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APPENDIX B
MDOT SHA's Draft Application for Interstate Access Point Approval (IAPA)
June 2022

This is MDOT SHA's draft application to FHWA for Interstate Access Point Approval. This application will be updated as needed based on continued coordination with FHWA, before FHWA final approval.

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

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EXECUTIVE SUMMARY

This is the Maryland Department of Transportation State Highway Administration's (MDOT SHA) Draft Application to the Federal Highway Administration (FHWA) for Interstate Access Point Approval (IAPA). This application will be updated as needed based on continued coordination with FHWA before FHWA final approval.

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 MDOT Draft 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

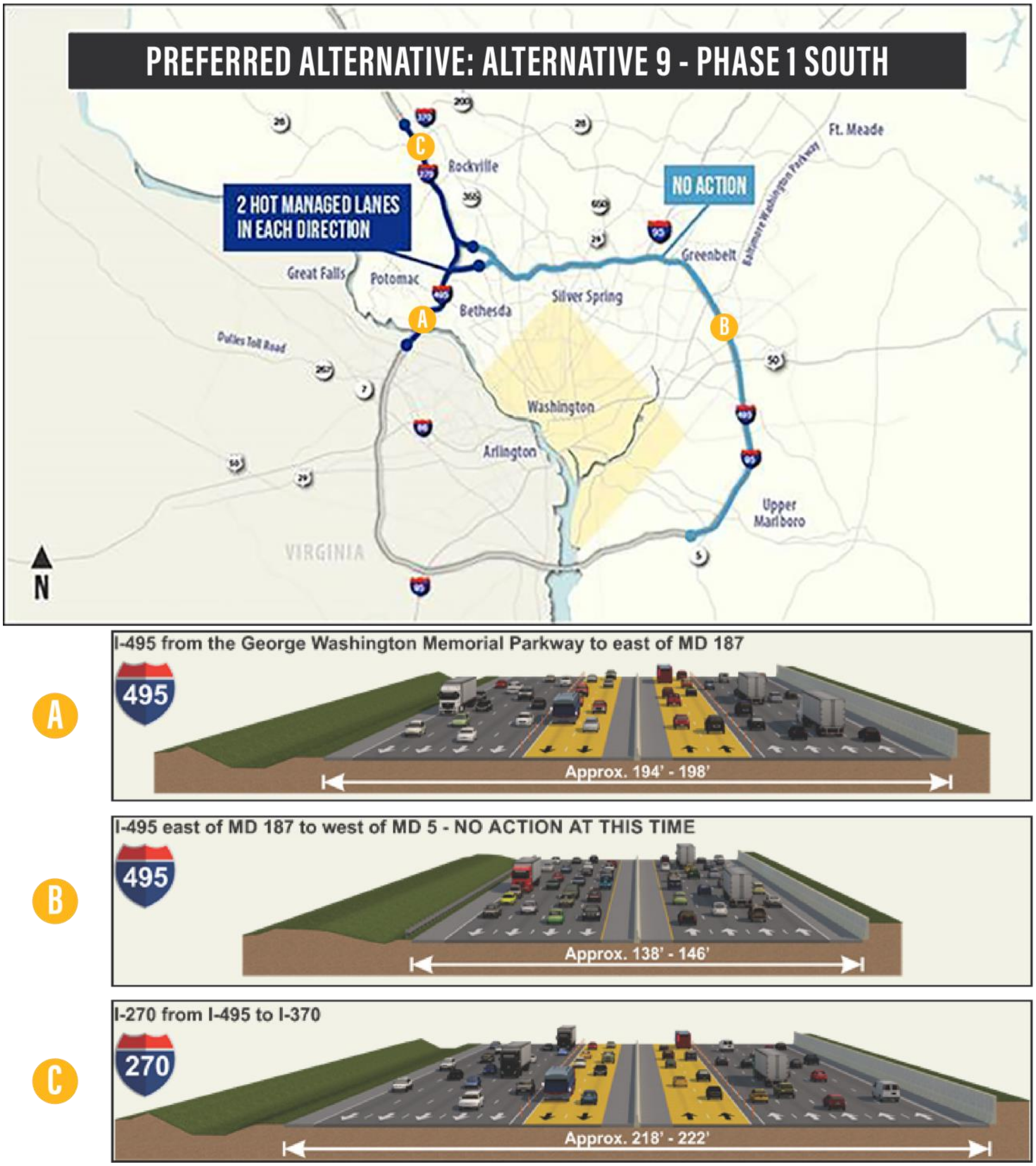
Spurs, as shown in **Figure ES-1**.

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	• 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 • 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
Lane-Miles of LOS ‘D’ or better and/or LOS ‘F’	• AM, I-495 Inner Loop: LOS ‘D’ or better – 61% No Build / 72% Preferred; LOS ‘F’ – 28% No Build / 25% Preferred • AM, I-495 Outer Loop: LOS ‘F’ – 35% No Build / 2% Preferred • AM, I-270 NB: LOS ‘D’or better – 97% No Build / 99% Preferred • AM, I-270 SB: LOS ‘D’ or better – 75% No Build / 89% Preferred; LOS ‘F’ – 12% No Build / 6% Preferred • PM, I-495 Inner Loop: LOS ‘F’ – 79% No Build / 67% Preferred • PM, I-495 Outer Loop: LOS ‘F’ – 24% No Build / 6% Preferred • PM, I-270 NB: LOS ‘D’or better – 36% No Build / 56% Preferred; LOS ‘F’ – 54% No Build / 38% Preferred • PM, I-270 SB: LOS ‘D’ or better – 95% No Build / 98% Preferred; LOS ‘F’ – 5% No Build / 1% Preferred
Travel Time	• AM, I-495 Inner Loop – Preferred Alternative improves both GP and HOT travel times between VA 193 and I-270 West Spur • AM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT travel times with significant reductions in 8-10 AM hours • AM, I-270 SB – Comparable travel time for GP, Preferred Alternative provides improved HOT travel times • AM, I-270 NB – Comparable travel times for both GP and HOT • 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 • PM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT, with significant improvements during 5-7 PM hours • PM, I-270 SB – Comparable travel times for both GP and HOT • 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
Throughput	• AM, I-495 Inner Loop & I-270 NB – Preferred Alternative increases throughput by 5% to 13% • AM, I-495 Outer Loop & I-270 SB – Preferred Alternative increases throughput by 10% to 12% • PM, I-495 Inner Loop & I-270 NB – Preferred Alternative increases throughput by 9% to 18% • PM, I-495 Outer Loop & I-270 SB – Preferred Alternative increases throughput by 13% to 18%
Queuing onto Mainline/Crossroads	• AM – Preferred Alternative improves queue spillback at over 15 ramps and eliminates queue spillback at all ramps • PM – Preferred Alternative improves queue spillback at over 35 ramps

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

Performance Metric	No Build vs. Preferred Alternative Conditions
Network Performance	• 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 • 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
Lane-Miles of LOS 'D' or better and/or LOS 'F'	• AM, I-495 Inner Loop: LOS 'D' or better – 55% No Build / 58% Preferred • AM, I-495 Outer Loop: LOS 'F' – 44% No Build / 2% Preferred • AM, I-270 NB: LOS 'D' or better – 98% No Build / 99% Preferred • AM, I-270 SB: LOS 'D' or better – 70% No Build / 87% Preferred; LOS 'F' – 16% No Build / 6% Preferred • PM, I-495 Inner Loop: LOS 'F' – 87% No Build / 78% Preferred • PM, I-495 Outer Loop: LOS 'F' – 45% No Build / 6% Preferred • PM, I-270 NB: LOS 'D' or better – 34% No Build / 55% Preferred; LOS 'F' – 57% No Build / 40% Preferred • PM, I-270 SB: LOS 'D' or better – 93% No Build / 99% Preferred; LOS 'F' – 7% No Build / 1% Preferred
Travel Time	• AM, I-495 Inner Loop – Preferred Alternative improves both GP and HOT travel times between VA 193 and I-270 West Spur • AM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT travel times with significant improvement in 8-10 AM hours • AM, I-270 SB – Comparable travel time for GP, Preferred Alternative provides improved HOT travel times • AM, I-270 NB – Comparable travel times for both GP and HOT • 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 • PM, I-495 Outer Loop – Preferred Alternative improves both GP and HOT with significant improvement in 5-7 PM hours • PM, I-270 SB – Comparable travel times for both GP and HOT • PM, I-270 NB – Comparable travel times for GP; Preferred Alternative improves HOT travel times for all PM hours with greatest savings during 5-7 PM hours
Throughput	• AM, I-495 Inner Loop & I-270 NB – Preferred Alternative increases throughput by 11% to 19% • AM, I-495 Outer Loop & I-270 SB – Preferred Alternative increases throughput by 11% to 19% • PM, I-495 Inner Loop & I-270 NB – Preferred Alternative increases throughput by 14% to 27% • PM, I-495 Outer Loop & I-270 SB – Preferred Alternative increases throughput by 9% to 20%
Queuing onto Mainline/Crossroads	• AM – Preferred Alternative improves queue spillback at over 15 ramps and eliminates queue spillback at most ramps • PM – Preferred Alternative improves queue spillback at over 30 ramps

D. SAFETY ANALYSIS FINDINGS

The safety evaluation conducted as part of this Draft 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 Draft 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 results 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 milage 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 show in **Table 4-1**.

1 INTRODUCTION

This is the Maryland Department of Transportation State Highway Administration's (MDOT SHA) Draft Application to the Federal Highway Administration (FHWA) for Interstate Access Point Approval (IAPA). This application will be updated as needed based on continued coordination with FHWA before FHWA final approval.

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[1]. The Supplemental Draft Environmental Impact Statement (SDEIS) was completed in October 2021[2]. The Final Environmental Impact Statement (FEIS) is planned to be completed in Spring 2022.

1.1 REPORT PURPOSE

MDOT SHA developed this Draft 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 Draft 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 Draft 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.

[1] https://oplanesmd.com/deis/
[2] 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** and included in **Appendix E**. 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.

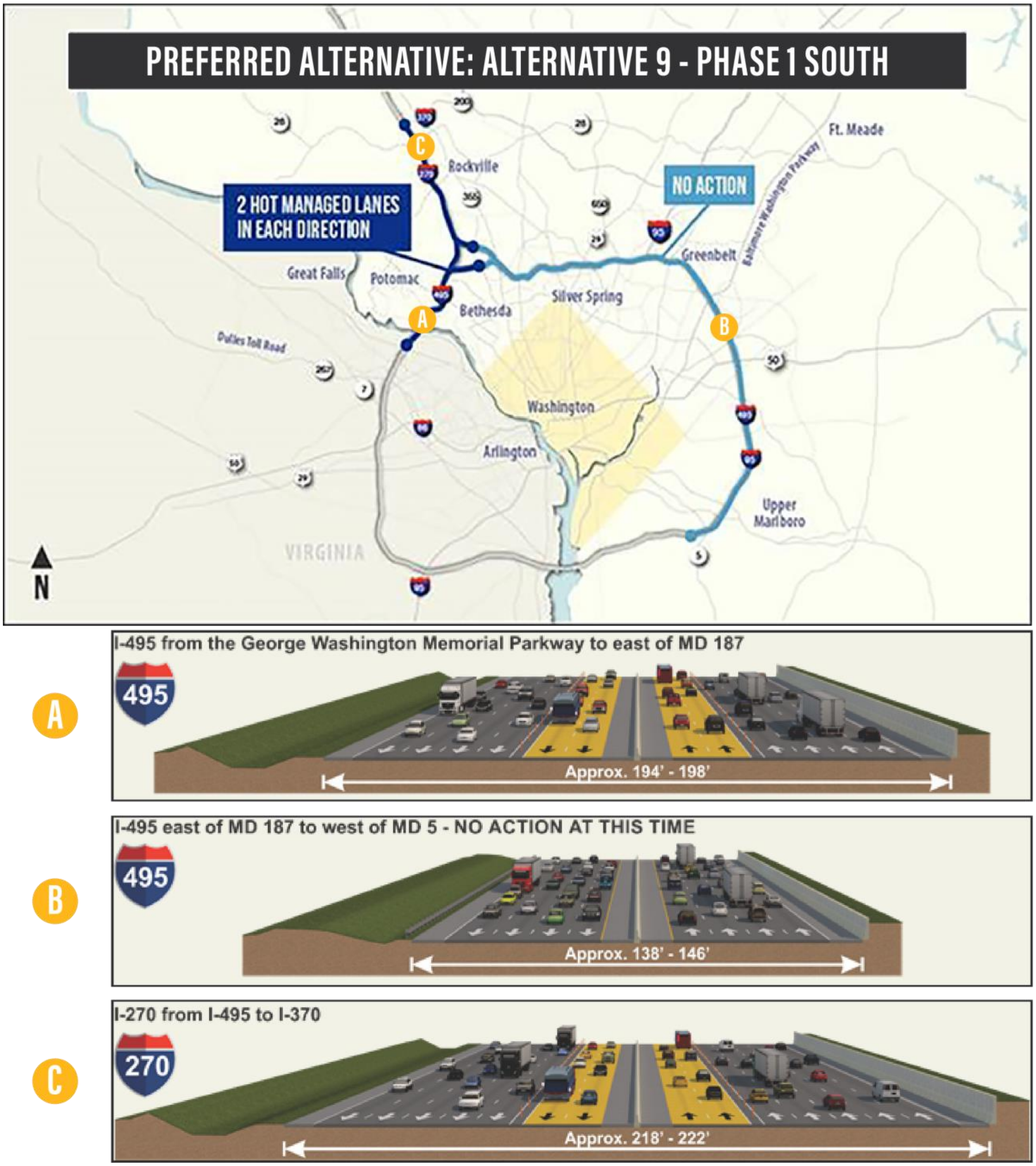
The IAPA Framework Document was agreed upon by both MDOT SHA and FHWA in December 2020 after a series of meetings and reviews. As recommended in the FHWA Interstate System Access Informational Guide, the purpose of the IAPA Framework Document is to engage in early coordination between the State DOT and 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

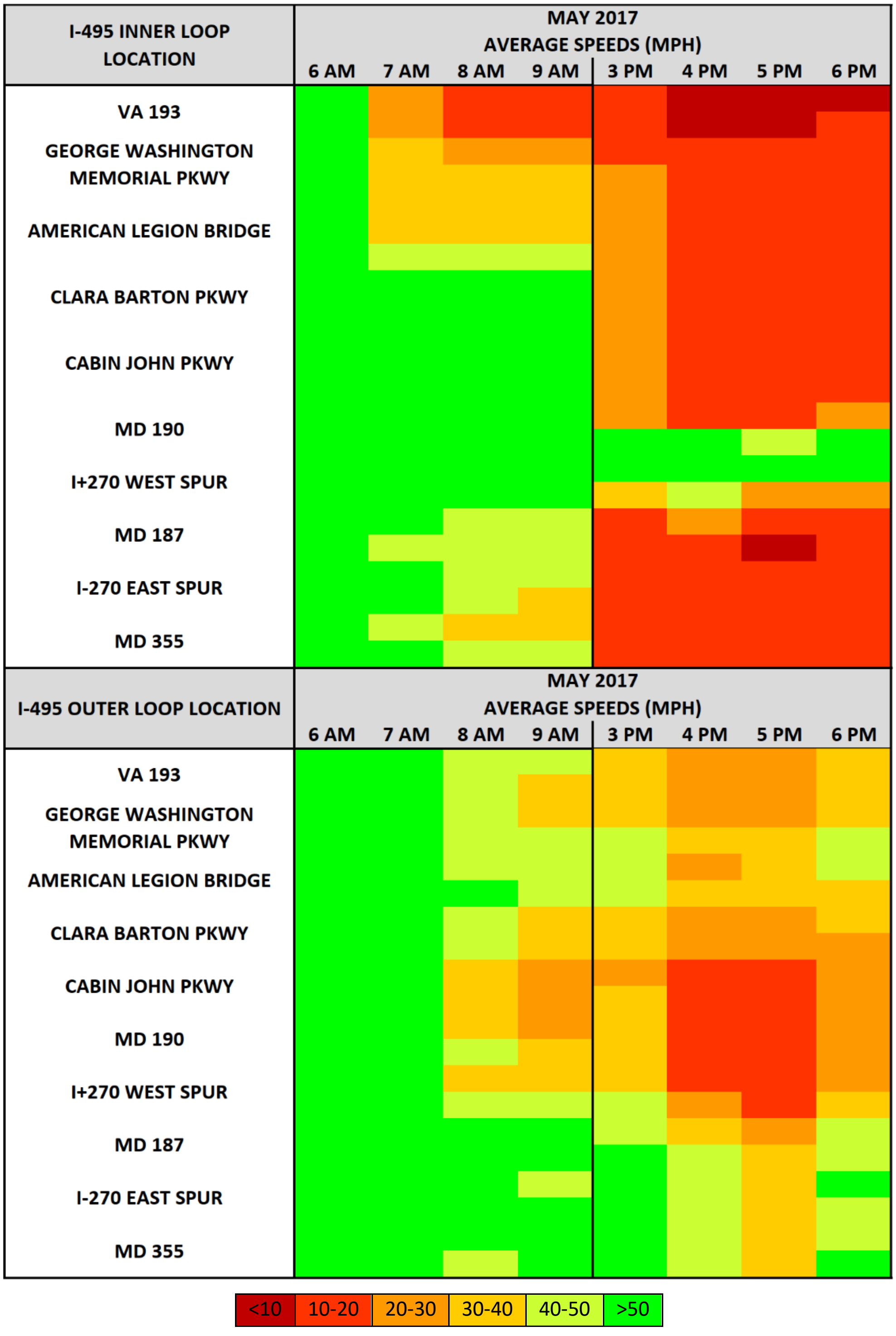
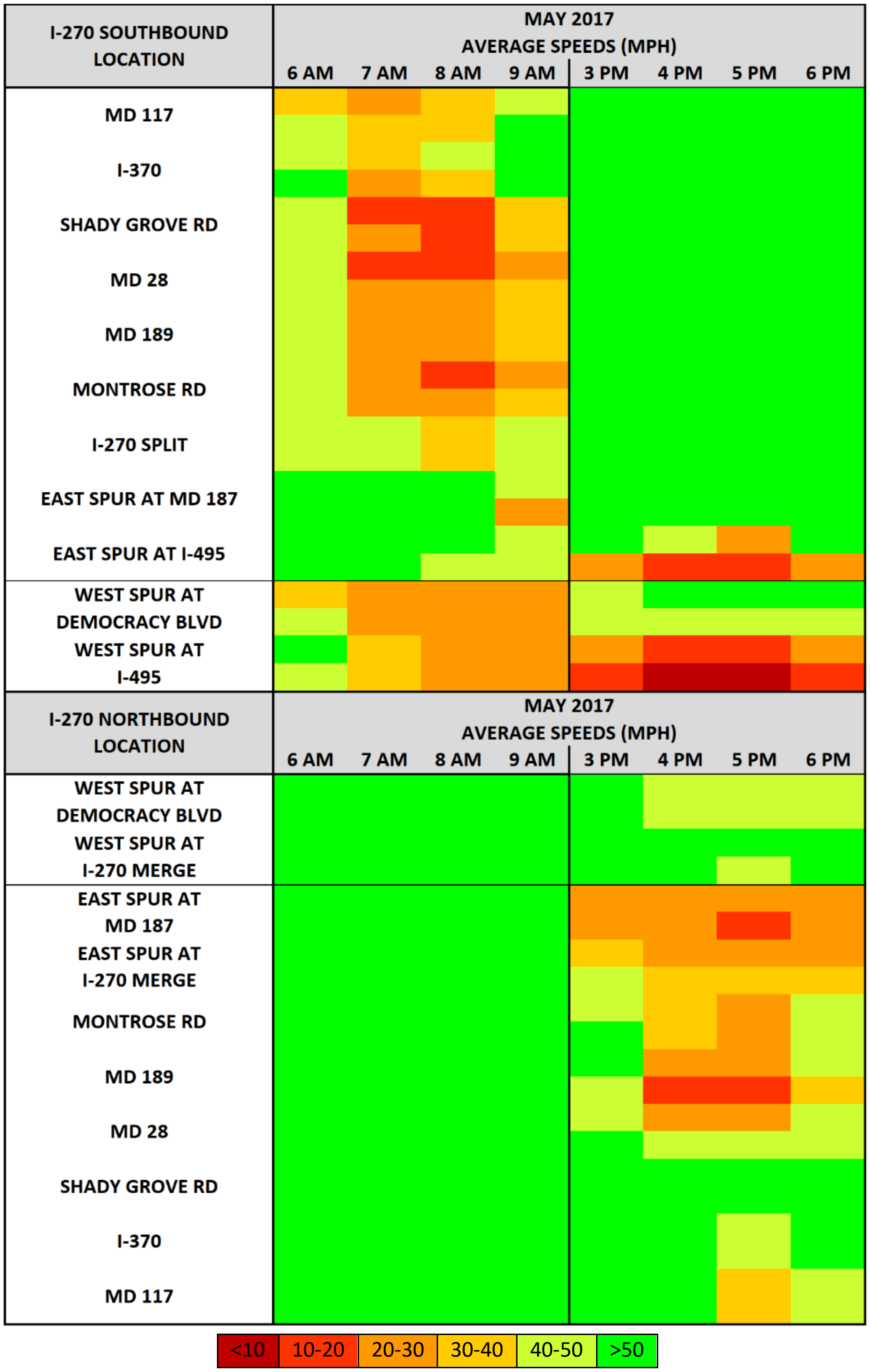


Figure 2-2: I-270 2017 Existing AM/PM Peak Period Average Speeds from RITIS



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 (MWCOG) – 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[3]:** 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 in 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[4]:** 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**.

[3] https://mdot-sha-i270-i70-to-i495-inno-cong-mgmt-mo0695172-maryland.hub.arcgis.com/
[4] https://mdot-sha-i270-watkins-mill-intrc-mo3515172r-maryland.hub.arcgis.com/

- **VDOT I-495 Express Lanes Northern Extension (NEXT) Study[5]:** VDOT is performing 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. Construction began in March 2022 and be completed by 2025. A map of the VDOT NEXT study area is shown in **Figure 2-5.**
- **MD 97 Montgomery Hills Project[6]:** 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.**
- **MD 185 Salt Barn[7]:** 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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[5] http://www.495northernextension.org/
[6] https://mdot-sha-md97-md390-to-md192-mo2242115-maryland.hub.arcgis.com/
[7] https://mdot-sha-md185-salt-barn-replacement-mo5245115-maryland.hub.arcgis.com/

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

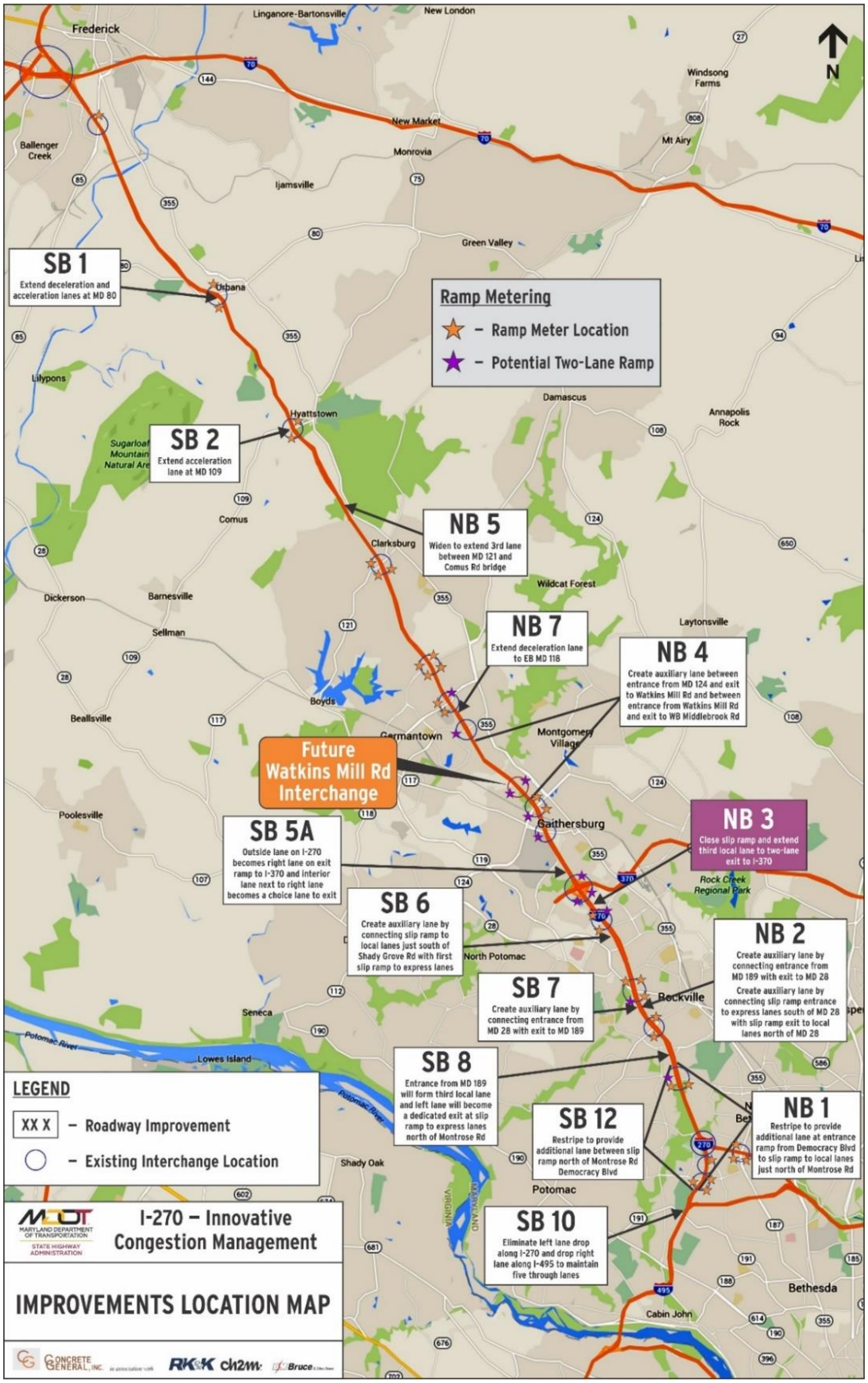


Figure 2-4: Greenbelt Metro Station Access Improvements

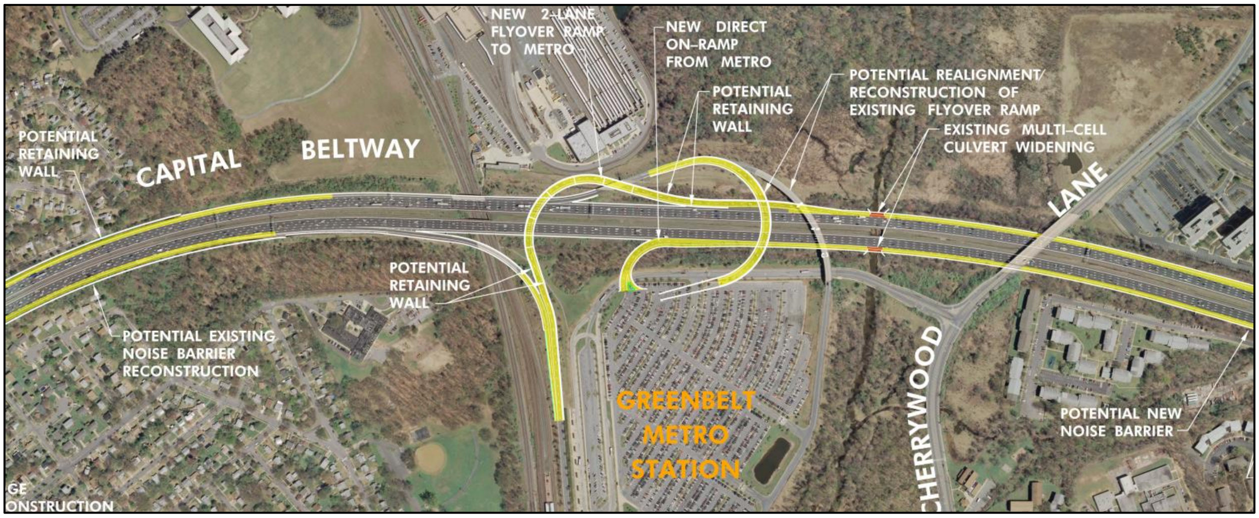


Figure 2-5: VDOT NEXT Study Area

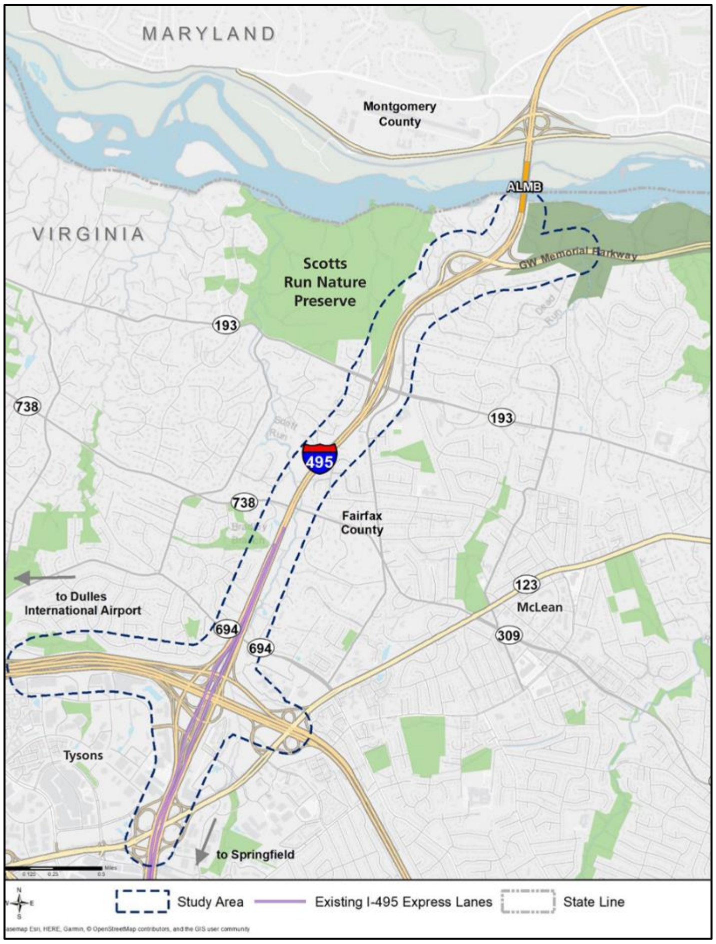
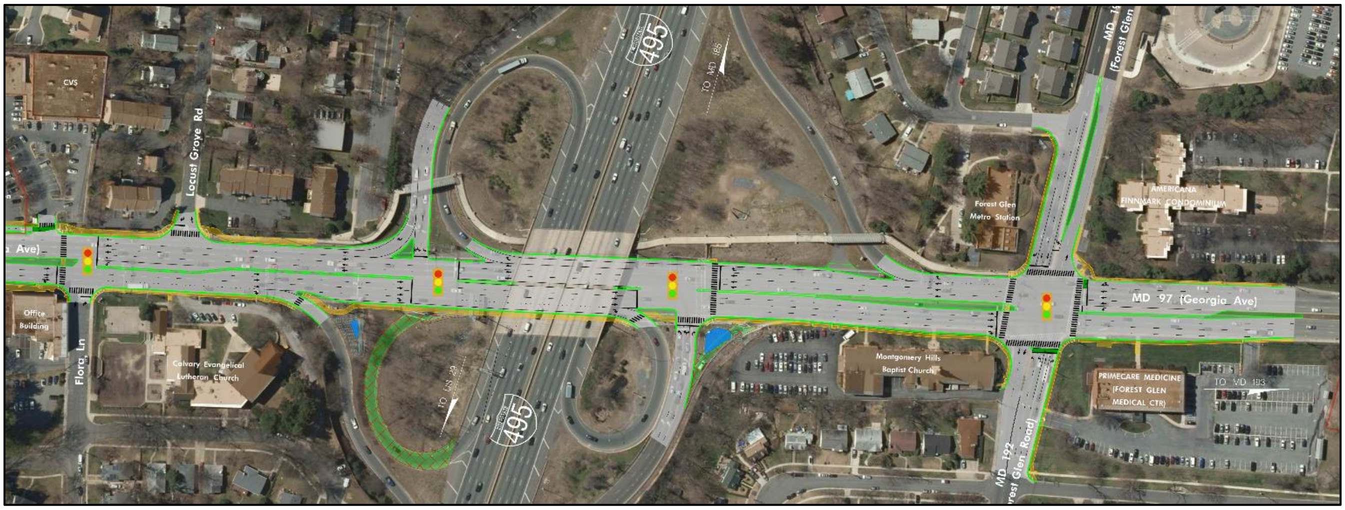


Figure 2-6: MD 97 Montgomery Hills Project



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.

