                   |                   |                       |                   |
| MD 189 at Wootton Pkwy                        | 53.1 (D)          | 44.2 (D)          | 49.4 (D)              | 43.7 (D)          |
| MD 189 at I-270 Ramps (SPUI)                  | 37.8 (D)          | 54.4 (D)          | N/A                   | N/A               |
| MD 189 Crossover at I-270 SB Ramps            | N/A               | N/A               | 16.4 (B)              | 21.2 (C)          |
| MD 189 EB at I-270 SB Off-Ramp                |                   |                   | 5.5 (A)               | 7.3 (A)           |
| MD 189 WB at I-270 NB Off-Ramp                |                   |                   | 2.0 (A)               | 5.5 (A)           |
| MD 189 Crossover at I-270 NB Ramps            |                   |                   | 21.7 (C)              | 24.3 (C)          |
| MD 189 EB at I-270 NB Ramps                   |                   |                   | 8.7 (A)               | 8.4 (A)           |
| MD 189 at Great Falls Rd/Potomac Valley Rd    | 16.8 (B)          | 15.0 (B)          | 18.1 (B)              | 16.8 (B)          |
| <b>I-270 at Wootton Pkwy</b>                  |                   |                   |                       |                   |
| Wootton Pkwy at Seven Locks Rd                | 33.2 (C)          | 30.0 (C)          | 22.8 (C)              | 32.6 (C)          |
| Wootton Pkwy at Tower Oaks Rd                 | 25.5 (C)          | 24.3 (C)          | 26.0 (C)              | 27.4 (C)          |
| Wootton Pkwy at I-270 HOT Lanes Access        | N/A               | N/A               | 24.7 (C)              | 23.2 (C)          |

\*Unsignalized (stop-controlled) intersection; delay and LOS for worst approach shown

**Table 6-25: 2027 No Build and Preferred Alternative Synchro Intersection Delay and LOS Results (Continued)**

| Intersection  | No Build       |                | Preferred Alternative |                |
|---|----------------|----------------|-----------------------|----------------|
|   | AM Delay (LOS) | PM Delay (LOS) | AM Delay (LOS)        | PM Delay (LOS) |
| <b>I-270 at Montrose Rd</b>                                       |                |                |                       |                |
| Montrose Rd at Seven Locks Rd                                     | 29.7 (C)       | 35.3 (D)       | 29.9 (C)              | 34.4 (C)       |
| Montrose Rd at Potomac Ave (Unsignalized)*                        | 42.5 (E)       | 104.9 (F)      | 37.7 (E)              | 104.9 (F)      |
| Montrose Rd at Tower Oaks Blvd                                    | 19.2 (B)       | 10.5 (B)       | 17.5 (B)              | 12.7 (B)       |
| Montrose Rd at Farm Ln  | 1.9 (A)        | 4.4 (A)        | 1.9 (A)               | 4.0 (A)        |
| Montrose Rd at Hitching Post Ln/Farm Haven Dr                     | 12.9 (B)       | 10.8 (B)       | 12.9 (B)              | 10.4 (B)       |
| Tower Oaks Blvd at I-270 NB Ramps/GEICO Entrance                  | 18.7 (B)       | 17.6 (B)       | 18.2 (B)              | 17.5 (B)       |
| Tower Oaks Blvd at Commercial Dr                                  | 3.6 (A)        | 5.0 (A)        | 3.4 (A)               | 4.8 (A)        |
| <b>I-270 West Spur at Westlake Terrace</b>                        |                |                |                       |                |
| Westlake Terrace at Westfield Montgomery Mall/Motor City Dr       | 12.6 (B)       | 23.7 (C)       | 9.6 (A)               | 18.9 (B)       |
| Westlake Terrace at I-270 West Spur Ramps                         | 12.0 (B)       | 8.8 (A)        | 33.3 (C)              | 31.9 (C)       |
| Westlake Terrace at Rockledge Dr                                  | 29.4 (C)       | 46.9 (D)       | 30.8 (C)              | 46.9 (D)       |
| <b>I-270 West Spur at Democracy Blvd</b>                          |                |                |                       |                |
| Democracy Blvd at Taveshire Way                                   | 10.5 (B)       | 12.1 (B)       | 10.4 (B)              | 12.0 (B)       |
| Democracy Blvd at I-270 SB On-Ramp/I-270 SB Off-Ramp              | 32.0 (C)       | 46.7 (D)       | 27.8 (C)              | 47.0 (D)       |
| Democracy Blvd at I-270 SB On-Ramp                                | 5.5 (A)        | 17.8 (B)       |                       |                |
| Democracy Blvd at I-270 NB Ramps                                  | 7.3 (A)        | 7.2 (A)        | 10.7 (B)              | 8.5 (A)        |
| Democracy Blvd at I-270 NB Off-Ramp                               | 18.8 (B)       | 8.6 (A)        | 16.8 (B)              | 7.8 (A)        |
| Democracy Blvd at Fernwood Rd                                     | 41.1 (D)       | 31.3 (C)       | 36.6 (D)              | 30.6 (C)       |
| <b>I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)</b> |                |                |                       |                |
| Rockledge Dr at Rock Forest Dr                                    | 24.3 (C)       | 34.8 (C)       | 24.7 (C)              | 34.5 (C)       |
| Rockledge Dr at I-270 SB Ramps                                    | 19.0 (B)       | 34.0 (C)       | 19.2 (B)              | 32.1 (C)       |
| Rockledge Dr at I-270 NB Ramps                                    | 39.0 (D)       | 25.0 (C)       | 39.6 (D)              | 28.5 (C)       |
| MD 187 at Rock Spring Dr  | 40.5 (D)       | 61.5 (E)       | 39.3 (D)              | 58.4 (E)       |
| MD 187 at I-270 SB Ramps  | 23.4 (C)       | 22.2 (C)       | 22.8 (C)              | 24.5 (C)       |
| MD 187 at I-270 NB Ramps  | 9.6 (A)        | 14.6 (B)       | 9.6 (A)               | 15.8 (B)       |
| MD 187 at Tuckerman Ln  | 139.6 (F)      | 76.7 (E)       | 148.8 (F)             | 73.6 (E)       |
| <b>I-495 at MD 190 (River Rd)</b>                                 |                |                |                       |                |
| MD 190 at Seven Locks Rd  | 37.4 (D)       | 45.0 (D)       | 34.4 (C)              | 51.9 (D)       |
| MD 190 at I-495 Outer Loop Off-Ramp                               | 12.1 (B)       | 9.4 (A)        | 20.8 (C)              | 17.6 (D)       |
| MD 190 at I-495 Inner Loop On-Ramp                                | 0.7 (A)        | 7.0 (A)        | 18.3 (B)              | 19.8 (B)       |
| MD 190 at Burdette Rd   | 18.1 (B)       | 40.9 (D)       | 20.7 (C)              | 44.7 (D)       |
| MD 190 at I-495 HOT Lanes Access                                  | N/A            | N/A            | 13.8 (B)              | 22.0 (C)       |
| <b>I-495 at MD 187 (Old Georgetown Rd)</b>                        |                |                |                       |                |
| MD 187 at Lone Oak Dr/Manor Oak Way                               | 15.9 (B)       | 17.4 (B)       | 15.5 (B)              | 17.7 (B)       |
| MD 187 at I-495 Outer Loop Off-Ramp                               | 37.3 (D)       | 14.9 (B)       | 37.3 (D)              | 17.9 (B)       |
| MD 187 at I-495 Inner Loop Off-Ramp                               | 8.9 (A)        | 21.5 (C)       | 10.6 (B)              | 22.5 (C)       |
| MD 187 at Ryland Dr/Church Driveway                               | 15.8 (B)       | 7.9 (A)        | 14.5 (B)              | 7.7 (A)        |
| <b>I-495 at MD 355 (Rockville Pk)/I-270 East Spur</b>             |                |                |                       |                |
| MD 355 at Grosvenor Ln  | 32.6 (C)       | 31.5 (C)       | 32.7 (C)              | 32.3 (C)       |
| MD 355 at I-495 Inner Loop Off-Ramp                               | 24.8 (C)       | 17.1 (B)       | 25.1 (C)              | 18.3 (B)       |
| MD 355 at Pooks Hill Rd   | 31.3 (C)       | 15.8 (B)       | 32.8 (C)              | 15.4 (B)       |
| MD 355 at Alta Vista Rd/Bellevue Dr                               | 15.2 (B)       | 27.1 (C)       | 16.3 (B)              | 23.5 (C)       |

\*Unsignalized (stop-controlled) intersection; delay and LOS for worst approach shown



**Table 6-26: 2027 Preferred Alternative Synchro Ramp Queuing Summary**

| Ramp  | AM 95 <sup>th</sup> %ile Queue (ft) | PM 95 <sup>th</sup> %ile Queue (ft) | Issue? |
|---|-------------------------------------|-------------------------------------|--------|
| <b>I-270 at Shady Grove Rd</b>                                    |                                     |                                     |        |
| I-270 SB Off-Ramp to Omega Dr                                     | 87                                  | 100                                 | No     |
| I-270 SB Off-Ramp to Shady Grove Rd                               | 492                                 | 235                                 | No     |
| I-270 NB Off-Ramp to Shady Grove Rd                               | 449                                 | 192                                 | No     |
| I-270 NB Off-Ramp to Piccard Dr/Redland Blvd                      | 48                                  | 65                                  | No     |
| <b>I-270 at Gude Dr</b>   |                                     |                                     |        |
| I-270 HOT Lanes SB Off-Ramp to Gude Dr                            | 189                                 | 217                                 | No     |
| I-270 HOT Lanes NB Off-Ramp to Gude Dr                            | 407                                 | 330                                 | No     |
| <b>I-270 at MD 28 (Montgomery Ave)</b>                            |                                     |                                     |        |
| I-270 SB Off-Ramp to MD 28  | 206                                 | 244                                 | No     |
| I-270 NB Off-Loop to WB MD 28                                     | N/A*                                | N/A*                                | N/A*   |
| I-270 NB Off-Ramp to EB MD 28 or Nelson St                        | 164                                 | 296                                 | No     |
| <b>I-270 at MD 189 (Falls Rd)</b>                                 |                                     |                                     |        |
| I-270 SB Off-Ramp to WB MD 189                                    | N/A*                                | N/A*                                | N/A*   |
| I-270 SB Off-Ramp to EB MD 189                                    | 11                                  | 64                                  | No     |
| I-270 NB Off-Ramp to WB MD 189                                    | 0                                   | 56                                  | No     |
| I-270 NB Off-Ramp to EB MD 189                                    | 163                                 | 144                                 | No     |
| <b>I-270 at Wootton Pkwy</b>                                      |                                     |                                     |        |
| I-270 HOT Lanes SB Off-Ramp to Wootton Pkwy                       | 139                                 | 184                                 | No     |
| I-270 HOT Lanes NB Off-Ramp to Wootton Pkwy                       | 198                                 | 196                                 | No     |
| <b>I-270 at Montrose Rd</b>                                       |                                     |                                     |        |
| I-270 SB Off-Ramp to WB Montrose Rd                               | N/A*                                | N/A*                                | N/A*   |
| I-270 SB Off-Loop to EB Montrose Rd                               | N/A*                                | N/A*                                | N/A*   |
| I-270 NB Off-Loop to WB Montrose Rd                               | N/A*                                | N/A*                                | N/A*   |
| I-270 NB Off-Ramp to EB Montrose Rd                               | 0                                   | 0                                   | No     |
| <b>I-270 West Spur at Westlake Terrace</b>                        |                                     |                                     |        |
| I-270 Spur SB Off-Ramp to Westlake Terrace                        | 437                                 | 283                                 | No     |
| I-270 Spur NB Off-Ramp to Westlake Terrace                        | 111                                 | 70                                  | No     |
| <b>I-270 West Spur at Democracy Blvd</b>                          |                                     |                                     |        |
| I-270 Spur SB Off-Ramp to Democracy Blvd                          | 250                                 | 818                                 | No     |
| I-270 NB Off-Ramp to WB Democracy Blvd                            | 172                                 | 165                                 | No     |
| I-270 NB Off-Ramp to EB Democracy Blvd                            | 477                                 | 211                                 | No     |
| <b>I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)</b> |                                     |                                     |        |
| I-270 SB/EB Off-Ramp to Rockledge Blvd                            | 441                                 | 351                                 | No     |
| I-270 NB/WB Off-Ramp to Rockledge Blvd                            | N/A*                                | N/A*                                | N/A*   |
| I-270 NB/WB Off-Ramp to MD 187                                    | 125                                 | 106                                 | No     |
| <b>I-495 at MD 190 (River Rd)</b>                                 |                                     |                                     |        |
| I-495 OL Off-Ramp to MD 190                                       | 156                                 | 140                                 | No     |
| I-495 OL HOT Lanes Off-Ramp to MD 190                             | 72                                  | 122                                 | No     |
| I-495 IL HOT Lanes Off-Ramp to MD 190                             | 17                                  | 160                                 | No     |
| I-495 IL Off-Ramp to MD 190                                       | 252                                 | 189                                 | No     |
| <b>I-495 at MD 187 (Old Georgetown Rd)</b>                        |                                     |                                     |        |
| I-495 OL Off-Ramp to MD 187                                       | 431                                 | 459                                 | No     |
| I-495 IL Off-Ramp to MD 187                                       | 166                                 | 357                                 | No     |
| <b>I-495 at MD 355 (Rockville Pk)/I-270 East Spur</b>             |                                     |                                     |        |
| I-495 OL Off-Ramp to NB MD 355                                    | N/A*                                | N/A*                                | N/A*   |
| I-495 IL Off-Ramp to SB MD 355                                    | 400                                 | 288                                 | No     |

\*Uncontrolled movement; no queue reported in Synchro

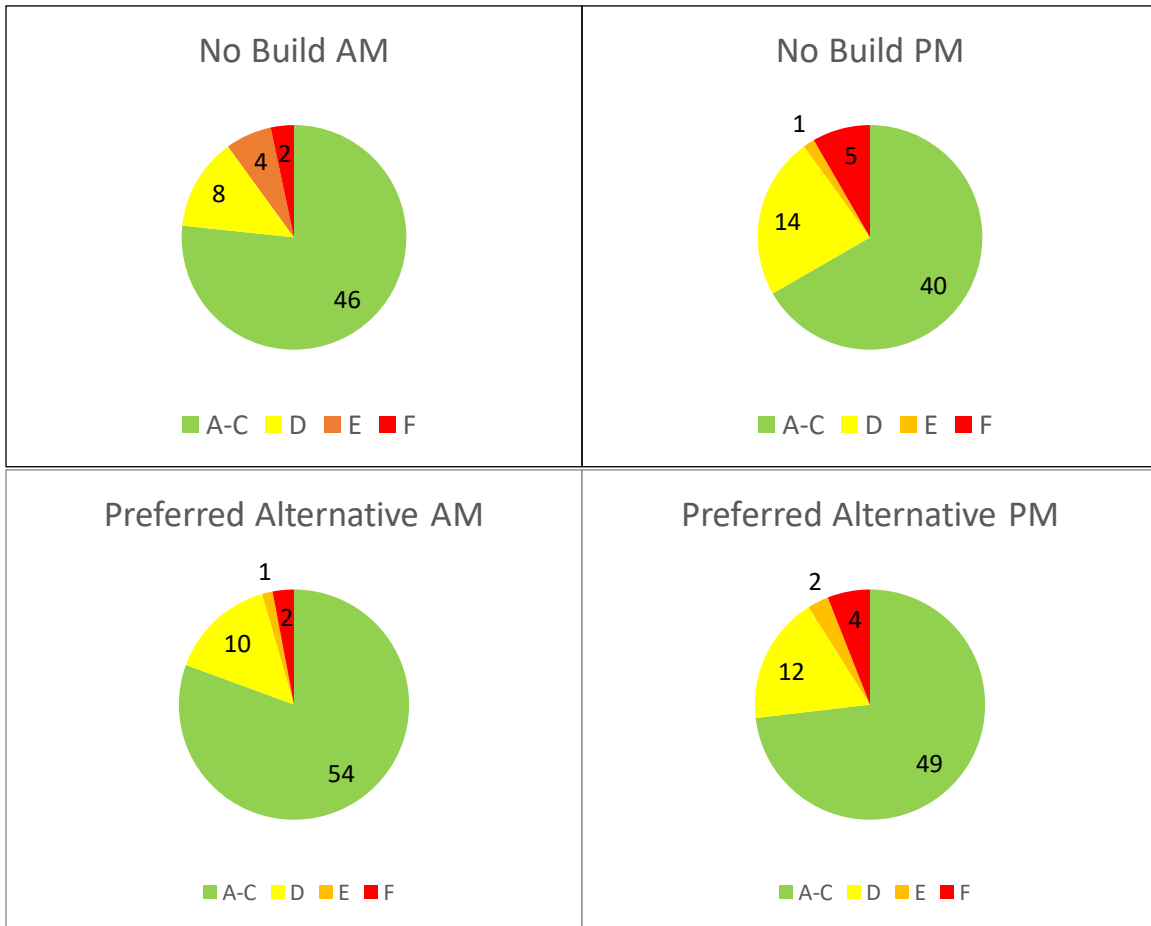
#### 6.5.4 2045 Conditions

**Figure 6-60** summarizes the number of intersections operating at LOS ‘A’ through ‘F’ with No Build conditions and the Preferred Alternative.

**Table 6-27** summarizes 2045 delay and LOS at study intersections, based on Synchro under No Build conditions and the Preferred Alternative. As shown, 2 intersections are projected to operate at LOS ‘F’ during the AM peak hour and 5 intersections are projected to operate at LOS ‘F’ during the PM peak hour with No Build conditions. Additionally, 4 intersections are projected to operate at LOS ‘E’ during the AM peak hour and 1 intersection is projected to operate at LOS ‘E’ during the PM peak hour with No Build conditions. With the Preferred Alternative, 1 intersection is projected to operate at LOS ‘F’ during the AM peak hour and 4 intersections are projected to operate at LOS ‘F’ during the PM peak hour. Additionally, 1 intersection is projected to operate at LOS ‘E’ during the AM peak hour and 2 intersections are projected to operate at LOS ‘E’ during the PM peak hour with the Preferred Alternative, including one intersection that operates at LOS ‘F’ with No Build conditions. While there are more intersections with the Preferred Alternative (67 intersections) than with No Build conditions (60 intersections), fewer intersections operate at LOS ‘E’/‘F’ with the Preferred Alternative.

**Table 6-28** summarizes queuing at ramp junction intersections. As shown, no queues spill back onto the freeways.

**Figure 6-60: 2045 No Build vs Preferred Alternative Synchro Number of Intersections by LOS**



**Table 6-27: 2045 No Build and Preferred Alternative Synchro Intersection Delay and LOS Results**

| Intersection                                  | No Build          |                   | Preferred Alternative |                   |
|---|-------------------|-------------------|-----------------------|-------------------|
|   | AM<br>Delay (LOS) | PM<br>Delay (LOS) | AM<br>Delay (LOS)     | PM<br>Delay (LOS) |
| <b>I-270 at I-370 (Sam Eig Hwy)</b>           |                   |                   |                       |                   |
| Sam Eig Hwy at Fields Rd                      | 23.4 (C)          | 29.6 (C)          | 23.5 (C)              | 29.1 (C)          |
| Washingtonian Blvd at I-370 WB Ramps          | 22.1 (C)          | 20.7 (C)          | 22.2 (C)              | 23.3 (C)          |
| Washingtonian Blvd at I-370 EB Ramps          | 11.5 (B)          | 21.7 (C)          | 14.0 (B)              | 26.9 (C)          |
| Sam Eig Hwy SBR at MD 119 (Great Seneca Hwy)  | 5.0 (A)           | 12.4 (B)          | 4.8 (A)               | 12.2 (B)          |
| Sam Eig Hwy at MD 119 (Great Seneca Hwy)      | 34.7 (C)          | 46.4 (D)          | 34.1 (C)              | 46.4 (D)          |
| Sam Eig Hwy at Diamondback Dr                 | 30.6 (C)          | 40.0 (D)          | 30.7 (C)              | 40.1 (D)          |
| <b>I-270 at Shady Grove Rd</b>                |                   |                   |                       |                   |
| Omega Dr at MD 28 (Key West Ave)              | 38.8 (D)          | 41.2 (D)          | 38.2 (D)              | 41.2 (D)          |
| Omega Dr at I-270 SB Off-Ramp (Unsignalized)* | 36.1 (E)          | 98.8 (F)          | 32.2 (D)              | 98.0 (F)          |
| Omega Dr/Fields Rd at Washingtonian Blvd      | 7.8 (A)           | 15.6 (B)          | 7.8 (A)               | 15.6 (B)          |
| Shady Grove Rd at Corporate Blvd              | 23.1 (C)          | 33.8 (C)          | 20.6 (C)              | 31.8 (C)          |
| Shady Grove Rd at I-270 SB Off-Ramp           | 26.5 (C)          | 18.6 (B)          | 21.1 (C)              | 18.4 (B)          |
| Shady Grove Rd at I-270 NB Off-Ramp           | 21.8 (C)          | 12.5 (B)          | 19.5 (B)              | 8.6 (A)           |
| Shady Grove Rd at Choke Cherry Rd             | 25.0 (C)          | 45.8 (D)          | 24.4 (C)              | 44.5 (D)          |
| Redland Blvd at Piccard Dr                    | 10.9 (B)          | 13.8 (B)          | 13.0 (B)              | 15.1 (B)          |
| <b>I-270 at Gude Dr</b>                       |                   |                   |                       |                   |
| Gude Dr at Research Blvd                      | 68.7 (E)          | 121.4 (F)         | 29.2 (C)              | 28.4 (C)          |
| Gude Dr at I-270 HOT Lanes Access             | N/A               | N/A               | 37.0 (D)              | 32.4 (C)          |
| Gude Dr at Piccard Dr                         | 11.5 (B)          | 20.0 (B)          | 14.8 (B)              | 32.3 (C)          |
| <b>I-270 at MD 28 (Montgomery Ave)</b>        |                   |                   |                       |                   |
| MD 28 at Hurley Ave                           | 16.9 (B)          | 24.2 (C)          | 17.4 (B)              | 24.4 (C)          |
| MD 28 at I-270 SB Ramps                       | 13.0 (B)          | 17.9 (B)          | 7.7 (A)               | 19.7 (B)          |
| MD 28 at I-270 NB Off-Ramp/Nelson St          | 23.3 (C)          | 26.6 (C)          | 21.1 (C)              | 24.2 (C)          |
| MD 28 at Laird St/Bullard Cir                 | 15.9 (B)          | 16.1 (B)          | 14.0 (B)              | 15.5 (B)          |
| <b>I-270 at MD 189 (Falls Rd)</b>             |                   |                   |                       |                   |
| MD 189 at Wootton Pkwy                        | 57.9 (E)          | 44.3 (D)          | 48.8 (D)              | 44.5 (D)          |
| MD 189 at I-270 Ramps (SPUI)                  | 38.5 (D)          | 55.1 (E)          | N/A                   | N/A               |
| MD 189 Crossover at I-270 SB Ramps            | N/A               | N/A               | 17.3 (B)              | 25.0 (C)          |
| MD 189 EB at I-270 SB Off-Ramp                |                   |                   | 5.1 (A)               | 6.8 (A)           |
| MD 189 WB at I-270 NB Off-Ramp                |                   |                   | 2.9 (A)               | 6.7 (A)           |
| MD 189 Crossover at I-270 NB Ramps            |                   |                   | 24.2 (C)              | 25.0 (B)          |
| MD 189 EB at I-270 NB Ramp                    |                   |                   | 7.9 (A)               | 8.1 (A)           |
| MD 189 at Great Falls Rd/Potomac Valley Rd    | 18.0 (B)          | 15.3 (B)          | 18.8 (B)              | 19.5 (B)          |
| <b>I-270 at Wootton Pkwy</b>                  |                   |                   |                       |                   |
| Wootton Pkwy at Seven Locks Rd                | 36.2 (D)          | 27.7 (C)          | 25.8 (C)              | 31.9 (C)          |
| Wootton Pkwy at Tower Oaks Rd                 | 25.3 (C)          | 24.0 (C)          | 26.2 (C)              | 36.0 (D)          |
| Wootton Pkwy at I-270 HOT Lanes Access        | N/A               | N/A               | 26.1 (C)              | 23.9 (C)          |

\*Unsignalized (stop-controlled) intersection; delay and LOS for worst approach shown