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, 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.

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)

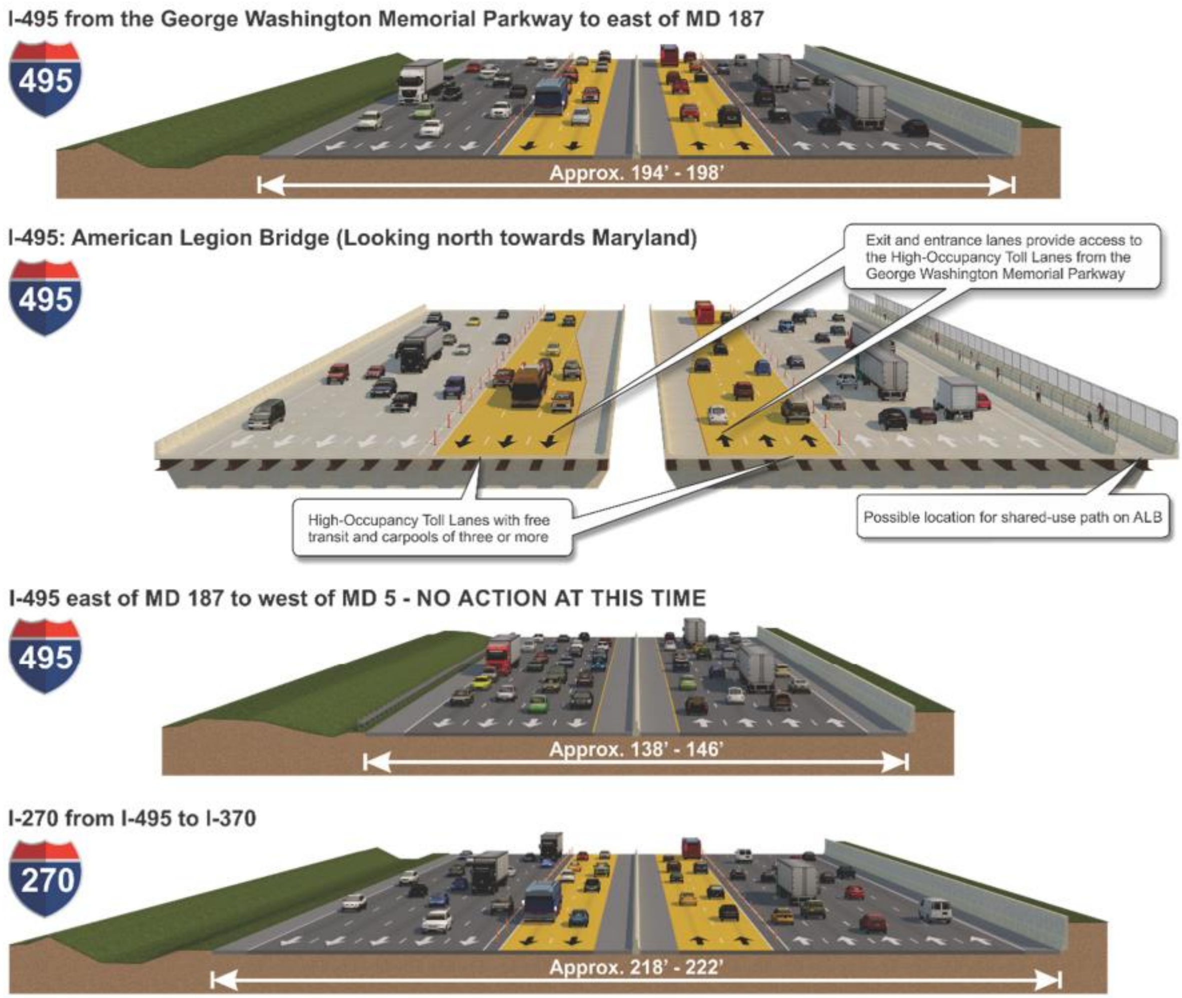


Table 3-1: Study Interchanges and HOT Managed Lane Access Locations under the Preferred Alternative

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 GPL 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 GPL 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 to GP and GP to HOT	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 to GP SB and from GP to HOT 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 (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 to Virginia GP and exchange ramp IL from Virginia GP to Maryland HOT	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
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 to GP EB and from GP to HOT WB	No change
I-495 at MD 187 (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

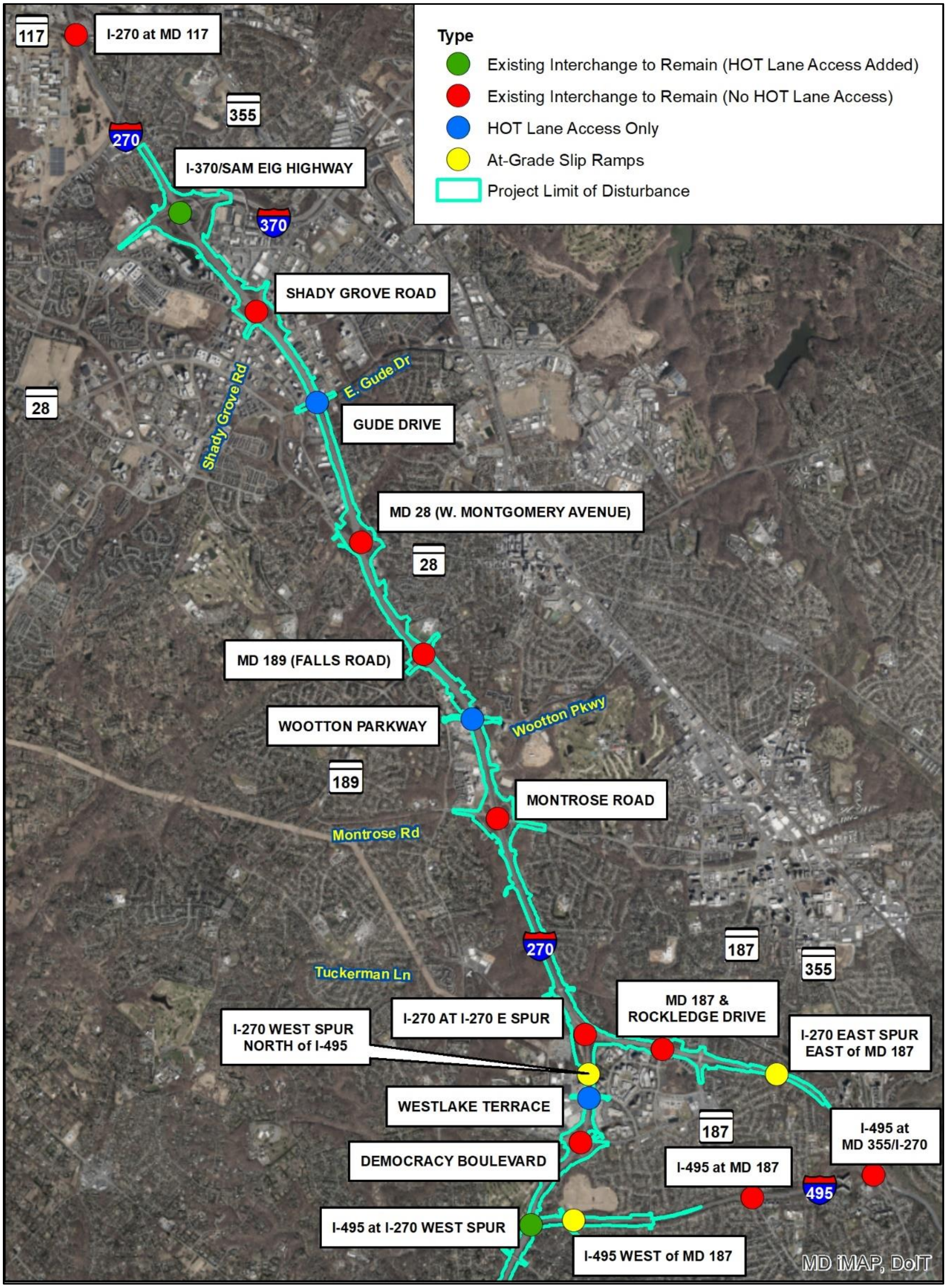
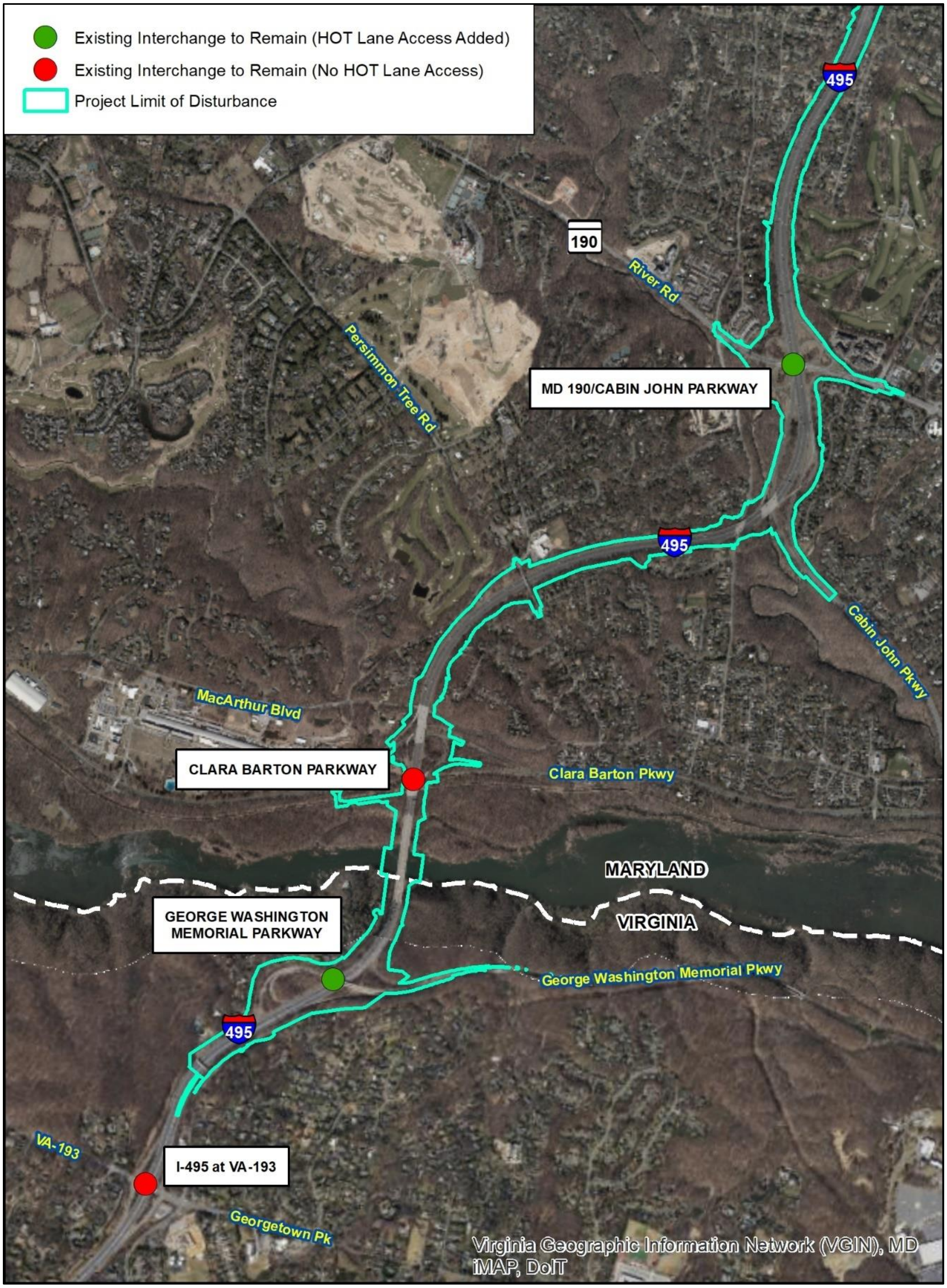


Figure 3-2: Study Interchanges and HOT Managed Lane Access Locations under the Preferred Alternative (Continued)



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.

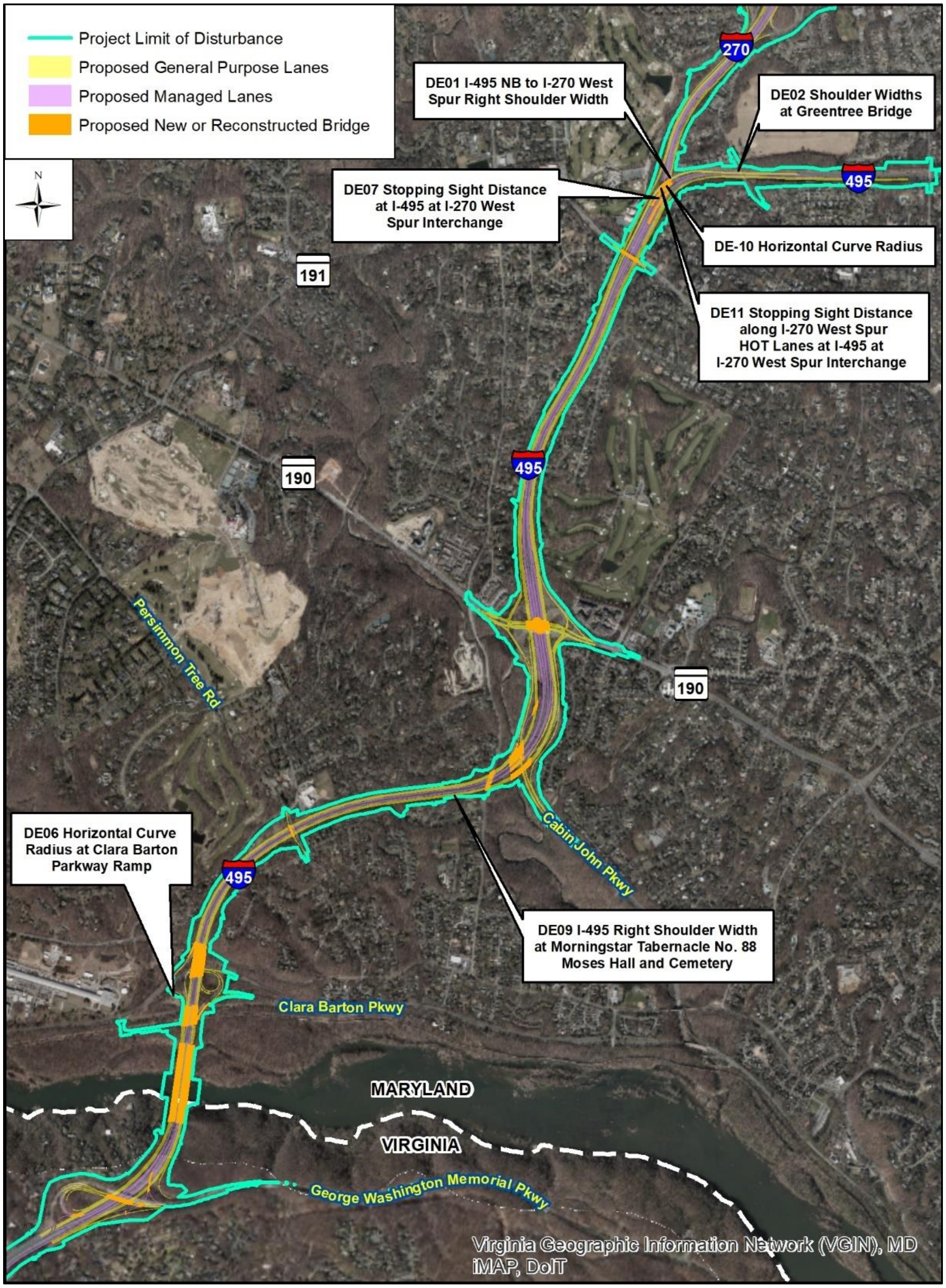
4.2 DESIGN EXCEPTIONS

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 will be included in **Appendix E** in a future submittal.

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 PML & GPL	2040+08 ± to 2042+90 ±	Right Shoulder Width	10 ft	6 ft min.
DE02	Shoulder Widths at Greentree Bridge	I-495 East EB PML (I-495 EB GPL Stationing)	2013+04 to 2027+75	Left Shoulder Width	10 ft	2 ft min.
		I-495 East WB PML	2049+60 to 2062+84			
DE06	Horizontal Curve Radius at Clara Barton Parkway Ramp	Ramp from Clara Barton Parkway EB to I-495 GPL 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 GPL	2004+00 to 2014+49	Stopping Sight Distance	60 mph	50 mph
		I-495 NB to EB PML	2025+21 to 2036+27			
		I-495 WB to SB PML	2036+23 to 2047+78			
		I-495 WB to SB GPL	2019+01 to 2031+47			
		I-495 NB to EB GPL	2012+60 to 2016+00			
		I-495 WB to SB GPL	2027+90 to 2029+70			
DE09	I-495 Right Shoulder Width at Morningstar Tabernacle No. 88 Moses Hall and Cemetery	I-495 NB GPL	1182+36 to 1184+70	Shoulder Width	10 ft paved 12 ft total	6 ft paved 6 ft total
DE10	Horizontal Curve Radius	I-495 NB to EB GPL	2004+00 to 2014+49	Horizontal Curve Radius	60 mph	50 mph
		I-495 NB to EB PML	2025+21 to 2036+27			
		I-495 WB to SB PML	2036+23 to 2047+78			
		I-495 WB to SB GPL	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-footpaved 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 Draft 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 June 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[8].

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:

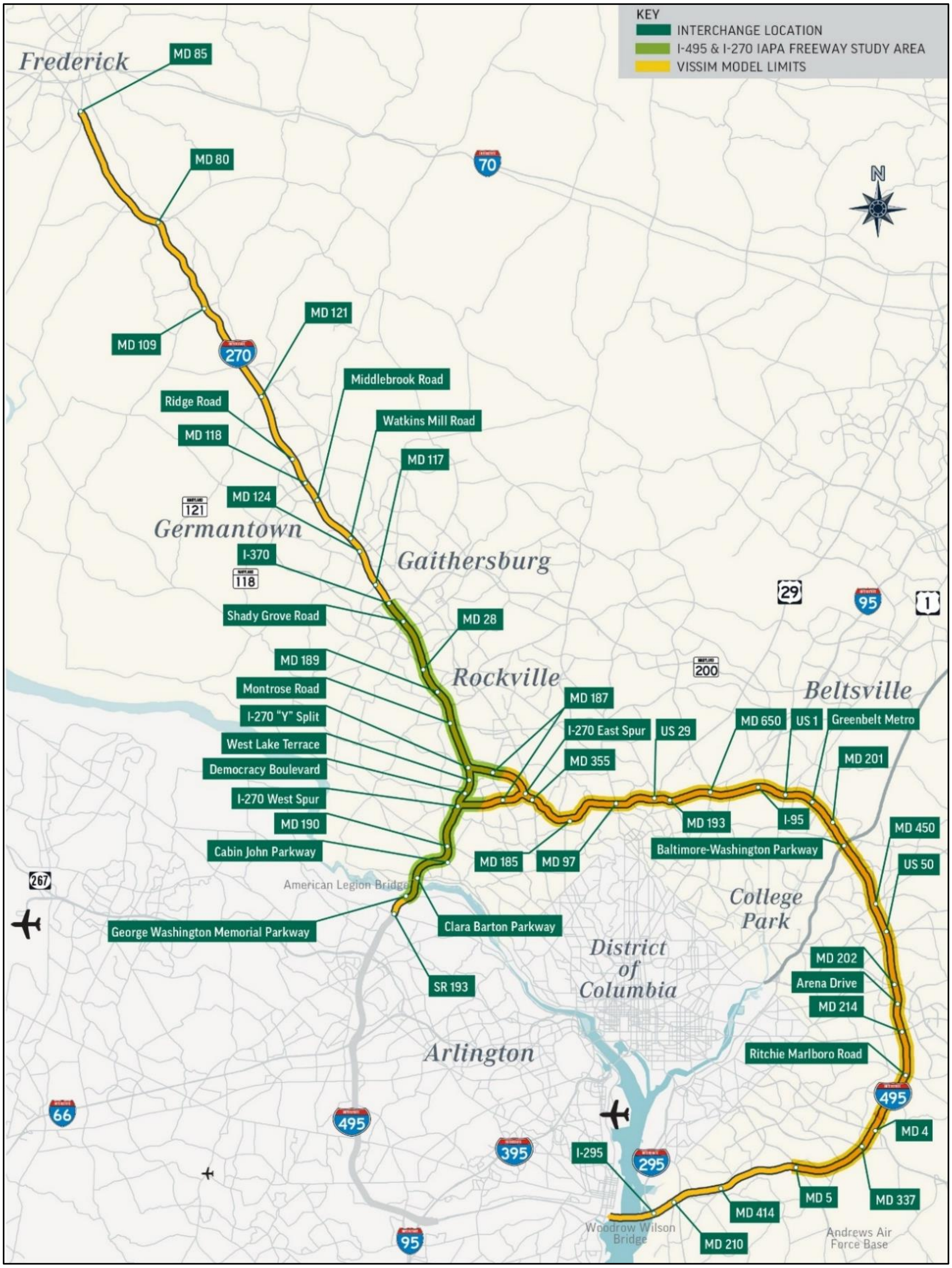
- I-495 from VA 193 in Virginia across the American Legion Bridge (ALB) and through the state of Maryland to the Woodrow Wilson Bridge
- I-270 from the I-70 ramp merges to I-495, including the East and West Spurs

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.

[8] 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[9].

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**.

[9] 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 crossword 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) 6th edition reports from Synchro in most cases, which are based on Chapter 19 of the HCM. At intersections that cannot be reported using HCM 6th 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

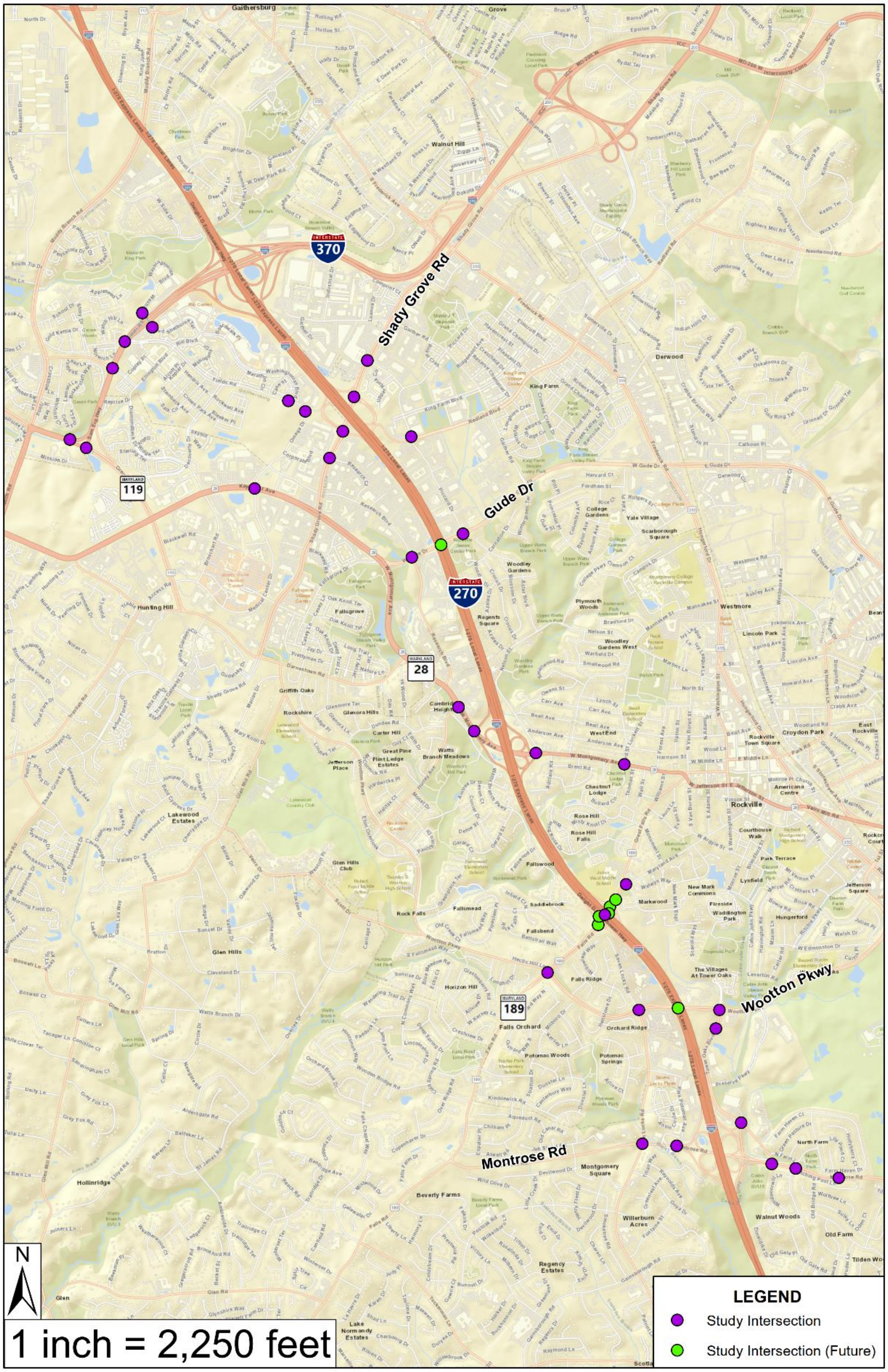
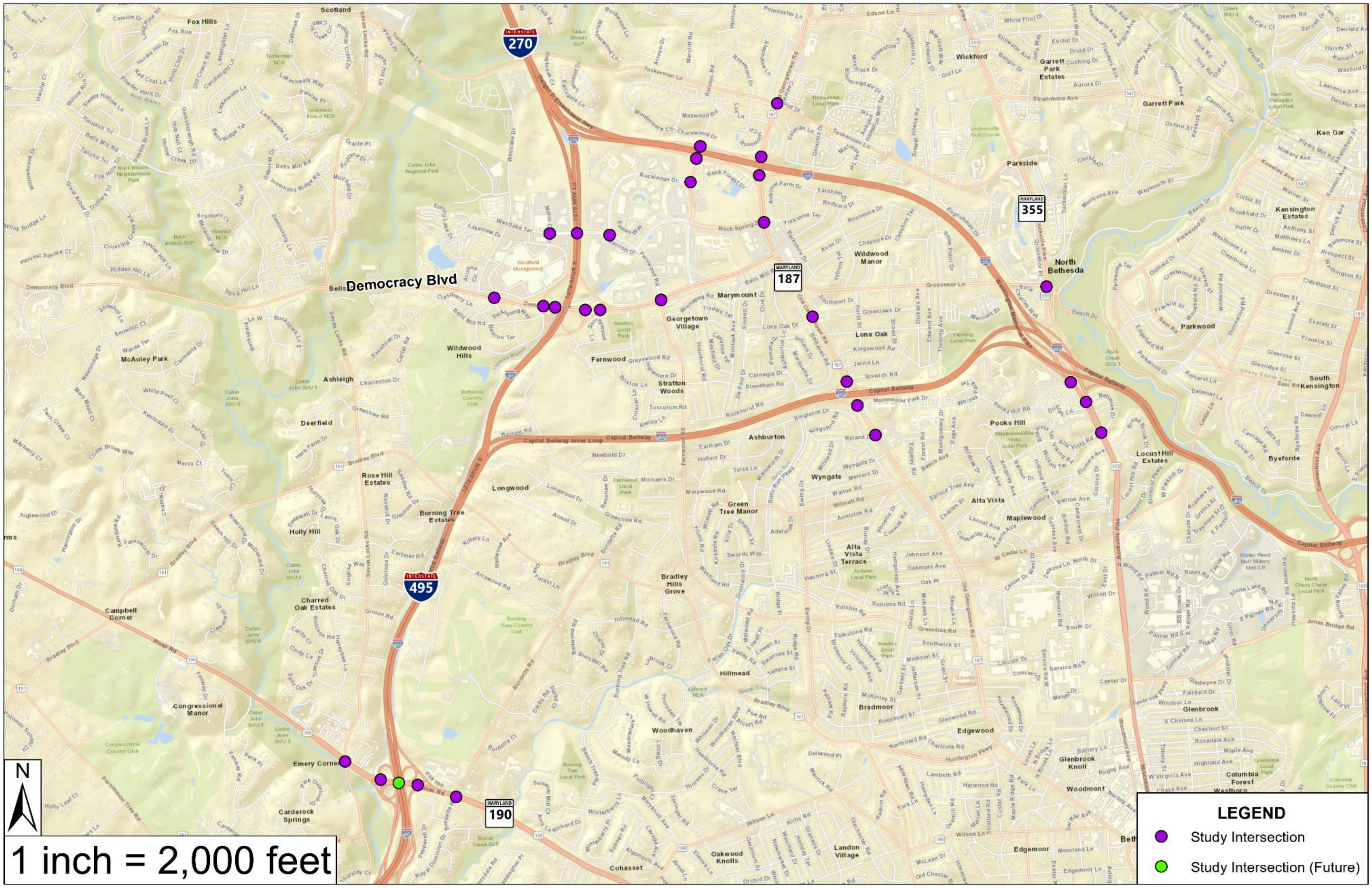