**Table 6-27: 2045 No Build and Preferred Alternative Synchro Intersection Delay and LOS Results (Continued)**

| Intersection  | No Build          |                   | Preferred Alternative |                   |
|---|-------------------|-------------------|-----------------------|-------------------|
|   | AM<br>Delay (LOS) | PM<br>Delay (LOS) | AM<br>Delay (LOS)     | PM<br>Delay (LOS) |
| <b>I-270 at Montrose Rd</b>                                       |                   |                   |                       |                   |
| Montrose Rd at Seven Locks Rd                                     | 30.0 (C)          | 37.6 (D)          | 29.9 (C)              | 36.7 (D)          |
| Montrose Rd at Potomac Ave (Unsignalized)*                        | 47.3 (E)          | 143.3 (F)         | 35.9 (E)              | 162.9 (F)         |
| Montrose Rd at Tower Oaks Blvd                                    | 20.4 (C)          | 12.0 (B)          | 17.6 (B)              | 15.1 (B)          |
| Montrose Rd at Farm Ln  | 2.0 (A)           | 4.8 (A)           | 2.0 (A)               | 4.3 (A)           |
| Montrose Rd at Hitching Post Ln/Farm Haven Dr                     | 14.3 (B)          | 11.7 (B)          | 14.2 (B)              | 11.4 (B)          |
| Tower Oaks Blvd at I-270 NB Ramps/GEICO Entrance                  | 19.1 (B)          | 18.5 (B)          | 17.9 (B)              | 19.0 (B)          |
| Tower Oaks Blvd at Commercial Dr                                  | 4.0 (A)           | 5.8 (A)           | 3.6 (A)               | 5.1 (A)           |
| <b>I-270 West Spur at Westlake Terrace</b>                        |                   |                   |                       |                   |
| Westlake Terrace at Westfield Montgomery Mall/Motor City Dr       | 13.5 (B)          | 24.1 (C)          | 9.8 (A)               | 20.7 (C)          |
| Westlake Terrace at I-270 West Spur Ramps                         | 14.1 (B)          | 10.1 (B)          | 37.5 (D)              | 32.2 (C)          |
| Westlake Terrace at Rockledge Dr                                  | 34.9 (C)          | 54.3 (D)          | 34.8 (C)              | 53.0 (D)          |
| <b>I-270 West Spur at Democracy Blvd</b>                          |                   |                   |                       |                   |
| Democracy Blvd at Taveshire Way                                   | 10.8 (B)          | 11.7 (B)          | 10.8 (B)              | 11.3 (B)          |
| Democracy Blvd at I-270 SB On-Ramp/I-270 SB Off-Ramp              | 33.0 (C)          | 50.9 (D)          | 28.2 (C)              | 39.5 (D)          |
| Democracy Blvd at I-270 SB On-Ramp                                | 5.5 (A)           | 18.6 (B)          |                       |                   |
| Democracy Blvd at I-270 NB Ramps                                  | 6.8 (A)           | 7.5 (A)           | 12.4 (B)              | 12.3 (B)          |
| Democracy Blvd at I-270 NB Off-Ramp                               | 20.0 (B)          | 9.7 (A)           | 16.3 (B)              | 8.3 (A)           |
| Democracy Blvd at Fernwood Rd                                     | 47.3 (D)          | 38.0 (D)          | 41.5 (D)              | 47.1 (D)          |
| <b>I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)</b> |                   |                   |                       |                   |
| Rockledge Dr at Rock Forest Dr                                    | 26.8 (C)          | 40.6 (D)          | 27.0 (C)              | 41.1 (D)          |
| Rockledge Dr at I-270 SB Ramps                                    | 20.1 (C)          | 40.6 (D)          | 22.0 (C)              | 34.8 (C)          |
| Rockledge Dr at I-270 NB Ramps                                    | 43.4 (D)          | 32.9 (C)          | 39.2 (D)              | 33.4 (C)          |
| MD 187 at Rock Spring Dr  | 46.6 (D)          | 98.7 (F)          | 48.7 (D)              | 96.8 (F)          |
| MD 187 at I-270 SB Ramps  | 25.8 (C)          | 31.7 (C)          | 25.9 (C)              | 27.2 (C)          |
| MD 187 at I-270 NB Ramps  | 11.1 (B)          | 15.6 (B)          | 12.7 (B)              | 14.8 (B)          |
| MD 187 at Tuckerman Ln  | 156.7 (F)         | 92.3 (F)          | 157.7 (F)             | 94.2 (F)          |
| <b>I-495 at MD 190 (River Rd)</b>                                 |                   |                   |                       |                   |
| MD 190 at Seven Locks Rd  | 41.6 (D)          | 49.3 (D)          | 38.0 (D)              | 58.3 (E)          |
| MD 190 at I-495 Outer Loop Off-Ramp                               | 13.5 (B)          | 10.7 (B)          | 21.6 (C)              | 17.9 (B)          |
| MD 190 at I-495 Inner Loop On-Ramp                                | 0.5 (A)           | 3.7 (A)           | 19.1 (B)              | 21.6 (C)          |
| MD 190 at Burdette Rd   | 21.5 (C)          | 49.9 (D)          | 24.8 (C)              | 79.9 (E)          |
| MD 190 at I-495 HOT Lanes Access                                  | N/A               | N/A               | 13.6 (B)              | 23.0 (C)          |
| <b>I-495 at MD 187 (Old Georgetown Rd)</b>                        |                   |                   |                       |                   |
| MD 187 at Lone Oak Dr/Manor Oak Way                               | 25.1 (C)          | 20.7 (C)          | 23.3 (C)              | 21.0 (C)          |
| MD 187 at I-495 Outer Loop Off-Ramp                               | 96.0 (F)          | 11.6 (B)          | 88.4 (F)              | 12.9 (B)          |
| MD 187 at I-495 Inner Loop Off-Ramp                               | 9.4 (A)           | 17.2 (B)          | 8.6 (A)               | 24.6 (C)          |
| MD 187 at Ryland Dr/Church Driveway                               | 16.5 (B)          | 10.4 (B)          | 17.7 (B)              | 11.3 (B)          |
| <b>I-495 at MD 355 (Rockville Pk)/I-270 East Spur</b>             |                   |                   |                       |                   |
| MD 355 at Grosvenor Ln  | 33.4 (C)          | 36.5 (D)          | 33.8 (C)              | 35.3 (D)          |
| MD 355 at I-495 Inner Loop Off-Ramp                               | 25.4 (C)          | 16.5 (B)          | 24.0 (C)              | 20.8 (C)          |
| MD 355 at Pooks Hill Rd   | 35.7 (D)          | 16.6 (B)          | 36.6 (D)              | 17.0 (B)          |
| MD 355 at Alta Vista Rd/Bellevue Dr                               | 17.5 (B)          | 29.3 (C)          | 19.1 (B)              | 28.4 (C)          |

\*Unsignalized (stop-controlled) intersection; delay and LOS for worst approach shown

**Table 6-28: 2045 Preferred Alternative Synchro Ramp Queuing Summary**

| Ramp  | AM 95 <sup>th</sup> %ile Queue (ft) | PM 95 <sup>th</sup> %ile Queue (ft) | Issue? |
|---|-------------------------------------|-------------------------------------|--------|
| <b>I-270 at Shady Grove Rd</b>                                    |                                     |                                     |        |
| I-270 SB Off-Ramp to Omega Dr                                     | 100                                 | 171                                 | No     |
| I-270 SB Off-Ramp to Shady Grove Rd                               | 513                                 | 232                                 | No     |
| I-270 NB Off-Ramp to Shady Grove Rd                               | 423                                 | 175                                 | No     |
| I-270 NB Off-Ramp to Piccard Dr/Redland Blvd                      | 41                                  | 51                                  | No     |
| <b>I-270 at Gude Dr</b>   |                                     |                                     |        |
| I-270 HOT Lanes SB Off-Ramp to Gude Dr                            | 205                                 | 281                                 | No     |
| I-270 HOT Lanes NB Off-Ramp to Gude Dr                            | 507                                 | 408                                 | No     |
| <b>I-270 at MD 28 (Montgomery Ave)</b>                            |                                     |                                     |        |
| I-270 SB Off-Ramp to MD 28  | 200                                 | 248                                 | No     |
| I-270 NB Off-Loop to WB MD 28                                     | N/A*                                | N/A*                                | N/A*   |
| I-270 NB Off-Ramp to EB MD 28 or Nelson St                        | 159                                 | 314                                 | No     |
| <b>I-270 at MD 189 (Falls Rd)</b>                                 |                                     |                                     |        |
| I-270 SB Off-Ramp to WB MD 189                                    | N/A*                                | N/A*                                | N/A*   |
| I-270 SB Off-Ramp to EB MD 189                                    | 34                                  | 48                                  | No     |
| I-270 NB Off-Ramp to WB MD 189                                    | 9                                   | 65                                  | No     |
| I-270 NB Off-Ramp to EB MD 189                                    | 152                                 | 101                                 | No     |
| <b>I-270 at Wootton Pkwy</b>                                      |                                     |                                     |        |
| I-270 HOT Lanes SB Off-Ramp to Wootton Pkwy                       | 156                                 | 203                                 | No     |
| I-270 HOT Lanes NB Off-Ramp to Wootton Pkwy                       | 254                                 | 248                                 | No     |
| <b>I-270 at Montrose Rd</b>                                       |                                     |                                     |        |
| I-270 SB Off-Ramp to WB Montrose Rd                               | N/A*                                | N/A*                                | N/A*   |
| I-270 SB Off-Loop to EB Montrose Rd                               | N/A*                                | N/A*                                | N/A*   |
| I-270 NB Off-Loop to WB Montrose Rd                               | N/A*                                | N/A*                                | N/A*   |
| I-270 NB Off-Ramp to EB Montrose Rd                               | 0                                   | 0                                   | No     |
| <b>I-270 West Spur at Westlake Terrace</b>                        |                                     |                                     |        |
| I-270 Spur SB Off-Ramp to Westlake Terrace                        | 497                                 | 327                                 | No     |
| I-270 Spur NB Off-Ramp to Westlake Terrace                        | 115                                 | 90                                  | No     |
| <b>I-270 West Spur at Democracy Blvd</b>                          |                                     |                                     |        |
| I-270 Spur SB Off-Ramp to Democracy Blvd                          | 286                                 | 716                                 | No     |
| I-270 NB Off-Ramp to WB Democracy Blvd                            | 201                                 | 251                                 | No     |
| I-270 NB Off-Ramp to EB Democracy Blvd                            | 522                                 | 253                                 | No     |
| <b>I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)</b> |                                     |                                     |        |
| I-270 SB/EB Off-Ramp to Rockledge Blvd                            | 523                                 | 421                                 | No     |
| I-270 NB/WB Off-Ramp to Rockledge Blvd                            | N/A*                                | N/A*                                | N/A*   |
| I-270 NB/WB Off-Ramp to MD 187                                    | 223                                 | 141                                 | No     |
| <b>I-495 at MD 190 (River Rd)</b>                                 |                                     |                                     |        |
| I-495 OL Off-Ramp to MD 190                                       | 163                                 | 145                                 | No     |
| I-495 OL HOT Lanes Off-Ramp to MD 190                             | 78                                  | 132                                 | No     |
| I-495 IL HOT Lanes Off-Ramp to MD 190                             | 17                                  | 194                                 | No     |
| I-495 IL Off-Ramp to MD 190                                       | 268                                 | 194                                 | No     |
| <b>I-495 at MD 187 (Old Georgetown Rd)</b>                        |                                     |                                     |        |
| I-495 OL Off-Ramp to MD 187                                       | 434                                 | 285                                 | No     |
| I-495 IL Off-Ramp to NB MD 187                                    | 107                                 | 425                                 | No     |
| <b>I-495 at MD 355 (Rockville Pk)/I-270 East Spur</b>             |                                     |                                     |        |
| I-495 OL Off-Ramp to NB MD 355                                    | N/A*                                | N/A*                                | N/A*   |
| I-495 IL Off-Ramp to SB MD 355                                    | 362                                 | 332                                 | No     |

\*Uncontrolled movement; no queue reported in Synchro

## 7 SAFETY ANALYSIS

### 7.1 INTRODUCTION

The purpose of the I-495 & I-270 Managed Lane Study (MLS) is to develop a travel demand management solution that addresses congestion, improves trip reliability on I-495 and I-270 within the study limits, and enhances existing and planned multimodal mobility and connectivity. As demonstrated through the previous sections of this document, the study area experiences heavy congestion on a regular basis, with the most prevalent congestion occurring during the morning and evening peak periods. Slow speeds and stop-and-go conditions increase the potential for congestion-related crashes, such as rear-end and sideswipe crashes. Congested conditions may also increase the potential for aggressive driving, as motorists become frustrated while sitting in traffic. In addition, due to the congested conditions along I-495 and I-270, drivers often divert to alternate routes on surrounding arterials, collectors, and other crossroads to reduce their travel time and delay. Motorists on the roadway that are searching for a way to re-route their trip may also create a safety risk.

The Preferred Alternative proposes to construct a two-lane, High Occupancy Toll (HOT) managed lane network on I-495 and I-270 within the Phase I South study area. The limits of Phase 1 South are along I-495 from the George Washington Memorial Parkway to west of MD 187 and along I-270 from I-495 to north of I-370 and on the I-270 East and West Spurs. On I-495, the Preferred Alternative will construct two new HOT managed lanes in each direction from the George Washington Memorial Parkway to west of MD 187. On I-270, the Preferred Alternative will convert the one existing HOV lane in each direction to a HOT managed lane and construct one new HOT managed lane in each direction from I-495 to I-370. By providing additional travel choices, the Preferred Alternative is expected to reduce congestion on I-270 and I-495 within the study area and local roadway networks, allowing for more reliable travel times for all users, including emergency responders, which in turn is expected to improve existing safety issues.

While improving safety was not identified as part of the Purpose and Need of the MLS, in accordance with Technical Requirement 1 from the FHWA May 22, 2017, Policy Statement, it is required to demonstrate that “the proposed change in access does not have a significant adverse impact on the safety and operation of the interstate facility or on the local street network based on both the current and planned future traffic projections.” The traffic safety analysis performed for this IAPA uses a combination of crash history review, identification of high crash locations, qualitative assessment, and predictive crash analysis to evaluate the safety impact of the Preferred Alternative on the study area. Safety impact evaluations include mainline lanes; existing, new, or modified ramps; ramp terminal intersections with a crossroad; or on the local street network within the study area, based on both the current traffic volumes and the planned future 2045 traffic volume projections. The safety methodologies are discussed below.



## 7.2 METHODOLOGIES

### 7.2.1 Historical Crash Data Review

Crash data within the study area was reviewed for a three-year period between January 1, 2016, and December 31, 2018, to determine existing predominant crash patterns and trends. The crash data used was obtained from MDOT SHA's Office of Traffic and Safety<sup>10</sup> and VDOT Tableau-Crash Analysis Tool (T-CAT)<sup>11</sup>. The crash study period reflects the most recent available crash data at the time of analysis initiation and the period specified in the IAPA Framework Document.

### 7.2.2 Existing High Crash Locations

To develop a concise list of locations along the freeways with more substantial crash patterns, crash rates for quarter-mile segments of the freeway mainline lanes were calculated and compared to the respective statewide average crash rates for other similar facilities to pinpoint locations with a crash rate at least two times the statewide average. The hot spot freeway locations were evaluated to determine the impact of the Preferred Alternative on existing safety performance. The statewide average crash rates used for this review were obtained from MDOT SHA's Office of Traffic and Safety and VDOT Tableau-Crash Analysis Tool (T-CAT).

The spatial analysis tool within ArcGIS software was used to map crashes and to pinpoint hot spot locations along the ramps, ramp intersections with a crossroad, and the local street network to identify crash clusters and recurring crash patterns. The hot spot locations were evaluated to determine the impact of the Preferred Alternative on existing safety performance. A visual crash cluster approach was used since MDOT statewide average crash rates were not available for these facility types. Additional information on the spatial analysis is in **Appendix J**.

Additionally, MDOT's Candidate Safety Improvement Locations (CSIL) were reviewed to determine locations previously identified through Maryland's systematic safety program that overlap with the study area. The CSIL are generated from a statewide ranking of frequency of Equivalent Property Damage Only (EPDO) crashes, which is a methodology that is intended to account for both crash frequency and severity to identify the state's most significant safety needs. The most recent and applicable CSIL lists were reviewed including the 2018 Candidate Safety Improvement Section (CSIS) list and the 2019 Candidate Safety Improvement Intersection (CSII) list.

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<sup>10</sup> MDOT SHA's Office of Traffic and Safety processes, reviews, and summarizes crash data from the Maryland Automated Crash Reporting System (ACRS), which is the singular source of all traffic crash data in Maryland that is reported by the Maryland State Police, Maryland Transportation Authority Police, and the local law enforcement departments for cities, towns, and counties in Maryland.

<sup>11</sup> VDOT's Crash Analysis Tool is the primary source of Virginia crash data. It is a Tableau-based database developed by the Traffic Engineering Division of Highway Safety at VDOT and maintained by the DMV's Traffic Records Electronic Data System (TREDS).

### 7.2.3 Qualitative Assessment

All study interchanges were qualitatively assessed for the Preferred Alternative's impact on the safety performance of the interstate facility and local street network. Specifically, the assessment includes an explanation of the proposed access and geometric changes compared to the existing interchange configuration and access. It also assesses how safety may be impacted with the Preferred Alternative because of the geometric or access changes, or because of operational impacts associated with the Preferred Alternative.

### 7.2.4 Predictive Crash Analysis

The predictive crash analysis methodologies outlined in the Highway Safety Manual (HSM) were used to provide a quantitative-based approach analysis on how the Preferred Alternative impacts safety performance. The HSM, published in 2010, introduced a quantitative approach to evaluating roadway safety. In 2014, a supplement to the HSM was released which includes two new chapters to estimate crash frequency for both freeways and ramps. Prior to the development of the HSM, safety analysis techniques largely focused on a review of crash history and qualitative assessments. The predicted crash frequency tools used are listed below. Additional information on application and limitations of these tools are discussed in **Section 7.6.2**.

- The Enhanced Interchange Safety Analysis Tool (ISATe) was used for the predictive crash analysis of mainline freeway segments (i.e., General Purpose and Collector-Distributor lanes); interchange ramps and acceleration lanes; and crossroad ramp terminals and intersections within the interchange influence area. The current version of the HSM does not provide a crash prediction methodology for estimating the safety performance of a separated managed lane facility. Due to this limitation, ISATe was not used to perform a predicted crash analysis for the HOT managed lanes, rather ISATe was used to provide a crash estimation for the General Purpose lanes, which was then used in combination with the other tools discussed below to assess the relative safety of the freeway facility.
- The Safety Performance Function (SPF) developed for the Virginia I-495 Express Lanes project was used for the predicted crash analysis of the proposed HOT managed lanes. This is the methodology that was used for VDOT's I-495 Express Lanes Northern Extension (NEXT) Interchange Justification Report. VDOT used historical crash data, traffic volume data, and roadway geometric data along the existing segments of I-495 Express Lanes to develop an SPF model for the I-495 Express Lanes. The VDOT SPF provides an estimation of future-year crashes for new Express Lane sections that will be included in the I-495 NEXT project Build Alternative. The Preferred Alternative will overlap and tie-in with the I-495 NEXT improvements on I-495 at the George Washington Memorial Parkway interchange. Due to the proximity and similarities between the HOT managed lanes proposed as part of the MLS and the Express Lanes in Virginia, VDOT's SPF for the I-495 Express Lanes was used to provide an estimation of the crashes in the HOT managed lanes for the analysis. These estimations were combined with the ISATe crash estimation for the General Purpose lanes to provide a relative comparison between the No Build conditions and the Preferred Alternative. See **Appendix K** for information on the development of the VDOT SPF.

- For specific ramp terminal configurations, the latest guidance published in TRB Journal Volume 2675 in 2021<sup>12</sup> was used for the analysis of the Single-Point Urban Interchange (SPUI) and Diverging Diamond Interchange (DDI) ramp terminals that are located within the study area. Please refer to **Appendix K** for the specific safety performance functions and crash modification factors used for this analysis as well as citations for the referenced research papers.
- The Urban and Suburban Arterial Analysis spreadsheets (which are based on the analysis outlined in Chapter 12 of the HSM) were used for the predicted crash analysis for study arterial crossroad segments and intersections with five or less travel lanes. Predicted crash analysis methodologies outlined in NCHRP 17-58 were used for the analysis of arterial crossroad segments and intersections with six or more lanes.

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<sup>12</sup> Publications sourced include “Safety Performance of Crossroad Ramp Terminals at Single-Point and Tight Diamond Interchanges” and the “Systematic Safety Evaluation of Diverging Diamond Interchanges Based on Nationwide Implementation Data”.

## 7.3 HISTORICAL CRASH DATA REVIEW

### 7.3.1 Overall Study Area

The historical crash trends within the study area during the crash study period (January 1, 2016 – December 31, 2018) are summarized below. Detailed summary tables supporting these trends are included in **Appendix J**. The summaries are shown by freeway (I-270 & East Spur, I-270 West Spur, I-495 in Maryland, or I-495 in Virginia) or by facility type (freeway, ramp, or crossroad).

- Approximately 4,700 crashes were reported over the three-year crash study period, of which nine resulted in a fatality; 68% of the crashes within the study area were property damage only. A breakdown of crash frequency and severity by freeway, ramp, and crossroads is provided in **Table 7-1**.
- Crash frequency increased between 2016 and 2018 by 8 – 10% each year while the AADT increased by approximately 1 – 2% per year. The crashes and AADT by year and facility are shown in **Figure 7-1** and **7-2**.
- The predominant crash type along the freeways is rear-end crashes, accounting for 57% of freeway crashes. The predominant crash type along the ramps is single vehicle crashes, accounting for 64% of ramp crashes. The predominant crash type along the crossroads is rear-end crashes, accounting for 40% of crossroad crashes. The distribution of crash type by facility is shown in **Figure 7-3**.
- The crash frequency, over year to year and across all study freeways is concentrated during select hours of the day, approximately between 6:00 AM and 10:00 AM and 3:00 PM and 7:00 PM. These hours are consistent with existing peak travel periods. The crash trends by hour by year are shown in **Figure 7-4**, and the crash trends by hour by facility are shown in **Figure 7-5**.
- Environmental factors such as lighting, weather, and pavement conditions did not significantly affect the overall safety performance of the freeway.

Almost three-fourths of the crashes along the study freeways are rear-end or sideswipe crashes. Research studies suggest that the unstable traffic flow during the rise and fall of congested operations increases the probability of rear-end and sideswipe crashes<sup>13</sup>. Additionally, across each of the four study freeways, 50 – 60% of the crashes occurred during the peak travel periods as defined by the operations analysis. The high proportion of rear-end and sideswipe crash types, along with the high occurrence of crashes during peak travel periods, suggests a strong correlation between the existing congested freeway conditions and the safety performance of those freeways. The Preferred Alternative provides congestion relief and addresses existing and future travel needs, which can have a positive influence on reducing the potential for congestion-related crashes.

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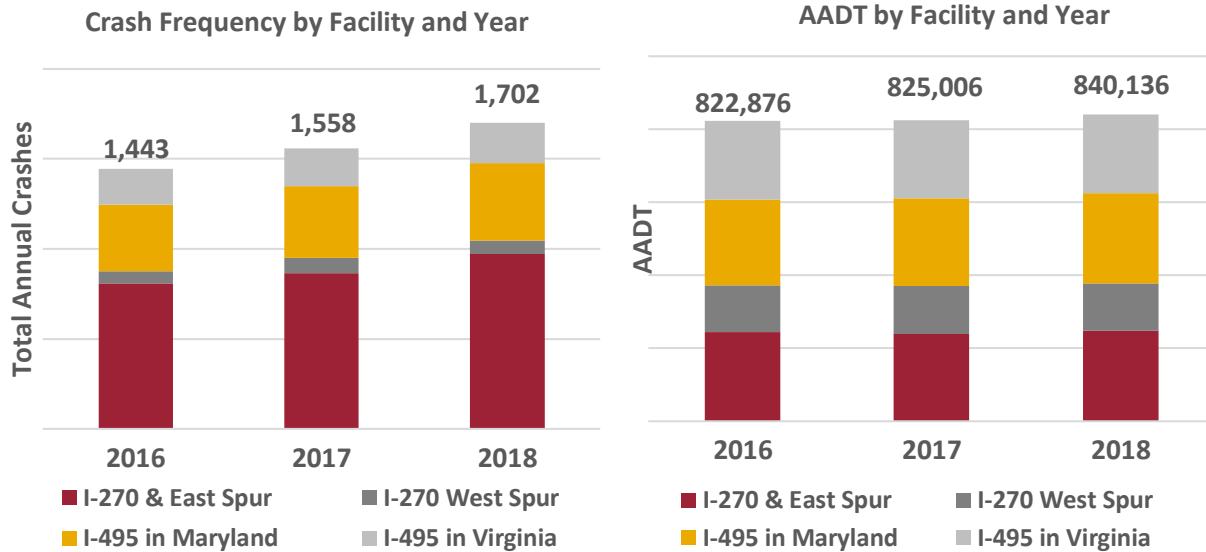
<sup>13</sup> Thomas F. Golob, Will Recker, Yannis Pavlis. (2008). Probabilistic models of freeway safety performance using traffic flow data as predictors. *Safety Science*, Volume 46, Issue 9, 2008, Pages 1306-1333, Retrieved April 6, 2022, from Science Direct database <<https://www.sciencedirect.com/science/article/pii/S0925753507001348>>.