Figure 6-2: Crossroad Intersection Locations (Continued)



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:
  - "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."
  - *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
  - "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."
  - *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
  - "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."
  - *Average and maximum simulated queues from VISSIM are reported. 50th and 95th 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, 64% of lane-miles along the I-495 Outer Loop, and 52% 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

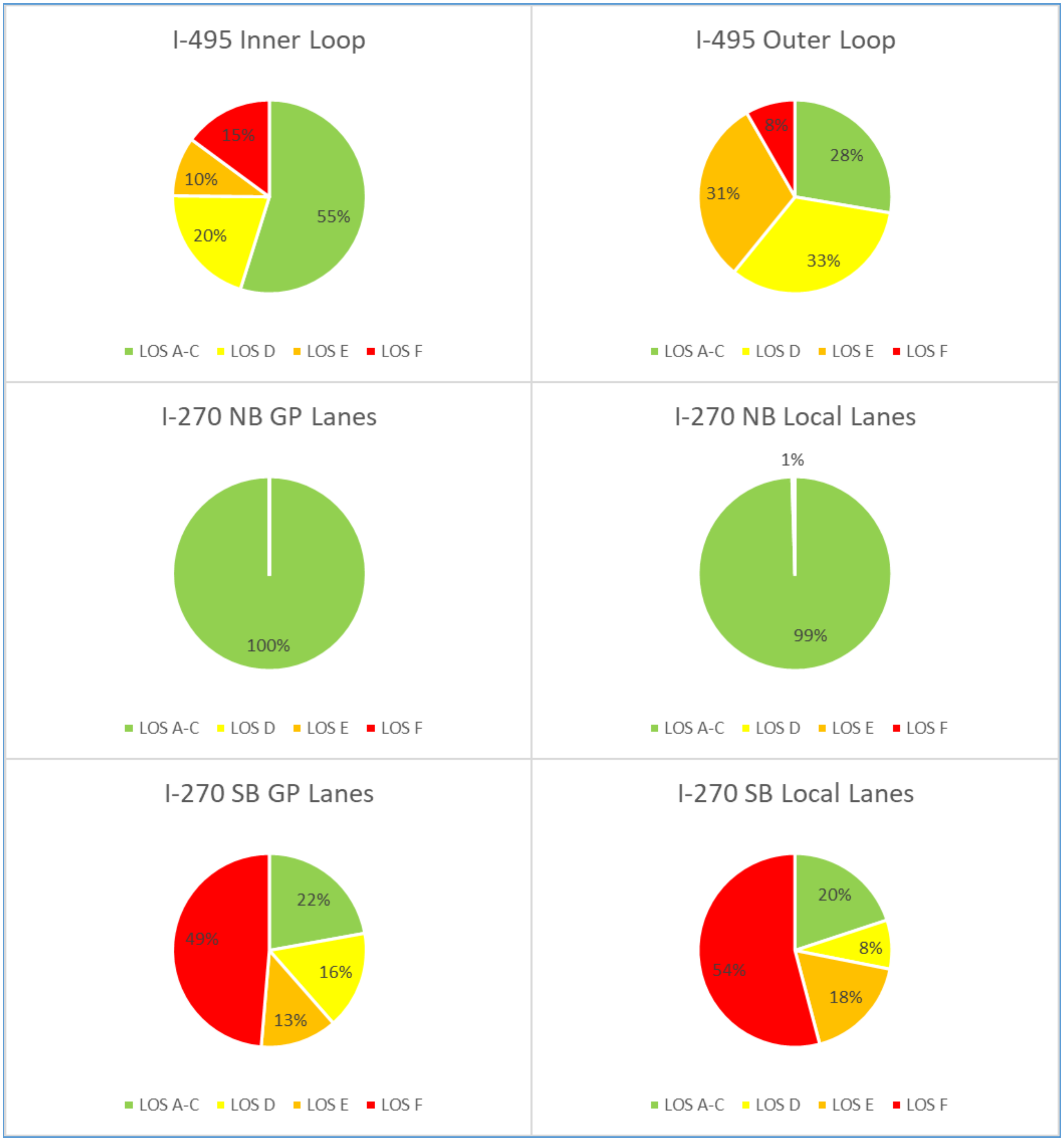


Figure 6-5: 2017 Existing PM Mainline Segment LOS

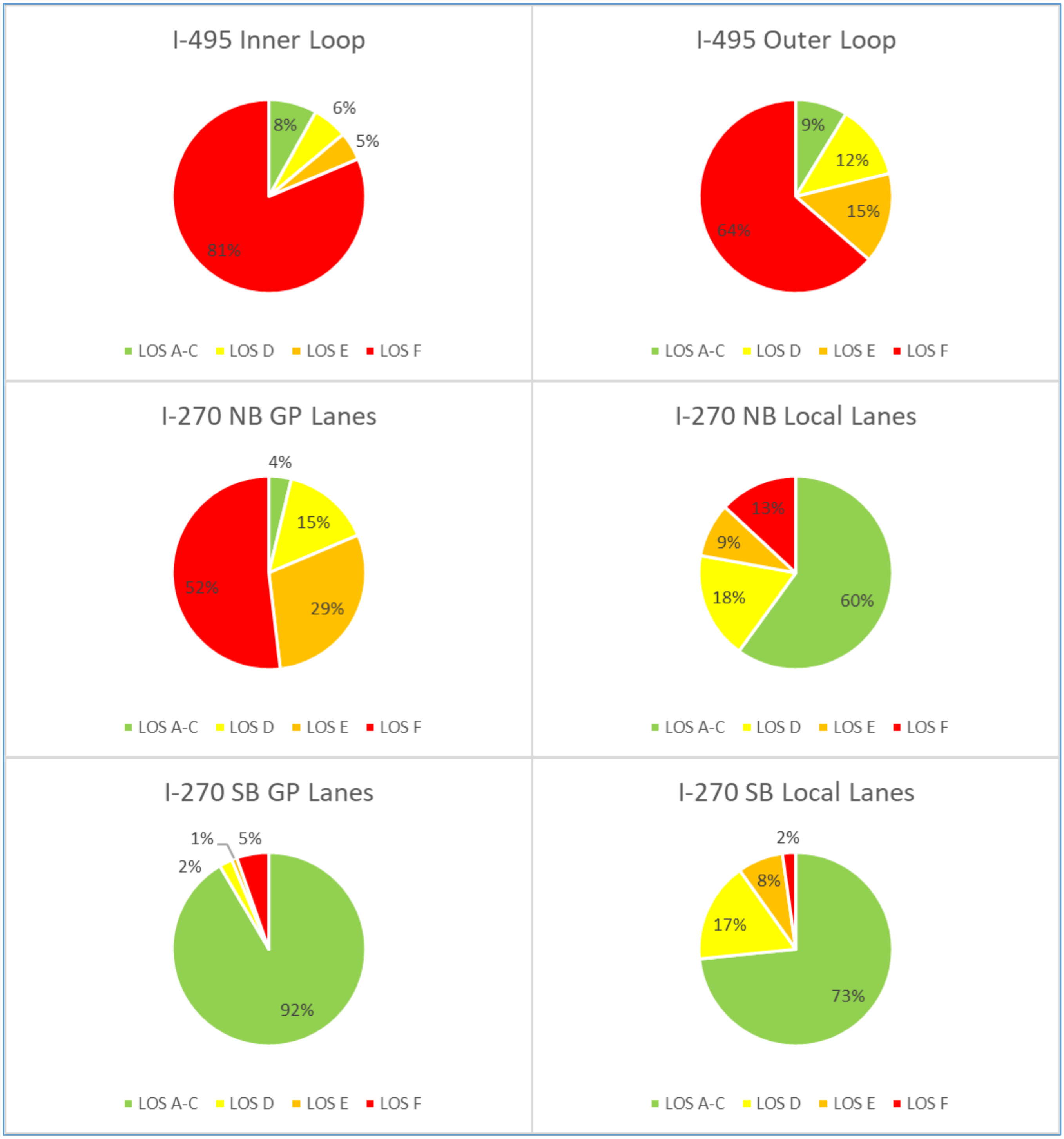


Table 6-4: 2017 Existing AM VISSIM Freeway Speed (mph) and Density (pc/hr/ln) by Segment

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	29	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	19	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

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 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	19	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	38
	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	LOS D	LOS E	LOS F

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

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-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	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 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

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 only approximately 200 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)
AM Peak Period							
6-7 AM	No Build	2482	1302	8517	9819	38	28739
	Preferred Alternative	2110	1092	8324	9416	39	28930
	Network Benefit	**372**	**210**	**193**	**403**	**1**	**-191**
7-8 AM	No Build	12252	6536	17719	24255	29	39115
	Preferred Alternative	11383	5879	16297	22176	31	38355
	Network Benefit	**869**	**657**	**1422**	**2079**	**2**	**760**
8-9 AM	No Build	24048	18306	17719	36025	26	44841
	Preferred Alternative	21104	16906	18860	35766	30	41541
	Network Benefit	**2944**	**1400**	**-1141**	**259**	**4**	**3300**
9-10 AM	No Build	29609	26710	21901	48611	26	42896
	Preferred Alternative	23174	21918	16851	38769	31	38594
	Network Benefit	**6435**	**4792**	**5050**	**9842**	**5**	**4302**
PM Peak Period							
3-4 PM	No Build	1468	851	9678	10529	37	33253
	Preferred Alternative	563	429	6891	7320	41	31363
	Network Benefit	**905**	**422**	**2787**	**3209**	**4**	**1890**
4-5 PM	No Build	7142	3734	18519	22253	29	41877
	Preferred Alternative	2188	1159	12621	13780	35	37537
	Network Benefit	**4954**	**2575**	**5898**	**8473**	**6**	**4340**
5-6 PM	No Build	21831	13300	18519	31819	22	51830
	Preferred Alternative	7234	4218	19956	24174	29	44375
	Network Benefit	**14597**	**9082**	**-1437**	**7645**	**7**	**7455**
6-7 PM	No Build	36817	29315	31240	60555	21	52566
	Preferred Alternative	12172	9806	21967	31773	27	45110
	Network Benefit	**24645**	**19509**	**9273**	**28782**	**6**	**7456**

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 throughput at all key locations during the AM peak period. Like the AM, all key locations have increased throughput during the 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	GP	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	GP	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%**

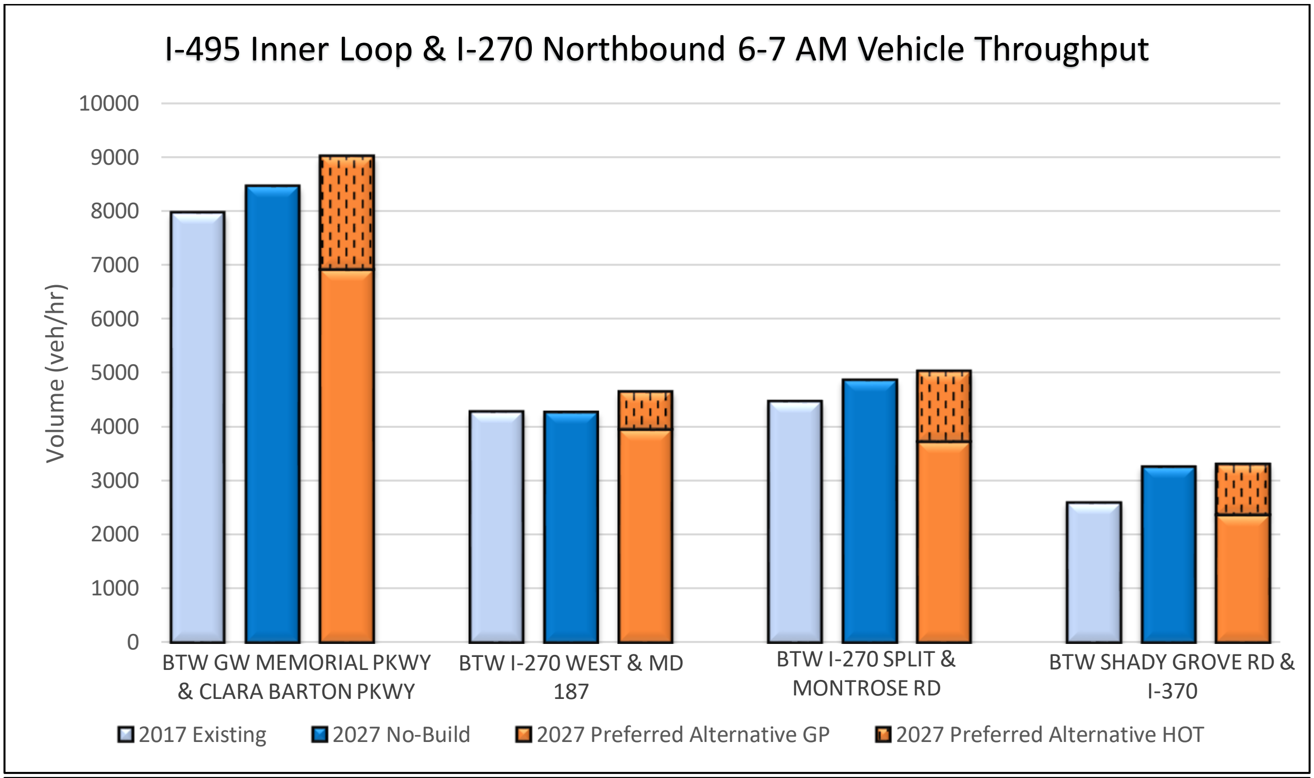
Table 6-8: 2027 PM Throughput Comparison

Time Interval	Existing	No Build	Preferred Alternative			
			HOT	GP	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	GP	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)



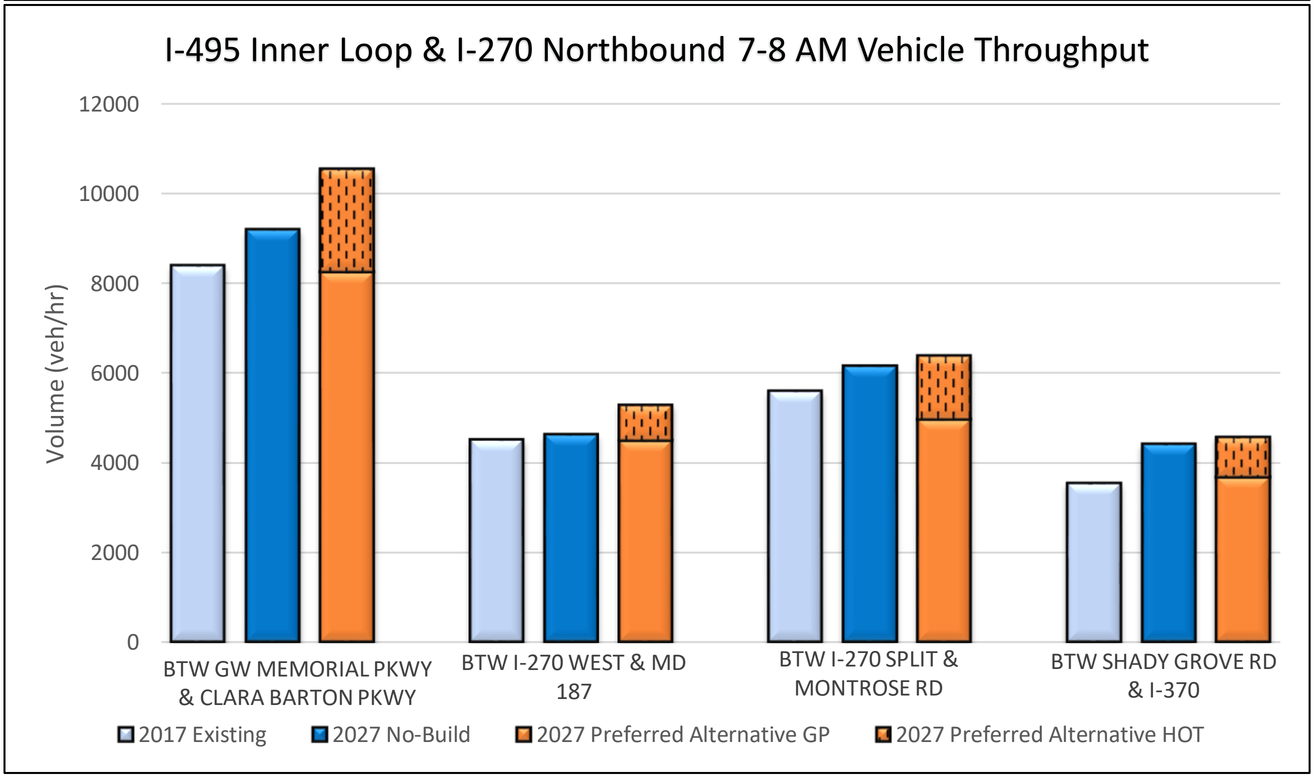
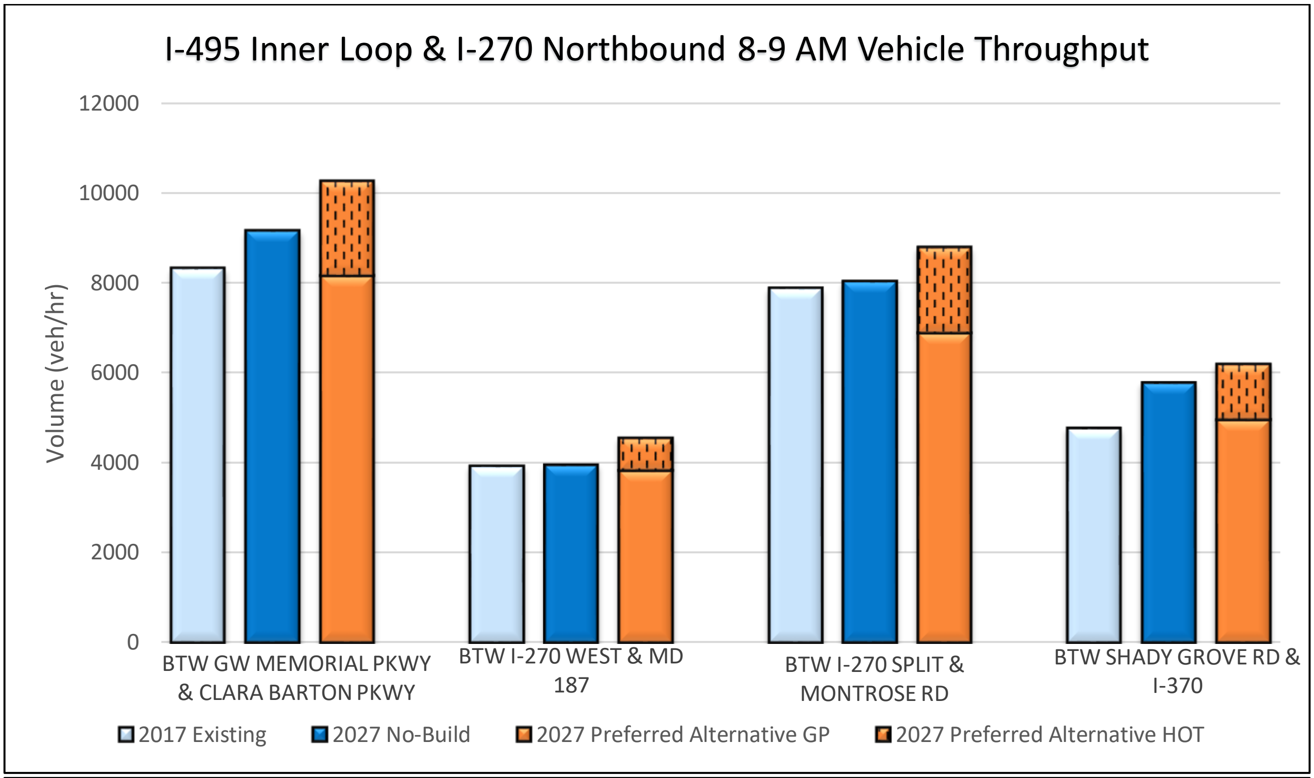


Figure 6-6: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)



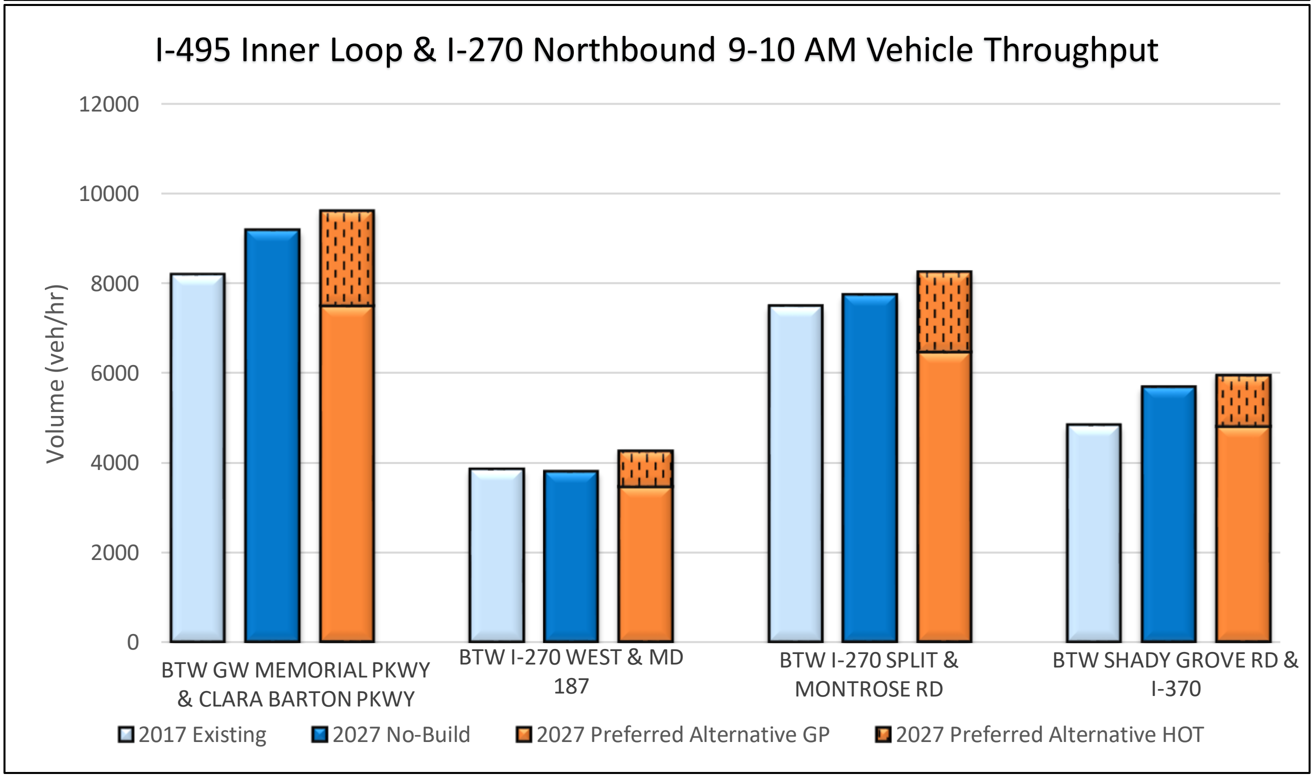
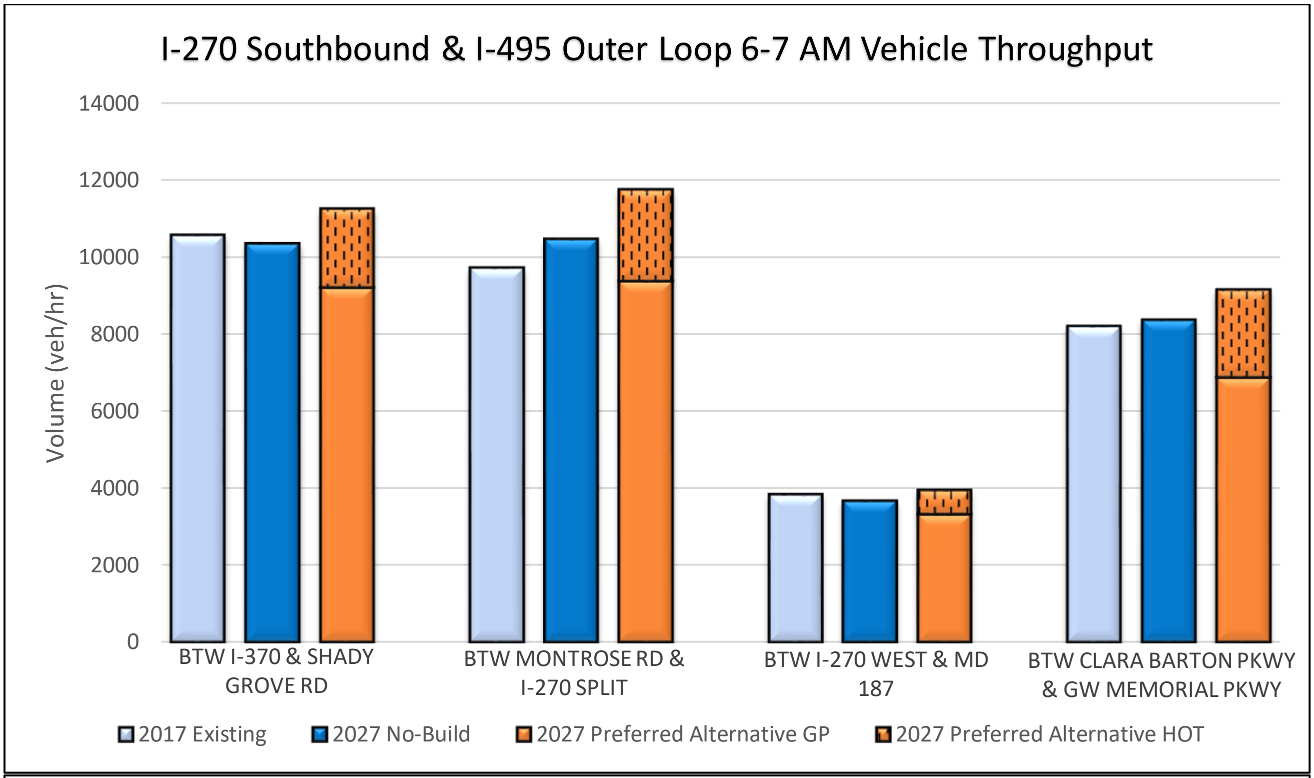


Figure 6-6: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)



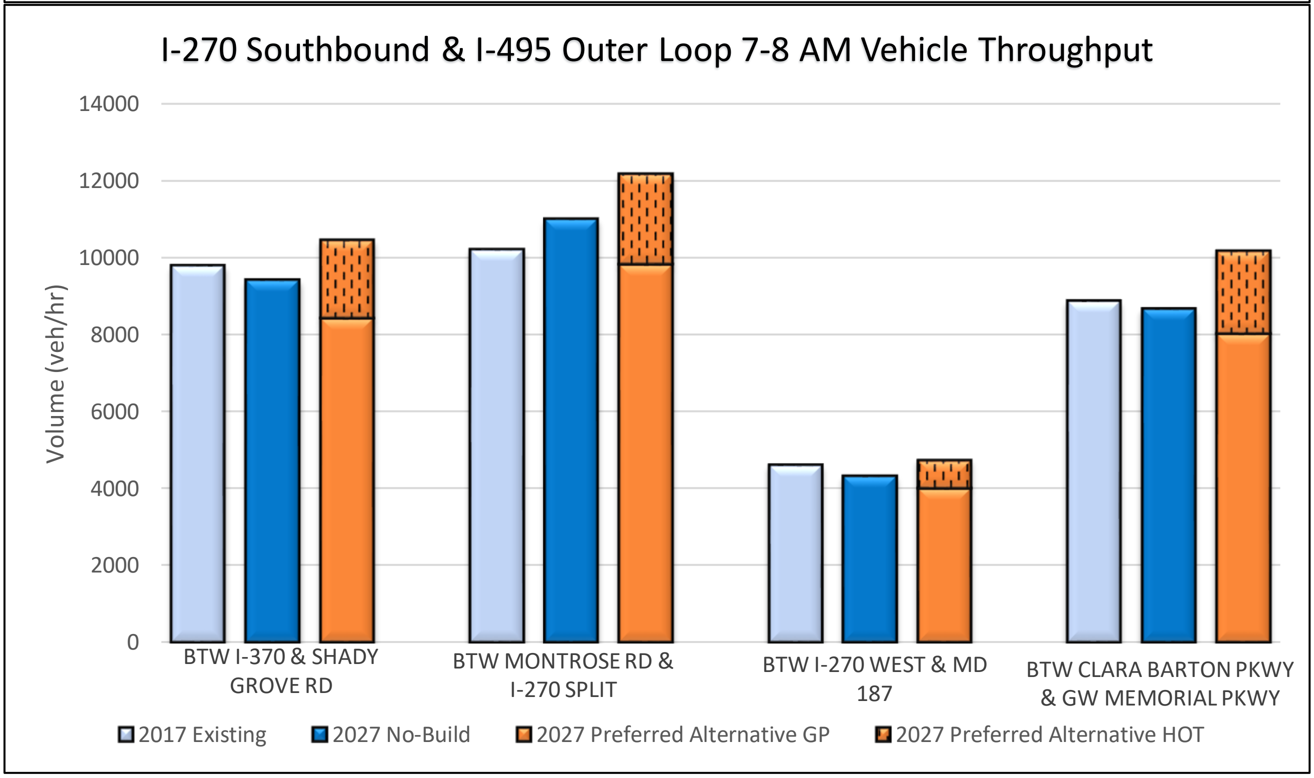
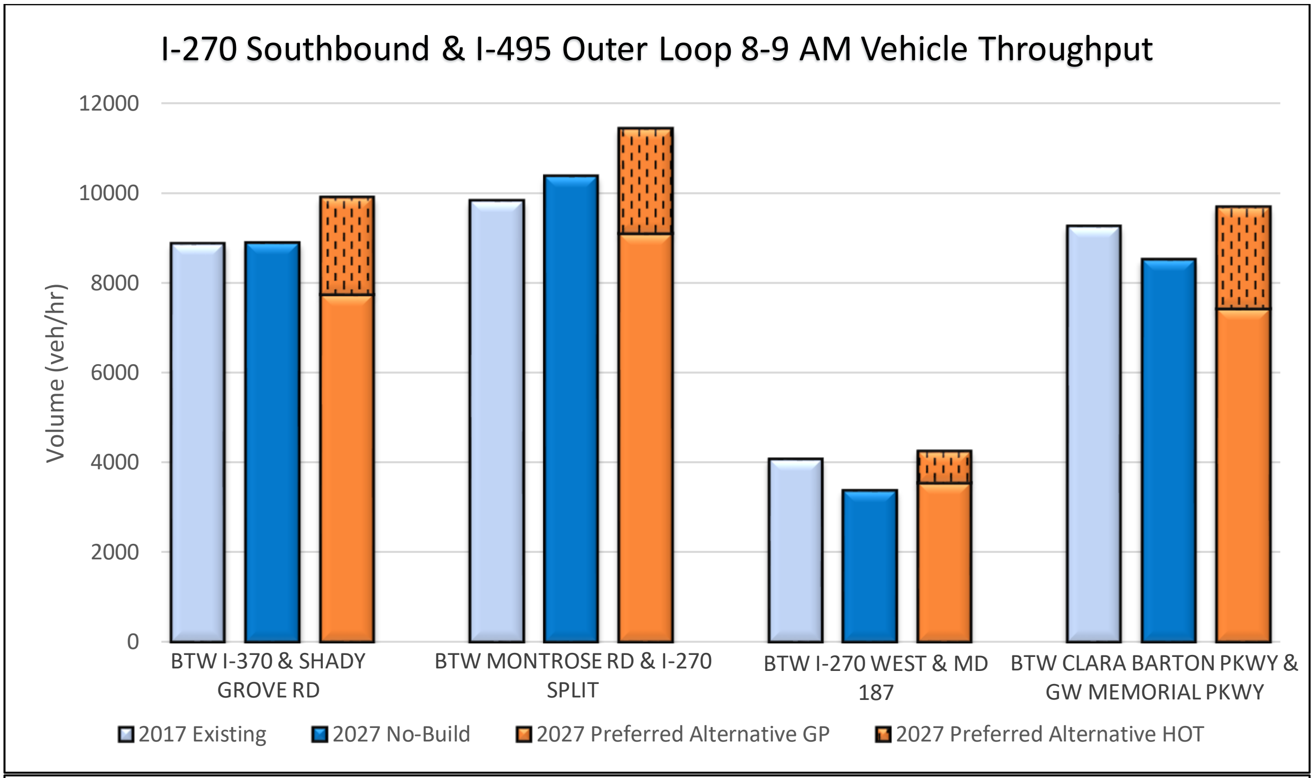


Figure 6-6: 2027 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)



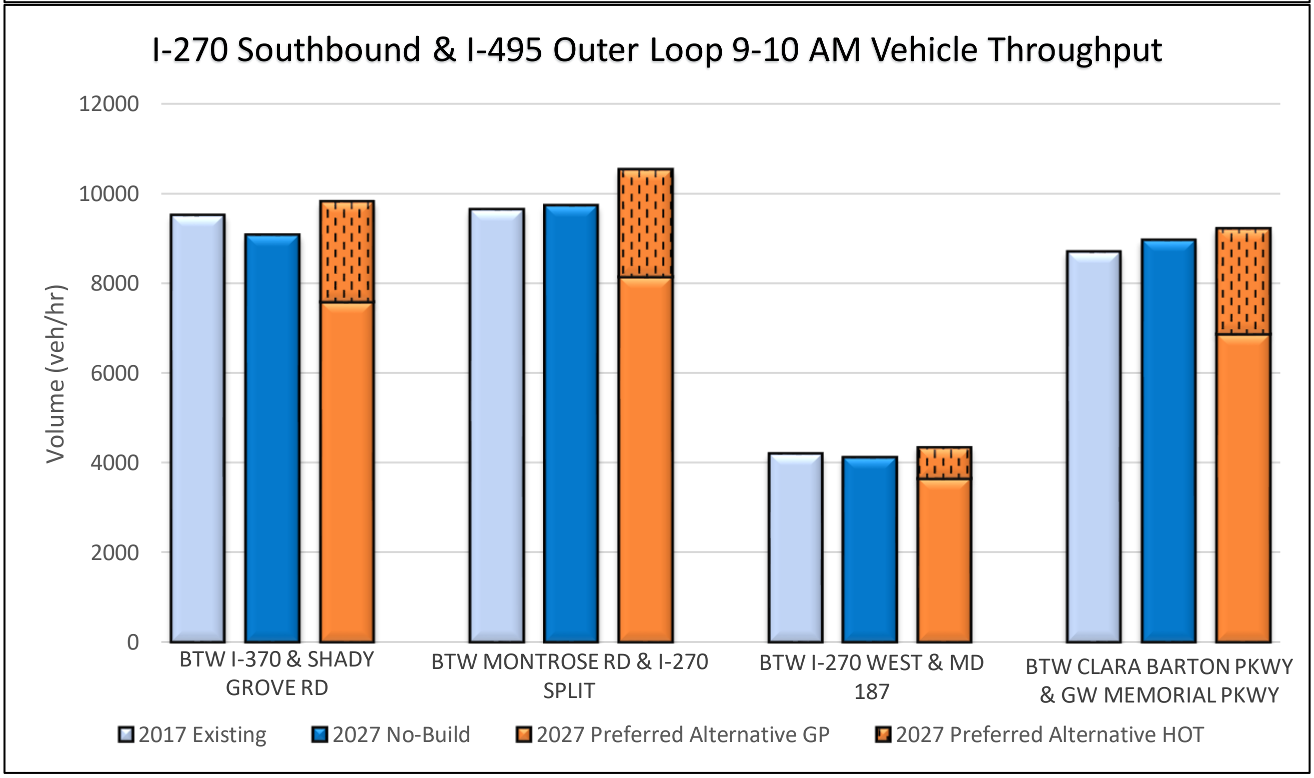
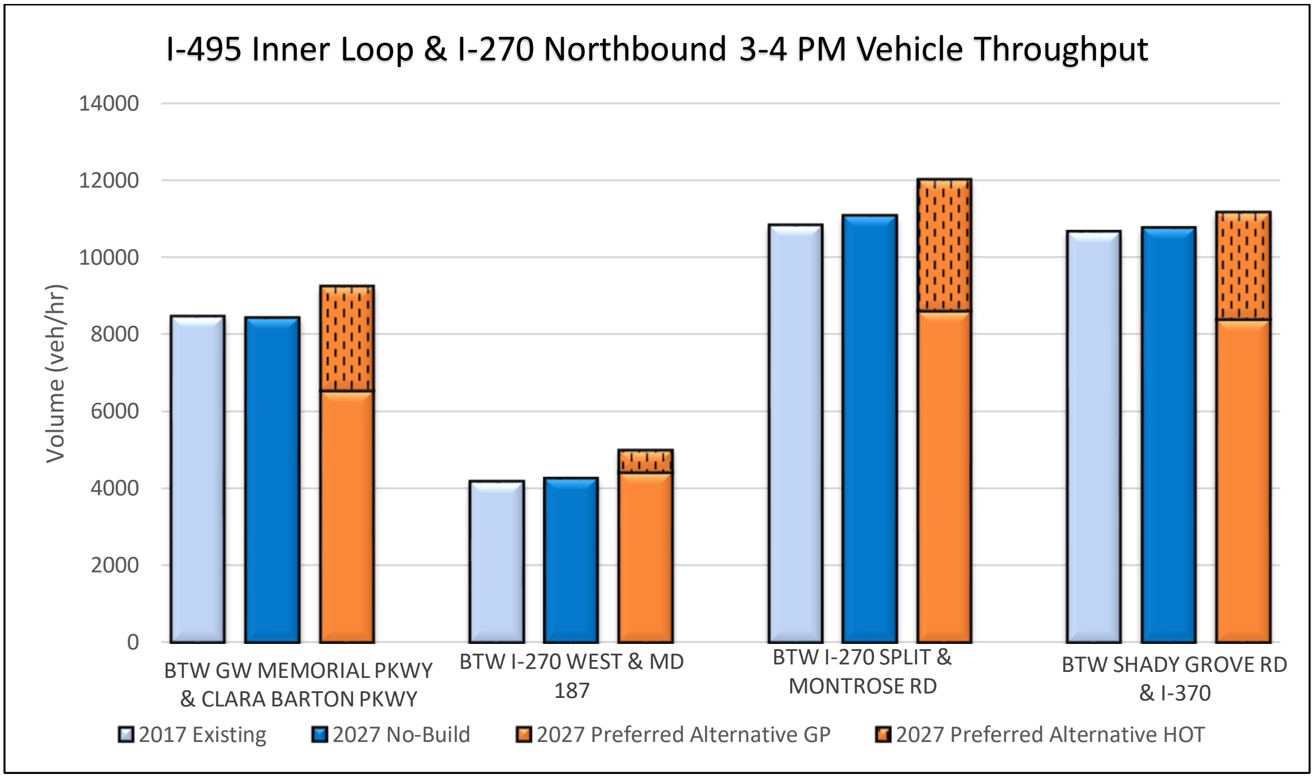


Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr)



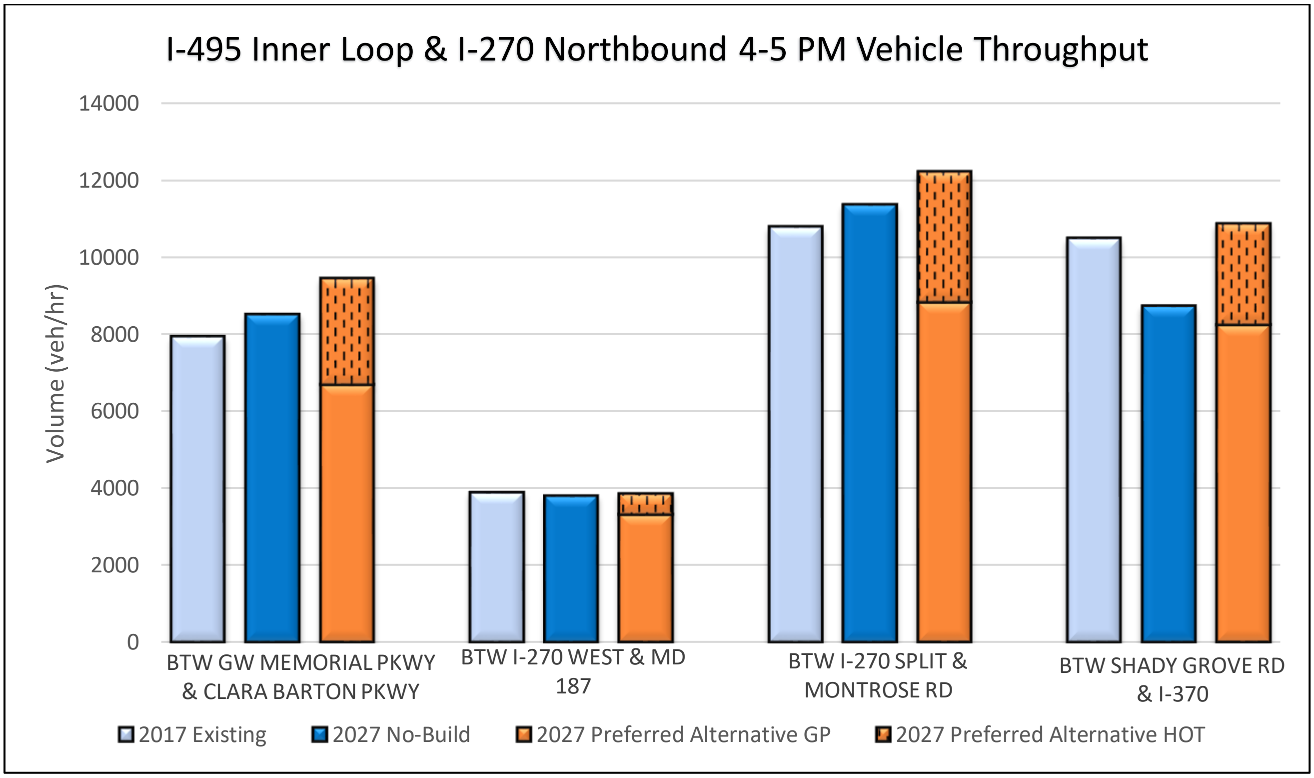
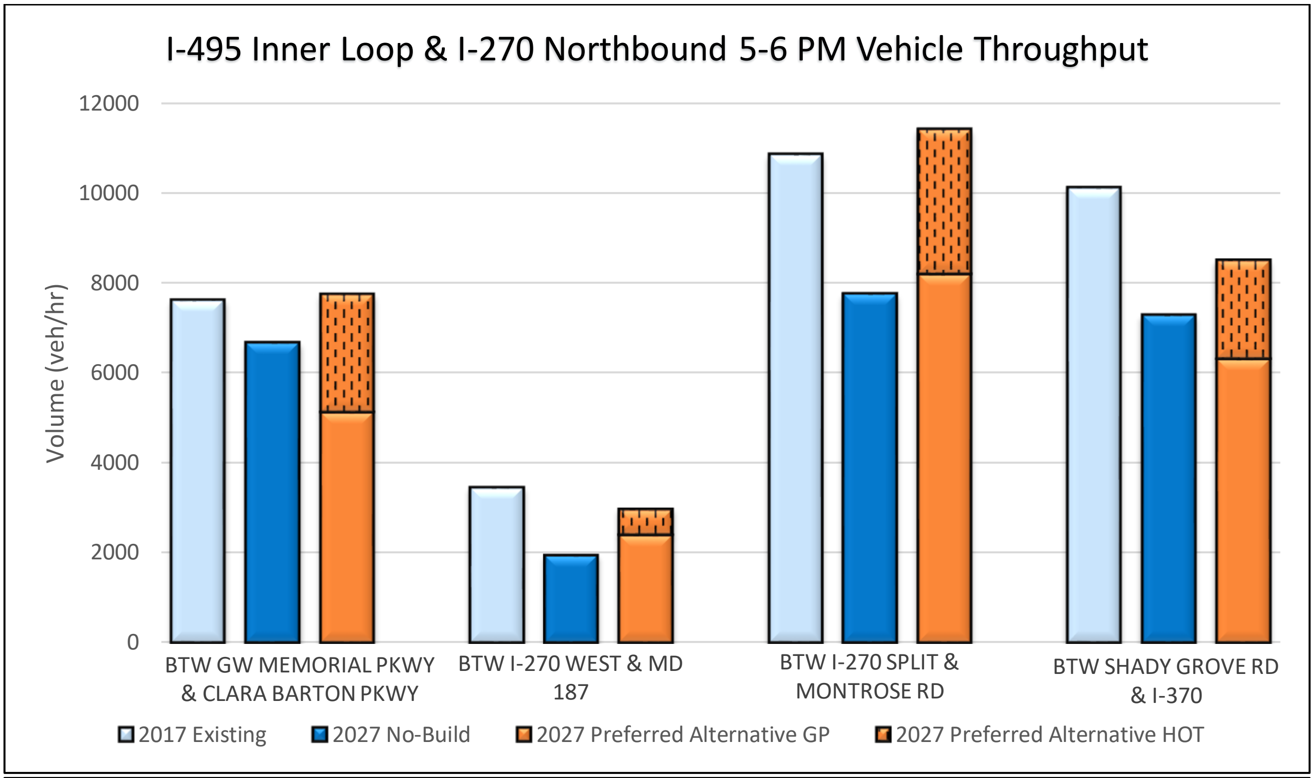


Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)



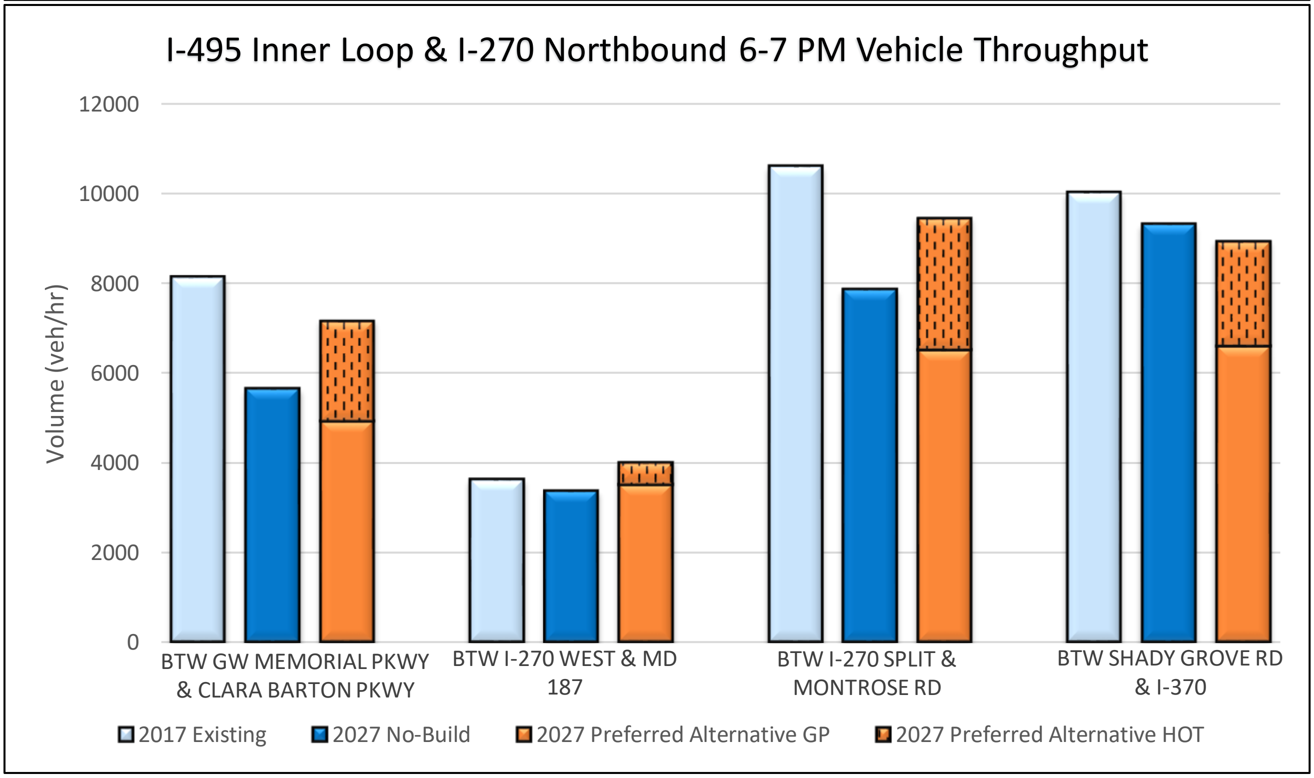
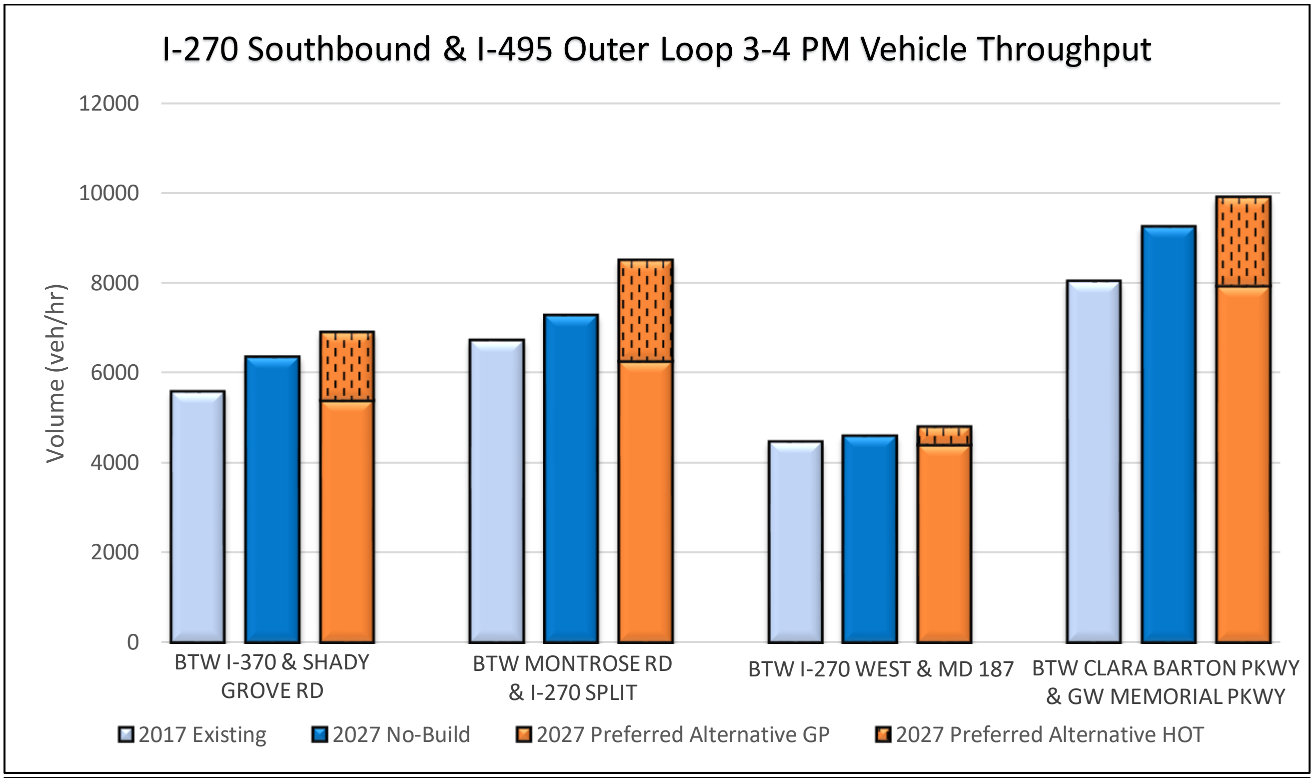


Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)



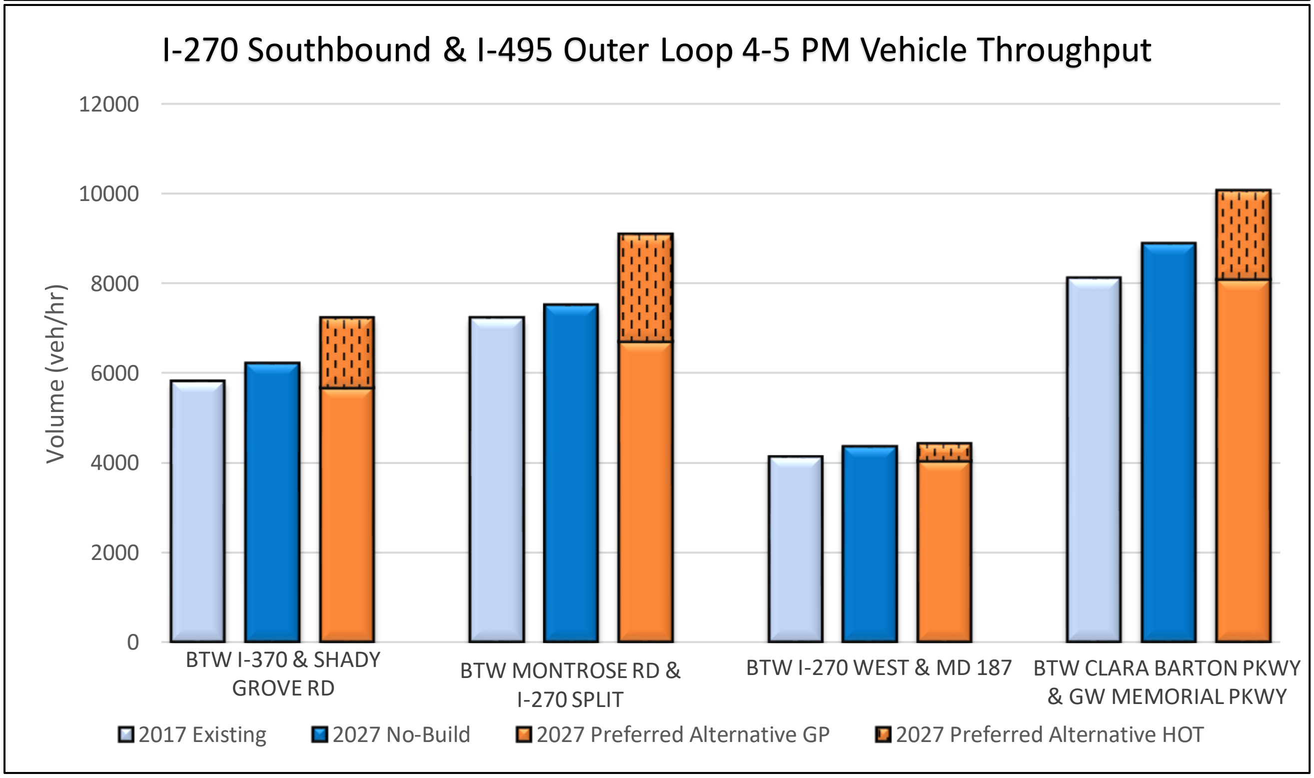
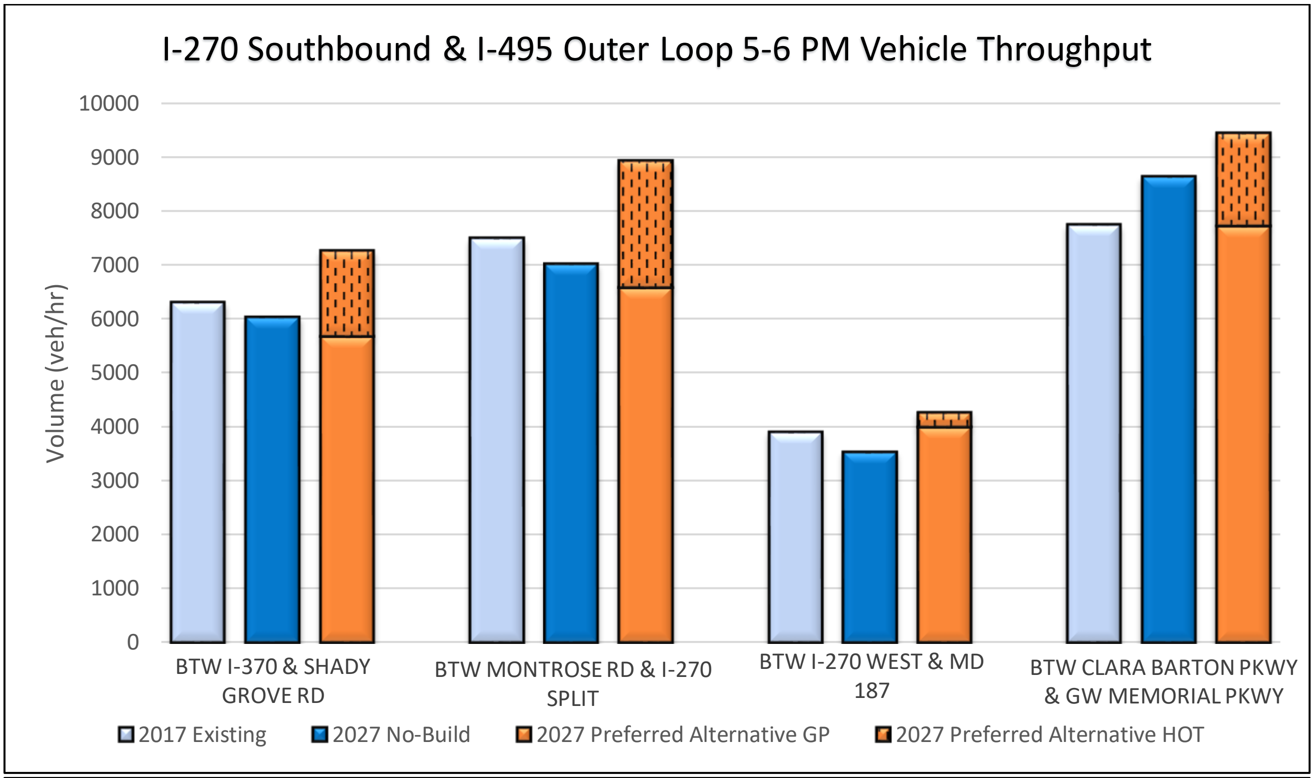
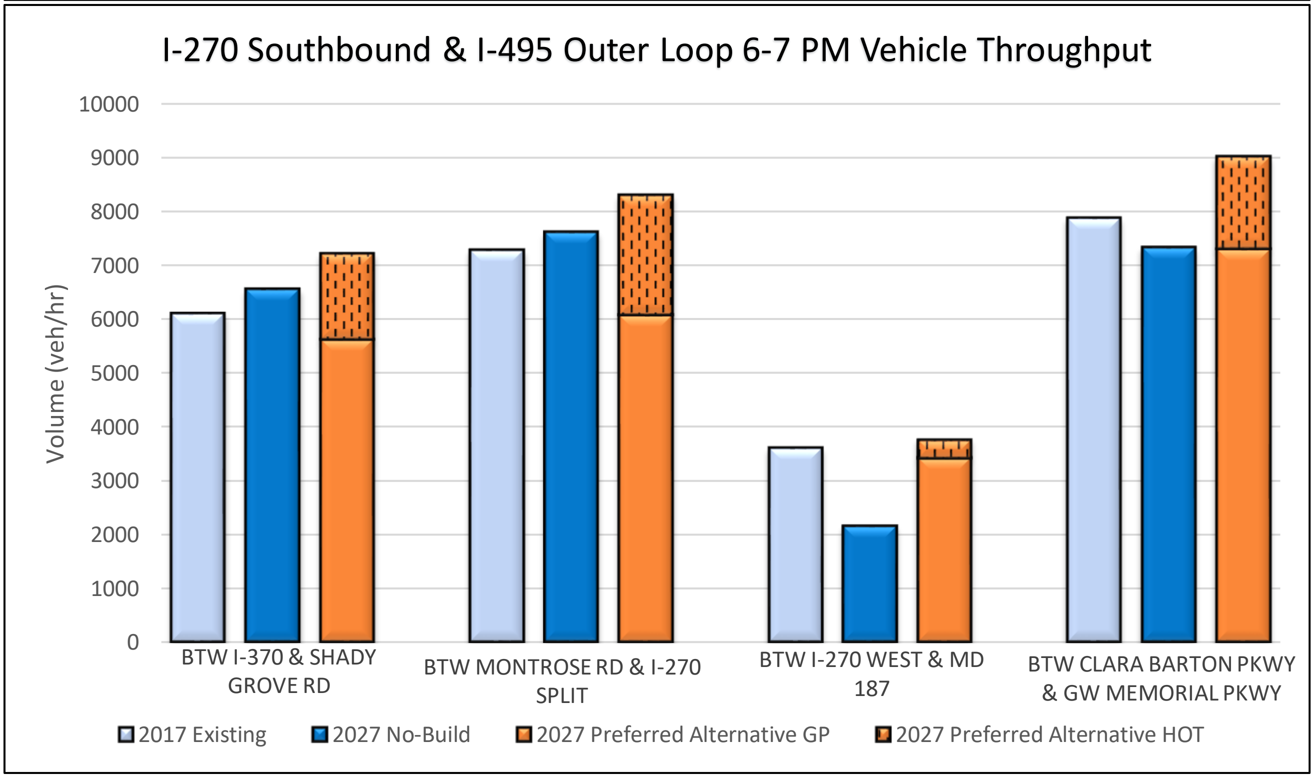