**Table 7-1: Number of Crashes and Crash Severity by Facility between 2016 and 2018**

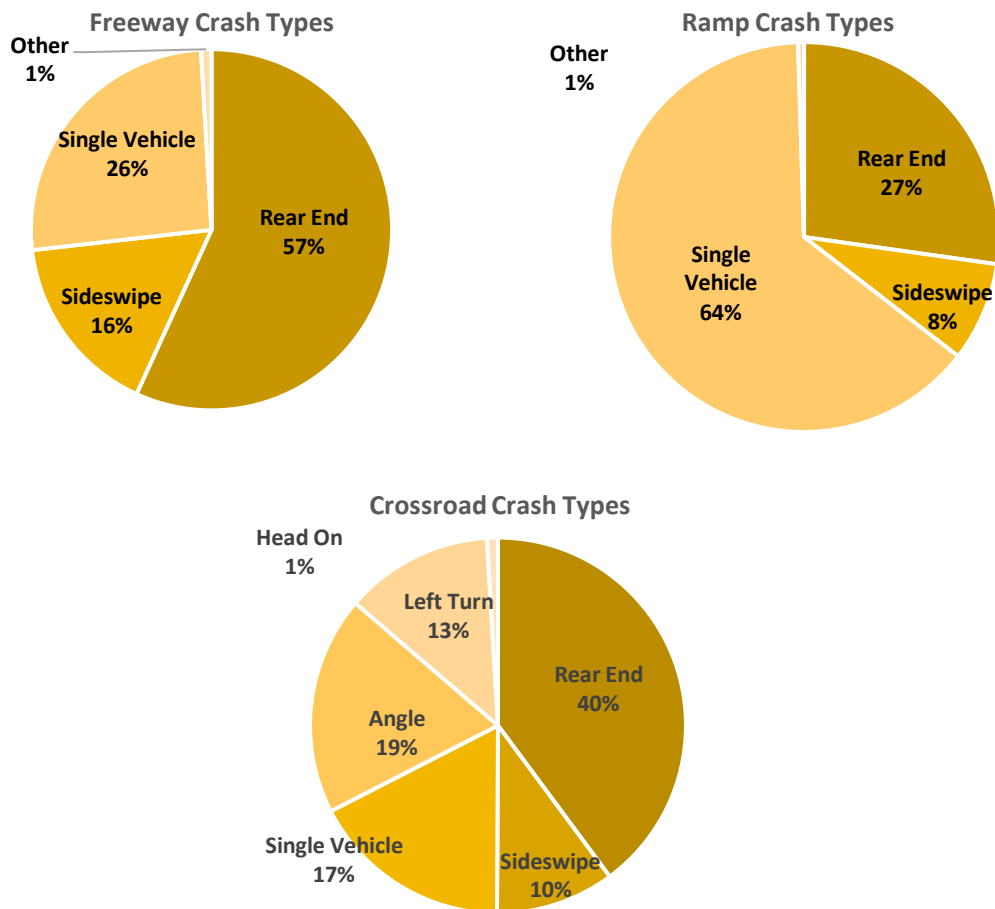
| FACILITY        | Facility          | Length in miles <sup>1</sup> | Total Number of Crashes | Fatal and Injury Crashes | Property Damage Only Crashes | Proportion of Fatal and Injury Crashes | Proportion of Property Damage Only Crashes |
|-----------------|-------------------|------------------------------|-------------------------|--------------------------|------------------------------|--|--|
| FREEWAY         | I-270 & East Spur | 9.6                          | 1453                    | 485                      | 968                          | 33%                                    | 67%  |
|                 | I-270 West Spur   | 2.0                          | 146                     | 42                       | 104                          | 29%                                    | 71%  |
|                 | I-495 in Maryland | 5.8                          | 849                     | 243                      | 606                          | 29%                                    | 71%  |
|                 | I-495 in Virginia | 1.5                          | 440                     | 112                      | 328                          | 25%                                    | 75%  |
| FREEWAY TOTAL   |                   | 18.9                         | 2,888                   | 882                      | 2,006                        | 31%                                    | 69%  |
| RAMP            | I-270 & East Spur | 25.7                         | 416                     | 105                      | 311                          | 25%                                    | 75%  |
|                 | I-270 West Spur   | 1.8                          | 20                      | 5                        | 15                           | 25%                                    | 75%  |
|                 | I-495 in Maryland | 14.6                         | 121                     | 35                       | 86                           | 29%                                    | 71%  |
|                 | I-495 in Virginia | 4.1                          | 46                      | 13                       | 33                           | 28%                                    | 72%  |
| RAMP TOTAL      |                   | 46.2                         | 603                     | 158                      | 445                          | 26%                                    | 74%  |
| CROSSROAD ALONG | I-270 & East Spur | 3.3                          | 777                     | 296                      | 481                          | 38%                                    | 62%  |
|                 | I-270 West Spur   | 0.5                          | 59                      | 20                       | 39                           | 34%                                    | 66%  |
|                 | I-495 in Maryland | 1.1                          | 230                     | 92                       | 138                          | 40%                                    | 60%  |
|                 | I-495 in Virginia | 0.2                          | 146                     | 45                       | 101                          | 31%                                    | 69%  |
| CROSSROAD TOTAL |                   | 5.1                          | 1,212                   | 453                      | 759                          | 37%                                    | 63%  |
| STUDY AREA      |                   | 70.2 miles                   | 4,703 crashes           | 1,493 F&I crashes        | 3,210 PDO crashes            | 32% F&I crashes                        | 68% PDO crashes                            |

<sup>1</sup>The mileage approximates the miles of roadway accounted for in the crash history assessment provided for the sole purpose of a frame of reference. The mileage values are comparable but may not be equal to the specific mileage of roadway evaluated for the traffic operations or predictive crash frequency.

**Figure 7-1 and 7-2: Annual Crash Frequency & AADT by Freeway Facility and Year**



**Figure 7-3: Crash Type Distribution for Freeways, Ramps, and Crossroads**



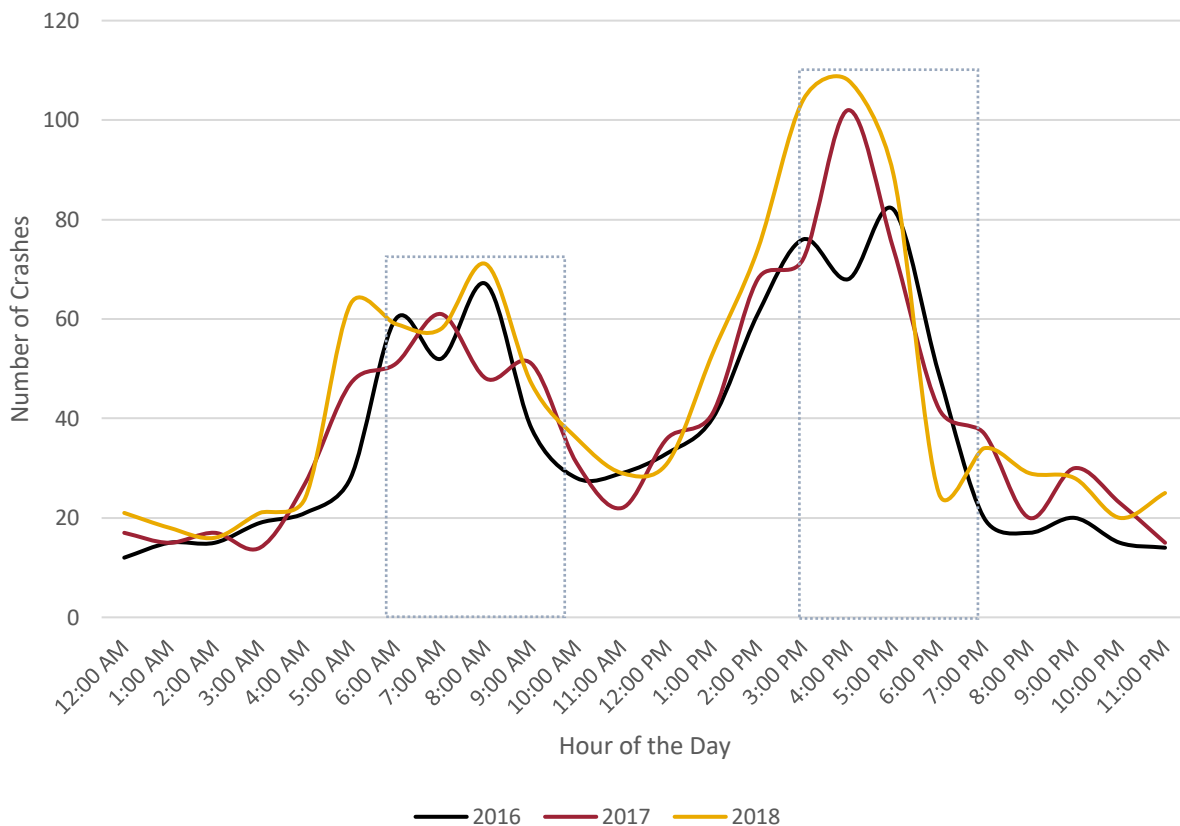
### 7.3.2 Freeway Crash Trends by Time of Day

**Figure 7-4** shows the proportion of crashes occurring by hour of the day for each year of the crash study period.

Based on a review of hourly traffic volumes collected for this study, in addition to speed and travel time data collected from probe data and obtained from the Regional Integrated Transportation Information System (RITIS), the identified peak periods for traffic operations are 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM with peak hours reported for 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM, when speeds are the lowest. Due to the heavy traffic volumes and insufficient roadway capacity, recurring congestion is prevalent throughout the study corridors under existing conditions, specifically during these peak periods as shown by the collected traffic volumes and speed data.

As shown in the figure below, the crash frequency is highest during the identified hours of peak travel (shown by the grey boxes in the figure) and lowest during the hours outside of the peak travel periods. This shows that existing crashes are correlated to peak travel patterns, indicating that the congested operations of the study area contribute to the crash trends.

**Figure 7-4: Crash Frequency Distribution by Time of Day by Year**

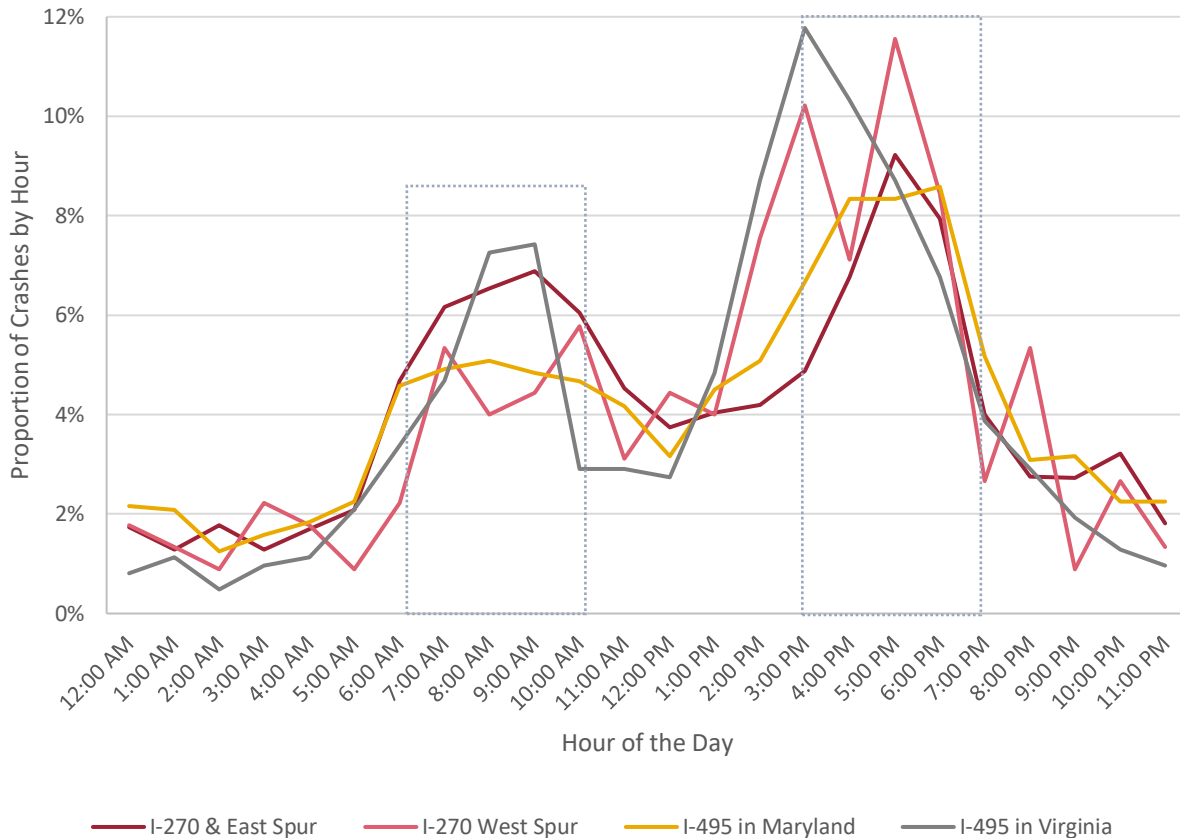




**Figure 7-5** shows the proportion of crashes occurring by hour by facility accounting for all crashes occurring within the three-year crash study period.

Across each of the four study freeways, 50 – 60% of the crashes occurred during peak periods (6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM, as shown by the grey boxes in the figure), and all four study freeways have the similar trend of an increase in crashes during the peak periods.

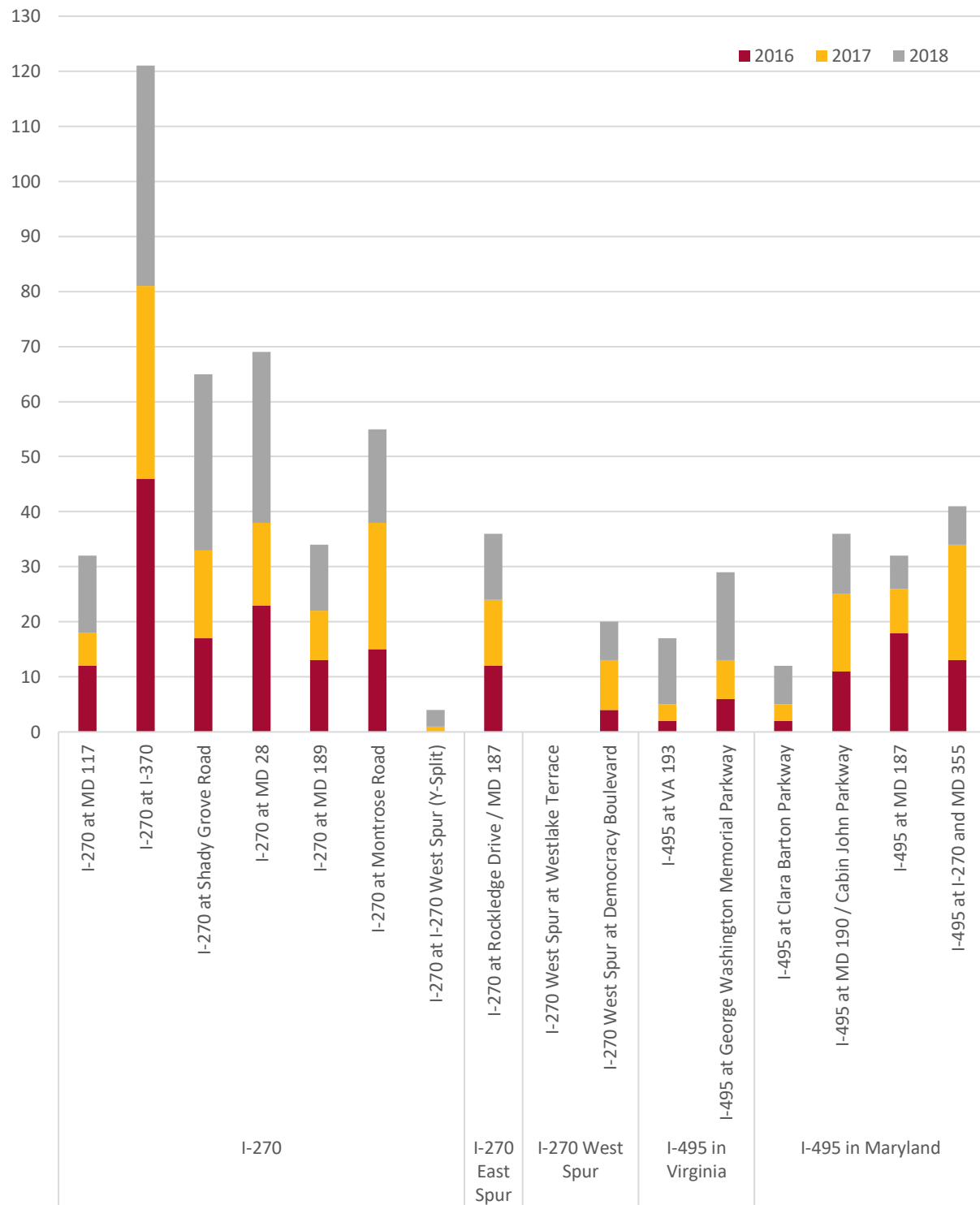
**Figure 7-5: Crash Frequency Distribution by Time of Day by Facility**



### 7.3.3 Ramp Crash Trends

The number of crashes occurring over the three-year crash study period from January 2016 through December 2018 on the ramps within each interchange of the study area are shown in **Figure 7-6**. Approximately 600 crashes occurred along the ramps within the study area between 2016 and 2018. The ramps serving the I-270 at I-370 interchange experienced the highest number of crashes, while no crashes were reported along the ramps within the I-270 at Westlake Terrace interchange during the crash study period. See **Table 7-6** for additional information on crash patterns along select ramps that are identified as high crash locations per this study's safety analysis methodologies.

**Figure 7-6: Ramp Crashes by Interchange by Year**



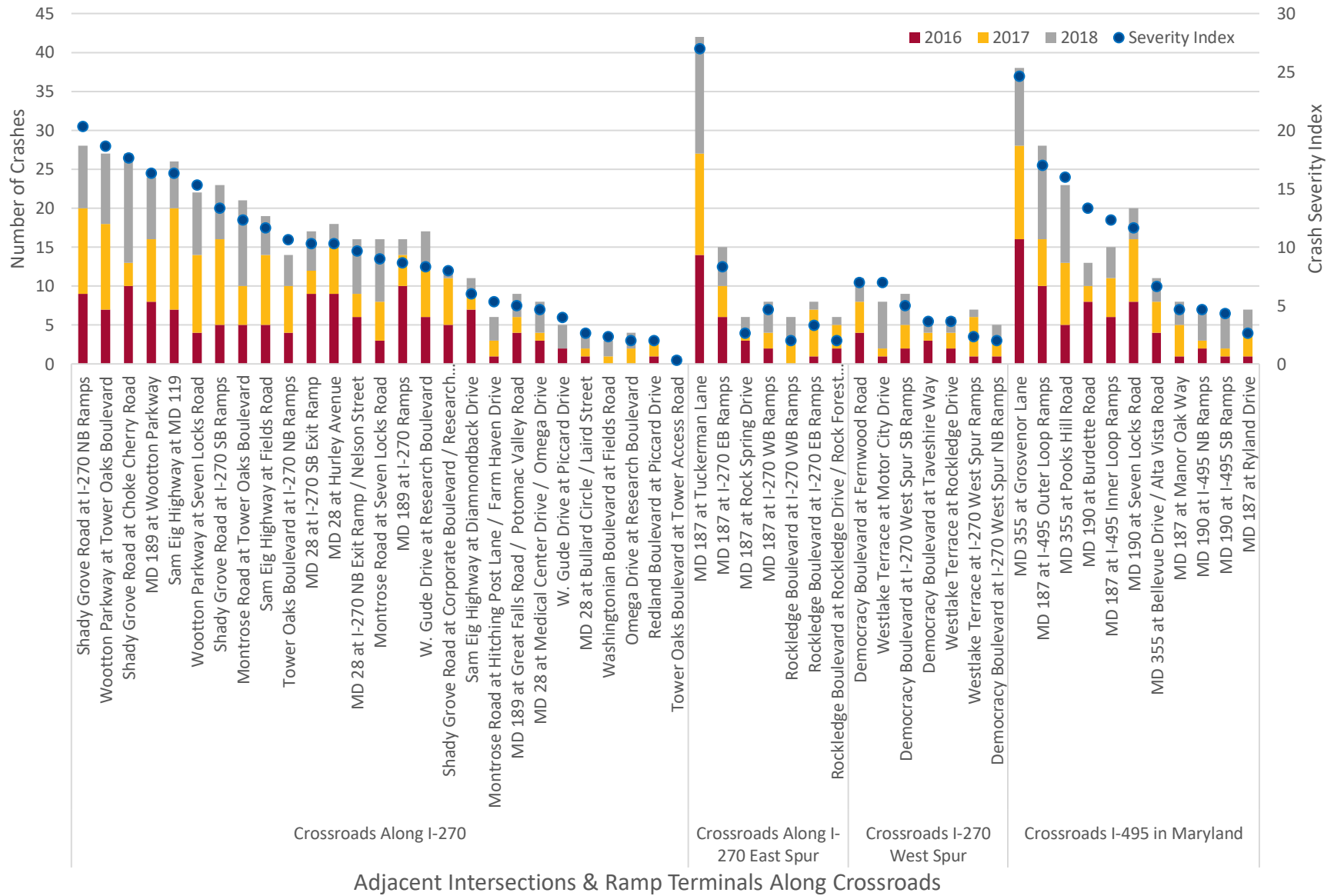
### 7.3.4 Intersection Crash Trends

**Figure 7-7** shows the number of crashes that occurred at each study intersection within the study area and include intersections within the interchange that serve ramp junctions, as well as the next adjacent major intersections. Additionally, the Crash Severity Index<sup>14</sup> for each intersection is graphed, indicated by the blue circles. The Crash Severity Index is a weighted crash frequency adjustment to account for crash severity and is one of MDOT's tools to screen for locations that may be a candidate for a safety study. It is also used to rank locations for MDOT's systematic safety program – CSIL program. The Crash Severity Index value is an average of the Crash Severity Index for each year of the three-year crash study period from January 2016 through December 2018. While the vertical bar shows the number of crashes that occurred at each intersection over a three-year period, the Crash Severity Index provides a frame of reference for the severity of the crashes experienced at the location. A higher Crash Severity Index indicates a higher proportion of fatal and injury crashes. None of the intersections within the study area are on MDOT's current CSIL list indicating that MDOT has not identified any of the intersections within the IAPA study area as a location with a significant crash severity history compared to other locations; refer to **Section 7.4.2** for more information. See **Table 7-6** for additional information on crash patterns at select intersections that are identified as a high crash location per this study's safety analysis methodology.

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<sup>14</sup> MDOT's crash severity index assigns the following weighting factors to each severity type: fatality (15), incapacitating injury (7), non-incapacitating injury (4), possibly injury (2), and property damage only (1)

Figure 7-7: Intersection Crashes by Year with Crash Severity Index



## 7.4 EXISTING HIGH CRASH LOCATIONS

The crash data analysis identifies existing high crash locations, and the qualitative analysis considers how the Preferred Alternative may influence the existing crash patterns. Two methods are employed to identify the high crash locations. Freeway high crash locations are identified through a crash rate comparison to the statewide average crash rates for similar facilities. Since average crash rates for ramps, crossroad segments, and intersections were not available, high crash locations on ramps and crossroads were identified through a visual crash cluster analysis.

### 7.4.1 Freeway High Crash Rate Locations

Freeway crash rates (crashes per year per one hundred million vehicle miles traveled), are often used by MDOT SHA to determine locations that have a crash rate that is higher than the average statewide crash rate. To further evaluate the crash data and identify crash trends for the study area, I-270 and I-495 were evenly divided into quarter-mile segments, and a crash rate was calculated for each segment. The crash rate calculation is based on crash data for the three-year study period and AADT averaged across the same three years. Evaluating the corridors by quarter-mile segments is a common practice for large-scale studies conducted by MDOT SHA. Additionally, VDOT's Interchange Justification Report for I-495 Express Lanes Northern Extension, a project within the same National Capital Area region as the Preferred Alternative, also used the quarter-mile segment methodology to analyze crash data and identify crash trends along I-495.

The crash rates for each quarter-mile segment were then compared to the respective Maryland and Virginia crash rates for similar facilities. The statewide average crash rates are shown in **Table 7-2**. Crash rates are provided for three categories: fatal/injury crash rates, property damage only crash rates, and total crash rates. The average crash rates for the Maryland freeways represent a statewide average crash rate for state-maintained freeways with full access-control and three or more lanes. These average rates are provided by MDOT SHA's Office of Traffic and Safety. The average crash rates shown for the Virginia facilities represent a statewide average crash rate for urban interstates and were obtained from VDOT's Tableau Crash Database. See **Figure 7-8 through Figure 7-11** for a graphical representation of the crash rates by quarter-mile segments by study freeway.

As shown in **Table 7-3**, of the 37.66 miles of freeway within the study area accounting for both directions of each freeway, 27% of the study freeway mileage have a crash rate greater than the respective statewide average. To identify locations with the greatest safety needs and highest crash rates, quarter-mile segments with twice the statewide average crash rate for fatal/injury, property damage only, and total crash rates were determined. These segments are shown in **Table 7-4**. Of the 37.66 miles of freeway within the study area, 12% of the study freeway mileage have a crash rate two times greater than the statewide average. Broken down by crash severity, 9% of the study freeway mileage has a fatal and injury crash rate two times greater than the statewide average, and 14% of the study freeway mileage has a property damage only crash rate two times greater than the statewide average.

See **Section 7.4.4** for more information on the predominant crash patterns at the high crash locations and the potential impacts associated with the Preferred Alternative.

**Table 7-2: Average Crash Rates for Freeways in Maryland and Virginia**

| Applicability to Study Freeways  | Average Fatal and Injury Crash Rate   | Average Property Damage Only Crash Rate | Average Total Crash Rate |
|--|---|---|--------------------------|
|  | <i>Rates shown in crashes per year per 100 million vehicle miles traveled</i> |   |                          |
| I-270 & East Spur<br>I-270 West Spur<br>I-495 in Maryland <sup>1</sup> | 16.1  | 28.2                                    | 44.3                     |
| I-495 in Virginia <sup>2</sup>   | 22.5  | 58.6                                    | 81.0                     |

<sup>1</sup>Maryland statewide average crash rates are based on crash data for the 2016 to 2018 three-year period and AADT averaged over the same three years. The average crash rates shown for the Maryland facilities are for state-maintained divided full access-controlled freeways with three or more lanes.

<sup>2</sup>Virginia statewide average crash rates shown are based on crash data for the 2016 to 2018 three-year period for urban interstates and are obtained from VDOT's Tableau Crash Database.