Figure 6-7: 2027 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)





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 61% (approximately 128,000 lane-miles) under No Build conditions to 72% (approximately 150,000 lane-miles) while reducing those of LOS 'F' from 28% (approximately 58,000 lane-miles) to 25% (approximately 53,000 lane-miles) with the Preferred Alternative. Along the I-495 Outer Loop, the lane-miles of LOS 'F' are reduced from 35% (approximately 72,000 lane-miles) under No Build conditions to 2% (approximately 5,000 lane-miles) with the Preferred Alternative.

During the AM peak period, the I-270 Northbound lane-miles with LOS 'D' or better increases from 97% (approximately 406,000 lane-miles) to 99% (approximately 517,000 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 75% (approximately 299,000 lane-miles) to 89% (approximately 438,000 lane-miles) while reducing those of LOS 'F' from 12% (approximately 48,000 lane-miles) to 6% (approximately 29,000 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

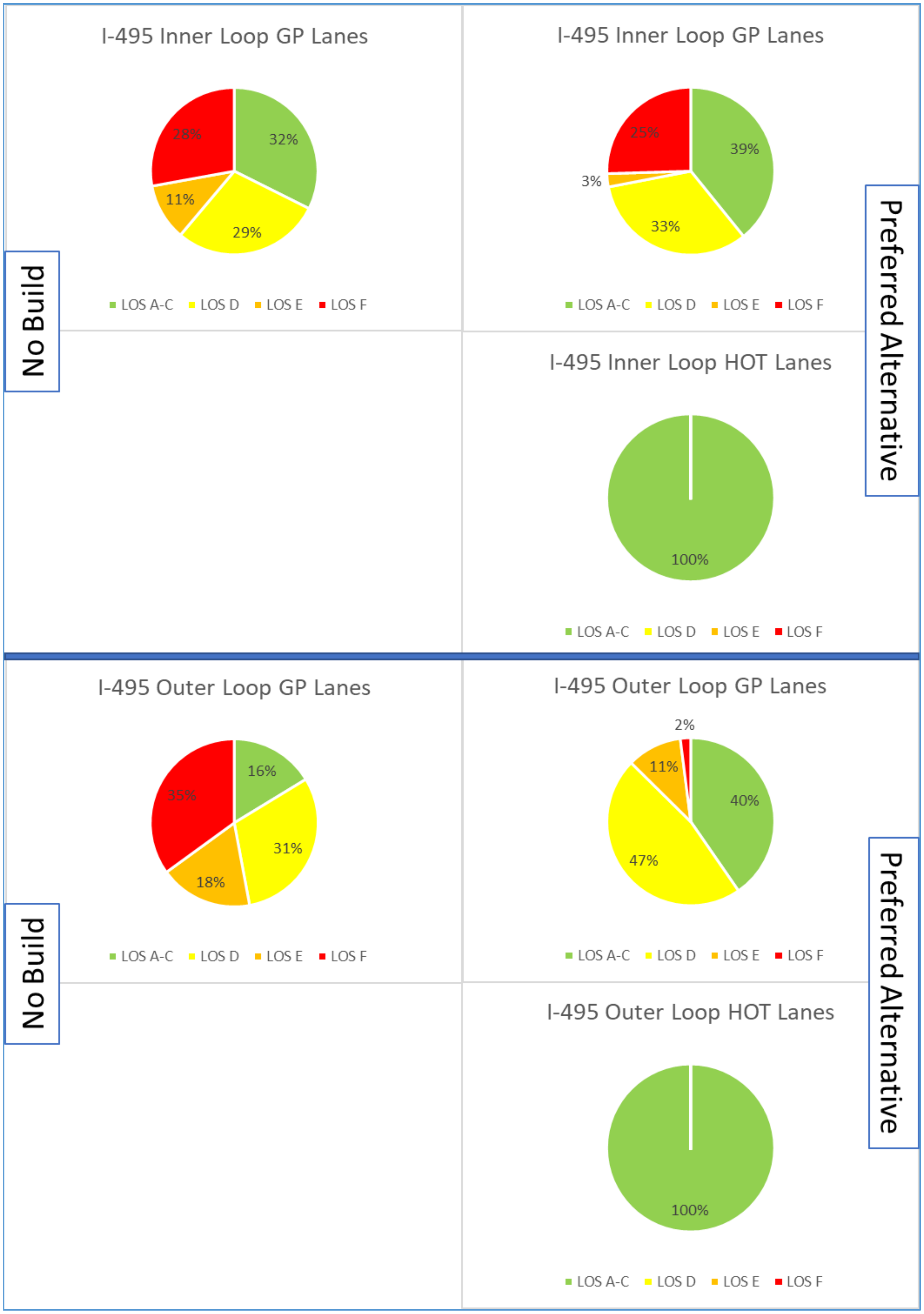


Figure 6-9: 2027 AM I-270 Mainline Segment LOS – No Build vs Preferred Alternative

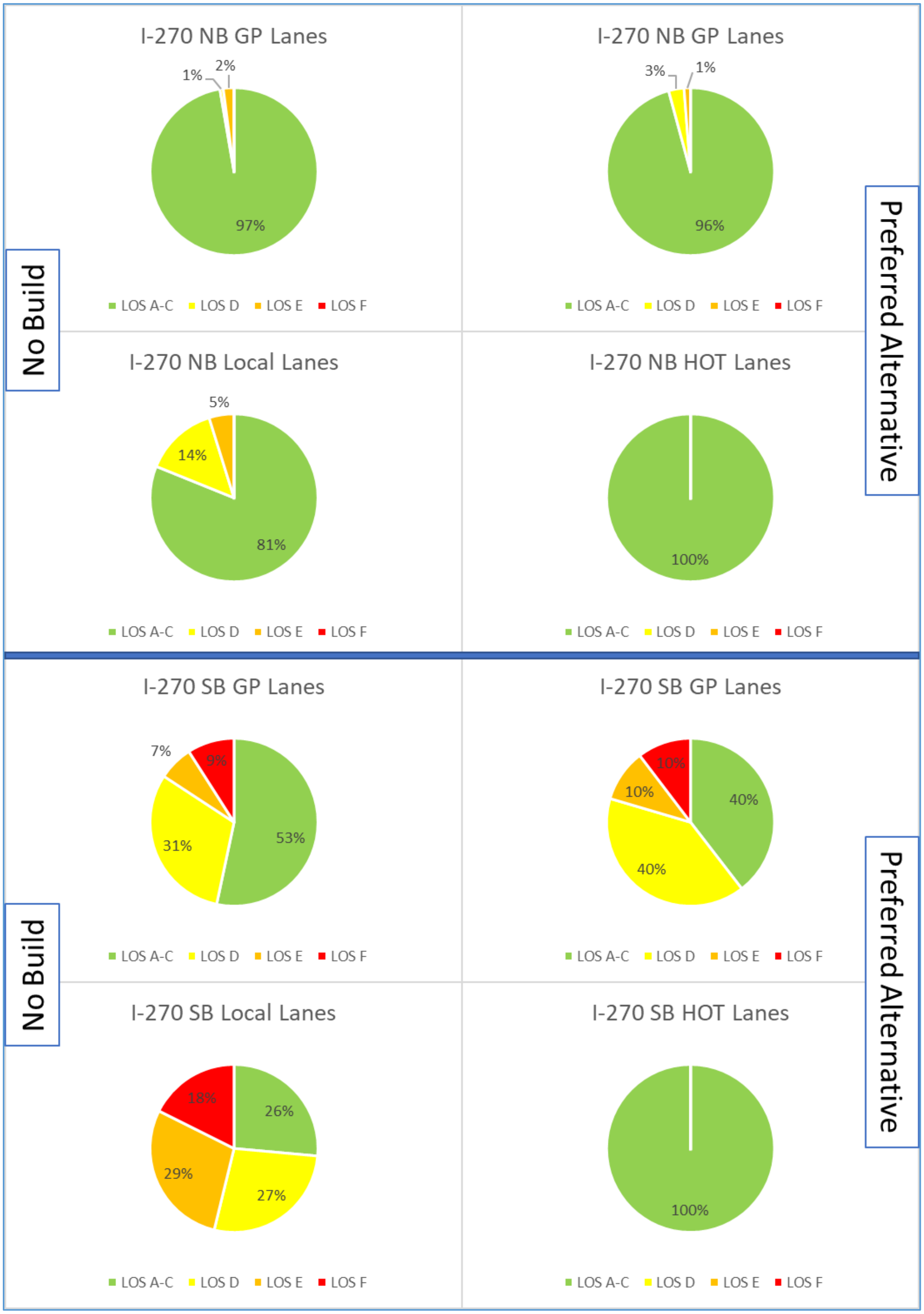


Figure 6-10 and Figure 6-11 compare the percentage of lane-miles operating at each LOS between No Build and Preferred Alternative PM conditions along I-495 and I-270, respectively; the lane-mile percentages are based on density for the entire PM peak period. Because the overall I-270 roadway system is 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 79% (approximately 165,000 lane-miles) to 67% (approximately 140,000 lane-miles) along the I-495 Inner Loop and from 24% (approximately 49,000 lane-miles) to 6% (approximately 13,000 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 36% (approximately 162,000 lane-miles) to 56% (approximately 289,000 lane-miles) while reducing those of LOS ‘F’ from 54% (approximately 244,000 lane-miles) to 38% (approximately 197,000 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 95% (approximately 378,000 lane-miles) to 98% (approximately 488,000 lane-miles) while reducing those of LOS ‘F’ from 5% (approximately 19,000 lane-miles) to 1% (approximately 3,000 lane-miles) 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

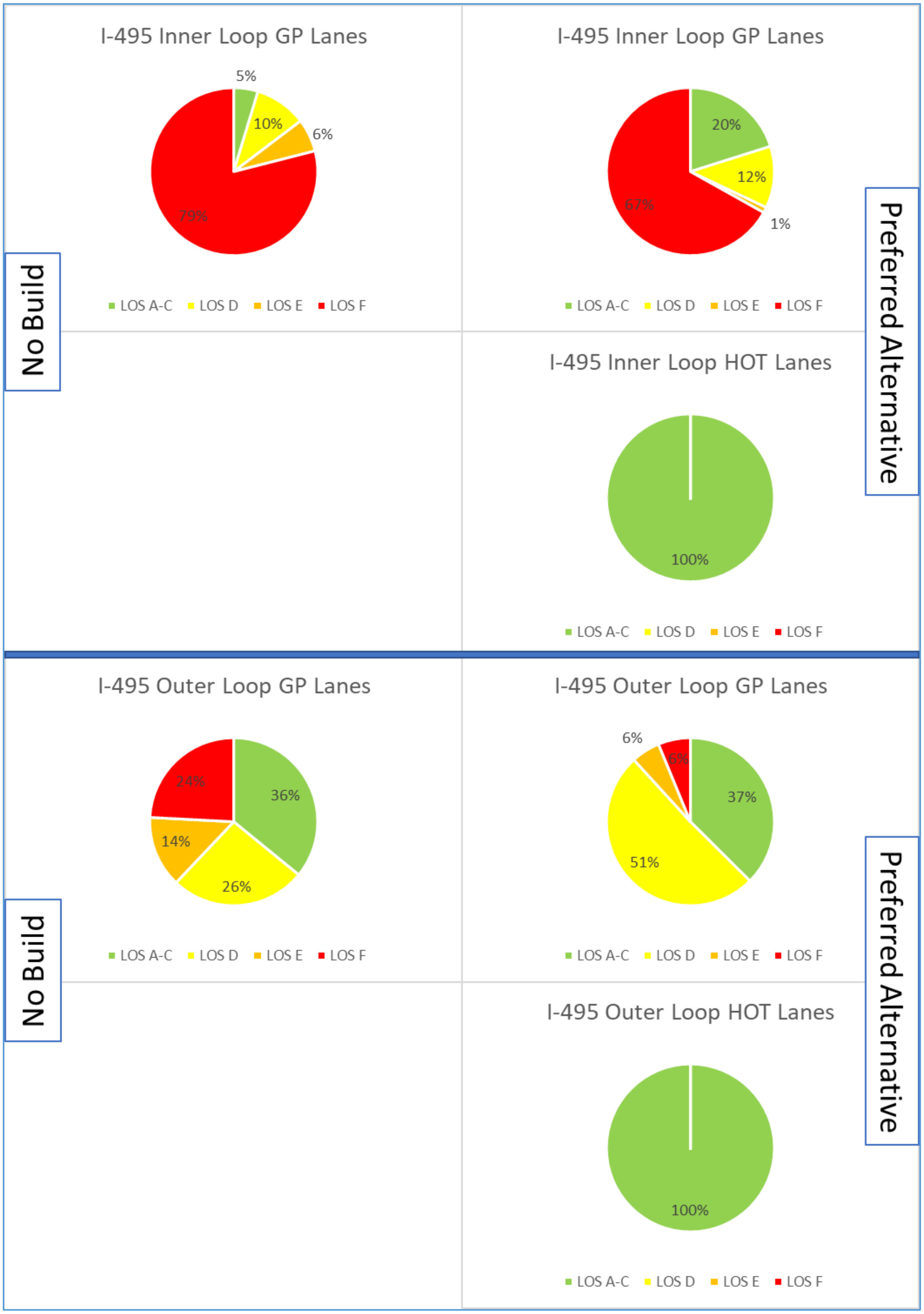


Figure 6-11: 2027 PM I-270 Mainline Segment LOS – No Build vs Preferred Alternative

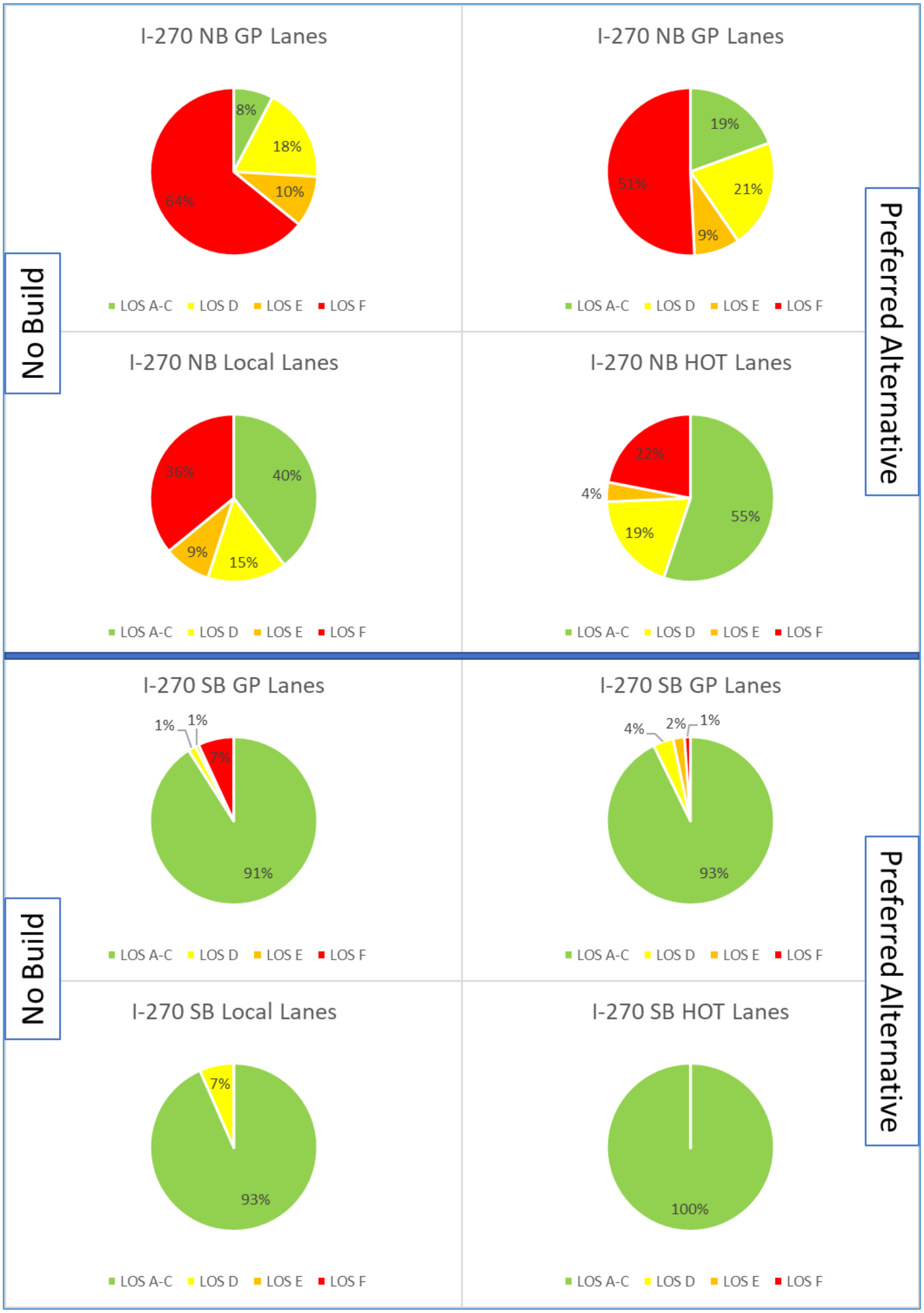


Table 6-9 and Table 6-10 detail freeway density by segment for both No Build and Preferred Alternative conditions, during the AM and PM peak periods, respectively. Refer to **Table 6-1** for LOS thresholds for basic segments and for merge, diverge, and weave segments. **Appendix H** contains a summary 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	32	93	31	93	28
	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		45		107		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	95	22	87
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	77	22	71
	Basic	27	29	42	48	37	51	31	51
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		14		14
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
Between George Washington Memorial Parkway and Clara Barton Parkway	Weave	32		34		34		35	
	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
	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
George Washington Memorial Parkway Interchange	Basic	12	18	12	17	11	18	13	19
	Merge		12		11		12		13
	Basic		16		15		15		15
	Diverge		14		14		14		14
	Basic		14		14		14		14
	Diverge	N/A	12	N/A	12	N/A	12	N/A	12
Between MD 190 & I-270 West Spur	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
	Diverge	12	11	17	17	20	22	17	20
Between MD 117 & I-370	Basic	9	10	12	14	15	18	14	17
	Merge	9	9	14	14	16	16	14	16
	Basic	8	10	11	14	14	19	13	18
I-370 Interchange	Merge	8	9	10	13	12	17	11	16
	Basic		9		16		20		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
	Basic		8		12		16		16
Shady Grove Road Interchange	Merge		8		12		16		16
	Basic	8	7	11	11	14	15	13	14
	Weave	8	N/A	11	N/A	14	N/A	14	N/A
	Diverge		7		11		15		15
Between Shady Grove Road & MD 28	Basic	N/A	8	N/A	11	N/A	16	N/A	15
	Basic		9		14		19		18
	Merge		7		10		13		12
	Basic	9	9	13	13	16	18	16	17
MD 28 Interchange	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
	Diverge	14	9	18	14	23	19	23	18
Between MD 189 & Montrose Road	Basic	11	11	15	16	18	23	19	22
	Merge	N/A	10	N/A	16	N/A	25	N/A	22
	Diverge	14	N/A	16	N/A	21	N/A	20	N/A
Montrose Road Interchange	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 No Build	6-7 AM Pref. Alt.	7-8 AM No Build	7-8 AM Pref. Alt.	8-9 AM No Build	8-9 AM Pref. Alt.	9-10 AM No Build	9-10 AM 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/ Fernwood Road	Basic	N/A	9	N/A	10	N/A	12	N/A	11
	Merge		6		6		8		8
Westlake Terrace/Fernwood Road 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	N/A	28	N/A	24	N/A	22	N/A	23
Between I-370 & Shady Grove Road	Weave		25		23		21		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	25	38	23	27
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
Democracy Boulevard	Merge		23		19		16		14
	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/ Fernwood Road	Basic	N/A	16	N/A	15	N/A	15	N/A	16
	Diverge		10		10		10		10
Westlake Terrace/Fernwood Road Interchange	Basic		12		12		12		12
	Diverge		8		9		8		8
	Basic		12		11		11		11
Westlake Terrace/Fernwood Road to I-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	N/A	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
Between MD 190 & I-270 West Spur	Diverge		9		9		8		8
	Basic		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	25	182	92
	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		18		54		38	
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	N/A	133	N/A	181	N/A	162	N/A
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/ Fernwood Road	Basic	N/A	24	N/A	24	N/A	22	N/A	21
	Merge		16		16		15		14
Westlake Terrace/Fernwood Road 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		12		13		13		13
	Basic	13	16	14	17	12	17	14	16
	Diverge	N/A	12	N/A	13	N/A	13	N/A	13
	Basic		12		13		13		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		16		17		21	
	Weave	19		20		18		26	
	Basic	16	N/A	17	N/A	13	N/A	17	N/A
	Merge	13		14		12		14	
	Basic	20		21		18		20	
I-270 Southbound HOT Managed Lanes									
I-370 Interchange	Basic		10		12		11		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	N/A	16	N/A	16	N/A	16	N/A	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/ Fernwood Road	Basic		15		16		16		15
	Diverge		10		11		11		10
Westlake Terrace/Fernwood Road Interchange	Basic		13		13		14		12
	Diverge		9		10		10		9
	Basic	N/A	8	N/A	8	N/A	7	N/A	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				

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	53	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	57
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
	Basic		57		42		15		24
	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	17	56	19
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	43	52	41	58	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	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		63
	Diverge		63		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		64
	Basic		65		64		64		64
Between MD 190 & I-270 West Spur	Merge		64		63		63		62
	Basic		64		64		64		64
	Diverge		63		63		63		63
Between I-270 West Spur & MD 187	Basic		59		58		56		57
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
Between George Washington Memorial Parkway and Clara Barton Parkway	Weave	53		52		52		52	
	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		53
	Merge	53	52	34	52	12	52	18	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	N/A	63	N/A	63	N/A	63	N/A	63
	Diverge	N/A	63	N/A	63	N/A	63	N/A	63
	Basic	N/A	63	N/A	63	N/A	63	N/A	63
Between MD 190 & I-270 West Spur	Diverge	N/A	63	N/A	63	N/A	63	N/A	63
	Basic	N/A	64	N/A	64	N/A	64	N/A	64
	Merge	N/A	63	N/A	63	N/A	63	N/A	63
Between I-270 West Spur & MD 187	Basic	N/A	58	N/A	58	N/A	58	N/A	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	N/A	60	N/A	57	N/A	55	N/A	56
Between I-370 & Shady Grove Road	Weave	N/A	61	N/A	59	N/A	59	N/A	59
Shady Grove Road Interchange	Basic	N/A	62	N/A	60	N/A	59	N/A	59
	Merge	N/A	61	N/A	59	N/A	58	N/A	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	N/A	61	N/A	60	N/A	59	N/A	59
	Basic	N/A	62	N/A	60	N/A	59	N/A	60
	Merge	N/A	59	N/A	58	N/A	57	N/A	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	N/A	62	N/A	61	N/A	60	N/A	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		43		43		43	
	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	N/A	42	N/A	42	N/A	42	N/A
	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		63		64		63		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	N/A	63	N/A	63	N/A	63	N/A	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/ Fernwood Road	Basic		64		64		64		64
	Merge	N/A	64	N/A	64	N/A	64	N/A	64
Westlake Terrace/Fernwood Road 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
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	53	N/A	53	N/A	53	N/A	53	N/A
	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
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
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
I-270 West Spur Southbound HOT Managed Lanes									
Spur Split to Westlake Terrace/ 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		62		62		62		62
	Basic	N/A	63	N/A	63	N/A	63	N/A	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	N/A	63	N/A	63	N/A	63	N/A	63
Between MD 190 & I-270 West Spur	Merge	N/A	62	N/A	61	N/A	61	N/A	61
	Basic	N/A	63	N/A	63	N/A	63	N/A	63
	Diverge	N/A	63	N/A	63	N/A	63	N/A	63
Between I-270 West Spur & MD 187	Basic	N/A	59	N/A	59	N/A	49	N/A	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	N/A	44	N/A	43	N/A	47	N/A
	Basic	N/A	53	N/A	53	N/A	53	N/A	53
	Merge	N/A	49	N/A	49	N/A	50	N/A	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	N/A	53	N/A	53	N/A	53	N/A	53
	Merge	52	52	52	52	53	52	53	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		64
	Diverge		64		64		64		64
	Basic		64		64		64		64
Between MD 190 & I-270 West Spur	Diverge		63		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	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		50		28		18		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		49		29		39	
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	N/A	7	N/A	4	N/A	6	N/A
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	N/A	40	N/A	39	N/A	12	N/A
	Diverge	53	N/A	49	N/A	49	N/A	29	N/A
	Weave	48	N/A	48	N/A	49	N/A	40	N/A
	Merge	47	N/A	47	N/A	47	N/A	40	N/A
MD 28 Interchange	Basic	52	N/A	52	N/A	52	N/A	45	N/A
	Weave	41	N/A	33	N/A	34	N/A	32	N/A
	Basic	50	N/A	48	N/A	48	N/A	44	N/A
Between MD 28 & MD 189	Diverge	45	N/A	38	N/A	34	N/A	23	N/A
	Basic	51	N/A	46	N/A	35	N/A	24	N/A
	Weave	51	N/A	38	N/A	7	N/A	12	N/A
	Basic	52	N/A	43	N/A	8	N/A	14	N/A
	Merge	48	N/A	42	N/A	7	N/A	15	N/A
MD 189 Interchange	Basic	53	N/A	48	N/A	7	N/A	16	N/A
Between MD 189 & Montrose Road	Diverge	49	N/A	47	N/A	16	N/A	24	N/A
	Basic	51	N/A	50	N/A	11	N/A	20	N/A
	Merge	49	N/A	47	N/A	10	N/A	14	N/A
	Basic	49	N/A	50	N/A	11	N/A	17	N/A
	Merge	45	N/A	47	N/A	8	N/A	15	N/A
Montrose Road Interchange	Basic	53	N/A	53	N/A	14	N/A	29	N/A
	Weave	48	N/A	48	N/A	29	N/A	37	N/A
	Basic	53	N/A	54	N/A	41	N/A	51	N/A
Between Montrose Road & Spur Split	Diverge	49	N/A	50	N/A	50	N/A	51	N/A
	Basic	53	N/A	53	N/A	51	N/A	51	N/A
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	N/A	61	N/A	33	N/A	23	N/A	24
	Basic	N/A	62	N/A	30	N/A	12	N/A	12
	Merge	N/A	62	N/A	36	N/A	11	N/A	10
Gude Drive Interchange	Basic	N/A	63	N/A	45	N/A	10	N/A	7
Between Gude Drive & Wootton Parkway	Diverge	N/A	60	N/A	59	N/A	27	N/A	17
	Basic	N/A	63	N/A	63	N/A	40	N/A	15
	Merge	N/A	62	N/A	62	N/A	54	N/A	22
Wootton Parkway Interchange	Basic	N/A	63	N/A	63	N/A	58	N/A	29
Between Wootton Parkway & Spur Split	Diverge	N/A	62	N/A	62	N/A	62	N/A	46
	Basic	N/A	63	N/A	63	N/A	63	N/A	50
	Weave	N/A	63	N/A	63	N/A	63	N/A	58
Spur Split through MD 187 Interchange	Basic	N/A	63	N/A	63	N/A	63	N/A	63
I-270 West Spur Northbound HOT Managed Lanes									
Spur Split to Westlake Terrace/ Fernwood Road	Basic	N/A	62	N/A	62	N/A	62	N/A	63
	Merge	N/A	60	N/A	60	N/A	60	N/A	60
Westlake Terrace/Fernwood Road Interchange	Basic	N/A	63	N/A	63	N/A	63	N/A	63
	Weave	N/A	63	N/A	63	N/A	63	N/A	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		58		57		57
	Basic	59	58	59	58	59	58	59	58
	Diverge	N/A	58	N/A	57	N/A	57	N/A	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
Between Gude Drive and Wootton Parkway	Merge		61		61		61		61
	Basic		63		63		63		63
	Diverge		62		62		63		62
Wootton Parkway Interchange	Basic		63		63		63		63
Between Wootton Parkway and Spur Split	Merge		61		61		61		62
	Basic		63		63		63		63
	Diverge		63		63		63		63
Spur Split through MD 187 Interchange	Basic		64		64		64		64
I-270 West Spur Southbound HOT Managed Lanes									
Spur Split to Westlake Terrace/ 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		64
	Basic		64		64		64		64
	Merge		62		62		62		62
	Basic		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

	2017 Existing				2027 No Build								2027 Preferred Alternative							
	GP Lanes				GP Lanes				HOT Lanes				GP Lanes				HOT Lanes			
	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM
	59	42	45	59	59	44	46	58					58	33	27	28				
	58	58	56	58	59	50	49	60					59	27	18	19				
MD 355	60	60	61	61	58	53	53	59					58	29	18	22				
	51	50	52	52	51	48	48	52					50	28	19	22				
	55	52	56	56	55	54	55	56					54	25	13	15				
MD 187	55	54	56	56	55	55	56	57					57	27	9	11				
	56	56	56	57	56	56	56	57					56	45	15	20	57	46	15	20
I-270 West Spur	57	57	58	58	56	56	54	51					56	55	34	55	61	61	61	61
	57	56	54	55	57	56	31	16					57	56	55	56	64	63	63	63
	57	57	56	56	57	57	56	15					57	57	57	57	64	64	64	64
MD 190	60	60	60	60	57	57	57	20					57	57	57	57	63	63	63	63
Cabin John Pkwy	57	57	57	57	57	57	56	27					57	56	56	56	63	63	63	63
	56	56	56	56	56	56	55	46					57	56	56	56	63	63	63	63
Clara Barton Pkwy	53	52	52	52	53	51	51	51					57	56	56	56	63	63	63	63
	38	36	36	35	44	43	42	43					57	55	55	56	62	62	63	63
American Legion Bridge	33	27	26	25	40	38	37	38					56	53	53	55	63	63	63	63
George Washington Memorial Pkwy	52	21	16	16	52	19	16	16	57	35	34	34	57	55	55	56	64	64	64	64
	57	28	10	9	57	23	12	13	64	64	64	64	57	55	54	55	64	64	64	64
VA-193	58	55	20	12	56	36	12	13	64	64	64	64	56	55	57	57	64	64	64	64

Travel Speed (mph)

10 20 30 40 50

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

Location	2017 Existing GP Lanes 3:00 PM	2017 Existing GP Lanes 4:00 PM	2017 Existing GP Lanes 5:00 PM	2017 Existing GP Lanes 6:00 PM	2027 No Build GP Lanes 3:00 PM	2027 No Build GP Lanes 4:00 PM	2027 No Build GP Lanes 5:00 PM	2027 No Build GP Lanes 6:00 PM	2027 No Build HOT Lanes 3:00 PM	2027 No Build HOT Lanes 4:00 PM	2027 No Build HOT Lanes 5:00 PM	2027 No Build HOT Lanes 6:00 PM	2027 Preferred Alternative GP Lanes 3:00 PM	2027 Preferred Alternative GP Lanes 4:00 PM	2027 Preferred Alternative GP Lanes 5:00 PM	2027 Preferred Alternative GP Lanes 6:00 PM	2027 Preferred Alternative HOT Lanes 3:00 PM	2027 Preferred Alternative HOT Lanes 4:00 PM	2027 Preferred Alternative HOT Lanes 5:00 PM	2027 Preferred Alternative HOT Lanes 6:00 PM
	26	16	15	15	39	14	9	17					25	17	13	15				
	30	13	12	13	55	13	7	15					26	13	10	13				
MD 355	39	15	13	15	57	15	7	16					31	15	12	15				
	39	15	13	15	50	14	5	13					31	12	9	15				
	47	12	9	12	50	13	4	8					26	8	6	10				
MD 187	53	14	6	10	53	14	3	6					32	6	4	8				
	54	49	20	15	54	35	4	6					51	9	5	9	54	11	7	11
I-270 West Spur	55	55	55	47	54	53	4	7					52	10	3	7	58	59	39	59
	28	23	20	21	28	29	9	9					54	23	5	8	63	63	63	63
	17	14	13	14	14	14	6	7					55	26	4	6	63	63	63	63
MD 190	17	15	13	14	14	14	6	7					55	29	4	6	63	63	63	63
Cabin John Pkwy	15	13	12	13	15	15	7	7					55	42	4	6	63	63	63	63
	20	15	13	15	19	17	10	7					55	54	8	5	63	63	63	63
Clara Barton Pkwy	27	16	14	16	22	17	10	7					56	55	9	5	63	63	63	63
	29	16	14	16	23	17	10	8					55	55	9	5	62	62	63	63
American Legion Bridge	30	17	15	18	25	20	11	8					55	55	12	6	63	63	63	63
George Washington Memorial Pkwy	36	12	11	13	20	14	9	5	35	30	12	5	56	56	18	6	63	63	63	63
	52	10	7	8	24	9	7	3	64	64	30	4	56	56	24	4	63	63	63	64
VA-193	57	18	7	8	51	11	8	4	64	64	59	8	59	59	39	5	64	63	64	64

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing				2027 No Build								2027 Preferred Alternative							
	GP Lanes				GP Lanes				HOT Lanes				GP Lanes				HOT Lanes			
	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM
	53	51	44	50	53	51	24	20					53	51	44	49				
MD 355	53	53	53	53	53	53	20	21					53	53	53	53				
	54	54	54	54	53	53	11	14					53	53	53	53				
	49	49	50	49	50	50	10	12					50	50	50	50				
	53	53	53	53	53	52	9	12					53	53	53	53				
MD 187	53	53	53	53	53	43	6	9					53	53	53	53				
	53	53	53	53	52	22	7	12					53	53	53	53	53	53	53	53
I-270 West Spur	52	51	52	52	37	16	7	18					52	52	52	52	59	59	59	59
	50	42	44	50	42	32	21	32					46	45	49	52	63	63	63	63
	52	52	52	52	52	51	51	51					53	52	53	53	63	63	63	63
MD 190	51	51	51	52	53	53	53	53					53	53	53	53	63	63	63	63
Cabin John Pkwy	53	44	51	53	53	53	53	53					53	53	53	53	63	63	63	63
	48	43	44	49	48	49	50	48					53	52	53	53	63	63	63	63
Clara Barton Pkwy	50	50	49	49	53	53	53	53					52	52	52	52	63	63	63	63
	52	52	51	52	53	53	53	53					53	53	52	53	63	63	63	63
American Legion Bridge	54	53	52	53	53	52	52	52					53	52	52	53	62	63	62	62
	53	52	52	52	52	52	50	51					53	52	52	53	61	62	61	60
George Washington Memorial Pkwy	53	52	52	52	53	53	52	52	59	59	59	59	53	52	52	52	63	64	63	63
	53	53	53	53	53	53	53	53	64	64	64	64	53	53	53	53	64	64	64	63
VA-193	53	53	51	52	53	53	53	53	64	64	64	64	53	53	53	53	63	64	63	63

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing				2027 No Build								2027 Preferred Alternative								
	GP Lanes				GP Lanes				HOT Lanes				GP Lanes				HOT Lanes				
	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
	40	47	44	26	36	38	24	6					41	46	50	32					
MD 355	53	53	41	24	53	53	17	6					53	53	53	28					MD 355
	54	54	50	39	53	53	42	35					53	53	53	49					
	49	49	49	48	50	50	49	49					50	50	50	50					
	53	53	53	46	53	53	53	54					53	53	53	53					
MD 187	53	53	45	21	53	53	53	54					53	53	53	53					MD 187
	53	43	20	11	52	52	50	53					53	53	53	53	53	53	53	53	
I-270 West Spur	51	20	9	9	48	49	40	52					52	52	52	52	59	59	59	59	
	41	19	14	13	53	47	33	56					53	54	53	54	64	64	64	64	I-270 West Spur
	27	15	13	13	54	36	22	54					53	53	53	53	64	64	64	64	
MD 190	23	13	12	13	52	31	20	51					53	53	53	54	64	64	64	64	MD 190
Cabin John Pkwy	21	14	13	14	43	27	20	50					53	53	53	54	63	63	64	64	Cabin John Pkwy
	25	22	21	23	34	25	23	44					53	53	53	53	63	63	63	63	
Clara Barton Pkwy	40	37	39	40	47	31	29	42					51	51	51	52	63	63	63	63	Clara Barton Pkwy
	48	44	49	50	51	33	32	42					52	52	52	52	63	63	63	63	
American Legion Bridge	47	36	52	53	51	46	46	45					53	52	53	53	63	63	63	63	American Legion Bridge
	44	28	50	55	52	52	52	44					52	52	52	53	63	63	63	63	
George Washington Memorial Pkwy	31	21	31	54	53	53	53	40	60	59	59	59	52	52	52	52	64	64	64	64	George Washington Memorial Pkwy
	17	14	21	54	54	54	53	46	64	64	64	64	53	53	53	53	64	63	64	64	
VA-193	15	15	17	22	54	54	54	54	64	64	64	64	53	54	54	54	63	63	63	64	VA-193

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing								2027 No Build								2027 Preferred Alternative							
	GP Lanes				CD Lanes				GP Lanes				CD Lanes				GP Lanes				HOT Lanes			
	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM
	23	22	21	37					19	17	16	19					24	21	21	31				
MD 117	27	30	31	45					20	17	17	20					23	22	21	28				
	29	33	34	48					35	40	40	40					34	34	33	37				
I-370	40	27	38	52	41	26	18	41	50	52	53	52	45	46	46	44	52	52	53	52	51	51	51	51
	30	15	23	46	41	34	33	39	53	53	53	53	41	40	40	41	53	53	53	53	60	59	59	59
Shady Grove Rd	36	28	28	40	42	42	42	42	47	50	52	52	42	42	42	42	52	53	53	53	63	63	63	63
	33	26	47	52	40	39	35	40	52	53	53	53	41	41	41	41	52	52	53	53	63	63	63	63
Gude Dr																								
	33	26	47	52	40	39	35	40	53	53	53	53	41	41	41	41	53	53	53	53	63	63	63	63
MD 28	36	30	42	51	24	19	14	36	51	51	52	52	42	42	42	42	53	53	53	53	63	63	63	63
	41	23	36	52	19	16	13	16	53	53	53	53	40	41	42	41	52	52	53	53	63	63	63	63
MD 189	38	18	29	53	35	20	15	18	53	53	53	53	38	38	38	38	52	52	53	53	63	63	63	63
	33	17	25	53	32	29	29	29	53	53	53	53	36	36	36	36	47	50	51	52	63	63	63	63
Wootton Pkwy																								
	33	17	25	53	32	29	29	29	53	53	53	53	36	36	36	36	49	50	50	50	63	63	63	63
Montrose Rd	29	20	26	52	36	35	36	37	53	53	53	53	36	36	37	37	53	51	52	53	63	63	63	63
	24	28	32	51	35	29	32	38	52	48	51	52	38	37	38	39	51	35	37	51	63	63	63	63
	21	22	24	53					53	53	52	52					53	53	53	53	63	63	63	63
Westlake Terrace	29	23	25	54					53	53	40	48					53	53	53	53	63	63	63	63
Democracy Blvd	45	28	28	53					53	53	35	43					53	53	53	53	64	64	64	63
	48	34	38	52					51	48	30	43					52	53	53	53	63	63	63	63
	58	57	58	60					60	59	60	60					61	60	60	60	64	64	64	64
Rockledge Blvd MD 187	63	63	63	63					63	62	63	63					63	62	62	63	64	64	64	64
	63	62	62	63					63	61	61	61					63	61	61	62	63	62	63	63
MD 355	63	63	63	63					63	63	63	63					63	52	47	55				

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing								2027 No Build								2027 Preferred Alternative							
	GP Lanes				CD Lanes				GP Lanes				CD Lanes				GP Lanes				HOT Lanes			
	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
	62	62	61	62					62	62	62	62					62	62	62	62				
MD 117	62	61	61	61					63	63	63	63					63	63	63	63				
	62	61	61	62					62	61	61	62					62	62	62	62				
I-370	64	64	63	63	60	60	60	60	64	64	64	63	60	60	59	60	63	63	63	63	59	59	59	59
	64	64	64	64	53	53	53	53	64	64	64	64	53	53	53	52	63	63	63	63	62	61	61	62
Shady Grove Rd	60	60	59	60	54	54	54	54	60	60	60	60	54	54	54	53	60	60	60	60	63	63	63	63
	60	60	59	60	53	52	51	53	61	61	61	60	53	53	53	53	58	57	57	58	64	64	64	64
Gude Dr																								
	60	60	59	60	53	52	51	53	61	61	61	60	53	53	53	53	58	58	58	58	63	63	63	63
MD 28	60	60	59	60	53	53	53	53	60	60	60	59	53	53	53	53	58	58	58	58	63	63	63	63
	60	60	60	60	52	51	44	51	60	60	60	60	53	53	53	53	57	57	57	57	63	63	63	63
MD 189	60	60	59	60	53	53	53	53	60	60	60	60	53	53	53	53	57	57	57	57	63	63	63	63
	60	60	60	60	49	49	48	49	60	60	60	59	53	53	52	46	57	57	57	57	63	63	63	63
Wootton Pkwy																								
	60	60	60	60	49	49	48	49	60	60	60	59	53	53	52	46	56	55	55	56	63	63	63	63
Montrose Rd / Montrose Road	60	60	60	60	53	52	53	53	61	61	61	60	53	53	53	52	57	57	57	57	63	63	63	63
	60	59	59	59	53	53	53	53	60	60	60	59	54	53	54	53	56	56	56	56	63	63	63	63
	59	59	59	59					59	59	59	59					59	58	58	59	63	63	63	63
Westlake Terrace	60	60	60	44					59	59	59	59					59	59	59	59	61	61	60	60
Democracy Blvd	59	59	43	9					59	59	59	59					58	58	58	58	64	64	64	64
	56	34	13	8					57	57	57	57					57	57	57	57	64	63	64	64
	59	59	59	59					59	59	59	59					58	58	57	58	64	64	64	64
Rockledge Blvd MD 187	59	59	59	59					59	59	24	32					58	57	43	58	64	64	64	64
	63	37	23	50					62	50	12	22					62	59	37	62	63	61	45	63
MD 355	54	15	15	24					62	23	10	21					58	36	27	47				

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing								2027 No Build								2027 Preferred Alternative							
	GP Lanes				CD Lanes				GP Lanes				CD Lanes				GP Lanes				HOT Lanes			
	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM
	63	63	63	63	44	44	44	44	64	64	64	64	43	43	42	42	60	59	58	59				
MD 117	63	63	63	63	41	41	41	41	64	64	64	64	43	42	34	38	60	59	58	59				
	64	63	63	63	43	43	42	42	64	63	63	63	42	42	42	42	58	57	56	56				
I-370	64	64	64	64	44	43	43	43	64	64	64	64	44	44	43	43	61	58	58	58	59	59	59	59
	64	64	64	64	46	45	44	44	64	64	64	64	49	46	45	45	61	59	58	59	63	64	63	63
Shady Grove Rd	64	64	63	63	43	43	43	42	64	64	63	63	43	43	43	43	61	59	58	58	64	64	63	63
	64	64	64	64	43	42	42	42	64	64	63	64	43	43	42	42	62	60	59	60	64	64	64	64
Gude Dr																								
	64	64	64	64	43	42	42	42	64	64	64	64	43	43	42	42	61	59	58	59	63	63	63	63
MD 28	64	63	61	62	43	43	42	42	64	63	63	63	43	43	40	41	62	60	59	60	63	64	63	63
	63	63	63	63	42	42	40	40	64	63	63	62	43	42	41	42	61	59	58	59	63	64	63	63
MD 189	64	63	63	63	42	42	41	41	64	63	63	63	42	42	42	42	62	61	60	61	63	63	63	63
	63	63	63	63	42	42	41	41	64	64	63	63	42	42	41	41	62	60	60	60	64	64	63	64
Wootton Pkwy																								
	63	63	63	63	42	42	41	41	64	64	63	63	42	42	41	41	62	60	59	60	64	64	63	63
Montrose Rd	63	63	63	63	43	42	42	42	64	64	63	63	43	42	42	42	64	64	63	63	64	64	63	63
	64	63	62	63	45	45	43	44	64	63	63	63	45	44	43	43	64	64	63	63	64	64	63	63
	63	63	63	63					64	64	63	64					64	64	63	63	64	64	64	64
Westlake Terrace	64	64	63	63					64	63	63	63					64	63	63	63	63	62	62	62
Democracy Blvd	63	63	63	63					64	63	63	63					64	64	63	63	64	64	64	64
	60	60	53	56					60	58	40	37					61	60	56	60	64	64	64	64
	63	63	62	62					64	63	61	62					64	63	63	63	64	64	64	64
Rockledge Blvd MD 187	64	64	63	64					64	64	63	63					64	63	62	63	64	64	64	64
	63	63	62	63					63	63	61	62					63	62	59	62	64	63	63	63
MD 355	61	61	60	61					60	60	49	55					60	60	59	60				

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing								2027 No Build								2027 Preferred Alternative							
	GP Lanes				CD Lanes				GP Lanes				CD Lanes				GP Lanes				HOT Lanes			
	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
	21	20	19	21	46	46	46	46	21	10	10	18	47	48	15	32	22	18	13	17				
MD 117	20	19	18	21	43	42	43	42	24	10	10	18	42	43	24	26	23	17	13	17				
	23	21	21	24	53	52	39	45	34	11	11	16	48	24	20	24	28	14	10	12				
I-370	31	26	23	25	54	54	27	31	43	11	9	13	44	7	5	6	36	11	7	9	45	15	12	14
	42	29	23	26	50	29	22	21	48	12	8	11	52	12	6	10	49	15	8	10	60	14	11	13
Shady Grove Rd	51	40	25	28	52	21	7	9	51	14	8	12	53	9	3	4	52	19	7	8	61	21	10	10
	53	51	37	30	52	47	38	52	52	20	9	13	53	43	34	11	53	25	7	7	63	27	8	7
Gude Dr																								
	53	51	37	30	52	47	38	52	52	30	11	17	53	43	34	11	52	38	11	8	63	60	14	8
MD 28	52	50	50	50	52	52	52	52	53	31	8	12	51	49	48	39	49	41	11	7	63	63	28	10
	52	52	52	52	47	49	50	51	50	35	10	13	51	45	13	15	48	37	17	7	63	63	39	12
MD 189	53	52	52	52	47	51	52	52	52	39	9	12	53	50	7	10	53	50	20	7	63	62	46	14
	52	51	51	51	50	51	51	52	53	45	9	11	50	50	10	12	53	53	25	8	63	63	52	14
Wootton Pkwy																								
	52	51	51	51	50	51	51	52	53	48	9	11	50	50	10	12	51	51	30	8	63	63	61	21
Montrose Rd	50	48	49	46	53	53	53	53	52	51	8	9	53	53	17	21	53	52	41	9	63	63	63	31
	49	47	47	47	52	52	52	53	51	51	11	10	52	52	51	50	53	52	50	9	63	63	63	53
	37	34	33	34					53	52	17	17					53	53	53	24	62	62	62	62
Westlake Terrace	31	27	25	26					54	53	23	21					54	54	54	36	63	63	63	63
Democracy Blvd	24	16	14	15					53	53	35	26					55	55	55	46	63	63	63	63
	46	29	25	27					53	53	42	33					54	51	40	45	63	63	63	63
	46	24	19	20					48	25	8	6					56	56	56	9	64	64	63	63
Rockledge Blvd MD 187	58	28	17	16					58	22	8	6					57	57	57	13	64	64	64	63
	58	51	26	20					57	44	10	6					57	56	57	18	60	61	61	35
MD 355	58	58	30	16					57	56	8	4					57	57	57	16				

Travel Speed (mph)

10 20 30 40 50

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 Alterative 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)

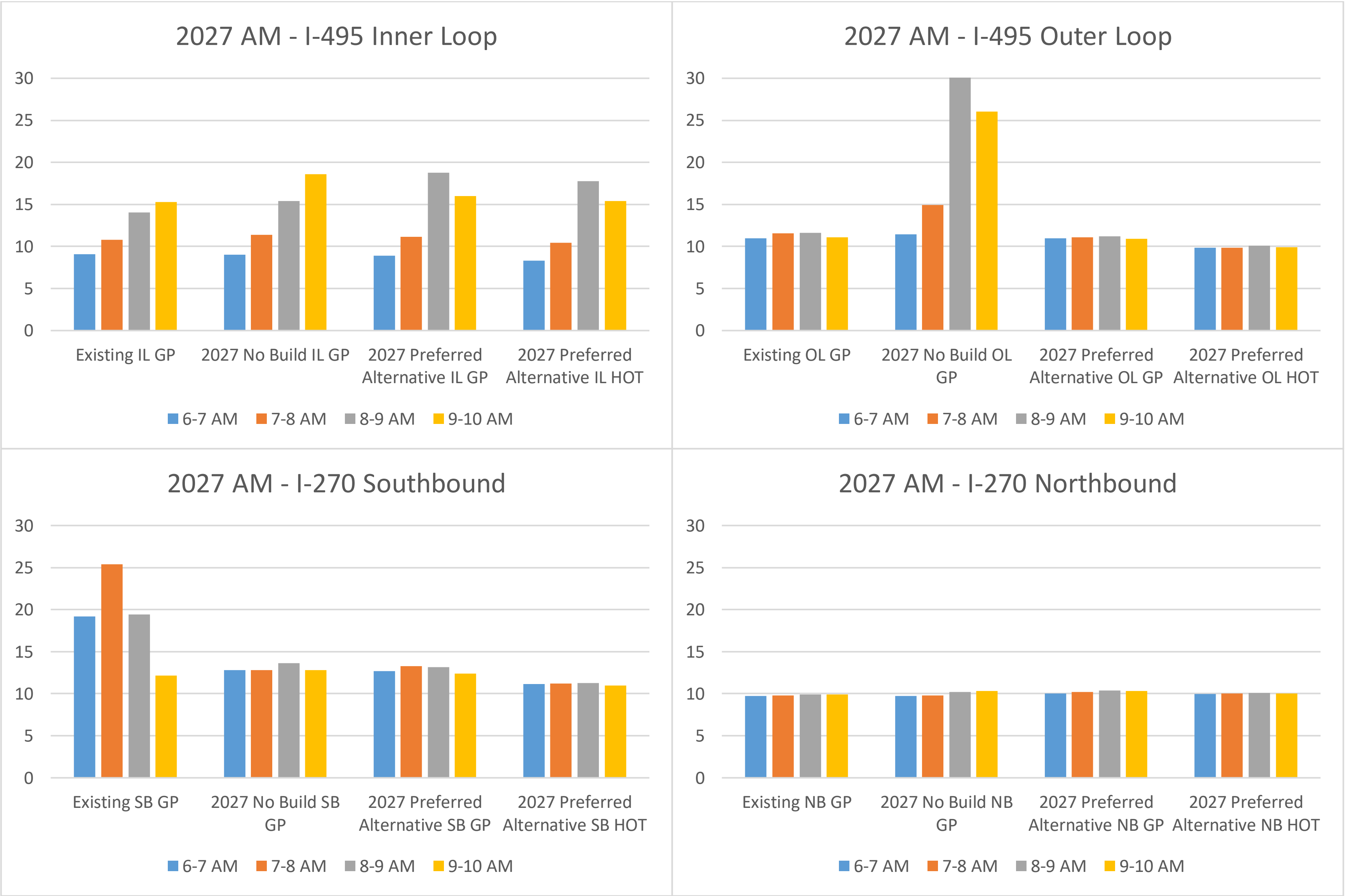


Figure 6-21: I-495 Inner Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period

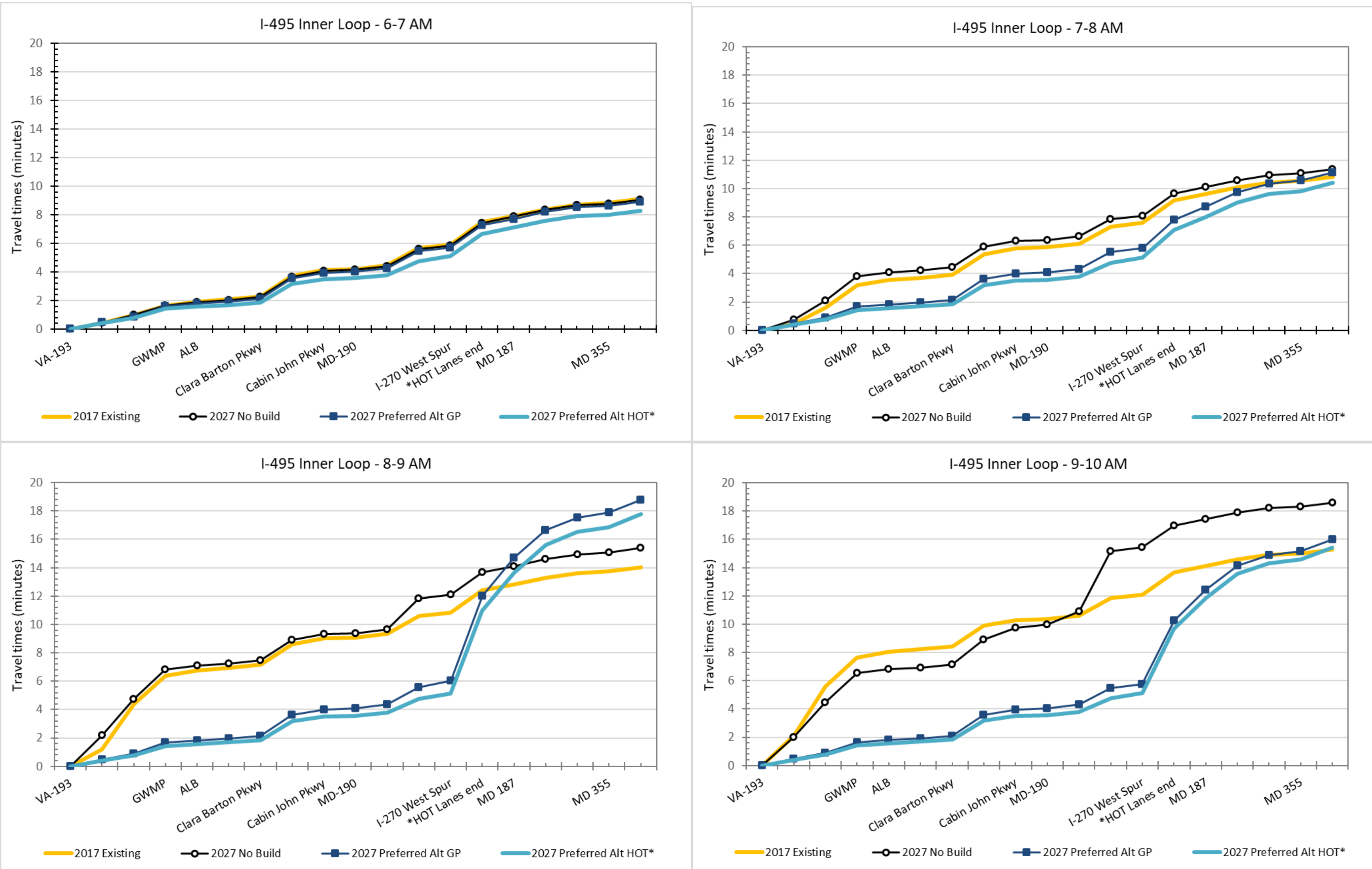


Figure 6-22: I-495 Outer Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period