**Table 7-3: Proportion of Freeway with a Crash Rate Greater than Statewide Average**

| Facility          | Direction of Travel | Total Miles of Roadway | Number of Quarter-Mile Segments with Total Crash Rate Greater than the Statewide Average Crash Rate for Similar Facilities | Miles of Roadway with Total Crash Rate Greater than the Statewide Average Crash Rate for Similar Facilities | Percent of Roadway with Total Crash Rate Greater than the Statewide Average Crash Rate for Similar Facilities |
|-------------------|---------------------|------------------------|--|---|---|
| I-270 & East Spur | Northbound          | 9.55                   | 12   | 3.00  | 31%   |
|                   | Southbound          | 9.55                   | 9  | 2.25  | 24%   |
| I-270 West Spur   | Northbound          | 2.00                   | 2  | 0.50  | 25%   |
|                   | Southbound          | 2.00                   | 1  | 0.25  | 13%   |
| I-495 in Maryland | Northbound          | 5.78                   | 3  | 0.75  | 13%   |
|                   | Southbound          | 5.78                   | 8  | 2.00  | 35%   |
| I-495 in Virginia | Northbound          | 1.50                   | 4  | 1.00  | 67%   |
|                   | Southbound          | 1.50                   | 2  | 0.50  | 33%   |
| <b>Total</b>      |                     | <b>37.66</b>           | <b>41</b>  | <b>10.25</b>  | <b>27%</b>  |

**Figure 7-8: Freeway Crash Rates by Quarter-Mile Segments for I-270 and East Spur**

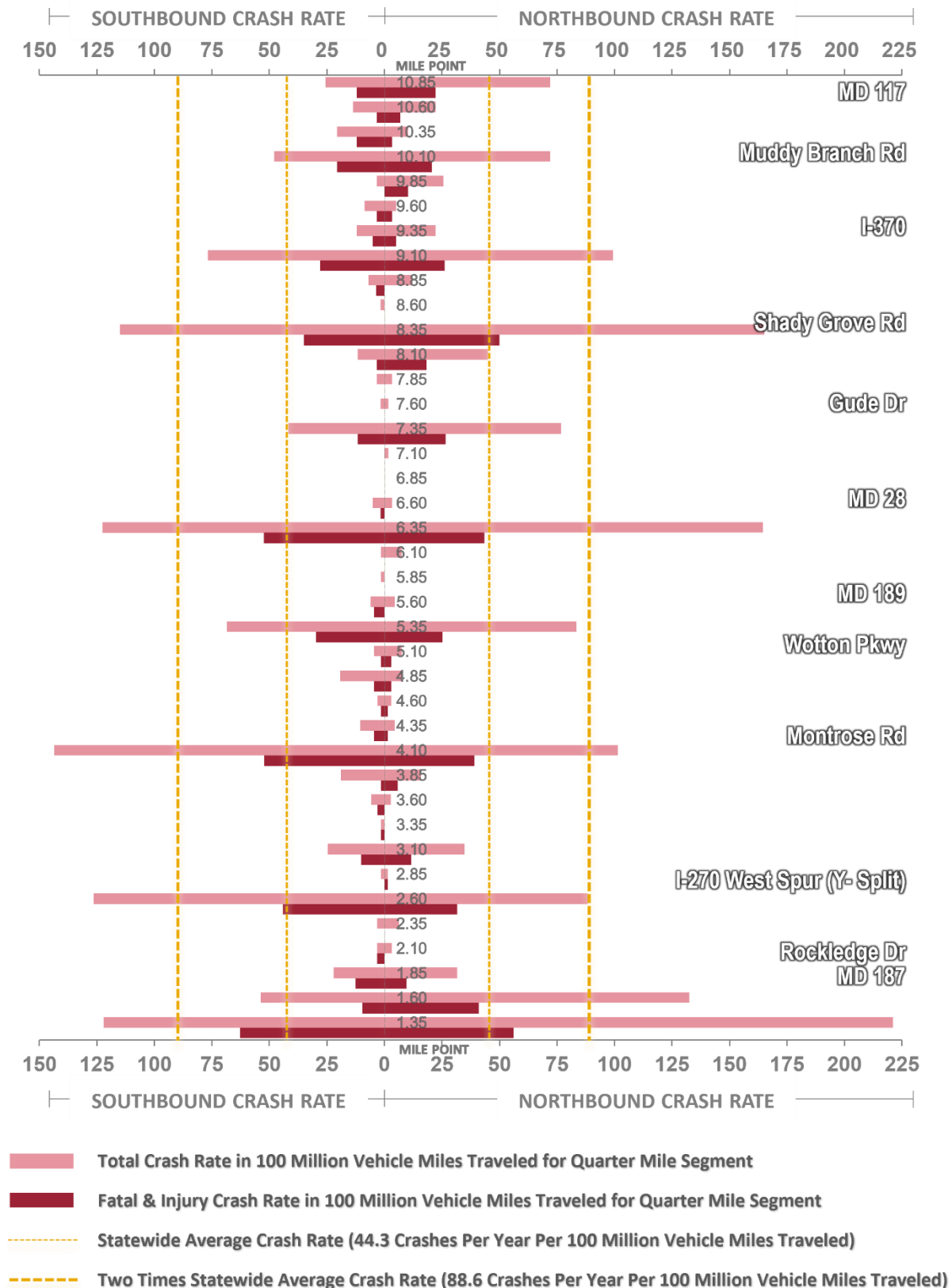
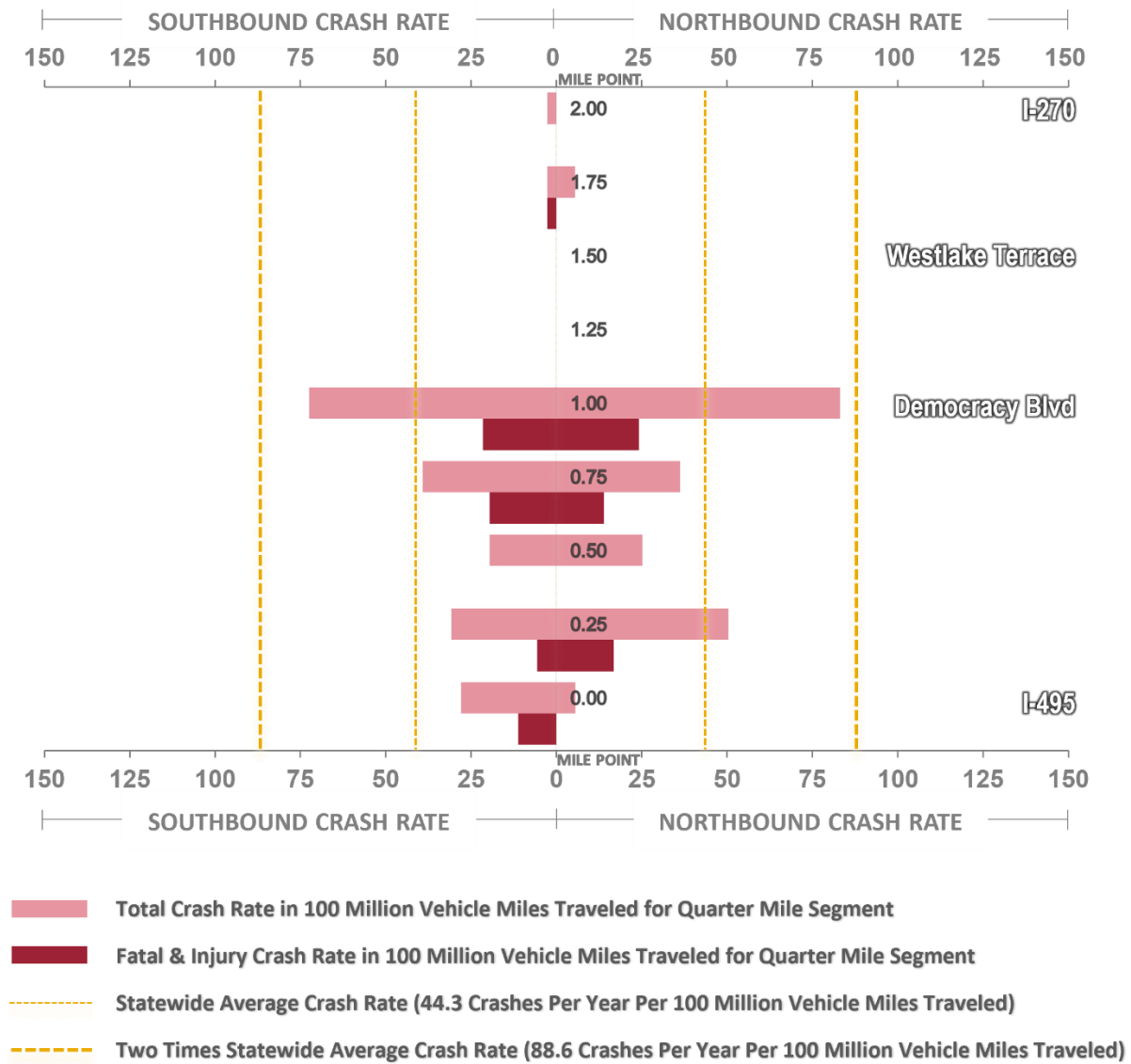
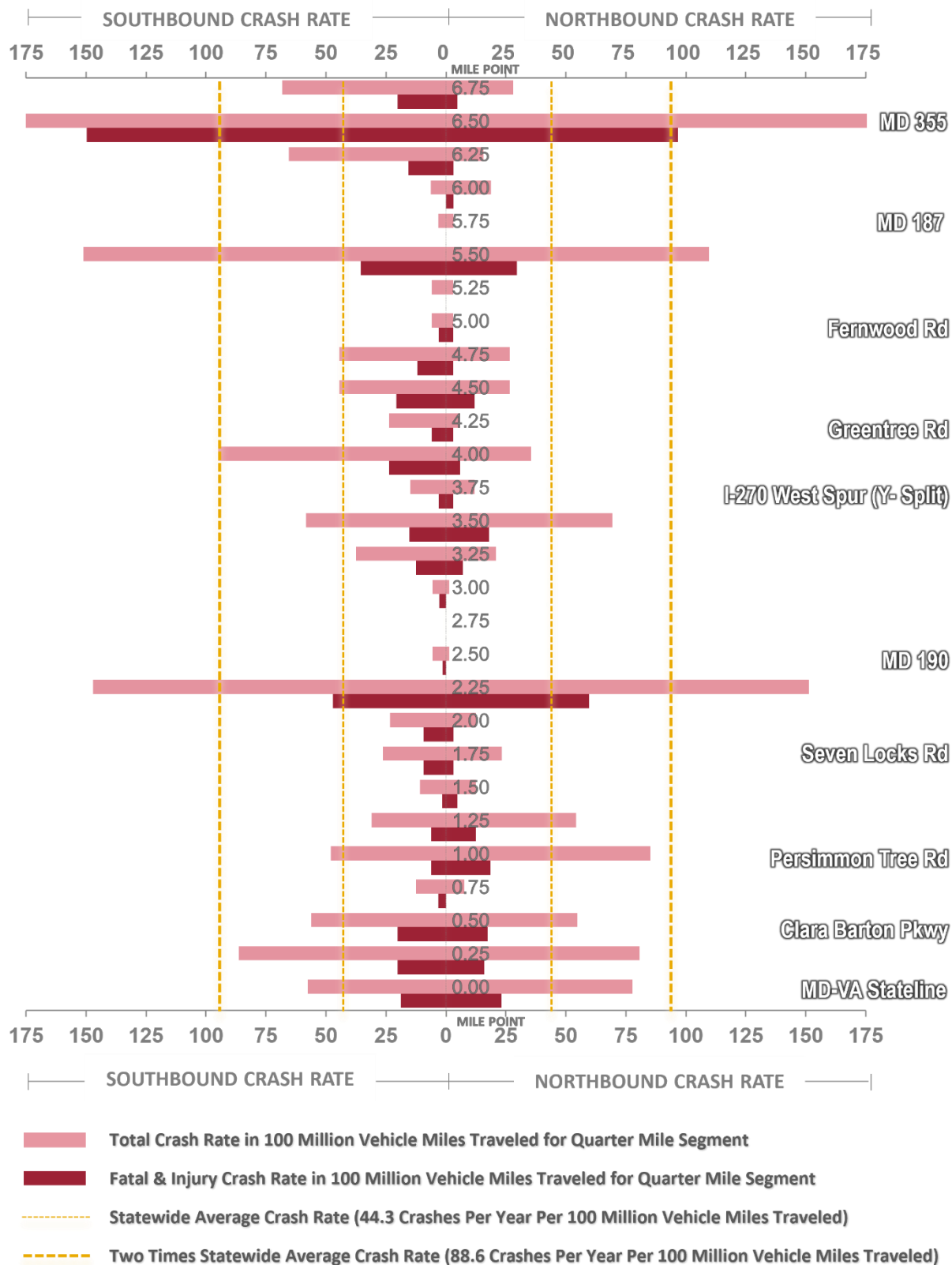




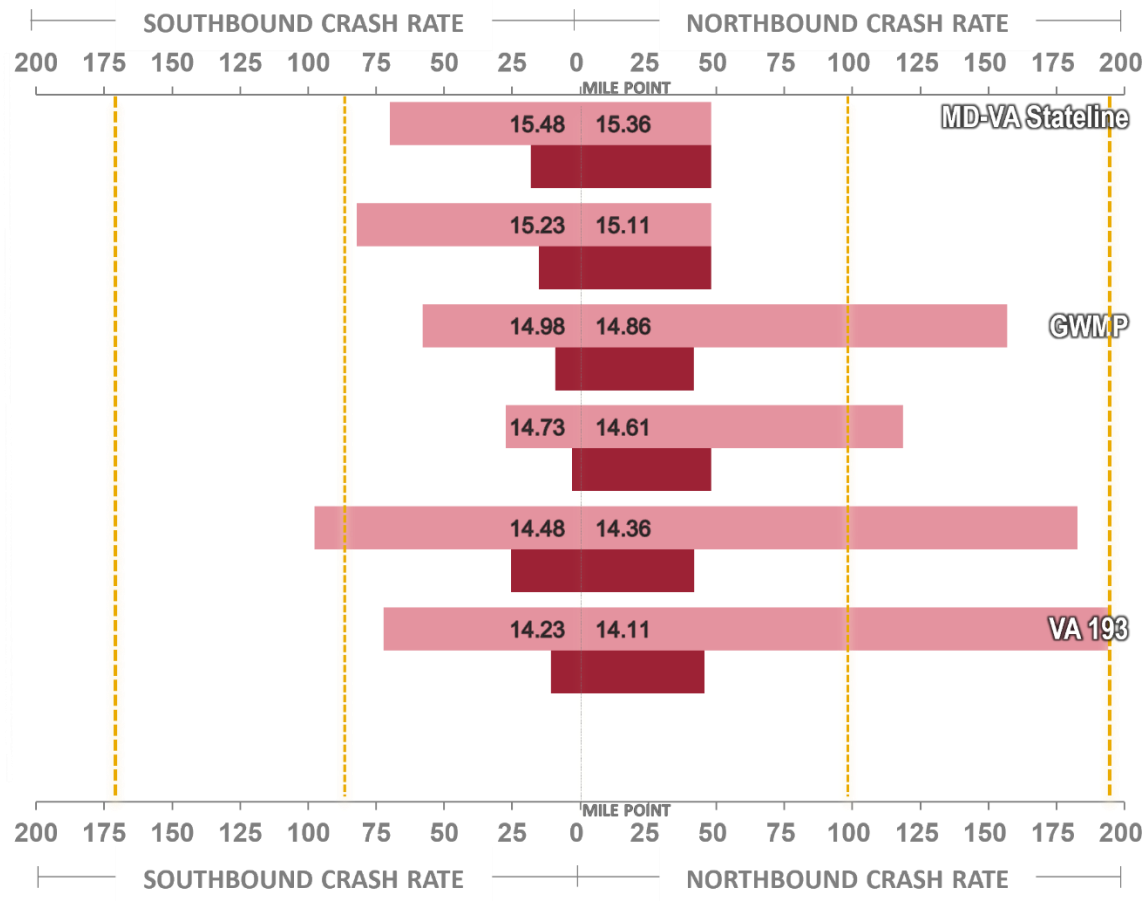
Figure 7-9: Freeway Crash Rates by Quarter Mile Segments for I-270 West Spur



**Figure 7-10: Freeway Crash Rates by Quarter-Mile Segments for I-495 in Maryland**



**Figure 7-11: Freeway Crash Rates by Quarter- Mile Segments for I-495 in Virginia**



- Total Crash Rate in 100 Million Vehicle Miles Traveled for Quarter Mile Segment
- Fatal & Injury Crash Rate in 100 Million Vehicle Miles Traveled for Quarter Mile Segment
- Statewide Average Crash Rate  
NB: 97.00 Crashes Per Year Per 100 Million Vehicle Miles Traveled  
SB: 86.00 Crashes Per Year Per 100 Million Vehicle Miles Traveled
- Two Times Statewide Average Crash Rate  
NB: 194.00 Crashes Per Year Per 100 Million Vehicle Miles Traveled  
SB: 172.00 Crashes Per Year Per 100 Million Vehicle Miles Traveled

**Table 7-4: Quarter-Mile Freeway Segments with a Crash Rate Two Times Above the Statewide Average**

| Facility          | Reference Interchange / Cross Street | Direction  | Start Mile Point | End Mile Point | Crash Rate<br><i>Number of crashes per year per 100 million vehicle miles traveled</i> |                      |              |
|-------------------|--------------------------------------|------------|------------------|----------------|--|----------------------|--------------|
|                   |                                      |            |                  |                | Fatal & Injury   | Property Damage Only | Total        |
| I-270 & East Spur | <u>MD 187</u>                        | NB         | 1.35             | 1.60           | <b>56.1</b>  | <b>165.1</b>         | <b>221.2</b> |
|                   |                                      | SB         |                  |                | <b>62.7</b>  | <b>59.4</b>          | <b>122.1</b> |
|                   | I-270 merge/split Tuckerman Lane     | NB         | 1.60             | 1.85           | <b>41.1</b>  | <b>91.6</b>          | <b>132.7</b> |
|                   |                                      | SB         |                  |                | 31.6   | <b>56.8</b>          | 88.4         |
|                   | Montrose Road                        | NB         | 2.60             | 2.85           | <b>44.2</b>  | <b>82.1</b>          | <b>126.3</b> |
|                   |                                      | SB         |                  |                | <b>39.2</b>  | <b>62.4</b>          | <b>101.6</b> |
|                   | MD 189                               | NB         | 4.10             | 4.35           | <b>52.2</b>  | <b>91.4</b>          | <b>143.6</b> |
|                   |                                      | SB         |                  |                | 25.3   | <b>58.1</b>          | 83.4         |
|                   | MD 28                                | NB         | 5.35             | 5.60           | <b>43.4</b>  | <b>121.2</b>         | <b>164.6</b> |
|                   |                                      | SB         |                  |                | <b>52.4</b>  | <b>70.3</b>          | <b>122.7</b> |
|                   | <u>Shady Grove Road</u>              | NB         | 6.35             | 6.60           | <b>50.0</b>  | <b>115.0</b>         | <b>165.0</b> |
|                   |                                      | SB         |                  |                | <b>35.0</b>  | <b>80.0</b>          | <b>115.0</b> |
|                   | I-370                                | NB         | 8.35             | 8.60           | 26.1   | <b>73.2</b>          | <b>99.3</b>  |
| I-270 West Spur   | Democracy Boulevard                  | NB         | 9.10             | 9.35           | 24.1   | <b>59.0</b>          | <b>83.1</b>  |
| I-495 in Maryland | <u>MD 190 / Cabin John Parkway</u>   | Inner Loop | 2.25             | 2.50           | <b>59.7</b>  | <b>91.6</b>          | <b>151.3</b> |
|                   |                                      | Outer Loop |                  |                | <b>47.2</b>  | <b>99.9</b>          | <b>147.1</b> |
|                   | Greentree Road Bridge                | Outer Loop | 4.00             | 4.25           | <b>23.7</b>  | <b>71.1</b>          | <b>94.8</b>  |
|                   | MD 187                               | Inner Loop | 5.50             | 5.75           | <b>29.6</b>  | <b>80.0</b>          | <b>109.6</b> |
|                   |                                      | Outer Loop |                  |                | <b>35.6</b>  | <b>115.6</b>         | <b>151.2</b> |
| I-495 in Virginia | VA 193                               | Inner Loop | 13.86            | 14.11          | 45.7   | <b>148.4</b>         | 194.1        |
|                   |                                      |            | 14.11            | 14.36          | 41.9   | <b>140.8</b>         | 182.7        |

Underlined interchanges indicate freeway segments that were identified as an MDOT SHA CSIL; see **Section 7.4.2**. **Bold** crash rates indicate freeway segments with average crash rates that are greater than two times the statewide average for similar facilities for respective crash rate type.

#### 7.4.2 MDOT SHA Candidate Safety Improvement Locations

As part of MDOT's Highway Safety Improvement Program, MDOT SHA Office of Traffic and Safety develops a ranking of state-maintained intersections and one-half mile roadway sections and identifies them as Candidate Safety Improvement Locations (CSIL). Each MDOT SHA District Traffic division then performs traffic engineering studies to develop practical conceptual solutions that address identified roadway features or conditions that may contribute to the historical crash patterns at the CSIL. Locations are either categorized as Candidate Safety Improvement Sections (CSIS) or Candidate Safety Improvement Intersections (CSII). The CSIS and CSII lists are developed approximately every three years with each list offset by one and a half years. Therefore, the applicable CSIL lists at the time of this study are the 2018 CSIS list and the 2019 CSII list.

Instead of crash rates, MDOT’s program identifies CSIL using a Crash Severity Index calculated from a modified Equivalent Property Damage Only (EPDO) scale. MDOT utilizes this method, as they found that high crash locations identified through these processes using three or more years of historical crash data often provide locations that have potential infrastructure solutions that may help reduce the severity of crashes. The 2018 CSIS list is based on 2018 Crash Severity Index data. The 2019 CSII list is based on 2019 Crash Severity Index data.

CSIS within the study area are shown in **Table 7-5**. These three segments are also identified in **Table 7-4** as locations with a crash rate more than two times the statewide average. No intersections within the study area have been identified as a CSII.

**Table 7-5: MDOT CSIL within the Study Area**

| Facility                 | Reference Interchange or Cross Street | Start Mile Point | End Mile Point | Total Crashes | Severity Index |
|--------------------------|---------------------------------------|------------------|----------------|---------------|----------------|
| <i>I-270 East Spur</i>   | <i>MD 187</i>                         | <i>1.39</i>      | <i>1.89</i>    | <i>82</i>     | <i>114</i>     |
| <i>I-270</i>             | <i>Shady Grove Road</i>               | <i>8.20</i>      | <i>8.70</i>    | <i>81</i>     | <i>110</i>     |
| <i>I-495 in Maryland</i> | <i>MD 190 / Cabin John Parkway</i>    | <i>1.90</i>      | <i>2.40</i>    | <i>86</i>     | <i>123</i>     |

### 7.4.3 Ramp and Crossroad High Crash Locations

High crash locations on ramps and along crossroads were identified through a visual crash cluster analysis since average crash rates were not available for these facilities. Crashes along the ramps and crossroads within the study area were spatially reviewed, visually identifying crash clusters. This process identified crash clusters using engineering judgement. For example, a pattern of multiple, run-off-the-road, fixed-object crashes along a ramp segment may be considered a crash cluster. Ramps and crossroads where no crash pattern was identified via the visual screening method were eliminated from further evaluation. Figures showing the results of the crash cluster analysis to identify high crash locations are in **Appendix J**.

### 7.4.4 High Crash Location Summary

The identified high crash locations along the freeway, ramps, ramp terminals, and intersections along the crossroads are shown on **Figure 7-12** and listed in **Table 7-6**. High crash locations were identified early on, so that each location with an existing crash pattern could be assessed to determine if there are design improvements that could be incorporated as part of the Preferred Alternative to better address safety performance concerns. **Table 7-6** provides a summary of the results of this process.

In **Table 7-6**, the locations are qualitatively discussed through identification of the predominant crash patterns; existing geometric features; an evaluation of the potential major contributing factors; and potential impacts (benefits and/or disbenefits) associated with the Preferred Alternative. For the purposes of this study, 12 quarter-mile freeway segments, 5 ramps, and 8 ramp terminals/intersections along the crossroads were identified as high crash locations based on historical crash rates and/or patterns. The identified freeway segments are those that experienced a crash rate greater than two times

the statewide average; three of which are CSIS and therefore are part of MDOT's CSIL program. Additional discussion of the proposed access and interchange modifications and potential safety impacts for each interchange is provided in **Section 7.5**.