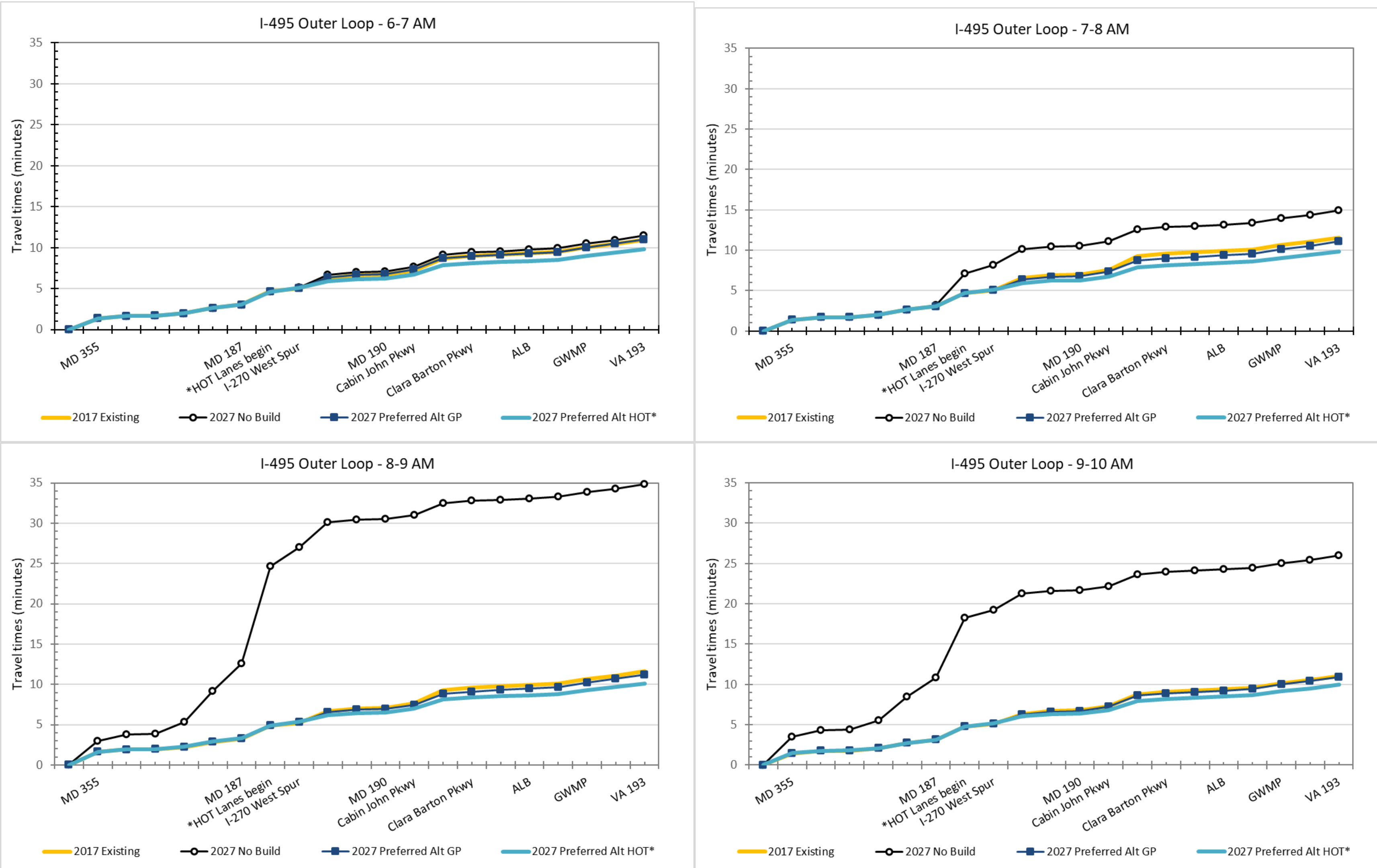


Figure 6-23: I-270 Southbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period

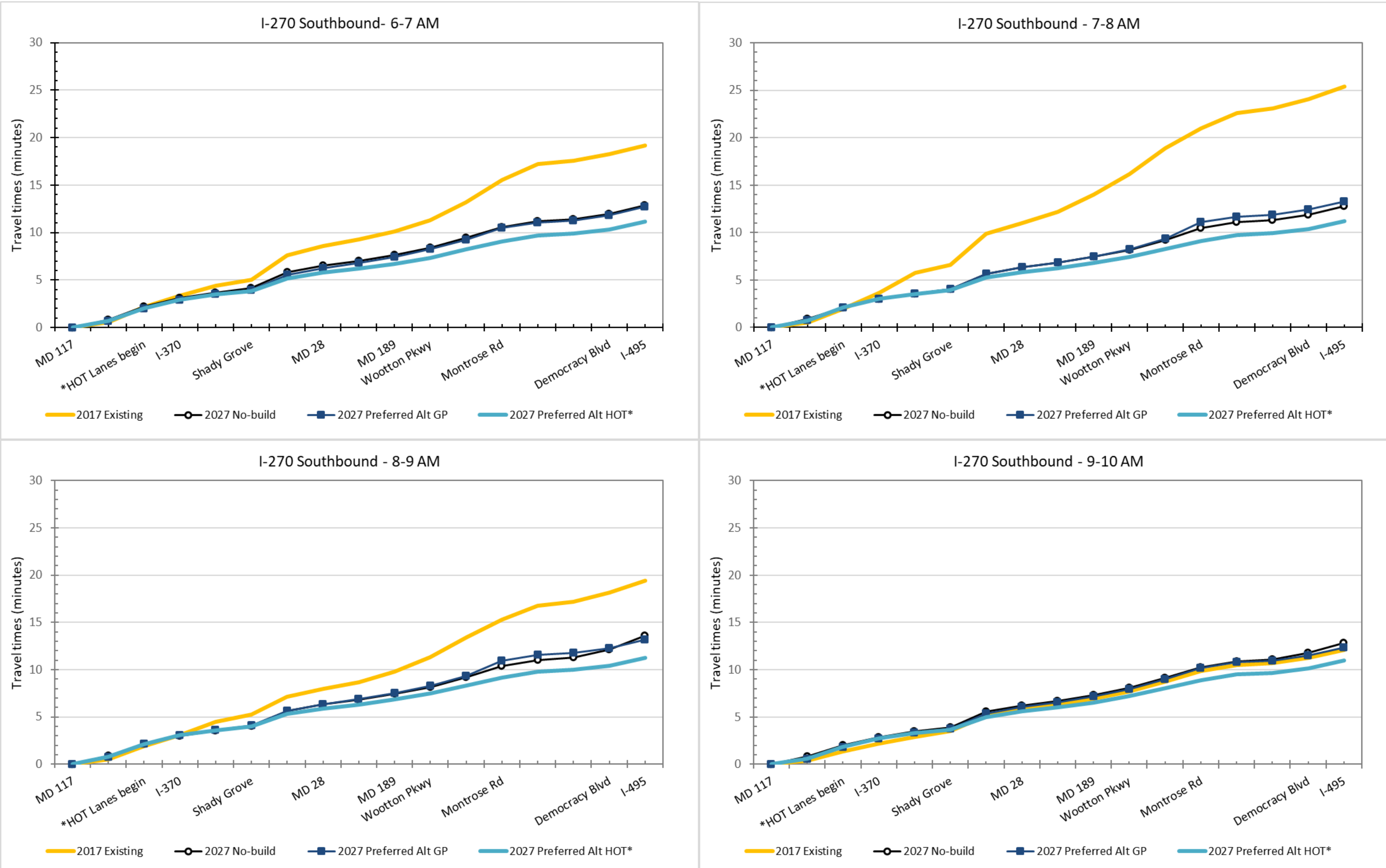
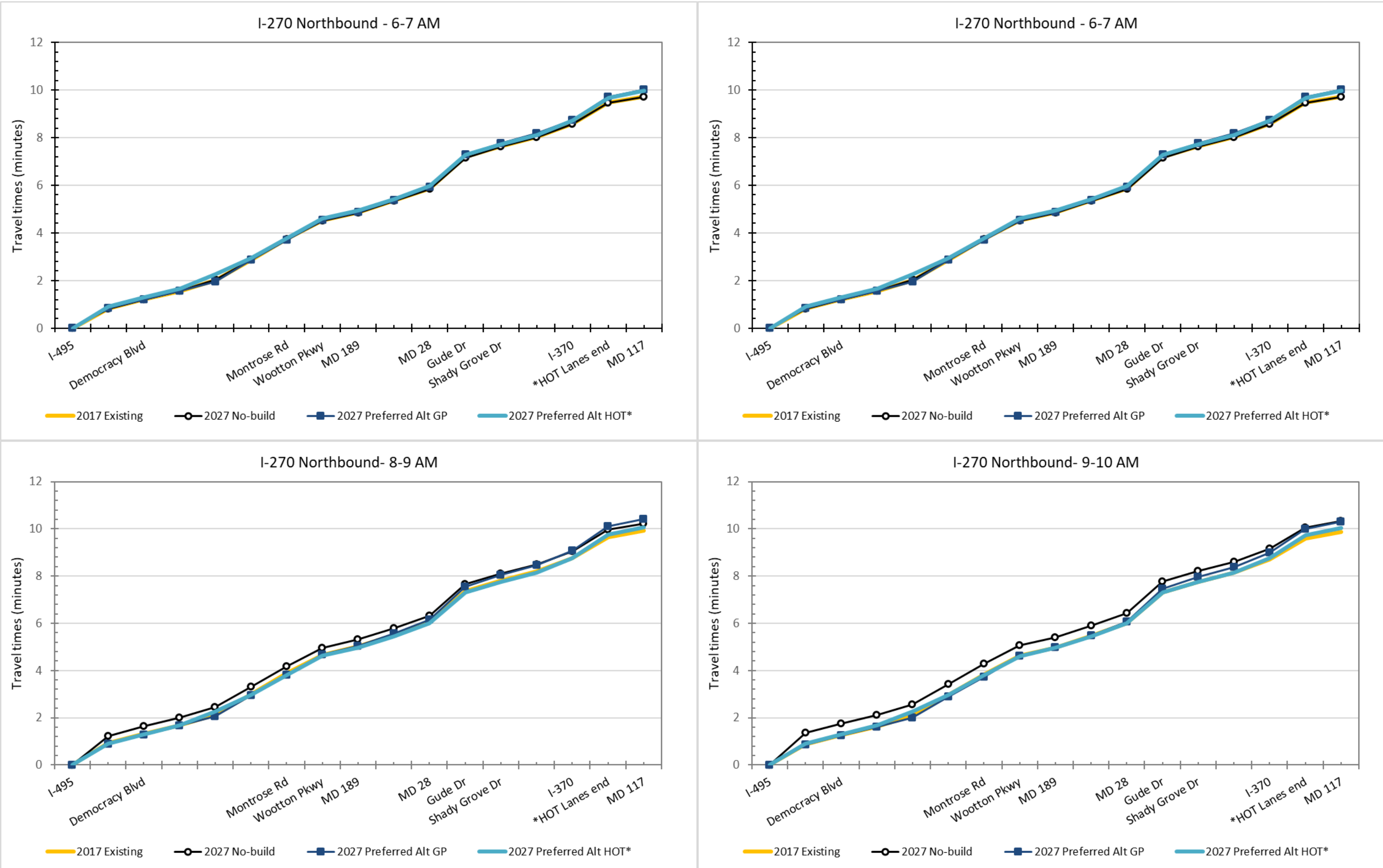


Figure 6-24: I-270 Northbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period



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)

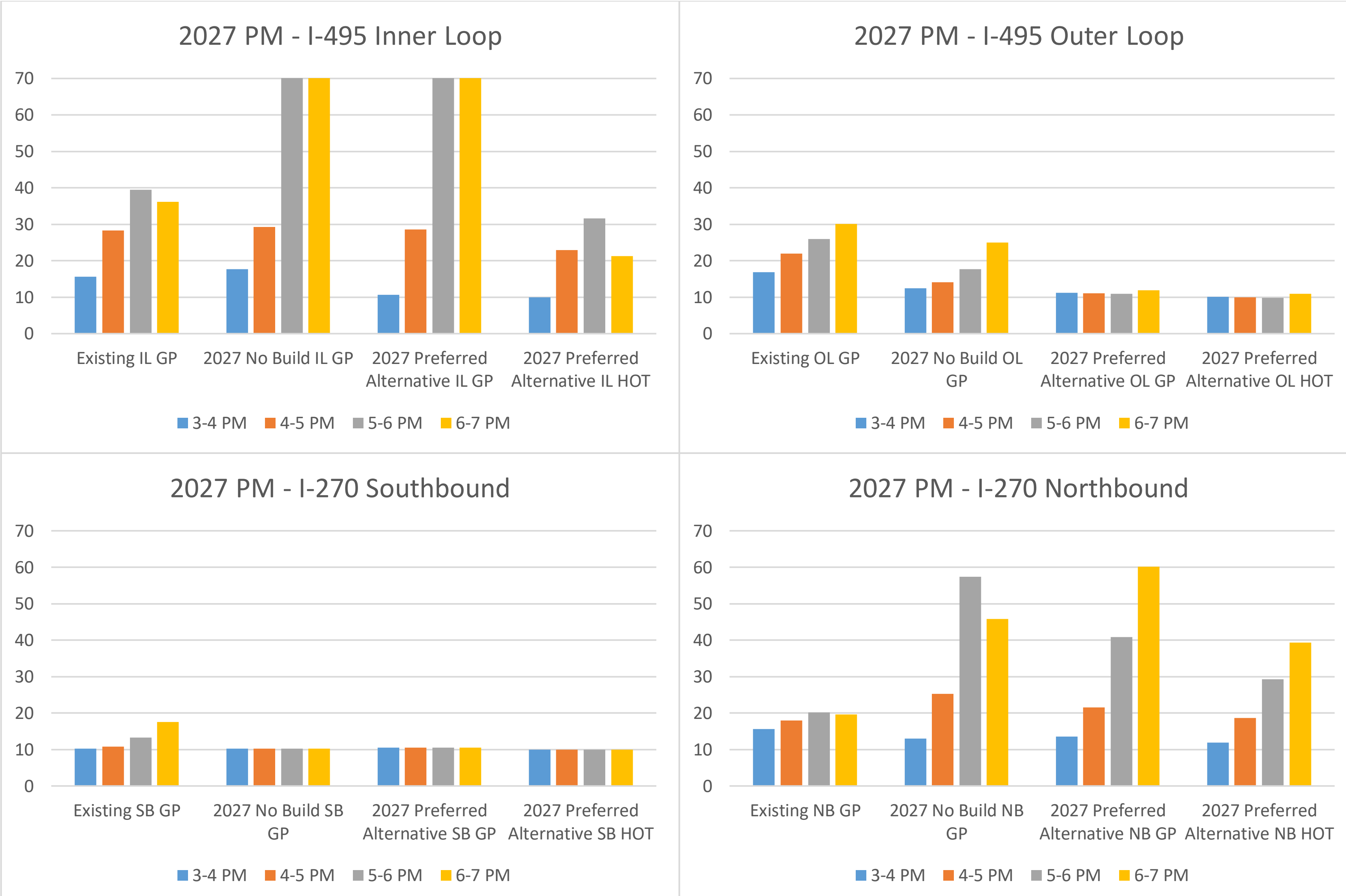


Figure 6-26: I-495 Inner Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period

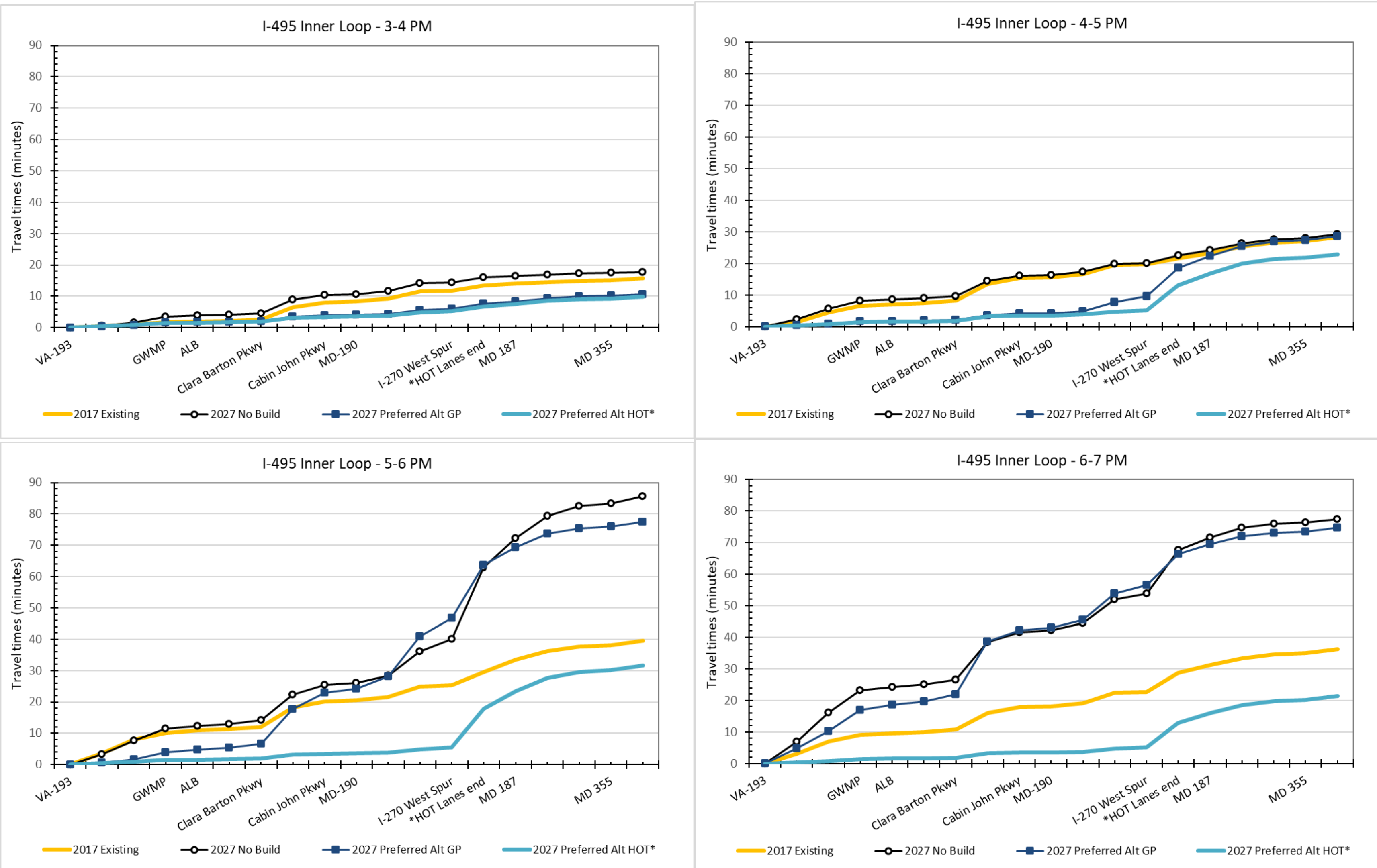


Figure 6-27: I-495 Outer Loop 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period

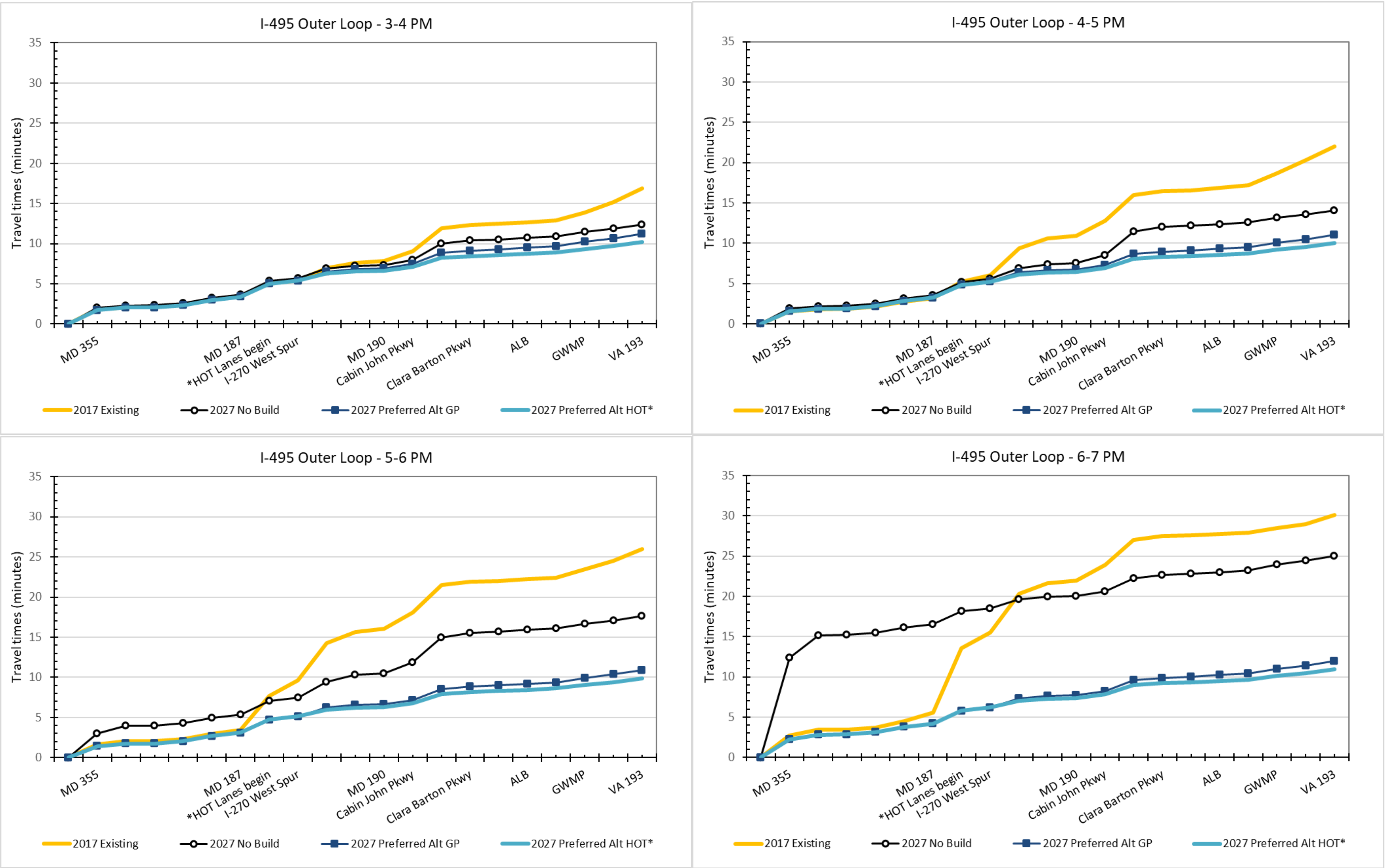


Figure 6-28: I-270 Southbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period

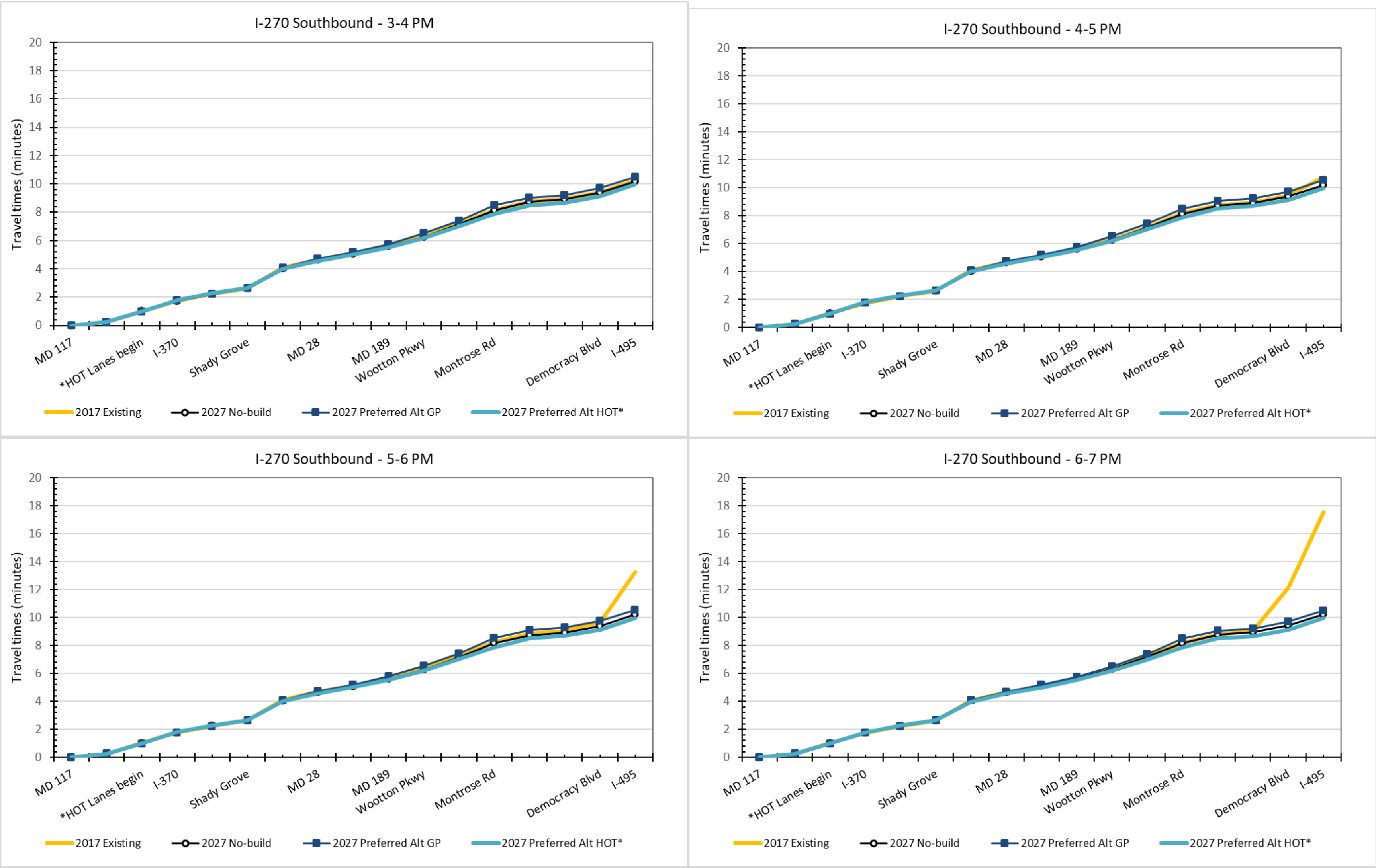
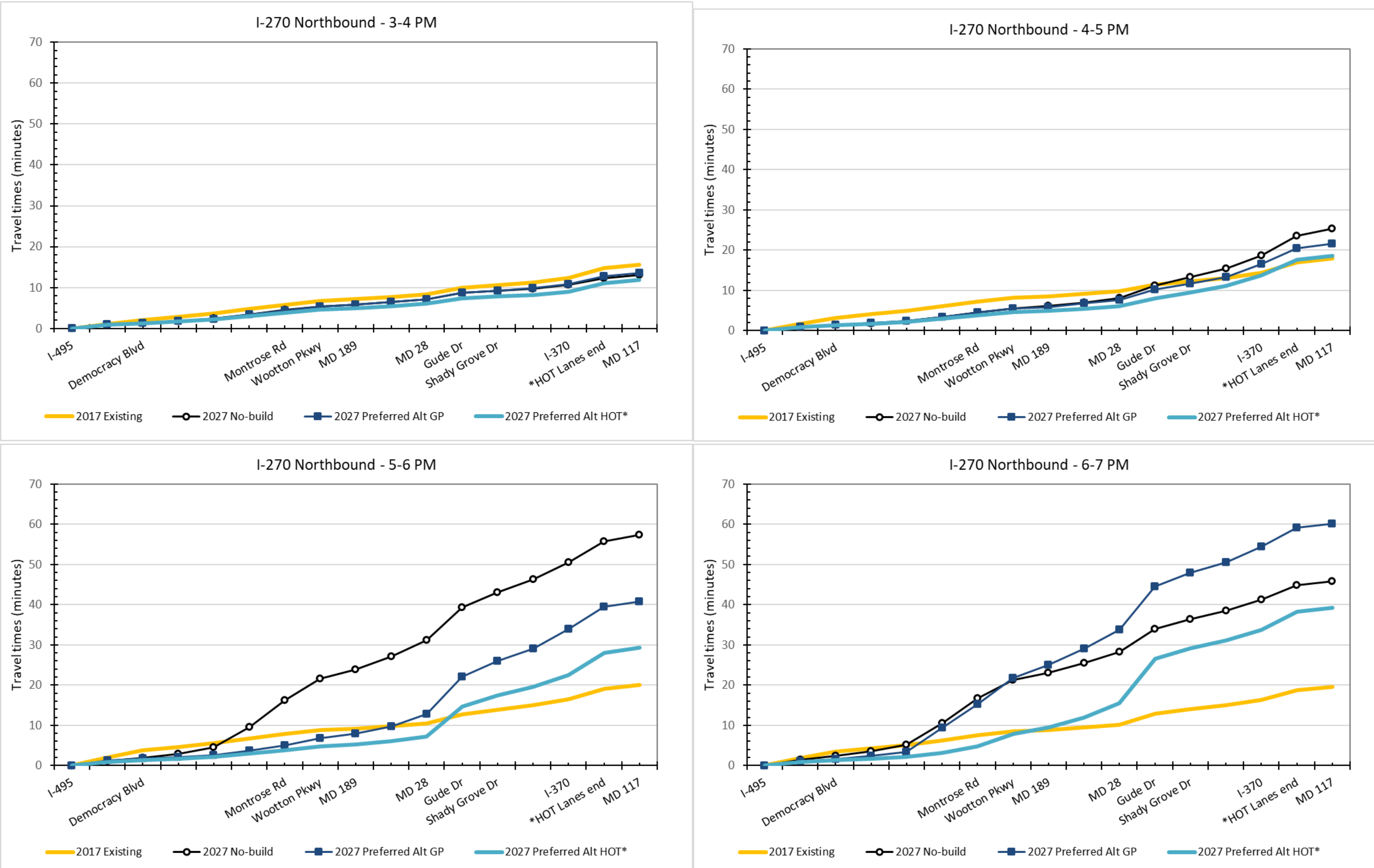