**Figure 7-12: High Crash Locations within the Study Area**





**Table 7-6: High-Crash Locations, Major Contributing Factors & Potential Impacts Associated with Preferred Alternative**

| Quarter Mile Freeway Segments with High Crash Rates |   |  |  |  |
|---|---|--|--|--|
| Location Shown from North to South                  |   | Predominant Crash Pattern  | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative  |
| A   | I-270 local lanes entrance south of I-370 | <ul style="list-style-type: none"> <li>NB rear-end crashes at slip ramp entrance from local lanes to the express lanes south of I-370</li> </ul> | <ul style="list-style-type: none"> <li>High-volume merge at ramp from local lanes</li> </ul> | <ul style="list-style-type: none"> <li>As part of the I-270 Innovative Congestion Management (ICM) project, the exit lane for I-370 will be extended to tie in with the entrance ramp from Shady Grove Road and the slip lane entrance from the local lanes to the express lanes will be removed; these improvements are expected to reduce weaving and the potential for weaving-related crashes in this section and will be maintained with the Preferred Alternative.</li> <li>With the Preferred Alternative, the separation between the express lanes and local lanes along I-270 will be removed as the local/Collector-Distributor system is over capacity. Six total northbound General Purpose lanes are proposed - five thru lanes and an auxiliary between Shady Grove Road and I-370.</li> </ul> |

| Quarter Mile Freeway Segments with High Crash Rates |  |  |  |  |
|---|--|--|--|--|
| Location Shown from North to South                  |  | Predominant Crash Pattern  | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative  |
| B   | I-270 at Shady Grove Road Interchange (CSIS) | <ul style="list-style-type: none"> <li>PM peak period rear-end crashes at merge from loop ramp from EB Shady Grove Road to I-270 NB local lanes</li> <li>Rear-end &amp; single-vehicle crashes along I-270 Northbound local lanes immediately downstream of exit ramp to EB and WB Shady Grove Road</li> </ul> | <ul style="list-style-type: none"> <li>High volume of traffic diverging and merging</li> <li>Congestion</li> </ul> | <ul style="list-style-type: none"> <li>With the Preferred Alternative, during peak congestion times, the volume using the existing on-ramp to I-270 Northbound will be reduced by approximately 8% in 2045, and the volume using the northbound off-ramp to Shady Grove Road will be reduced by approximately 30% which may reduce the potential for crashes due to reduced exposure/frequency of weaving maneuvers.</li> <li>The Preferred Alternative removes the barrier-separated local lanes along I-270, which eliminates the slip ramps and respective merge/diverge conflict points but introduces a weaving section along the General Purpose lanes through this interchange area.</li> <li>The maximum queue lengths on the Shady Grove EB and WB on-ramps to I-270 NB will be significantly reduced with the 2045 Preferred Alternative during the PM peak period which reduces the magnitude of stop-and-go conditions that can increase the potential for crashes.</li> </ul> |

| Quarter Mile Freeway Segments with High Crash Rates |                               |  |   |  |
|---|-------------------------------|--|---|--|
| Location<br>Shown from North to<br>South            |                               | Predominant Crash Pattern  | Geometric Features & Potential<br>Contributing Factors  | Potential Impacts Associated with Preferred<br>Alternative   |
| C   | I-270 at MD 28<br>Interchange | <ul style="list-style-type: none"> <li>Single-vehicle &amp; rear-end crashes at I-270 NB local lanes slip ramp merge to the express lanes south of MD 28 interchange</li> <li>Rear-end crashes at slip ramp from I-270 NB General Purpose lanes to local lanes north of MD 28</li> </ul> | <ul style="list-style-type: none"> <li>High volume traffic merges</li> <li>Left-hand merge condition</li> </ul> | <ul style="list-style-type: none"> <li>The I-270 ICM project provides additional auxiliary lanes in both directions along I-270 between the MD 189 and MD 28 interchanges; these auxiliary lanes are intended to help reduce bottlenecks and weaving and will be maintained with the Preferred Alternative.</li> <li>The Preferred Alternative removes the Collector-Distributor facility along I-270, eliminating slip ramps and respective merge/diverge conflict points between the General Purpose and local lanes, which mitigates the hot spot crash location at the through and local lane merge points, but also adds a weaving section along the General Purpose lanes.</li> <li>The duration of maximum queue lengths on the MD 28 WB on-ramp to I-270 NB will be reduced with the 2045 Preferred Alternative which reduces the duration and magnitude of stop-and-go conditions that can increase the potential for crashes.</li> </ul> |

| Quarter Mile Freeway Segments with High Crash Rates |                                |  |   |   |
|---|--------------------------------|--|---|---|
| Location<br>Shown from North to<br>South            |                                | Predominant Crash Pattern  | Geometric Features & Potential<br>Contributing Factors                                      | Potential Impacts Associated with Preferred<br>Alternative  |
| D   | I-270 at MD 189<br>Interchange | <ul style="list-style-type: none"> <li>NB PM peak period rear-end crashes</li> </ul> | <ul style="list-style-type: none"> <li>Basic freeway segment</li> <li>Congestion</li> </ul> | <ul style="list-style-type: none"> <li>The traffic analysis shows that the Preferred Alternative reduces density along the NB General Purpose lanes approaching this interchange, specifically in the northbound direction within the diverge segment to MD 189, which reduces the potential for stop-and-go conditions that can contribute to crashes.</li> <li>The duration of maximum queue lengths on the MD 189 EB and WB on-ramps to I-270 NB will be reduced with the 2045 Preferred Alternative which reduces the duration and magnitude of stop-and-go conditions that can increase the potential for crashes.</li> <li>The Preferred Alternative removes the barrier-separated local lanes along I-270, which eliminates the slip ramps and respective merge/diverge conflict points but introduces a weaving section along the General Purpose lanes through this interchange area.</li> </ul> |

| Quarter Mile Freeway Segments with High Crash Rates |                                       |   |   |   |
|---|---------------------------------------|---|---|---|
| Location<br>Shown from North to<br>South            |                                       | Predominant Crash Pattern   | Geometric Features & Potential<br>Contributing Factors  | Potential Impacts Associated with Preferred<br>Alternative  |
| E   | I-270 at Montrose<br>Road Interchange | <ul style="list-style-type: none"> <li>SB rear-end crashes</li> </ul> | <ul style="list-style-type: none"> <li>Cloverleaf interchange with short weaving sections along local lanes between loop ramps</li> <li>Congestion</li> </ul> | <ul style="list-style-type: none"> <li>The I-270 ICM project provides an additional auxiliary lane along I-270 SB from Montrose Road to the West Spur, which is intended to help reduce bottlenecks and weaving and will be maintained with the Preferred Alternative.</li> <li>Although the weaving conflicts cited as a potential contributing factor exists under the Preferred Alternative, the removal of the Collector-Distributor facility will provide more capacity through the interchange, reducing congestion and the potential for stop-and-go conditions which can be a contributing circumstance to rear-end crashes.</li> </ul> |

| Quarter Mile Freeway Segments with High Crash Rates |  |  |  |  |
|---|--|--|--|--|
| Location Shown from North to South                  |  | Predominant Crash Pattern  | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative  |
| F   | I-270 over Tuckerman Lane & I-270 Y-Split    | <ul style="list-style-type: none"> <li>Single-vehicle wet pavement crashes involving vehicles striking traffic barrier along I-270 SB over I-270 West Spur</li> <li>Rear-end crashes in both directions north of Tuckerman Lane</li> </ul> | <ul style="list-style-type: none"> <li>Horizontal curve on bridge along I-270 SB over I-270 West Spur</li> <li>Potentially poor surface friction</li> <li>Potential speeding during uncongested times</li> <li>Congestion during peak periods</li> </ul> | <ul style="list-style-type: none"> <li>The Preferred Alternative proposes increased shoulder widths and addresses variations in superelevation to make them AASHTO compliant.</li> <li>The surface friction will improve due to resurfacing proposed throughout the Preferred Alternative.</li> <li>The I-270 ICM project provides additional auxiliary lanes in both directions along the I-270 West Spur and I-270 mainline up to Montrose Road; these auxiliary lanes are intended to help reduce bottlenecks and weaving and will be maintained with the Preferred Alternative.</li> <li>The Preferred Alternative improvements further reduce the duration of congestion along I-270 which reduces the potential for stop-and-go conditions that can contribute to crashes, including rear-end crashes or vehicles swerving to avoid stopped vehicles.</li> </ul> |
| G   | I-270 East Spur at MD 187 Interchange (CSIS) | <ul style="list-style-type: none"> <li>Off-peak rear-end crashes along I-270 East Spur WB upstream of MD 187 interchange</li> </ul>  | <ul style="list-style-type: none"> <li>Diverge for right-side exit ramp</li> </ul>   | <ul style="list-style-type: none"> <li>No geometric changes are proposed as part of the Preferred Alternative at this diverge location.</li> <li>The Preferred Alternative reduces the duration of congestion along I-270 East Spur which reduces the potential for stop-and-go conditions that can contribute to crashes, including rear-end crashes or vehicles swerving to avoid stopped vehicles.</li> </ul>   |

| Quarter Mile Freeway Segments with High Crash Rates |  |   |  |   |
|---|--|---|--|---|
| Location Shown from North to South                  |  | Predominant Crash Pattern   | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative   |
| H   | I-270 West Spur at Democracy Boulevard | <ul style="list-style-type: none"> <li>NB rear-end crashes throughout the day approaching the exit ramp to Democracy Boulevard</li> </ul> | <ul style="list-style-type: none"> <li>Beginning of HOV lane</li> <li>High volume non-HOV2 vehicles and trucks from left-most lane merge right to avoid a \$500 fine &amp; 1 point on license</li> </ul> | <ul style="list-style-type: none"> <li>As the Preferred Alternative replaces the one HOV lane in each direction along I-270 Northbound and Southbound with two HOT managed lanes in each direction, the existing lane-change movement of northbound non-HOV vehicles weaving out of the leftmost lane when peak-period HOV restrictions are in effect will be eliminated.</li> <li>The Preferred Alternative reduces the duration of congestion along I-270 West Spur which reduces the potential for stop-and-go conditions that can be a contributing circumstance to crashes, including rear-end crashes.</li> </ul> |
| I   | I-495 at MD 187 Interchange            | <ul style="list-style-type: none"> <li>Inner Loop rear-end crashes</li> </ul>   | <ul style="list-style-type: none"> <li>Diverge for right-side exit ramp</li> <li>Congestion</li> </ul>   | <ul style="list-style-type: none"> <li>No geometric changes are proposed at this interchange which is outside the limits of the Preferred Alternative.</li> <li>The HOT lane facility truncates approximately one mile west of the MD 187 interchange with at-grade ramps between the HOT lane facility and the General Purpose lanes creating new merge and diverge points along I-495.</li> <li>The Preferred Alternative reduces the duration of congestion along the Inner Loop, but congestion is still present due to downstream bottlenecks located outside the limits of the Preferred Alternative.</li> </ul>  |



| Quarter Mile Freeway Segments with High Crash Rates |                                   |   |   |   |
|---|-----------------------------------|---|---|---|
| Location<br>Shown from North to<br>South            |                                   | Predominant Crash Pattern   | Geometric Features & Potential<br>Contributing Factors  | Potential Impacts Associated with Preferred<br>Alternative  |
| J   | I-495 at Greentree<br>Road Bridge | <ul style="list-style-type: none"> <li>AM and PM peak period Outer Loop rear-end crashes</li> </ul> | <ul style="list-style-type: none"> <li>Rightmost lane reduction on the Outer Loop requiring vehicles to merge left</li> <li>Congestion</li> </ul> | <ul style="list-style-type: none"> <li>The Preferred Alternative removes the existing downstream lane reduction where the Outer Loop merges with traffic from the I-270 West Spur, eliminating this merge condition as contributing factor for rear-end crashes with the Preferred Alternative.</li> <li>The Preferred Alternative reduces the magnitude and duration of congestion along the Outer Loop, which reduces the potential for stop-and-go conditions that can be a contributing factor to crashes, including rear-end crashes.</li> </ul> |

| Quarter Mile Freeway Segments with High Crash Rates |   |  |  |  |
|---|---|--|--|--|
| Location Shown from North to South                  |   | Predominant Crash Pattern  | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative  |
| K   | I-495 at MD 190/Cabin John Parkway Interchange (CSIS) | <ul style="list-style-type: none"> <li>Outer Loop, rear-end, PM peak period crash cluster at diverge to Cabin John Parkway</li> <li>Inner Loop, rear-end crash clusters at merges from Cabin John Parkway &amp; at entrance ramp from MD 190 WB</li> </ul> | <ul style="list-style-type: none"> <li>Multiple, closely spaced merges and diverges</li> <li>Congestion</li> </ul> | <ul style="list-style-type: none"> <li>The Preferred Alternative reduces the magnitude and duration of congestion along the Outer Loop, which reduces the potential for stop-and-go conditions that can be a contributing factor to crashes, including rear-end crashes.</li> <li>The Preferred Alternative reduces the duration of congestion along the Inner Loop, but congestion is still present due to downstream bottlenecks located outside the limits of the Preferred Alternative.</li> <li>With less General Purpose lane mainline and ramp volumes, less merging friction during the AM and PM peak periods is expected to be reduced.</li> <li>The duration that maximum ramp queues exceed their storage capacity will be reduced during the afternoon peak period (compared to the No Build).</li> <li>The Preferred Alternative removes all three existing loop ramps, reconfiguring the clover-leaf design to a diamond interchange. The reconfiguration removes the weaving segments between the existing loop ramps along the Outer Loop and reduces the potential for crashes due to horizontal curvature.</li> </ul> |

| Quarter Mile Freeway Segments with High Crash Rates |                             |   |   |  |
|---|-----------------------------|---|---|--|
| Location Shown from North to South                  |                             | Predominant Crash Pattern   | Geometric Features & Potential Contributing Factors   | Potential Impacts Associated with Preferred Alternative  |
| L   | I-495 at VA 193 Interchange | <ul style="list-style-type: none"> <li>Inner Loop peak period rear-end crashes upstream of diverge to VA 193 and downstream of diverge to GWMP</li> </ul> | <ul style="list-style-type: none"> <li>High volume diverges and left-hand merge from shoulder lane</li> <li>Congestion</li> </ul> | <ul style="list-style-type: none"> <li>This interchange is included in VDOT's I-495 Express Lane Northern Extension IJR, which concludes that predictive safety analysis of the proposed Express Lanes through this interchange shows a significant reduction in crashes in the I-495 General Purpose lanes near VA 193. Furthermore, with the full Express Lanes network extended into Maryland, it is anticipated that the I-495 corridor in Virginia will operate with less congestion and improved safety.<sup>15</sup></li> </ul> |

<sup>15</sup> VDOT. I-495 Express Lanes Northern Extension (NEXT) Interchange Justification Report. April 2021.

| Ramps with High Crash Frequencies  |                             |   |  |  |
|------------------------------------|-----------------------------|---|--|--|
| Location Shown from North to South |                             | Predominant Crash Pattern   | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative  |
| 1                                  | I-270 NB exit ramp to I-370 | <ul style="list-style-type: none"> <li>58 crashes including 49 wet pavement crashes (38 fixed object, 4 sideswipes, 1 rear-end, &amp; 6 other) which resulted in 1 fatality &amp; 12 persons injured</li> </ul> | <ul style="list-style-type: none"> <li>Weaving conditions approaching the ramp diverge</li> <li>Reverse curve</li> <li>Potentially high speeds</li> <li>Overhead guide signing</li> <li>Potentially poor surface friction</li> </ul> | <ul style="list-style-type: none"> <li>As part of the I-270 ICM project (under construction), the exit lane for I-370 will be extended to tie in with the entrance ramp from Shady Grove Road and the slip lane entrance from the local lanes to the express lanes will be closed; these improvements are expected to reduce weaving approaching the diverge to I-370 and will be maintained with the Preferred Alternative.</li> <li>With the Preferred Alternative, there will be two HOT managed lanes along I-270 Northbound, that will have their own separate off-ramp to I-370. During peak congestion times, the volume using the existing ramp that will serve general-purpose traffic will be reduced by approximately 30% in 2045, which may reduce the potential for crashes due to reduced exposure.</li> <li>The Preferred Alternative also includes roadway resurfacing, which will improve roadway surface friction, address any existing cross-slope deficiencies and/or rutting that may be contributing towards wet-weather crashes.</li> </ul> |

| Ramps with High Crash Frequencies  |  |   |  |  |
|------------------------------------|--|---|--|--|
| Location Shown from North to South |  | Predominant Crash Pattern   | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative  |
| 2                                  | I-270 SB exit ramp to Shady Grove Road/Omega Drive       | <ul style="list-style-type: none"> <li>30 crashes including 21 wet pavement crashes (20 fixed object &amp; 1 other) which resulted in 1 injury</li> </ul>             | <ul style="list-style-type: none"> <li>Tight horizontal curvature</li> <li>Lane drop along I-270 SB onto Shady Grove Road</li> <li>Potentially poor surface friction</li> <li>Congestion</li> <li>Split within ramp to Omega Drive may be contrary to driver's expectations</li> <li>Vegetation overgrowth may limit horizontal sight distance during certain seasons</li> </ul> | <ul style="list-style-type: none"> <li>The Preferred Alternative widens this ramp to three lanes approaching the split to Omega Drive providing additional deceleration and storage length for the movement from I-270 Southbound to Shady Grove Road.</li> <li>The surface friction will improve due to resurfacing proposed throughout the project.</li> </ul>   |
| 3                                  | I-270 NB exit ramp to Shady Grove Road/Redland Boulevard | <ul style="list-style-type: none"> <li>17 crashes including 7 wet pavement crashes (6 fixed object &amp; 1 sideswipe) which resulted in 1 injury</li> </ul>           | <ul style="list-style-type: none"> <li>Tight horizontal curvature</li> <li>Potentially poor surface friction</li> <li>Congestion</li> <li>Split within ramp to Redland Boulevard may be contrary to driver's expectations</li> </ul>   | <ul style="list-style-type: none"> <li>The Preferred Alternative widens this ramp and provides additional deceleration length for the movement from I-270 Southbound to Redland Boulevard.</li> <li>The surface friction will improve due to resurfacing proposed throughout the project.</li> </ul>   |
| 4                                  | I-270 NB exit ramp to MD 28 WB                           | <ul style="list-style-type: none"> <li>39 crashes all wet pavement crashes (1 rear-end, 35 fixed object &amp; 3 other) which resulted in 4 persons injured</li> </ul> | <ul style="list-style-type: none"> <li>Tight horizontal curvature (loop ramp)</li> <li>Short deceleration lane</li> <li>Potentially poor surface friction</li> <li>Congestion</li> <li>Vegetation overgrowth may limit horizontal sight distance during certain seasons</li> </ul>   | <ul style="list-style-type: none"> <li>The Preferred Alternative reduces the duration of congestion along I-270 Northbound, which reduces the potential for stop-and-go conditions which can be a contributing circumstance to crashes.</li> <li>With the Preferred Alternative, during AM and PM peak congestion times in 2045, the volume using the existing off-ramp from I-270 Northbound to MD 28 Westbound is anticipated to be reduced by approximately 18% and 11%, respectively, which may reduce the potential for crashes due to reduced exposure.</li> </ul> |

| Ramps with High Crash Frequencies  |  |  |   |  |
|------------------------------------|--|--|---|--|
| Location Shown from North to South |  | Predominant Crash Pattern  | Geometric Features & Potential Contributing Factors   | Potential Impacts Associated with Preferred Alternative  |
| 5                                  | I-270 SB exit ramp to Montrose Road EB | <ul style="list-style-type: none"> <li>24 crashes, 20 of which were wet pavement crashes (all fixed object PDO)</li> </ul> | <ul style="list-style-type: none"> <li>Tight horizontal curve (loop ramp)</li> <li>Potentially poor friction</li> <li>Congestion</li> </ul> | <ul style="list-style-type: none"> <li>With the Preferred Alternative, the separation between the express lanes and local lanes along I-270 will be removed as the local/Collector-Distributor system is over capacity. Construction of the HOT managed lane facility and removal of the Collector-Distributor facility will provide more capacity through interchange, reducing congestion and the potential for stop-and-go conditions which can be a contributing circumstance to rear-end crashes.</li> <li>With the Preferred Alternative peak congestion times in 2045, the volume using the existing off-ramp from I-270 Southbound to Montrose Road Eastbound is anticipated to be reduced by approximately 9%, which could reduce the potential for crashes due to reduced exposure.</li> </ul> |

| Ramp Terminals & Adjacent Intersections along Crossroad |  |  |  |  |
|---|--|--|--|--|
| Location Shown from North to South                      |  | Predominant Crash Pattern  | Geometric Features & Potential Contributing Factors  | Potential Impacts Associated with Preferred Alternative  |
| 1   | MD 119 at Sam Eig Highway Intersection               | <ul style="list-style-type: none"> <li>19 rear-end crashes with concentrations along the WB right-turn lane and the PM peak period</li> </ul>  | <ul style="list-style-type: none"> <li>Double right-turn with signal control</li> <li>Congestion</li> <li>Vegetation overgrowth obstructing ground-mounted signs</li> </ul>  | <ul style="list-style-type: none"> <li>The Preferred Alternative does not include changes at this location and volumes are expected to remain relatively the same. Therefore, the crash experience at this location is expected to remain like No Build conditions.</li> </ul>   |
| 2   | I-270 NB ramp terminal at Shady Grove Road           | <ul style="list-style-type: none"> <li>22 angle crashes which resulted in 30 persons injured; angle crashes related to failure to obey traffic signal (7) or failure to give full attention (8)</li> </ul> | <ul style="list-style-type: none"> <li>Ramp terminal</li> <li>Far side span wire mounted signal heads are difficult to see as they fade out into the background</li> <li>Vegetation overgrowth limits corner sight distance</li> </ul> | <ul style="list-style-type: none"> <li>The Preferred Alternative proposes to relocate Shady Grove Road approx. 25 feet north of the existing centerline, which includes relocating and reconstructing the traffic signal at the I-270 Northbound ramp terminal at Shady Grove Road. The proposed new traffic signal will have near side and far side mast arm poles, with improved signal visibility.</li> </ul> |
| 3   | Shady Grove Road at Choke Cherry Road Intersection   | <ul style="list-style-type: none"> <li>14 left-turn crashes (6 in 2016, 2 in 2017, 6 in 2018) which resulted in 7 persons injured</li> </ul>   | <ul style="list-style-type: none"> <li>Signalized intersection</li> <li>Blocked sightline for left-turning movements</li> <li>Protected-permissive signal phasing</li> </ul>   | <ul style="list-style-type: none"> <li>The Preferred Alternative does not include changes at this location and volumes are expected to remain relatively the same. Therefore, the crash experience at this location is expected to remain like No Build conditions.</li> </ul>   |
| 4   | Wootton Parkway at Seven Locks Road Intersection     | <ul style="list-style-type: none"> <li>13 left-turn crashes all involving EB &amp; WB left-turns (5 in 2018, 6 in 2017, 2 in 2016) which resulted in 15 persons injured</li> </ul>                         | <ul style="list-style-type: none"> <li>Signalized intersection</li> <li>High volume EB left-turns with permissive-only signal phasing</li> <li>WB left-turn protected-permissive signal phasing</li> </ul>                             | <ul style="list-style-type: none"> <li>The Preferred Alternative includes modifying the signal phasing at this intersection to protected-only for eastbound and westbound left-turns, which will eliminate the potential for permissive left-turn crashes.</li> </ul>  |
| 5   | Wootton Parkway at Tower Oaks Boulevard Intersection | <ul style="list-style-type: none"> <li>15 left-turn crashes involving left-turns from Wootton Parkway</li> </ul>   | <ul style="list-style-type: none"> <li>Signalized intersection</li> <li>Protected-permissive signal phasing</li> <li>WB Wootton Parkway double-left movement recently converted to protected-only signal phasing</li> </ul>            | <ul style="list-style-type: none"> <li>The Preferred Alternative does not include changes at this location; however, the recent change to protected-only left-turn phasing addresses the largest crash cluster.</li> </ul>   |



| Ramp Terminals & Adjacent Intersections along Crossroad |  |  |   |  |
|---|--|--|---|--|
| Location Shown from North to South                      |  | Predominant Crash Pattern  | Geometric Features & Potential Contributing Factors   | Potential Impacts Associated with Preferred Alternative  |
| 6   | Montrose Road at Tower Oaks Boulevard Intersection | <ul style="list-style-type: none"> <li>3 angle crashes (1 injury, 2 PDO) involving SB left-turns from Tower Oaks Boulevard &amp; WB through Montrose Road resulting in 1 person injured</li> <li>10 rear-end crashes (4 WB, 6 EB) which resulted in 5 persons injured</li> </ul> | <ul style="list-style-type: none"> <li>Signalized intersection</li> <li>Signal head visibility is restricted</li> </ul>   | <ul style="list-style-type: none"> <li>The Preferred Alternative does not include changes at this location and volumes are expected to remain relatively the same. Therefore, the crash experience at this location is expected to remain like No Build conditions.</li> </ul> |
| 7   | MD 187 at Tuckerman Lane Intersection              | <ul style="list-style-type: none"> <li>11 NB MD 187 NB left-turn vs SB through crashes (3 in 2016, 4 in 2017, 4 in 2018) which resulted in 15 persons injured</li> <li>6 SB MD 187 rear-end crashes</li> </ul>   | <ul style="list-style-type: none"> <li>Signalized intersection</li> <li>Left-turn lanes do not have a positive offset</li> <li>NB left-turn protected-permissive signal phasing</li> </ul>              | <ul style="list-style-type: none"> <li>The Preferred Alternative does not include changes at this location and volumes are expected to remain relatively the same. Therefore, the crash experience at this location is expected to remain like No Build conditions.</li> </ul> |
| 8   | MD 355 at Grosvenor Lane                           | <ul style="list-style-type: none"> <li>8 angle crashes for the Grosvenor Lane WB and MD 355 SB movement</li> <li>6 rear-end crashes for MD 355 NB and 5 for SB movement</li> <li>3 angle crashes related to the illegal MD 355 NBL movement</li> </ul>                           | <ul style="list-style-type: none"> <li>Signalized intersection</li> <li>Signal head visibility is restricted</li> <li>Driver confusion may contribute towards illegal left turning movements</li> </ul> | <ul style="list-style-type: none"> <li>The Preferred Alternative does not include changes at this location and volumes are expected to remain relatively the same. Therefore, the crash experience at this location is expected to like No Build conditions.</li> </ul>        |

## 7.5 QUALITATIVE SAFETY ASSESSMENT

The Preferred Alternative proposes to construct a two-lane, managed facility along I-270 and I-495. On I-495, the Preferred Alternative will construct two new HOT managed lanes in each direction from the George Washington Memorial Parkway to west of MD 187. On I-270, the Preferred Alternative will convert the one existing HOV lane in each direction to a HOT managed lane and construct one new HOT managed lane in each direction from I-495 to I-370. However, there are other geometric modifications that are planned as part of the Preferred Alternative that may influence safety. For each interchange, a discussion is provided below to explain the proposed access and geometric changes compared to the existing interchange configuration and access. It also assesses how safety may be impacted with the Preferred Alternative because of the geometric or access changes, or because of operational impacts associated with the Preferred Alternative. **Table 3-1** provides an overall summary of the interchanges, proposed HOT managed lanes access, and proposed changes to the General Purpose lanes access. Please refer to **Appendix C** for the proposed lane diagrams and interchange configurations for the Preferred Alternative and **Appendix F** for the proposed conceptual guide signing plan for the Preferred Alternative.

There are 19 total interchanges within the IAPA influence area – this includes four interchanges that are the next adjacent interchange outside the limits of the Preferred Alternative (I-270 at MD 117, I-495 at VA 193, I-495 at MD 187, and I-495 at MD 355/I-270 East Spur). Access to the HOT managed lane facility is proposed at nine interchanges, which includes two locations where no access (General Purpose or managed) between the freeway and crossroad is currently provided. Additionally, new merges and diverges are proposed along I-495 west of MD 187 and I-270 East Spur east of MD 187 at the terminal locations of the HOT lane facility where the HOT managed lanes within the median tie into the General Purpose lanes along the freeway. Lastly, at-grade slip ramps are proposed along I-270 West Spur just north of I-495 near Democracy Boulevard to provide ingress and egress between the HOT managed lanes and General Purpose lanes in both directions.

### 7.5.1 Interchanges along I-270

#### I-270 at MD 117 (next adjacent interchange)

The interchange at I-270 and MD 117 is within the study area; however, the HOT lane facility terminates prior to this interchange at the adjacent interchange to the south (I-370). The Preferred Alternative maintains existing access to the freeway and does not include geometric changes. Impacts to the existing safety performance are not anticipated based on geometry; however, the expected reduction in congestion along I-270 may reduce the potential for congestion-related crashes such as rear-end crashes.

No existing hot spot locations were identified at this interchange.

#### I-270 at I-370 (proposed HOT managed lane access)

The existing interchange at I-270 and I-370 is a partial clover leaf interchange with a loop ramp in the southeast quadrant and directional ramps, including flyover ramps, for the remainder of the ramp connections. The proposed HOT managed lane facility starts and ends along I-270 at I-370. Drivers traveling eastbound or westbound on I-370 wishing to enter the HOT lane facility along I-270 Southbound may do so from new ramps connecting I-370 to I-270 Southbound HOT managed lanes. Similarly, new ramps will connect northbound vehicles using the HOT managed lanes along I-270 with access to I-370 Eastbound and Westbound. The

rightmost lane of the two northbound HOT managed lanes along I-270 will diverge to serve vehicles wanting to access I-370 Eastbound or Westbound and the second HOT managed lane will transition to the HOV lane (operating adjacent to the General Purposes lanes) just north of the bridge over I-370, where the alignment will tie into existing geometry. In the southbound direction, the first HOT managed lane will form from the HOV lane along I-270 just south of the bridge over I-370, which will transition to two southbound HOT managed lanes when the HOT lane ramps from I-370 Eastbound and Westbound merge together and then form the second HOT managed lane along I-270 Southbound.

As part of the I-270 Innovative Congestion Management project (under construction), the exit lane for I-370 will be extended to tie in with the entrance ramp from Shady Grove Road and the slip lane entrance from the local lanes to the express lanes will be closed; these improvements are expected to reduce weaving and the potential for weaving-related crashes in this section and will be maintained with the Preferred Alternative. In addition, with the Preferred Alternative, the separation between the express lanes and local lanes along I-270 south of the I-370 interchange will be removed. Six total northbound General Purpose lanes are proposed, including five thru lanes and an auxiliary lane between Shady Grove Road and I-370. The proposed transition back to existing geometry has the northbound local/Collector-Distributor system begin approximately 1,000 feet south of I-370, after the diverge to I-370 Eastbound and Westbound.

See *Location A, Ramp 1, and Intersection 1* in **Table 7-6** for a discussion of the hot spot locations at this interchange.

### **I-270 at Shady Grove Road**

The existing interchange at I-270 and Shady Grove Road is a partial cloverleaf service interchange with loop ramps in the southeast and northwest quadrants. Access to the HOT managed lane facility is not proposed at this interchange; however, the Preferred Alternative modifies the existing ramps to accommodate mainline widening. As part of the I-270 Innovative Congestion Management project (under construction), the exit lane for I-370 will be extended to tie in with the entrance ramp from Shady Grove Road. This improvement will be retained with the Preferred Alternative. In addition, the off-ramp from I-270 Southbound to Shady Grove Road/Omega Drive will be widened to three lanes approaching the split to Omega Drive, and the off-ramp from I-270 Northbound to Redland Boulevard will be widened and additional deceleration length will be provided for the diverge. Otherwise, the entrance ramp and exit ramps to/from Shady Grove Road are realigned at the respective merge and diverge points to tie in with the widened mainline facility, but the realignments yield minimal changes to the ramp geometry and overall interchange operations relative to existing conditions.

In addition to providing a separate managed lane facility with two HOT lanes, the Preferred Alternative removes the existing Collector-Distributor facility through this interchange, which changes the typical General-Purpose lane cross-section along I-270 from four existing General Purpose (HOV/express) lanes in each direction that are vertically and horizontally barrier separated from two Collector-Distributor (local) lanes to five General Purpose lanes and an auxiliary lane. Removing the Collector-Distributor facility eliminates slip ramps and respective merge/diverge conflict points between the General Purpose and local lanes but also adds a weaving section through the interchange along the General Purpose lanes.

See *Location B, Ramps 2 and 3, and Intersections 2 and 3* in **Table 7-6** for a discussion of the hot spot locations at this interchange.

**I-270 at Gude Drive (new proposed interchange with HOT managed lane access only)**

Gude Drive overpasses I-270 with no existing access to the freeway. The Preferred Alternative does not provide access to the General Purpose lanes along I-270 but modifies the overpass, constructing new directional ramps in the median of I-270 to provide direct access to the HOT lane facility. A new signalized intersection is proposed at the HOT lane facility ramp terminal. The new signal introduces new conflict points; however, the new access to I-270 draws volume from adjacent interchanges (including Shady Grove Road and MD 28), reducing crash exposure at those interchanges. This interchange falls within an existing bottleneck location (see **Section 6.4.1**) where the bottleneck is partly caused by high traffic volumes entering and exiting I-270 from I-370, MD 28, MD 189, and Montrose Road. Providing additional access to the freeway, directly to the HOT lane facility, is expected to help alleviate existing bottleneck conditions and reduce the potential for congestion-related crashes without introducing merge, diverge, or weaving conditions to the General Purpose lanes.

No existing hot spot locations were identified at this interchange.

**I-270 at MD 28**

The existing interchange at I-270 and MD 28 is a partial cloverleaf interchange with loop ramps in the northwest, northeast, and southeast quadrants. Access to the HOT lane facility is not proposed at this interchange; however, the Preferred Alternative modifies the existing ramps to accommodate mainline widening. The entrance ramp and exit ramps to/from MD 28 are realigned at the respective merge and diverge points to tie in with the widened mainline facility, but the realignments yield minimal changes to the ramp geometry and overall interchange operations relative to existing conditions.

In addition to providing a separate managed lane facility with two HOT lanes, the Preferred Alternative removes the existing Collector-Distributor facility through this interchange, which changes the typical General-Purpose lane cross-section along I-270 from four existing General Purposes (HOV/express) lanes in each direction that are vertically and horizontally barrier separated from two Collector-Distributor (local) lanes to five General Purpose lanes and an auxiliary lane. Removing the Collector-Distributor facility eliminates slip ramps and respective merge/diverge conflict points between the General Purpose and local lanes but also adds a weaving section through the interchange along the General Purpose lanes.

See *Location C* and *Ramp 4* in **Table 7-6** for a discussion of the hot spot locations at this interchange.

**I-270 at MD 189 (reconfigure interchange to Diverging Diamond)**

The existing interchange between I-270 and MD 189 is a Single-Point Urban Diamond Interchange (SPUI). The Preferred Alternative converts this interchange to a Diverging Diamond Interchange (DDI) to accommodate mainline widening and maintain access to the General Purpose lanes. Access to the HOT lane facility is not proposed at this interchange. As a DDI requires a smaller footprint than a SPUI to process a similar volume of traffic, the conversion accommodates the mainline widening necessary to provide for the HOT lane facility within the median. In addition, during constructability reviews, it was determined that it would not be feasible to maintain the existing SPUI while building a new one during construction of the Preferred Alternative. The proposed configuration allows the interchange to be converted to a Tight Urban Diamond Interchange (TUDI) during construction/MOT and ultimately to a DDI.

In addition to operational benefits, a DDI has less conflict points than a SPUI, thus reducing the potential for crashes. Per *Diverging Diamond Interchange Informational Guide, Second Edition* (2021) “the reduction in conflict points is due to the unique crossover movements, which remove off-ramp to on-ramp through movements and eliminate several left-turning conflicts between the ramps and cross street. The biggest distinction in the significant decrease in crossing conflicts that typically lead to dangerous angle crashes”. The DDI eliminates the potential for this type of crash since the left-turning traffic does not turn across the opposing through movement in a DDI configuration. In addition, the *Diverging Diamond Interchange Informational Guide, Second Edition* also states, “field studies at DDIs in the United States have shown that free-flow speeds through and between the crossovers are lower than the posted speed limit, even without interaction effects of other traffic.” The geometric design of a SPUI is like a traditional intersection and does not require through traffic to slow down with a green signal indication. Slower speeds that could be expected with a DDI are less likely to result in crashes with serious injuries compared to when crashes occur at higher speeds.

In addition to providing a separate managed lane facility with two HOT lanes, the Preferred Alternative removes the existing Collector-Distributor facility through this interchange, which changes the typical General-Purpose lane cross-section along I-270 from four existing General Purposes (HOV/express) lanes in each direction that are vertically and horizontally barrier separated from two Collector-Distributor (local) lanes to five General Purpose lanes. Removing the Collector-Distributor facility eliminates slip ramps and respective merge/diverge conflict points between the General Purpose and local lanes but also adds a weaving section through the interchange along the General Purpose lanes.

See *Location D* in **Table 7-6** for a discussion of the hot spot location at this interchange.

#### **I-270 at Wootton Parkway (new proposed interchange with HOT managed lane access only)**

Wootton Parkway overpasses I-270 with no existing access to the freeway. The Preferred Alternative does not provide access to the General Purpose lanes along I-270 but modifies the overpass, constructing new directional ramps in the median of I-270, to provide direct access to the managed lane facility. A new signalized intersection is proposed at the HOT lane facility ramp terminal. The new signal introduces new conflict points; however, the new access to I-270 HOT managed lanes draw volume from adjacent interchanges (including MD 189 and Montrose Road), reducing crash exposure at those interchanges. This interchange falls within an existing bottleneck location (see **Section 6.4.1**) where the bottleneck is partly caused by high traffic volumes entering and exiting I-270 from I-370, MD 28, MD 189, and Montrose Road. Providing additional access to the freeway, directly to the HOT lane facility, is expected to help alleviate existing bottleneck conditions and reduce the potential for congestion-related crashes without introducing merge, diverge, or weaving conditions to the General Purpose lanes.

See *Intersections 4 and 5* in **Table 7-6** for a discussion of the hot spot locations at this interchange.

#### **I-270 at Montrose Road**

The existing interchange at I-270 and Montrose Road is a full, cloverleaf interchange. Access to the HOT lane facility is not proposed at this interchange; however, the Preferred Alternative modifies the existing ramps to accommodate mainline widening. The entrance ramp and exit ramps to/from Montrose Road are realigned at the respective merge and diverge points to tie in with the widened mainline facility, but the realignments yield minimal changes to the ramp geometry and overall interchange operations relative to existing conditions.

In addition to providing a separate managed lane facility with two HOT lanes, the Preferred Alternative removes the existing Collector-Distributor facility through this interchange, which changes the typical General-Purpose lane cross-section along I-270 from four existing General Purposes (HOV/express) lanes in each direction that are vertically and horizontally barrier separated from two Collector-Distributor (local) lanes to five General Purpose lanes and an auxiliary lane. Removing the Collector-Distributor facility eliminates slip ramps and respective merge/diverge conflict points between the General Purpose and local lanes but also adds a weaving section through the interchange along the General Purpose lanes.

See *Location E, Ramp 5, and Intersection 6* in **Table 7-6** for a discussion of the hot spot locations at this interchange.

### **I-270 Y-Split/I-270 at I-270 West Spur (proposed partial HOT managed lane access)**

The interchange at I-270 and the I-270 West Spur is a system interchange, often referred to as the Y-split, where the north-south running I-270 splits, forming two legs of a triangle. The part veering to the west is referred to as the I-270 West Spur and the part veering east is referred to as the I-270 East Spur. Both spurs terminate at system interchanges with I-495, which serves as the third leg of the triangle. The I-270 West Spur at I-495 interchange and the I-495 at MD 355/I-270 East Spur interchanges are discussed in more detail below.

I-270 at the I-270 West Spur is a partial interchange where traffic from both I-270 West and East Spurs traveling northbound come together as I-270 Northbound traffic. I-270 Southbound diverges, splitting the freeway into I-270 West Spur traffic and I-270 East Spur traffic. With the Preferred Alternative, the freeway facility is widened to accommodate the median HOT lane facility. Ramps are proposed to serve the HOT managed lane facility for the same General Purpose movements that exist today, but access between (to/from) the HOT managed lanes and General Purpose lanes is not proposed within this interchange.

The crash cluster identified a trend of single-vehicle wet weather crashes striking the barrier along the overpass from I-270 Southbound to the I-270 East Spur. The Preferred Alternative reconstructs this existing flyover ramp by shifting the alignment and curvature slightly to the south to tie into the widened I-270 East Spur mainline. The reconstructed ramp is proposed to increase the right shoulder width on the bridge (edge line to barrier) by 1 to 2 feet, to provide a 10-foot shoulder and 2-foot offset. The left shoulder width on the bridge, on the inside of the curve, is proposed to increase from approximately 12.5 feet to 21 feet to provide increased horizontal sight distance. There is some existing variation in superelevation on either side of the bridge ranging from 4.9% to 6.5%; these will be addressed to be consistent with AASHTO compliant superelevation criteria by reconstruction of the ramp. The reconstructed ramp will also provide improved surface friction which may help mitigate the existing crash pattern.

Another crash cluster of rear-ends was identified along I-270 just north of this interchange, near Tuckerman Lane. This crash pattern was identified in both the northbound and southbound lanes. In general, the Preferred Alternative is expected to reduce congestion along I-270 and therefore reduce the potential for congestion-related crashes such as rear-end crashes. Specifically, future 2045 traffic operations show improved flow through this interchange when compared to No Build conditions not only between the Y-Split and MD 187 but also between the Y-Split and Democracy Boulevard during the afternoon peak period.

See *Location F* in **Table 7-6** for a discussion of the hot spot location at this interchange.



### 7.5.2 Interchanges along I-270 West Spur

#### **I-270 West Spur at Westlake Terrace (proposed HOT managed lane access)**

The interchange at I-270 West Spur and Westlake Terrace currently provides direct access ramps within the median to existing High Occupancy Vehicle (HOV) lanes to the north of the interchange only. As the Preferred Alternative replaces the one HOV lane in each direction along I-270 Northbound and Southbound with two HOT managed lanes in each direction, at this interchange the Preferred Alternative will replace the existing north-facing ramps in addition to constructing new south-facing ramps to provide full access to the HOT lane facility within the median of the I-270 West Spur. The new ramps will add a fourth leg to the existing signalized ramp terminal, introducing new conflict points. The Preferred Alternative does not provide access to the General Purpose lanes at this interchange.

No existing hot spot locations were identified at this interchange.

#### **I-270 West Spur at Democracy Boulevard**

The existing interchange at I-270 and Democracy Boulevard is a full access diamond interchange with a loop ramp in the southeast quadrant. Access to the HOT lane facility is not proposed at this interchange; however, the Preferred Alternative modifies the existing ramps to accommodate mainline widening. The entrance ramp and exit ramps to/from Democracy Boulevard are realigned at the respective merge and diverge points to tie in with the widened mainline facility, but the realignments generally yield minimal changes to the ramp geometry and overall interchange operations relative to existing conditions. The exception is that the Preferred Alternative consolidates the two existing signalized ramp terminals to the west of I-270 to a single, signalized ramp terminal, relocating the left-turn from Democracy Boulevard Westbound to the ramp to I-270 so that it aligns with the ramp terminal from I-270 Southbound. Consolidating these conflict points to a single location may improve driver expectancy and provide a safety benefit.

See *Location H* in **Table 7-6** for a discussion of the hot spot location at this interchange.

#### **I-270 West Spur north of I-495 (proposed at-grade slip ramps between HOT and General Purpose lanes)**

Slip ramps are proposed along I-270 West Spur Northbound and Southbound, serving vehicles traveling from the HOT lanes to the General Purpose lanes and from the General Purpose lanes to the HOT lanes, in both directions of I-270 West Spur. Along I-270 West Spur Northbound, the slip ramp from the General Purpose lanes to the HOT lanes runs from approximately 1,800 feet north of I-495 to approximately 200 feet north of Democracy Boulevard, and the slip ramp from the HOT lanes to the General Purpose lanes runs from approximately 500 feet north of Westlake Terrace to approximately 1,300 feet north of Westlake Terrace. Along I-270 West Spur Southbound, the slip ramp from the HOT lanes to the General Purpose lanes runs from just south of Westlake Terrace to approximately 700 feet south of Westlake Terrace, and the slip ramp from the General Purpose lanes to the HOT lanes runs from approximately 1,500 feet north of I-495 to approximately 500 feet north of I-495.

In 2045, with the Preferred Alternative, all General-Purpose lane segments along I-270 West Spur operate at LOS 'D' or better except during the 6-7 PM hour when some segments operate at LOS 'E' or 'F' due to spillback from a downstream bottleneck, though with significantly improved operations compared to the No Build



conditions. All HOT-lane segments along I-270 West Spur operate at LOS 'D' or better during all peak hours in 2045. These improved operations and reduced levels of congestion can be expected to reduce the potential for stop-and-go conditions that can contribute to crashes.

See *Location H* in **Table 7-6** for a discussion of the hot spot location in proximity to the proposed at-grade slip ramps.

### 7.5.3 Interchanges along I-270 East Spur

#### **I-270 East Spur at Rockledge Drive/MD 187**

The existing interchange at I-270 East Spur and Rockledge Drive/MD 187 consists of adjacent Tight Urban Diamond Interchanges (TUDIs). Access to the HOT lane facility is not proposed at this interchange; however, the Preferred Alternative modifies the existing ramps to accommodate mainline widening. The entrance ramp and exit ramps to/from Rockledge Drive/MD 187 are realigned at the respective merge and diverge points to tie in with the widened mainline facility, but the realignments generally yield minimal changes to the ramp geometry and overall interchange operations relative to existing conditions.

See *Location G* and *Intersection 7* in **Table 7-6** for a discussion of the hot spot locations at this interchange.

#### **I-270 East Spur east of MD 187 (proposed HOT managed lane truncation area)**

The HOT lane facility terminates to the east of the MD 187 interchange with at-grade ramps between the HOT lane facility and the General Purpose lanes creating new merge and diverge points along I-270. The existing left-most northbound lane (which currently operates adjacent to the General Purpose lanes and under HOV restrictions during peak periods) transitions into the northbound HOT lane. The southbound HOT lane transitions into a General Purpose lane. The horizontal and vertical barrier between the General Purpose lanes and the HOT lanes (northbound and southbound) terminates at this location.

No existing hot spot locations were identified in proximity to the proposed HOT managed lane truncation area.

#### **I-495 at MD 355/I-270 East Spur (next adjacent interchange)**

The Preferred Alternative does not propose any geometric changes at the I-495 at MD 355/I-270 East Spur interchange. The study area includes the interchange at I-495 at MD 355/I-270 East Spur, but the HOT lane facility's eastern truncation is upstream of this interchange, along I-495 just west of MD 187 and along I-270 East Spur just east of MD 187. Future 2045 AM traffic operations are expected to experience some degradation on the Inner Loop through the MD 355/I-270 East Spur interchange due to increased throughput reaching the downstream bottleneck between MD 97 and MD 185 more quickly in the Preferred Alternative. Comparable levels of congestion are anticipated through this area in both No Build and Preferred Alternative during the PM peak period. The Outer Loop operations through MD 355/I-270 East Spur are expected to be similar in the 6-8 AM hours but significantly improved compared to No Build conditions in the 8-10 AM hours. The PM peak period is expected to experience similar trends as the AM peak period, but with more congestion in the 6-7 PM hour. Traveling toward MD 355 along the I-270 East Spur, traffic operations are expected to experience comparable levels of congestion on I-270 East Spur Southbound with increased congestion approaching MD 355 during the 7-9 AM hours in the Preferred Alternative due to increased throughput reaching the downstream bottleneck between MD 97 and MD 185 more quickly. The Preferred Alternative is, however,

expected to experience significantly less congestion during the PM peak period, particularly between the 4-7 PM hours.

See *Intersection 8* in **Table 7-6** for a discussion of the hot spot location associated with the interchange.

#### **7.5.4 Interchanges along I-495 in Virginia**

##### **I-495 at VA 193 (next adjacent interchange)**

The Preferred Alternative does not propose any geometric changes at the I-495 at VA 193 interchange. The study area includes the interchange at I-495 and VA 193, but the HOT lane facility's southern truncation is upstream of this interchange.

See *Location L* in **Table 7-6** for a discussion of the hot spot location at this interchange.

##### **I-495 at George Washington Memorial Parkway (proposed HOT managed lane access)**

The HOT lane facility ties in with the Virginia Express Lane facility at this interchange and will be used as a continuous system, with two through travel lanes in each direction through the interchange. The Preferred Alternative provides full access to the HOT lane facility at this interchange and adjustment to the ramp geometry to accommodate mainline widening. Additionally, motorists traveling northbound in the General Purpose lanes will be able to access the northbound HOT managed lanes within the interchange, and motorists traveling southbound in the HOT managed lanes will be able to exit the HOT-lane system to access the southbound General Purpose lanes; both movements will be accommodated with grade-separated flyover ramps. In the southbound direction, a two-lane HOT lane exit ramp (one dedicated exit lane and one choice lane) will diverge from the HOT-lane mainline; a downstream decision point on the ramp will allow motorists to access either the George Washington Memorial Parkway (from the rightmost ramp lane) or a Collector-Distributor road, which will access the southbound General Purpose lanes/Georgetown Pike (from the leftmost ramp lane). In the northbound direction, the exit from the General Purpose lanes to the George Washington Memorial Parkway will be reconstructed to a two-lane exit ramp (one dedicated exit lane and one choice lane). A downstream decision point on the ramp will allow motorists to access George Washington Memorial Parkway from the rightmost ramp lane or the northbound HOT managed lanes from the leftmost ramp lane. The HOT lane access will merge with the ramp from the George Washington Memorial Parkway Westbound to the northbound HOT managed lanes prior to joining the HOT managed lanes as a left entrance just prior to the American Legion Bridge. The acceleration lane for this ramp will extend across the American Legion Bridge. Along the George Washington Memorial Parkway Westbound approaching I-495, motorists may first choose the right lane to access I-495 Northbound or the left lane to access I-495 Southbound. The existing exit to the I-495 Northbound General Purpose lanes will be unaltered, and downstream from the gore point for that exit, the right lane will exit to the I-495 Northbound HOT managed lanes. The left lane will continue to a downstream location where motorists can choose to access the I-495 Southbound General Purpose lanes or Express Toll Lanes.

Future 2045 traffic operations show that with the Preferred Alternative, morning and afternoon peak period congestion is significantly reduced, mitigating existing and future No Build stop-and-go conditions which can be a contributing factor in crashes. In addition to the improved mainline traffic flow, the existing George Washington Memorial Parkway Westbound to the Inner Loop ramp queue will no longer exceed available

storage with the Preferred Alternative, thereby reducing the potential for crashes due to an unexpected stop condition associated with vehicles approaching the back of queue.

No existing hot spot locations were identified at this interchange.

### **7.5.5 Interchanges along I-495 in Maryland**

#### **I-495 at Clara Barton Parkway**

The existing interchange at I-495 and Clara Barton Parkway is a system interchange consisting of a variety of ramp configurations. The Preferred Alternative does not provide access to the HOT lane facility and existing access to the General Purpose lanes are maintained; however, the Preferred Alternative widens the I-495 facility at this location resulting in a realignment of the existing ramps. Specifically, the loop ramp from Clara Barton Parkway to I-495 Northbound is realigned, resulting in a tighter radius. The new radius meets the project design speed standards, and an extended acceleration lane is provided along this merge segment providing distance and time for entering vehicles to reach travel speeds along I-495 and have an opportunity to safely merge.

Future 2045 traffic operations show that with the Preferred Alternative, morning and afternoon peak period speeds are significantly improved, particularly traveling along the Inner Loop over the American Legion Bridge toward and through this interchange. Traveling toward and through this interchange on the Outer Loop is also expected to be significantly improved, particularly during the afternoon peak period.

No existing hot spot locations were identified at this interchange.

#### **I-495 at MD 190/Cabin John Parkway (proposed HOT managed lane access)**

The existing interchanges between I-495 and MD 190 and I-495 and Cabin John Parkway are evaluated as one, inter-connected interchange for the purposes of this study. The interchange at MD 190 is currently configured with loop ramps in the northwest, northeast, and southwest quadrants, and a directional ramp in the southeast quadrant. Directional ramps are also provided in the northeast and southwest quadrants. The interchange with Cabin John Parkway acts as system interchange (there are no ramp terminals) connecting with direct ramps servicing MD 190. The Preferred Alternative removes all three existing loop ramps and provides directional ramps at MD 190, reconfiguring the cloverleaf design to a diamond design. The reconfiguration introduces one new signalized intersection at the HOT managed lane ramp terminals within the median of I-495, which is proposed to be constructed along MD 190 between two existing traffic signals currently serving the General Purpose ramp terminals from the Inner and Outer Loops. The Preferred Alternative removes the weaving segments associated with the loop ramp configuration along I-495 Southbound and eliminates the potential for crashes occurring due to the horizontal curvature along the loop ramps. Although the new ramp from Cabin John Parkway Westbound comes together with the General Purpose lanes from the left, as a lane addition, there is no merge condition with traffic along the Inner Loop of I-495. While right-hand merges are typically preferred to left-hand merges in this case, the left-hand merge is proposed because it is expected to reduce the number of weaving movements. A large portion of the vehicles coming from Cabin John Parkway onto the Inner Loop are expected to continue onto I-270 Northbound just downstream of the MD 190/Cabin John Parkway interchange, rather than continue along the Inner Loop east of the West Spur interchange. Therefore, by positioning vehicles in the left lane when they enter the Inner Loop, they will be in the correct lane to

continue north to I-270 at a downstream interchange. If the lane addition was proposed on the right-hand side of the Inner Loop, these vehicles would need to weave across General Purpose lanes to access I-270.

See *Location K* in **Table 7-6** for a discussion of the hot spot location at this interchange.

#### **I-495 at I-270 West Spur (proposed partial HOT managed lane access)**

The interchange at I-270 West Spur and I-495 is a partial system interchange where traffic from I-270 Southbound comes together with traffic from I-495 Westbound and a northbound diverge, splitting the freeway into I-270 Northbound traffic and I-495 Eastbound traffic. With the Preferred Alternative, the freeway facility is widened to accommodate the median HOT lane facility. Ramps are proposed to serve the HOT managed lane facility for the same General Purpose movements that exist today, but access between (to/from) the HOT managed lanes and General Purpose lanes is not proposed within this interchange.

No existing hot spot locations were identified at this interchange.

#### **I-495 west of MD 187 (proposed HOT managed lane truncation area)**

The HOT lane facility ends approximately one mile west of the MD 187 interchange with at-grade ramps between the HOT lane facility and the General Purpose lanes, creating new merge and diverge points along I-495. This introduces new access points along the freeway facility, but the proposed slip ramp designs provide for merges and diverges at similar speeds, reducing friction due to speed discrepancy between the HOT managed lanes and the General Purpose lanes.

See *Location J* in **Table 7-6** for a discussion of the hot spot location at this interchange.

#### **I-495 at MD 187 (next adjacent interchange)**

The Preferred Alternative does not propose any geometric changes at the I-495 and MD 187 interchange. The study area includes the interchange at I-495 and MD 187, but the HOT lane facility's eastern truncation is upstream of this interchange.

See *Location I* in **Table 7-6** for a discussion of the hot spot location at this interchange.

## **7.6 PREDICTIVE CRASH ANALYSIS**

Like analyzing the future operational conditions, predictive crash analysis methods can be used to quantitatively assess the future safety performance of transportation projects. These methods allow safety to be considered when evaluating roadway improvement alternatives, like other alternative analysis metrics such as capacity, delay, project costs, and environmental impacts. AASHTO's Highway Safety Manual (HSM), published in 2010, presents a variety of quantitative methods for estimating crash frequency or severity for various facility types. In 2014, a supplement to the HSM was released which includes two new chapters to estimate crash frequency for both freeways and ramps. The application of the predictive crash analysis presented in the HSM can be used to evaluate improvement alternatives for an existing facility under current and future traffic volumes. It should be clearly noted that the predictive crash analysis performed for the purposes of this study is not intended to predict the exact number of crashes in the future, with or without the Preferred Alternative. Nor is it intended to determine that the project will not result in significant adverse

safety impacts. Rather, the quantitative safety analysis was performed to provide additional information to assist in the overall safety evaluation of the Preferred Alternative – to identify any potential inconsistencies that can be used when reviewing and reassessing the Preferred Alternative design in the context of the project improvements. This work is useful to flag locations, focus the engineering efforts to where discrepancies exist, and refine design decisions that were discussed in detail in the qualitative discussion of the design decisions. Along with the historical crash analysis and qualitative assessment of the project design components, the predictive crash analysis can be used to further support a more comprehensive safety evaluation.

### *Advantages*

There are many advantages to incorporating predictive crash analysis as part of transportation planning and project engineering. While historical crash history provides a picture of existing crash patterns and trends highly localized to the study area, such an evaluation suffers from a regression-to-the-mean bias as crash patterns can fluctuate randomly over short time periods. The predictive analysis tools are based on regression models (that is, safety performance functions) developed from data for several similar facilities codified by specific geometric design and traffic control features. Since these functions are developed from several locations, an advantage of the predictive method is a reduced reliance on and availability of reliable crash data. While the predictive safety analysis cannot provide reliable results for predictive crash frequency for the Preferred Alternative, as discussed in more detail in the following sections, it still provides value.

### *Limitations*

While incorporation of a predictive method can be advantageous by providing a quantifiable assessment, it is important to be aware of the limitations of the available tools and models. The safety performance functions used in the predictive method account for the effects on roadway safety and crashes of many geometric and traffic control conditions, but not all. For example, the current version of the HSM does not provide a crash prediction methodology for estimating the safety performance of a separated managed lane facility. Additionally, the HSM predictive methodology is primarily based on geometric, traffic control, and volume characteristics of a roadway. Factors not directly accounted for include site specific driver populations, effects of climate conditions, and effects of vehicle types such as motorcycles and trucks, or of daily traffic volume variations. Since addressing peak period congestion is an important goal of the project and the Preferred Alternative constructs a separate managed lane facility, the predictive method cannot be used to predict the safety performance of the Preferred Alternative but can be used to make a relative comparison.

It is important to note that the results of the predictive crash analysis for this study are intended to improve the engineering design of the Preferred Alternative, not determine predicted safety performance. The following sections outline the input data and tools utilized.

## **7.6.1 Input Data**

### **Roadway Geometry**

Roadway inventory data and inputs were collected from multiple sources. For the No Build condition, roadway data elements were collected using a combination of Google Earth and available topographic survey data, as well as the latest information available for the ongoing construction of MDOT's I-270 Innovative Congestion Management (ICM) Project. For the Preferred Alternative, roadway data was obtained from the proposed roadway design files. The Preferred Alternative roadway design evaluated for this safety analysis was a result of ongoing coordination during the predevelopment phase, which incorporated various design elements that

mitigate safety and operational concerns while also minimizing impacts to environmental resources and right-of-way.

## **Traffic Volumes**

One of the inputs into the predictive analysis tools is the Annual Average Daily Traffic (AADT) volumes for the facility being analyzed. Future No Build and Preferred Alternative traffic volume forecasts for the MLS included Average Daily Traffic (ADT), which needed to be converted to AADT values for use in the predictive safety analysis. AADT data for the freeway segments (i.e., General Purpose and HOV lanes) and ramps are calculated from the ADT volumes from the travel forecasts and the weekday adjustment factors derived from MDOT's automated traffic count station data along I-270 and I-495. The weekday adjustment factor for I-270 and I-495 is 0.97, and the AADT is computed as follows:  $AADT \text{ (vehicles/day)} = ADT \text{ (vehicles/day)} \times 0.97$ . AADT data for crossroad segments, intersections, and ramp terminals are calculated from the total peak period volumes from the travel forecasts, MDOT's conversion factors for peak hour volumes to ADT, and the weekday adjustment factors derived from MDOT's automated traffic count station data along I-270 and I-495.

### **7.6.2 Predictive Crash Analysis Tools**

The following tools were used to perform an assessment of the relative comparison of the predictive crash analysis results between the 2045 No Build scenario and the 2045 Build scenario (Preferred Alternative). This relative comparison can be helpful in the engineering process by identifying locations where there may be disparity between the No Build and Preferred Alternative. There are several tool limitations and therefore assumptions that were made by MDOT to be able to apply the tools (which are discussed in more detail below). However, if it is clearly understood that the quantitative results cannot and should not be used as a prediction on the frequency of crashes in the future, the predictive crash analysis can still be used for the purposes of this IAPA to assist in the engineering design process by providing relative comparison results between the No Build and Preferred Alternative to determine if there are areas requiring further investigation.

#### **Highway Safety Manual (HSM) - Enhanced Interchange Safety Analysis Tool (ISATe)**

ISATe is a spreadsheet-based, safety analysis tool intended to perform safety assessments of freeway-to-arterial and freeway-to-freeway interchanges. Employing the predictive method of the HSM, ISATe predicts crashes by crash location, that is by mainline freeway segments, ramp segments, and ramp terminals using geometric and operational characteristics of roadway and ramp facilities, as well as incorporating daily traffic volumes. ISATe also analyzes ramp terminal crossroad intersections based on the number of lanes, arrangement of lanes, and type of traffic control. ISATe, version 06.10, is used to evaluate the predictive safety performance of the No Build and Preferred Alternative freeway segments, ramp segments, and conventional ramp terminals except for HOT managed lanes freeway segments within the study area.

#### *General Assumptions and Modeling Applications*

- I-270 carries a High Occupancy Vehicle (HOV 2+) lane along both northbound and southbound directions. The I-270 Southbound HOV lane begins at I-370 and ends at I-495 along the East Spur and south of Democracy Boulevard along the West Spur. The I-270 Northbound HOV lane begins at I-495 along the East Spur and south of Democracy Boulevard along the West Spur and ends at MD 121. The HOV lanes are in service weekdays from 6:00-9:00 AM in the southbound direction and 3:30-6:30 PM



in the northbound direction reflecting peak period travel patterns. General traffic may use these lanes at other times. The HOV lanes are not barrier-separated and are rather marked by signage, white-diamond shaped pavement markings, and a white-dotted separated line allowing traffic to freely move in and out. Anecdotally, flow in and out of the HOV lanes is observed. Since the existing HOV lanes are not HOV-restricted for 18 out of 24 hours during the weekdays and for all 24 hours on a weekend day, in ISATe the existing HOV lanes along I-270 are assumed to operate as General Purpose lanes. If excluded, the ISATe analysis may underestimate the predicted crashes under No Build conditions.

- The typical section under the Preferred Alternative includes four or five General Purpose travel lanes and two HOT managed lanes in each direction where the General Purpose and HOT managed lanes are separated by four-foot horizontal buffer along with vertical markers. A limitation of ISATe is its inability to model managed lanes. Therefore, ISATe was used to predict the crashes along the General Purpose lanes only (a separate, project-specific, safety performance function was used to model the HOT lane facility to complete the predictive crash assessment of the freeway). Although the HOT managed lane facility and the General Purpose lanes operate as separate facilities, since only the General Purpose lanes were modeled in ISATe, consideration was taken on how to appropriately model the cross-section with ISATe. The bullets below discuss how the cross-section related inputs were measured.
  - Inside shoulder width ( $W_{is}$ ): This input represents the average width of the paved shoulder along each segment. The inside shoulder width was measured from the edge of the traveled way for the General Purpose lanes to the edge of the traveled way for the managed lanes, which was generally four feet and represents the proposed horizontal buffer. For those segments with a wider buffer space between the General Purpose lanes and managed lanes, the average width was inputted.
  - Median width ( $W_m$ ): This input represents the distance between the edges of the traveled way for the two opposing roadways and includes the width of the inside shoulder. According to the ISATe manual, where barrier-separated HOT managed lanes are provided, the median width includes the width of the HOT managed lane facility. The median width was measured between the edges of the traveled way of the General Purpose lanes for the two roadways in the opposite direction of travel, including the width of the managed lanes and the inside shoulders.
  - Median barrier width ( $W_{ib}$ ): This input represents the width between the face of barrier for each travel direction. The proposed managed lane facility includes a vertical separation between the General Purposes lanes and the HOT managed lane facility, acting as a barrier. The HOT managed lanes were considered as part of the median barrier, and the median barrier width was measured between the edges of the traveled way for the two roadways in the opposite direction of travel, excluding the width of the inside shoulder ( $W_m - 2W_{is}$ ).
  - Nearest distance from edge of traveled way to barrier face ( $W_{near}$ ): The nearest distance was not required for the majority General-Purpose segments because the buffer width was 4 feet in both northbound and southbound directions, which resulted in the centered median barrier. For the General-Purpose segments with varying inside shoulder widths along the segment and between the northbound and southbound directions, the averaged inside shoulder width (final  $W_{is}$  value) was inputted as the nearest distance due to the range requirement that the nearest distance  $W_{near}$  must be greater than or equal to the inside shoulder width  $W_{is}$ .



- o Clear zone width ( $W_{hc}$ ): This input represents the width from the edge of traveled way to typical limits of a vertical obstruction (e.g., a non-traversable slope, fence line, or utility poles) along the roadway. According to the ISATe manual, if a roadside barrier is present for the full length of the segment, then enter a value of 30 feet for this input. For this analysis, a value of 30 feet was used for the General Purpose lanes in the Preferred Alternative based on MDOT SHA design guidelines, which indicate that all critical slopes located within 30 feet from the edge of the traveled way should be protected by barrier.
    - Per MDOT SHA policy, all critical slopes located within 30 feet from the edge of the traveled way are protected by the barrier and according to ISATe manual, if the roadside barrier is present for the full length of the segment, then 30 feet is entered as the clear zone width.
    - The ground mounted signs and light poles are on a breakaway base and are not considered as a hazard.
- At a select locations, the number of existing or proposed travel lanes exceed the maximum allowable input within ISATe. At these freeway segments, the maximum allowable input was used (10 lanes) and the corresponding AADT input was modified and extrapolated as follows:  $AADT_{INPUT} = AADT_{ACTUAL} \times (\text{Number of Lanes}_{MAXIMUM} / \text{Number of Lanes}_{ACTUAL})$ . Although the precise number of lanes and traffic volumes were not assessed using the tool at locations where the number of lanes exceeds 10, the ratio between the number of travel lanes and traffic volumes, specifically the traffic flow, was maintained. However, it should be noted there is no predictive model provided by the HSM for a freeway with more than 10 General Purpose lanes – extrapolating and applying a modified AADT value was performed so that the tool may be used, but this method is expected to produce slightly different results compared to a scenario where precise safety performance functions are available. The magnitude of this difference is undetermined; however, the “work around” used by this study for locations that exceed 10 lanes is not expected to skew the relative comparison results, since the method was applied to both the No Build and Build conditions.
- The Empirical Bayes (EB) module of the ISATe tool was not employed for the predictive crash analysis. The EB estimation is a technique in which the prior distribution of crashes is estimated from historical crash data. The output is an estimated expected crash frequency, instead of a predicted crash frequency. Guidance in the HSM outlines scenarios when the EB method is applicable including “projects in which the roadway cross section is modified by the basic number of through lanes remains the same”. The removal of the local lanes along I-270 with the Preferred Alternative rendered incorporation of the EB method inapplicable along I-270. For consistency across the analysis with the IAPA study area, the EB method was excluded.
- Local calibration factors were not included in the ISATe analysis. Local calibration factors are used to account for the differences between the area where the predictive crash models were developed and the area where the models are applied. Some local calibration factors specific to Maryland are available to apply the predictive methods of the HSM. However local calibration factors for certain facility types, including collector-distributor systems, ramps, and managed lane facilities are limited at this time. Due to the lack of available local calibration factors for every study facility, a factor of 1 was assumed.

## NCHRP Guidance on Crash Prediction for Unconventional Ramp Terminals

To fill in the gaps where predictive methodologies and tools within the HSM do not apply to unconventional ramp terminals, the latest guidance from NCHRP-TRB research publications is employed. This applies to the I-270 at MD 189 interchange where the Preferred Alternative converts the existing Single-Point Urban Diamond Interchange (SPUI) to a Diverging Diamond Interchange (DDI). Two publications are employed, and additional information on the publications is provided in **Appendix K**. The first publication, *Safety Performance of Crossroad Ramp Terminals at Single-Point and Tight Diamond Interchanges* supplies a safety performance function for a SPUI, which predicts crashes based on traffic volumes on the ramps and crossroad, and number of free-flow right-turns from the exit ramps to the crossroad. This SPF is used to assess the number of crashes at the MD 189 interchange, which is a SPUI with no free-flow right-turns from the exit ramps to the crossroad for the No Build scenario.

The second publication, *Systematic Safety Evaluation of Diverging Diamond Interchanges Based on Nationwide Implementation Data* supplies a Crash Modification Factor for converting a conventional diamond interchange to a DDI. The HSM, Chapter 19 Table 19-15, supplies a safety performance function for a conventional diamond interchange that predicts crashes at each of the ramp terminals based on traffic volumes on the ramps and crossroad, intensity of development, and number of crossroads through lanes. These two methods are used in conjunction to predict the crash frequency for the DDI at MD 189 under the Preferred Alternative. The SPF supplied in the HSM is used to calculate predicted crashes for the conventional diamond interchange. The Crash Modification Factor is then used to compute predicted crashes for the DDI. See **Appendix K** for the citations for the two publications used, the specific performance function equations, and inputs.

## Highway Safety Manual (HSM) Chapter 12 and NCHRP 17-58 Predictive Crash Tools for Arterials

The Urban and Suburban Arterial Analysis spreadsheet (V3.1), based on the analysis outlined in Chapter 12 of the HSM, was used for the predictive crash analysis for study arterial crossroad segments and intersections with four lane arterials. Predictive crash analysis methodologies outlined in NCHRP 17-58 were used for the analysis of arterial crossroad segments and intersection with six or more lanes. **Table 7-7** outlines which predictive crash analysis tool was utilized for each crossroad.

When defining the facility types applicable to the Urban and Suburban Arterial Analysis spreadsheet tool, Chapter 12 of the HSM states that “the term ‘arterial’ refers to facilities that meet the FHWA definition of ‘roads serving major traffic movements (high-speed, high volume) for travel between major points.’” MDOT SHA functionally classifies all study area crossroads for which these tools were applied as either principal arterial or minor arterial except for Westlake Terrace (minor collector) and Rockledge Drive (local). Although Westlake Terrace and Rockledge Drive are not classified as arterials, they carry a relatively high annual average daily traffic, both over 10,000 vehicles per day, as well as providing key connections within the area where I-270 and I-495 interchange.

**Table 7-7: Predictive Crash Analysis Tool Applied to Study Area Arterial Crossroads**

| Tool               | Predictive Method for Urban and Suburban Arterials Analysis Spreadsheets<br><i>HSM 1<sup>st</sup> Edition, Volume 2, Chapter 12</i><br><i>Applied to Arterial with Five or Less Lanes</i> | Safety Prediction Models for Six-Lane and One-Way Urban and Suburban Arterials<br><i>NCHRP Project 17-58</i><br><i>Applied to Arterial with Six or More Lanes</i> |
|--------------------|---|---|
|                    |   |   |
| Arterial Crossroad | MD 117  | Sam Eig Highway   |
|                    | Shady Grove Road<br>(Omega Drive from MD 28 to I-270 SB Ramp Terminal)  | Shady Grove Road<br>(Shady Grove Road from Corporate Blvd to Cherry Coke Rd)  |
|                    | Gude Drive  | Democracy Boulevard   |
|                    | MD 28   | MD 187 (at I-270)   |
|                    | MD 189  | MD 187 (at I-495)   |
|                    | Wootton Parkway   | MD 355  |
|                    | Montrose Road   |   |
|                    | Westlake Terrace  |   |
|                    | Rockledge Drive   |   |
|                    | MD 190  |   |

### Safety Performance Functions (SPFs) for HOT Managed Lanes

The HSM does not cover a crash prediction methodology for estimating the safety performance of managed lanes. Therefore, the Safety Performance Function (SPF) developed for the managed lanes as part of the I-495 Express Lanes Northern Extension Project was used for the predicted crash frequency for the HOT managed lanes proposed under the Preferred Alternative. This SPF specific to the managed lanes along I-495 in Virginia was developed using available historical crash data, traffic volume data, and roadway geometric data for the existing segments of I-495 Express Lanes. The predicted number of crashes is a function of the segment length and daily volume. The non-linear regression model SPF used to evaluate the predicted number of crashes on the managed lanes in our study area is as follows:

$$e^{0.011022579 + 0.987113593 \cdot \ln(L) + 0.141283034 \cdot \ln(AADT)}$$

L = Segment length in miles

AADT = Annual Average Daily Traffic volume in vehicles per day

There are two main assumptions associated with the use of the SPF shown above. First, this SPF does not allow for various geometric data to be used as input in the way that ISATe does. Overall, the existing I-495 express lanes and the proposed HOT managed lanes for the Preferred Alternative have similar geometric elements (e.g., lane widths, buffer widths, insider shoulder widths); however, there are areas where these elements do vary so it needs to be acknowledged that the SPF applied assumes the same geometric conditions as the existing I-495 express lanes. In addition, the Virginia SPF was developed for a two-lane managed facility and there are sections of the Preferred Alternative where three managed lanes are proposed. For the managed lane sections where the number of lanes exceeds two, the AADT volumes were extrapolated as follows:

$$AADT_{Adjusted} = AADT_{Actual} * \left( \frac{2}{\text{Actual Number of Lanes}} \right)$$

Additional information on the development of Safety Performance Functions for the I-495 Express Lanes in Virginia can be found in **Appendix K**.

### 7.6.3 Predictive Crash Frequency Results

**Table 7-8** shows the results of the predictive crash frequency results by facility accounting for all study area roadways including freeways, ramps, HOT managed lanes, crossroad ramp terminals/adjacent intersections, and crossroads. The results compare the 2045 No Build scenario to the 2045 Preferred Alternative scenario. Based on the HSM methodology applied for this study, it is inadvisable to compare the predictive crash frequency with the existing crash data since the safety prediction models were not calibrated for this study and the EB method was not applied, as discussed in previous sections of this document. Existing crash data was evaluated, and hot spot locations were identified, as part of separate safety analyses methods discussed earlier in this document, but existing crash data was not applied to the predictive method for the purposes of this study. The crash prediction analysis is based on empirical HSM SPF and was neither calibrated to local parameters nor was a project-specific SPF developed to account for the effects of other potential influential factors to crashes (e.g., relative congestion, intensity of adjacent development, traffic composition, and geographic influence factors, etc.). Although the crash prediction results were not compared to the existing crash data, No Build and Preferred Alternative results were compared to each other to evaluate the extent the proposed improvements may influence traffic safety performance, which is the intent of the quantitative safety analysis.

The results of the relative comparison of the quantitative analysis show that the Preferred Alternative is not expected to result in an increase in total crashes within the study area. A more detailed breakdown summary of predictive crash frequency is provided across three tables in **Appendix K**. It is important to remember that these results are being used for relative comparison purposes only and not as a prediction of the number of crashes for any scenario or facility.

**Table 7-8: 2045 Predicted Annual Crash Frequency**

| Study Freeway<br>(Also includes<br>Ramps and<br>Crossroads) <sup>1</sup> | 2045 No Build Predicted<br>Annual Crash Frequency |              |              | 2045 Preferred<br>Alternative Predicted<br>Annual Crash Frequency |              |              | Change in Predicted<br>Annual Crash Frequency |          |             |
|--|---|--------------|--------------|---|--------------|--------------|---|----------|-------------|
|  | Fatal<br>and<br>Injury                            | PDO          | Total        | Fatal<br>and<br>Injury  | PDO          | Total        | Fatal<br>and<br>Injury                        | PDO      | Total       |
| I-270 & East Spur <sup>2</sup>   | 513   | 779          | 1,292        | 348   | 717          | 1,065        | -165  | -62      | -227        |
| I-270 West Spur  | 53  | 99           | 152          | 53  | 105          | 158          | 0   | 6        | 6           |
| I-495 in Maryland  | 212   | 427          | 639          | 239   | 475          | 714          | 27  | 48       | 75          |
| I-495 in Virginia <sup>3</sup>   | 50  | 119          | 169          | 53  | 129          | 182          | 3   | 10       | 13          |
| <b>Total</b>   | <b>828</b>  | <b>1,424</b> | <b>2,252</b> | <b>693</b>  | <b>1,426</b> | <b>2,119</b> | <b>-135</b>                                   | <b>2</b> | <b>-133</b> |

<sup>1</sup> Predicted crashes for each study freeway include predicted crashes along all facility types including freeways, HOT managed lanes, and crossroads.

<sup>2</sup> Predicted crashes shown for I-270 & East Spur include predicted crashes along I-370.

<sup>3</sup> Predicted crashes shown for I-495 in Virginia include predicted crashes along the George Washington Memorial Parkway.

The discussion below provides a relative comparison between the change in predicted crash frequency between No Build and the Preferred Alternative by freeway (I-270, I-270 West Spur, I-495 in Maryland, and I-495 in Virginia) and by facility type. Discussions are provided for each facility type, including – the freeway General Purpose lanes; ramps including freeway General Purpose lanes and HOT managed lanes ramps; the overall freeway facility including HOT managed lanes, General Purpose lanes and ramps; and the adjacent intersections along the crossroads.

The information provided in the sections below were reviewed in conjunction with the Preferred Alternative design to identify and address locations where concerns were observed by the safety analysis for this study – by either the qualitative or predictive analysis. The numbers provided in the discussion below are relative differences, but they are not intended to be interpreted as actual anticipated safety performance. These results and the locations identified can also be used as part of final design considerations for potential mitigation. **Chapter 8** includes improvements and mitigation elements to consider as part of future design efforts to address both operational and safety concerns.

#### **7.6.3.1 I-270 and East Spur and I-370**

Comparing the relative change in predicted crashes frequency between the 2045 Preferred Alternative and the 2045 No Build scenario, the I-270 and East Spur and I-370 show an overall 18% decrease in total crash frequency including a 32% decrease in fatal and injury crash frequency and an 8% decrease in property damage only crash frequency. A discussion of the predicted crash frequency results by freeway segments, ramps, and adjacent intersections along the crossroads is below.

##### **Freeway General Purpose Lanes**

The freeway segments along I-270 and the East Spur and I-370, which include the General Purpose and HOV lanes, show a 5% increase in fatal and injury crash frequency, a 10% increase in property damage only crash frequency, and a 9% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The crash frequency increase appears to be attributed at least in part to 1) the removal of the I-270 local lanes located south of the I-370 interchange, and 2) the proposed new interchange at I-270 at Wootton Parkway. The removal of the local lanes shifts the volume assigned to the freeway lanes within the predictive analysis tools and therefore impacts the predicted crash frequencies. The freeway segments adjacent to the proposed new interchange between MD 28 and Wootton Parkway shows the highest increase in crash frequencies along I-270 and the East Spur because the proposed new interchange introduces ramp merges and diverges within a basic freeway section along I-270 Northbound and the forecasted daily traffic volumes are expected to increase.

##### **Ramps (General Purpose Lane Ramps and HOT Managed Lanes Ramps)**

The ramps within the interchanges along I-270 and the East Spur and I-370, which include General Purpose and HOT managed lanes ramps, show an 87% reduction in fatal and injury crash frequency, a 78% reduction in property damage only crash frequency, and an 83% reduction in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The removal of the I-270 local lanes south of the I-370 interchange contribute to the reduction in predicted crashes frequencies. For the No Build scenario, the local lanes that run parallel to the freeway were considered Collector-Distributor (C-D) lanes, and therefore were included in the predictive method for ramp segments per the ISATe tool guidelines. Their removal in the

Preferred Alternative scenario shifts the local lane volumes to the freeway lanes and reduces the length of roadways that count as ramps which may subsequently reduce the number of crashes for ramps.

### **Overall Freeway Facility (HOT Managed Lanes combined with A. General Purpose lanes and B. Ramps)**

Since the HOT managed lanes do not exist in the No Build scenario, the comparison discussion for the HOT lanes was combined with General Purpose lanes and ramps. The combined HOT managed lanes, General Purpose lanes, and ramps along I-270 and the East Spur and I-370 show a 42% reduction in fatal and injury crash frequency, an 11% reduction in property damage only crash frequency, and a 23% reduction in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. This reduction includes the addition of HOT managed lanes, the effect of traffic shifting from the local roads to the freeway, and the proposed new interchanges, which are explained in the previous paragraphs.

### **Adjacent Intersections**

The adjacent intersections along the crossroads along I-270 and the East Spur, which include General Purpose and HOT lane ramp terminals, show a 1% increase in fatal and injury crash frequency, a 3% increase in property damage only crash frequency, and a 2% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The main reason for this increase is the proposed new interchanges at Gude Drive and Wootton Parkway.

#### **7.6.3.2 I-270 West Spur**

Comparing the relative change in predicted crash frequency between the 2045 Preferred Alternative and the 2045 No Build scenario, the I-270 West Spur shows an overall 4% increase in total crash frequency including a 1% decrease in fatal and injury crash frequency and a 6% increase in property damage only crash frequency. A discussion of the predicted crash frequency results by freeway segments, ramps, and adjacent intersections along the crossroads is below.

### **Freeway General Purpose Lanes**

I-270 West Spur freeway segments, which include the General Purpose and HOV lanes, show a 16% decrease in fatal and injury crash frequency, a 7% decrease in property damage only crash frequency, and a 10% decrease in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The freeway segment between Westlake Terrace and I-270 split shows the largest decrease in predicted crash frequencies, where the ADT traffic volumes along the General Purpose lanes are forecasted to decrease in both the northbound and southbound directions.

### **Ramps (General Purpose Lane Ramps and HOT Managed Lanes Ramps)**

The ramps within the interchanges along the I-270 West Spur, which include the General Purpose and HOT managed lanes ramps, show an 11% increase in fatal and injury crash frequency, a 23% increase in property damage only crash frequency, and a 17% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The main reason for these increases is the proposed new direct access to the HOT managed lanes at Westlake Terrace that increases the number of ramps from two to four and increases the total ramp length at this interchange. As a result, the HSM methodology will predict a higher number of crashes since the ramp length increase is assumed to raise the exposure of ramps to traffic.



### **Overall Freeway Facility (HOT Managed Lanes combined with A. General Purpose lanes and B. Ramps)**

Since the HOT managed lanes do not exist in the No Build scenario, the comparison discussion for the HOT lanes was combined with General Purpose lanes and ramps. The combined HOT managed lanes, General Purpose lanes, and ramps along I-270 West Spur show a 3% reduction in fatal and injury crash frequency, an 8% increase in property damage only crash frequency, and a 5% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. This change in crash frequency includes the addition of HOT managed lanes, the reduction of ADT for General Purpose lanes, and the additional HOT ramps at Westlake Terrace, which are explained in the previous paragraphs.

### **Adjacent Intersections**

The adjacent intersections along the crossroads along the I-270 West Spur, which include the General Purpose and HOT lane ramp terminals, show a 3% increase in fatal and injury crash frequency, a 2% increase in property damage only crash frequency, and a 3% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The main reason for these increases is the proposed new HOT lane ramp terminals at the Westlake Terrace interchange.

#### **7.6.3.3 I-495 in Maryland**

Comparing the relative change in predicted crash frequency between the 2045 Preferred Alternative and the 2045 No Build scenario, I-495 in Maryland shows an overall 12% increase in total crash frequency, a 13% increase fatal and injury crash frequency, and an 11% increase in property damage only crash frequency. A discussion of the predicted crash frequency results by freeway segments, ramps, and adjacent intersections along the crossroads is below.

### **Freeway General Purpose Lanes**

I-495 freeway segments in Maryland show a 1% increase in fatal and injury crash frequency, a 1% increase in property damage only crash frequency, and 1% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The freeway segments between I-270 West Spur and MD 187 shows the largest increase in predicted crash frequencies, where the ADT traffic volumes along the General Purpose lanes are forecasted to increase along both the Inner and Outer Loops.

### **Ramps (General Purpose Lane Ramps and HOT Managed Lanes Ramps)**

The ramps within the interchanges along I-495 in Maryland, which include the General Purpose and HOT lane ramps, shows a 13% decrease in fatal and injury crash frequency, a 1% decrease in property damage only crash frequency, and a 7% decrease in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The ramp segments at the I-495 and Clara Barton Parkway interchange account for the largest decrease in predicted crash frequency, where the ADT along four of the six ramps are forecasted to decrease in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario.

### **Overall Freeway Facility (HOT Managed Lanes combined with A. General Purpose lanes and B. Ramps)**

Since the HOT managed lanes do not exist in the No Build scenario, the comparison discussion for the HOT lanes was combined with General Purpose lanes and ramps to consider the freeway facilities as a whole. The



combined HOT managed lanes, General Purpose lanes, and ramps along I-495 in Maryland show a 5% increase in fatal and injury crash frequency, a 7% increase in property damage only crash frequency, and a 6% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. This increase is mainly attributed to the addition of HOT managed lanes that do not exist in the No Build condition, which, based on the predictive analysis, is not outweighed by a decrease in crashes in the General Purpose lanes and ramps, along with the increase in ADT being served with the Preferred Alternative.

### **Adjacent Intersections**

Intersections along crossroads along I-495 in Maryland, which include ramp terminals from General Purpose and HOT lane ramps, show a 37% increase in fatal and injury crash frequency, a 48% increase in property damage only crash frequency, and a 42% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The largest increase in crash frequency occurs at the ramp terminals at the I-495 at MD 190 interchange. The main reason for this increase is the proposed new access to the HOT managed lanes at this interchange, where the ADT at the ramp terminals along the crossroad legs inside of the interchange access points are expected to increase along both the Inner and Outer Loops in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The next largest increase in crash frequency occurs at the ramp terminals at the I-495 at MD 187 interchange. The reason for this increase is the volume at the ramp terminals where the ADTs entering the Inner and Outer Loop intersections with MD 187 are forecasted to increase in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario.

#### **7.6.3.4 I-495 in Virginia and George Washington Memorial Parkway**

The predictive crash frequency analysis includes the transition of the Preferred Alternative in Maryland to the proposed Express Lanes in Virginia<sup>16</sup>, accounting for one-and-a-half miles of I-495 between the American Legion Bridge and the I-495 at MD 193 interchange. Comparing the relative change in predicted crashes frequency between the 2045 Preferred Alternative and the 2045 No Build scenario, I-495 in Virginia shows an overall 8% increase in total crash frequency including an 8% increase in fatal and injury crash frequency and an 8% increase in property damage only crash frequency. A discussion of the predicted crash frequency results by freeway segments, ramps, and adjacent intersections along the crossroads is below.

### **Freeway General Purpose Lanes**

I-495 freeway segments in Virginia show an 11% increase in fatal and injury crash frequency, a 9% increase in property damage only crash frequency, and a 10% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario, which include the managed lanes constructed by the 495 NEXT project. The freeway segments between the George Washington Memorial Parkway interchange to just south of the Route 193 interchange show a 24% increase in fatal and injury crash frequency, a 26% increase in property damage only crash frequency, and a 25% increase in total crash frequency in the

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<sup>16</sup> The predicted crash frequency results shown in this Application for Interstate Access Point Approval may differ from the predicted crash frequency results shown in VDOT's I-495 Express Lanes Northern Extension (NEXT) Interchange Justification Report. One primary reason for this difference is the assumptions under the respective No Build scenarios. The No Build scenario for this Application includes the completion and operation of the I-495 Express Lanes in Virginia.

2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The northbound and southbound General Purpose lanes within this section of I-495 in Virginia are expected to increase in the forecasted ADT in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario.

### **Ramps (General Purpose Lane Ramps and HOT Managed Lanes Ramps)**

The ramps within the interchanges along I-495 in Virginia, which include the General Purpose and managed lane ramps, show a 28% decrease in fatal and injury crash frequency, a 24% decrease in property damage only crash frequency, and a 25% decrease in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The ramps at the Route 193 interchange and George Washington Memorial Parkway interchange account for the decrease in predicted crash frequency, where the ADT along the Inner Loop and Outer Loop ramps are generally forecasted to decrease in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario.

### **Overall Freeway Facility (HOT Managed Lanes combined with A. General Purpose lanes and B. Ramps)**

To be consistent with the previous HOT managed lane discussions and since the managed lanes are partially present in the No Build scenario in Virginia, the comparison discussion for the managed lanes was combined with General Purpose lanes and ramps to be able provide a relative comparison. The combined HOT managed lanes, General Purpose lanes, and ramps along I-495 in Virginia show an 8% increase in fatal and injury crash frequency, a 9% increase in property damage only crash frequency, and a 9% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. This increase is mainly attributed to the freeway General Purpose lanes that is discussed in the previous paragraphs, and the addition of HOT managed lanes north of George Washington Memorial Parkway to Maryland State Line that do not exist in the No Build condition.

### **Adjacent Intersections**

I-495 General Purpose ramp terminals in Virginia show a 7% increase in fatal and injury crash frequency, a 1% increase in property damage only crash frequency, and a 3% increase in total crash frequency in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. The ramp terminals at the Route 193 interchange account for these increases in predicted crash frequency, where the ADT increases at the ramp terminals by 1 to 4% in the 2045 Preferred Alternative scenario compared to the 2045 No Build scenario. Although no geometric changes are proposed in the Preferred Alternative at the I-495 and Route 193 interchange, the additional ramps proposed at the adjacent interchange at I-495 and George Washington Memorial Parkway influence the forecasted volumes at the Route 193 interchange and therefore influence the predicted crash frequency.

## **7.7 SAFETY ANALYSIS SUMMARY**

The safety evaluation conducted as part of this Application for IAPA included a thorough review of existing crash data and crash patterns for all freeways, ramps, intersections, and crossroads; an evaluation of crash rates and the identification of high crash locations within the study area; a qualitative assessment of how key design elements from the Preferred Alternative would be expected to influence safety and affect high crash locations within the study area; and a quantitative analysis that focuses on the relative comparison results from predictive crash analysis under the No Build Alternative and the Preferred Alternative. This multifaceted

evaluation was used to develop engineering solutions to incorporate into the Preferred Alternative to reduce congestion-related crashes, consistent with the Purpose and Need of the MLS, and improve existing or potentially future high crash locations to enhance safety performance. Safety was not explicitly identified in the Purpose and Need of the MLS; however, the mobility and operational improvements associated with the Preferred Alternative are expected to reduce the potential for crashes attributed to congested roadway conditions. Specifically, the Preferred Alternative is expected to reduce congestion on the interstates and local roadway networks within the study limits, providing more reliable travel times for all users, including emergency responders.

Over the three-year crash study period, approximately 4,700 crashes occurred within the study area; 73% of the crashes along the freeways were rear end and sideswipe collisions that occurred during congested roadway conditions. The three-year crash history shows that 50 to 60% of the crashes occurring within the study area occurred during peak periods of congestion. As demonstrated through the operational analysis of this Application, the Preferred Alternative reduces congestion levels during peak periods to address the needs of the system and accommodate existing traffic and long-term traffic growth on I-270 and I-495. By reducing the extent and duration that the freeways and local roadways operate under congestion, unstable flow, and stop-and-go conditions, it can be anticipated that the Preferred Alternative will reduce the potential for congestion-related crashes, such as rear-end and sideswipe crashes occurring during peak periods.

All study interchanges were qualitatively assessed for the Preferred Alternative's impact on safety performance of the interstate facility and local roadway network. High crash locations were identified based on historical crash data for the freeway segments, ramps, and intersections along the crossroads – and those locations were reviewed to identify crash clusters, trends, and contributing factors as well as to assess the safety impacts associated with the Preferred Alternative. In addition, the predictive crash analysis methodologies outlined in the HSM were used to provide a quantitative-based analysis on how the Preferred Alternative would potentially impact safety performance in the future. While the predictive methods currently available must be applied and interpreted with caution for the purposes of the predictive safety performance of the Preferred Alternative, the results of the predictive analysis may still be beneficial through a relative comparison of the predicted annual crash frequency under the No Build Alternative and the Preferred Alternative. The relative comparison results of this study were reviewed in conjunction with the proposed Preferred Alternative design to identify and address locations where concerns were observed by the safety analysis.

As a result of this safety analysis effort, the Preferred Alternative was developed and refined through an iterative process in support of the project. Furthermore, the Preferred Alternative will replace aging structures, provide new pavement, and include improved geometrics, which will likely result in safety improvements. The removal of the Collector-Distributor lanes along I-270 minimizes the project footprint and associated impacts while also eliminating conflict points at the slip ramps, though there is some tradeoff expected with additional merging and weaving in the General Purpose lanes. While the project will include tighter cross sections through small areas to avoid impacts to critical resources, introduce new signalized intersections along some crossroads, and include additional merge and diverge access points along the freeway at certain locations, safety improvement and mitigation considerations have been identified and will continue to be evaluated through the future design efforts. Areas where safety considerations should continue to be evaluated through the ongoing and future design efforts are identified in **Chapter 8**. Overall, this safety assessment demonstrates the Preferred Alternative should not have a significant adverse impact on the safety of the study corridors.

## 8 ADDITIONAL DESIGN AND MITIGATION CONSIDERATIONS

There are corridor, interchange, and intersection geometric, operational, and safety aspects within the Phase 1 South study area, in which additional improvements or mitigation strategies may be considered as part of future and ongoing design efforts. Due to its size and complexity, the Preferred Alternative will be implemented via multiple phases of construction within the limits of the Preferred Alternative, Phase 1 South. These operational and safety measures were identified as part of the IAPA analysis and will be considered further as the design and construction progresses:

- As part of the Preferred Alternative, new signals are proposed, and signal phasing modifications were identified where needed to provide safe operations and reduce conflicting movements. During final design and construction, signal phasing, timings, and offsets at adjacent intersections along crossroads should be reviewed to incorporate traffic shifts and new traffic signals into the system. Signal phasing or timing modifications may be needed to reduce the potential for conflicts, accommodate forecasted traffic volumes, or reduce queue spillback from occurring. In addition, ramp metering locations should be monitored, and adjustments may need to be considered to optimize traffic flow safely and operationally.
- New pavement and resurfacing will improve friction along the roadway and help to mitigate specific crash patterns associated with reduced pavement friction, such as wet-weather related crashes. Following construction, crash data should continue to be monitored to determine the need for additional measures such as high friction surface treatments to specific ramps with identified wet-weather crash patterns.
- Signing and pavement markings should be designed to clearly communicate message to motorists who may be unfamiliar with the roadway. Both the No Build and Preferred Alternative includes a combination of left and right-hand ramps and varying interchange configurations, which along with the HOT managed lane facility may contribute to driver confusion. Guide signing and markings will be designed to current MUTCD standards to best guide drivers without overloading the driver with information. Regulatory signs will be provided per the MUTCD to discourage wrong way movements at the HOT managed lane junctions.
- Additional opportunities to refine the proposed geometry to further discourage wrong way movements will be reviewed as part of final design. Opportunities to enhance pedestrian safety relative to existing conditions will also continue to be reviewed as design progresses.
- The trends of rear end, sideswipe, and peak period crashes that were identified through the safety analysis were found to be largely attributable to recurring congestion. The safety performance of these locations is expected to improve with the Preferred Alternative due to the improved operations, traffic volume shifts, and reduced duration of congested conditions. In addition, the demand to use the HOT lanes will be managed by toll rates, which will be set to achieve a minimum operating speed for the HOT lanes. However, congestion is still expected during the PM peak period on I-270 Northbound and the I-495 Inner Loop in the design year of 2045 due to downstream bottlenecks outside of the Preferred Alternative limits. Following implementation of the Preferred Alternative, conditions should be monitored to determine if additional safety measures are needed. For example:
  - The Preferred Alternative will include ITS devices that will have the ability to collect data and measure speeds along the roadway. These devices can be tied into an active warning system to alert motorists to downstream roadway conditions, such as congestion and slow speeds

ahead. Both the General Purpose lanes and the HOT lanes may be monitored through the vehicle data collection. This monitoring will be very beneficial for driver information systems, such as triggering messaging/signing to motorists. An active warning system, such as queue detection and warning messaging, has been found to reduce crashes in several studies:

- Following the implementation of Minnesota Queue Warning System (MN-QWARN) along a section of I-94 in Minneapolis, the freeway was found to have experienced a 49% reduction of crashes and an 82% reduction in near-crash events.<sup>17</sup> The ATM system incorporates intelligent lane control signals (ILCS) placed over selected lanes at half-mile increments. The ILCS units displayed the message Slow Traffic Ahead, which would direct drivers to reduce speed due to the congested lanes downstream. Research has shown that rear-end collisions tend to occur during extended lines of stop-and-go traffic and at end-of-queue locations. Overhead, real-time electronic messages that warn of queuing conditions ahead can prepare motorists to reduce speed and avoid potential rear-end collisions.<sup>18</sup>
- An innovative end-of-queue warning system was implemented on a 96-mile section of Interstate 35 (I-35) in central Texas as part of a freeway widening project. The system was designed to alert motorists of slowed or stopped vehicles ahead as they approached active construction projects on I-35. Preliminary results indicated that the end-of-queue warning system reduced crash potential by 18-45%.<sup>19</sup>

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<sup>17</sup> <https://trid.trb.org/view/1759599>

<sup>18</sup> <https://mntransportationresearch.org/2017/07/26/atm-queue-warning-systems-can-reduce-freeway-crashes/>

<sup>19</sup> <https://www.itskrs.its.dot.gov/node/209197>

## 9 FINDINGS AND CONCLUSION

FHWA Policy on Access to the Interstate System, published on May 22, 2017, addresses the two considerations and requirements defined in the memorandum as follows:

- Consideration and Requirement 1: Operational and safety analysis
- Consideration and Requirement 2: Connects to a public road and provides for all movements and is designed to meet or exceed current standards

This Application for Interstate Access Point Approval meets these two considerations and requirements.

### **Consideration and Requirement 1: Operational and Safety Analysis**

*An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

Traffic operational and safety analyses are documented in **Chapters 6 and 7**, respectively. The operational study area limits consist of the Phase 1 South limits shown in **Figure 1-1**, the adjacent freeway segments and interchanges along I-495 and I-270, as well as the adjacent signalized intersections along the 13 crossroads. The methodology used to develop traffic forecasts for the project is summarized in **Chapter 5**. VISSIM microsimulation software was used for the evaluation of traffic operations for the project. Safety analysis using historical crash data and HSM methodologies were used for the evaluation of safety. The traffic analysis demonstrates that the “the proposed change in access does not have a significant adverse impact on the safety and operation of the interstate facility or on the local street network based on both the current and planned future traffic projections.”

The operational analysis includes both the Preferred Alternative and No Build conditions for 2027 opening and 2045 design years, documented in **Chapter 6**. All proposed merge and diverge junctions associated with the Preferred Alternative, proposed at-grade exchange ramps along I-270 West Spur, new HOT lane ramps, and the truncation areas where the HOT lanes end and tie into the General Purpose lanes were evaluated. In addition, the proposed interchange modifications at MD 190 (where General Purpose loop ramps will be replaced with directional ramps) and I-270 at MD 189 (where the existing SPUI will be replaced with a DDI) as well as all the proposed HOT lane ramp connections onto the crossroads were evaluated and assessed to determine their operation and safety impacts. With the Preferred Alternative, there are significant operational benefits to the system. In addition to increased throughput there is a significant decrease in the lane mileage of failing freeway segments. While congestion will still be present during the PM peak period on I-270 Northbound



and the I-495 Inner Loop in the design year of 2045 due to downstream bottlenecks outside of the Preferred Alternative limits, in most cases, the Preferred Alternative will also increase speeds and reduce travel times and delays compared to the No Build Alternative.

Existing crash data was summarized, high crash locations were identified, and both a qualitative assessment and predictive safety analysis were performed to document the anticipated safety impacts of the Preferred Alternative in **Chapter 7**. By reducing the extent and duration that the freeways and local roadways operate under congestion, unstable flow, and stop-and-go conditions, it can be anticipated that the Preferred Alternative will reduce the potential for congestion-related crashes, such as rear-end and sideswipe crashes occurring during peak periods. As a result of the safety analysis effort, the Preferred Alternative was developed and refined through an iterative process in support of the project. Furthermore, the Preferred Alternative will replace aging structures, provide new pavement, and include improved geometrics, which will likely result in safety improvements. The removal of the Collector-Distributor lanes along I-270 minimizes the project footprint and associated impacts while also eliminating conflict points at the slip ramps, though there is some tradeoff expected with additional merging and weaving in the General Purpose lanes. While the project will include tighter cross sections through small areas to avoid impacts to critical resources, introduce new signalized intersections along some crossroads, and include additional merge and diverge access points along the freeway at certain locations, safety improvement and mitigation considerations have been identified and will continue to be evaluated through the future design efforts. Areas where safety considerations should continue to be evaluated through the ongoing and future design efforts are identified in **Chapter 8**. Overall, the safety assessment demonstrates the Preferred Alternative should not have a significant adverse impact on the safety of the study corridors.

A conceptual signing plan depicting all major guide signs was prepared and is included in **Appendix F**.

### **Consideration and Requirement 2: Connects to Public Road and Provides for All Movements**

*The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.*

The Preferred Alternative will provide additional new access at existing interchanges to serve traffic to/from the HOT managed lanes, as shown in **Table 3-1**. New access locations would include two new interchanges where access does not currently exist: on I-270 at Wootton Parkway and Gude Drive. A new interchange would be constructed at the existing Wootton Parkway overpass to provide direct access to and from the I-270 HOT managed lanes only. A new interchange would also be constructed at Gude Drive to provide direct access to and from the I-270 HOT managed lanes only. Additionally, direct access to the northbound HOT managed lanes and from the southbound HOT managed lanes on the I-270 West Spur would be provided at Westlake Terrace by repurposing the existing HOV entrance and exit ramps. The existing intersection at Westlake Terrace would be converted to a four-leg intersection with new exit and entrance ramps to/from the south to provide direct



access for all directions on the HOT managed lanes. Per Consideration and Requirement 2, less than “full interchanges” are allowed for managed lanes or park and ride lots. There are no existing or proposed interchange access to serve park and ride lots. Wootton Parkway, Gude Drive, and Westlake Terrace are less than full interchanges but have proposed HOT managed lanes access. All existing traffic movements that are currently accommodated along I-270 and I-495 within the limits of the Preferred Alternative will continue to be accommodated.

All elements of the project will be designed in accordance with AASHTO and MDOT SHA standards to the extent practical. Design criteria are identified in Section 4.1 and Appendix D. The Design Exceptions under consideration for the Preferred Alternative are shown in Table 4-1.