Figure 6-29: I-270 Northbound 2027 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period



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 over 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 35 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 GP:* 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 GP:* 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 GP:* 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 GP:* 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 GP:* 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 GP:* 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 GP:* 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 GP:* 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	No-Build Available Storage (feet)	No-Build 3-4 PM Avg. (ft)	No-Build 3-4 PM Max. (ft)	No-Build 4-5 PM Avg. (ft)	No-Build 4-5 PM Max. (ft)	No-Build 5-6 PM Avg. (ft)	No-Build 5-6 PM Max. (ft)	No-Build 6-7 PM Avg. (ft)	No-Build 6-7 PM Max. (ft)	Preferred Available Storage (feet)	Preferred 3-4 PM Avg. (ft)	Preferred 3-4 PM Max. (ft)	Preferred 4-5 PM Avg. (ft)	Preferred 4-5 PM Max. (ft)	Preferred 5-6 PM Avg. (ft)	Preferred 5-6 PM Max. (ft)	Preferred 6-7 PM Avg. (ft)	Preferred 6-7 PM 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

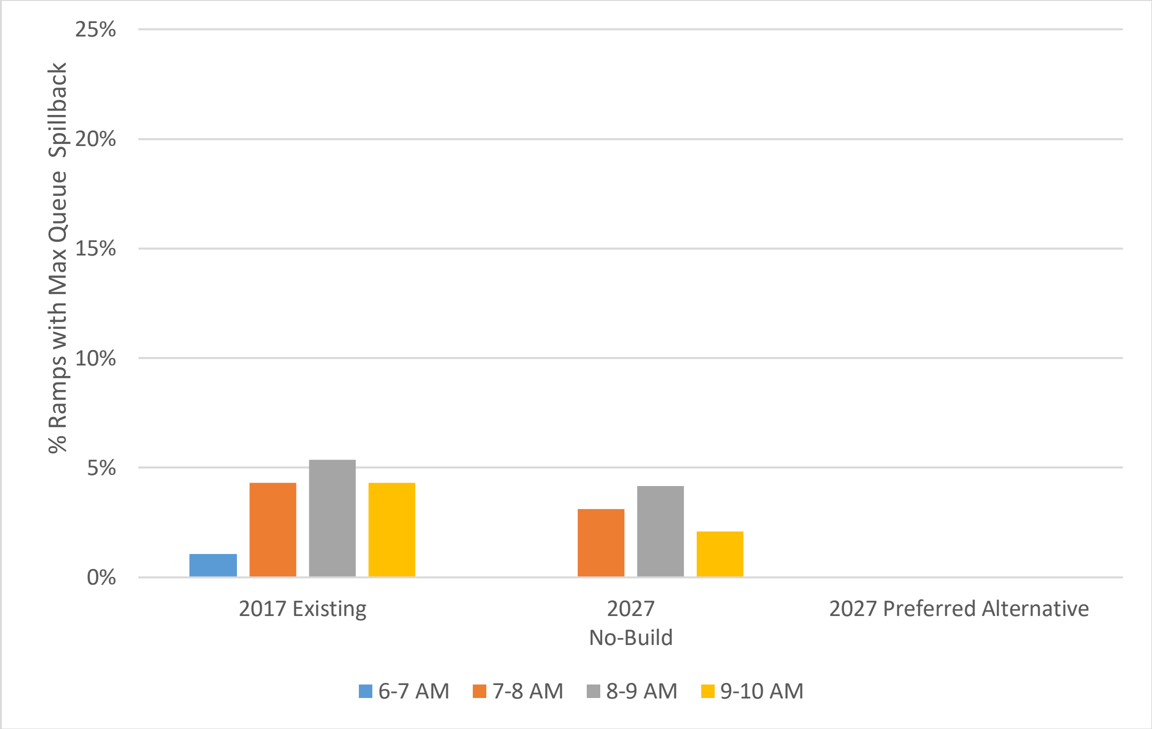
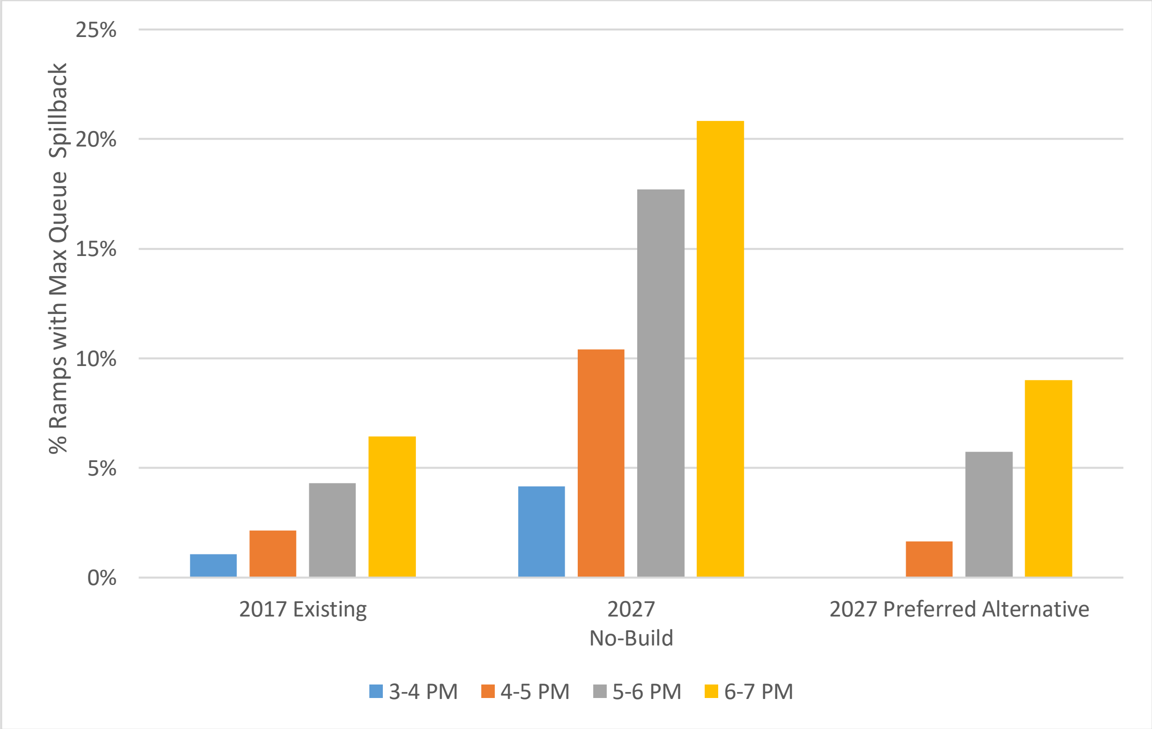


Figure 6-31: 2027 PM No Build vs Preferred Alternative Ramp Queue Spillback



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 35% (approximately 72,000 lane-miles) under No Build conditions to 2% (approximately 5,000 lane-miles) with the Preferred Alternative; and the I-270 Southbound lane-miles with LOS 'D' or better increasing from 75% (approximately 299,000 lane-miles) to 89% (approximately 438,000 lane-miles) while reducing those of LOS 'F' from 12% (approximately 48,000 lane-miles) to 6% (approximately 29,000 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 24% (approximately 49,000 lane-miles) under No Build conditions to 6% (approximately 13,000 lane-miles) with the Preferred Alternative; and the I-270 Northbound lane-miles with LOS 'D' or better increasing from 36% (approximately 162,000 lane-miles) to 56% (approximately 289,000 lane-miles) while reducing those of LOS 'F' from 54% (approximately 244,000 lane-miles) to 38% (approximately 197,000 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 throughput at all key locations during the AM peak period. Like the AM, all key locations have increased throughput during the 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

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)
AM Peak Period							
6-7 AM	**No Build**	6340	12712	3192	15904	33	33136
	Preferred Alternative	6752	12039	3558	15597	35	32863
	Network Benefit	**-412**	**673**	**-366**	**307**	**2**	**273**
7-8 AM	**No Build**	25373	23288	15551	38839	26	44700
	Preferred Alternative	25050	22802	15095	37897	27	44745
	Network Benefit	**323**	**486**	**456**	**942**	**1**	**-45**
8-9 AM	**No Build**	49704	23288	37078	60366	22	51891
	Preferred Alternative	44647	27587	34713	62300	24	49838
	Network Benefit	**5057**	**-4299**	**2365**	**-1934**	**2**	**2053**
9-10 AM	**No Build**	62789	30367	55664	86031	22	51244
	Preferred Alternative	53972	23398	48830	72228	27	45611
	Network Benefit	**8817**	**6969**	**6834**	**13803**	**5**	**5633**
PM Peak Period							
3-4 PM	**No Build**	5041	12473	2840	15313	34	36416
	Preferred Alternative	1691	9651	861	10512	38	34685
	Network Benefit	**3350**	**2822**	**1979**	**4801**	**4**	**1731**
4-5 PM	**No Build**	15715	22733	9600	32333	27	46362
	Preferred Alternative	7620	16615	4269	20884	32	41779
	Network Benefit	**8095**	**6118**	**5331**	**11449**	**5**	**4583**
5-6 PM	**No Build**	42028	22733	27440	50173	20	56886
	Preferred Alternative	18770	25166	12417	37583	26	49683
	Network Benefit	**23258**	**-2433**	**15023**	**12590**	**6**	**7203**
6-7 PM	**No Build**	64860	36865	53221	90086	19	57619
	Preferred Alternative	29749	27445	24053	51498	24	50665
	Network Benefit	**35111**	**9420**	**29168**	**38588**	**5**	**6954**

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 throughput at all key locations during the AM peak period. Like the AM, all four I-495 Outer Loop and I-270 Southbound key locations have increased throughput during the 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	GP	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	GP	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%**

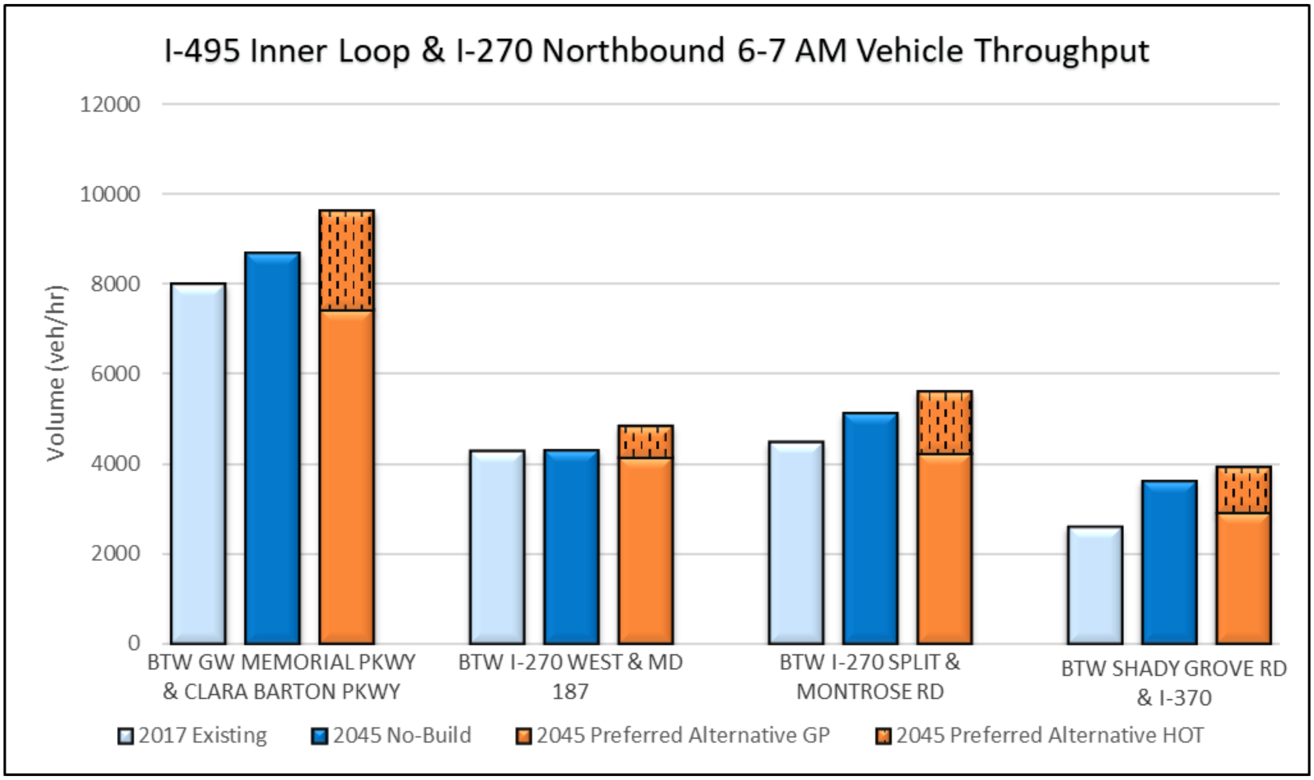
Table 6-17: 2045 PM Throughput Comparison

Time Interval	Existing	No Build	Preferred Alternative			
			HOT	GP	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	GP	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)



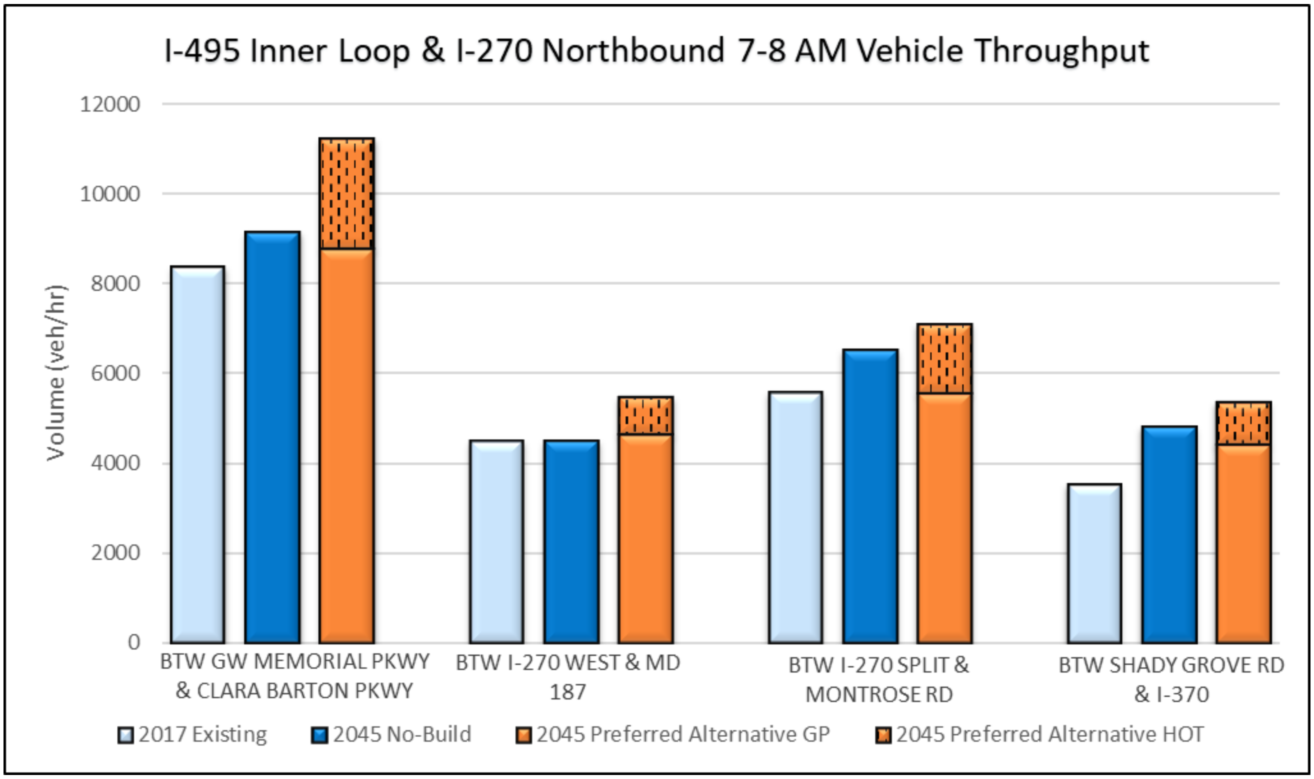
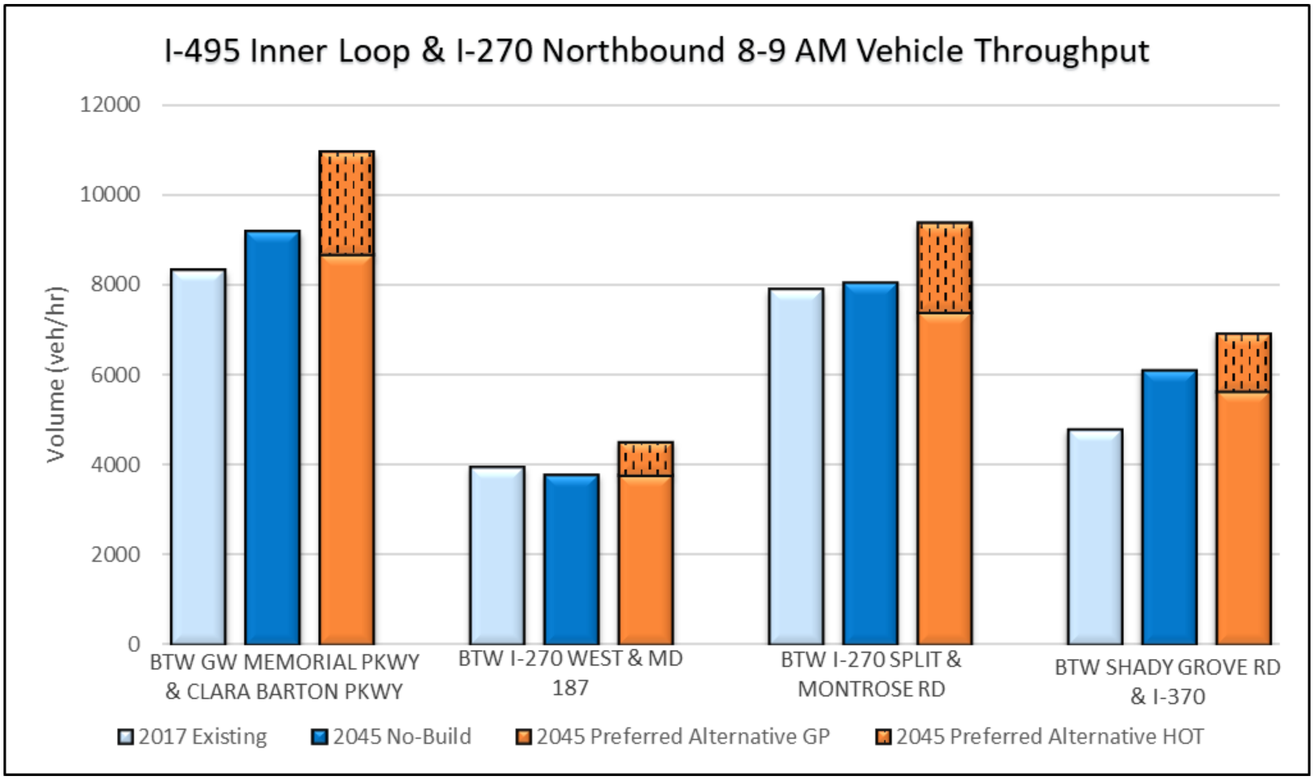


Figure 6-32: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)



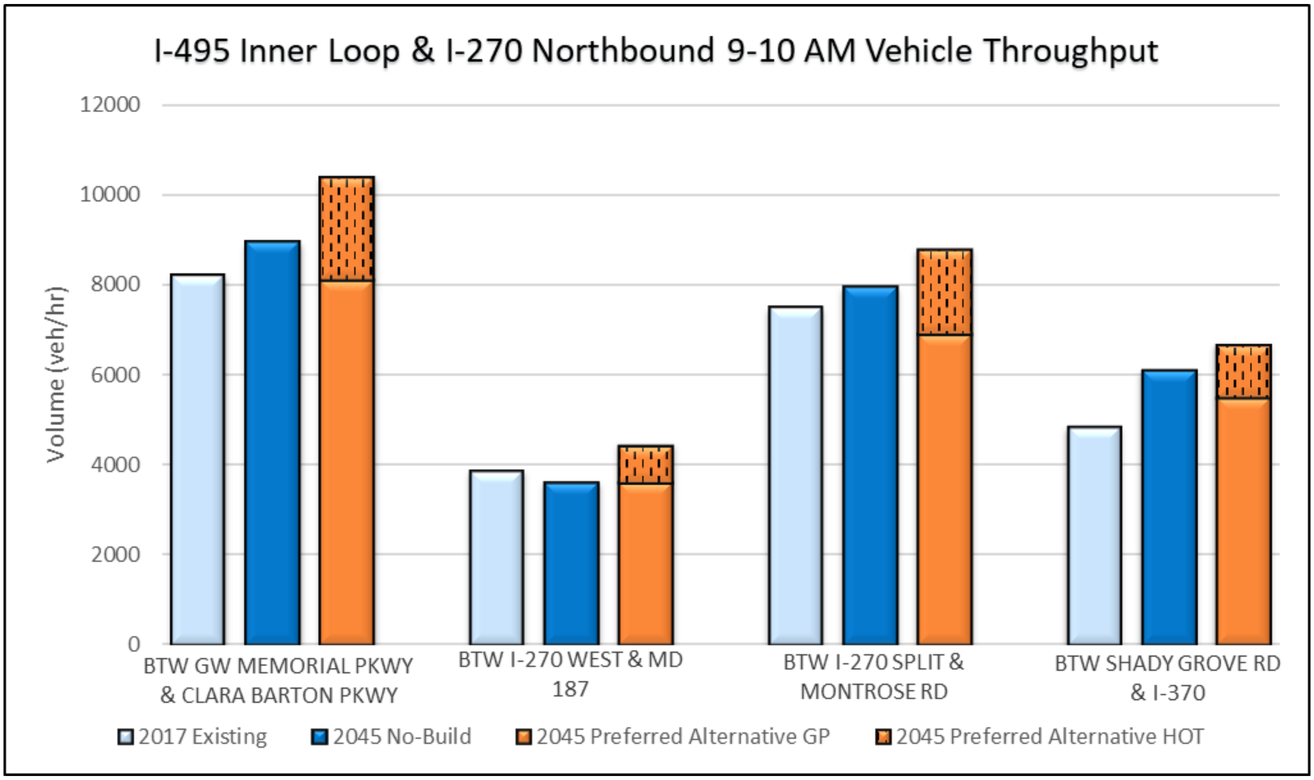
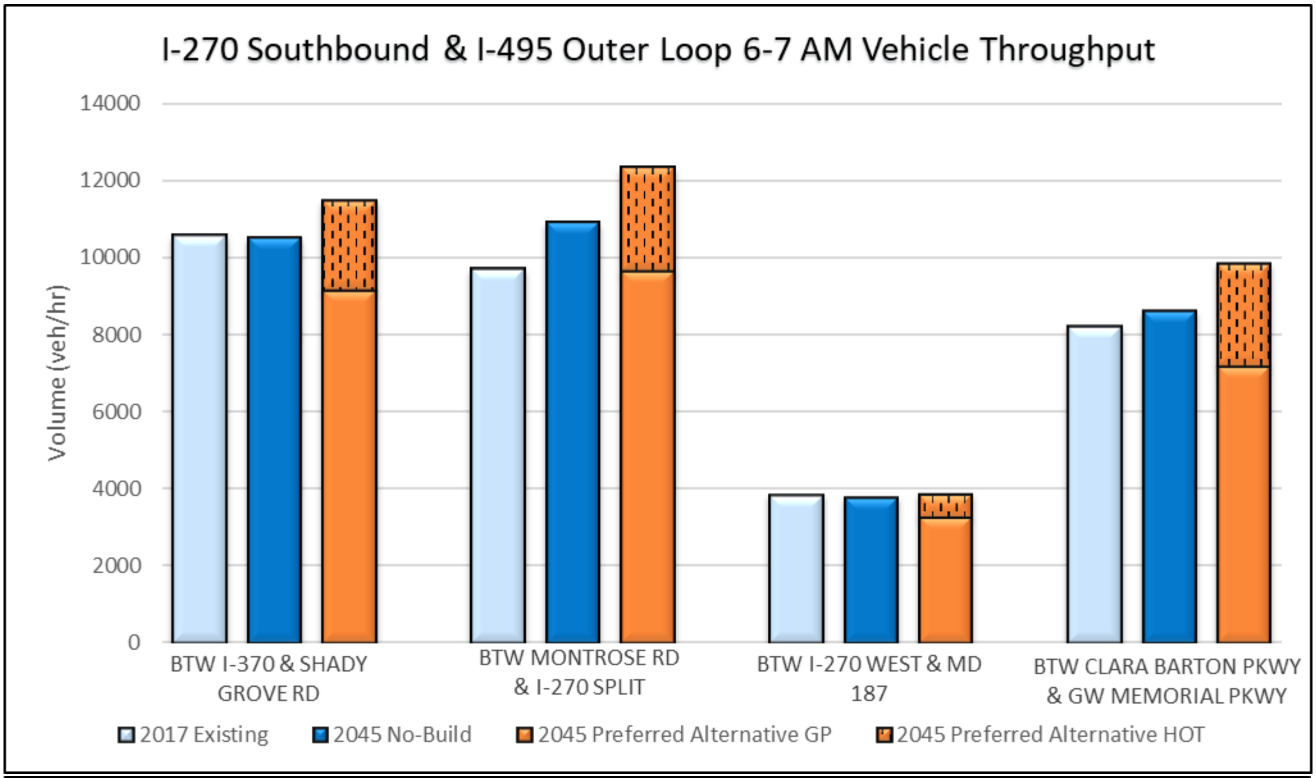


Figure 6-32: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)



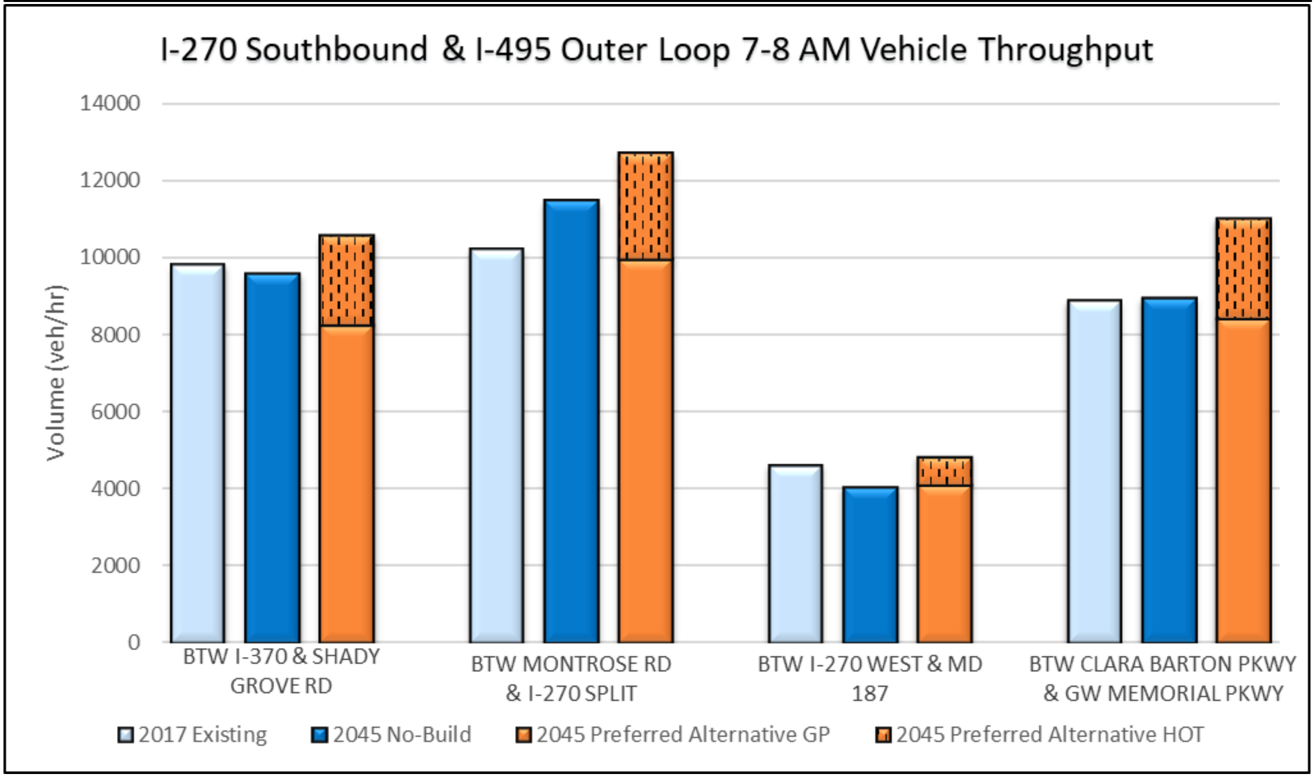
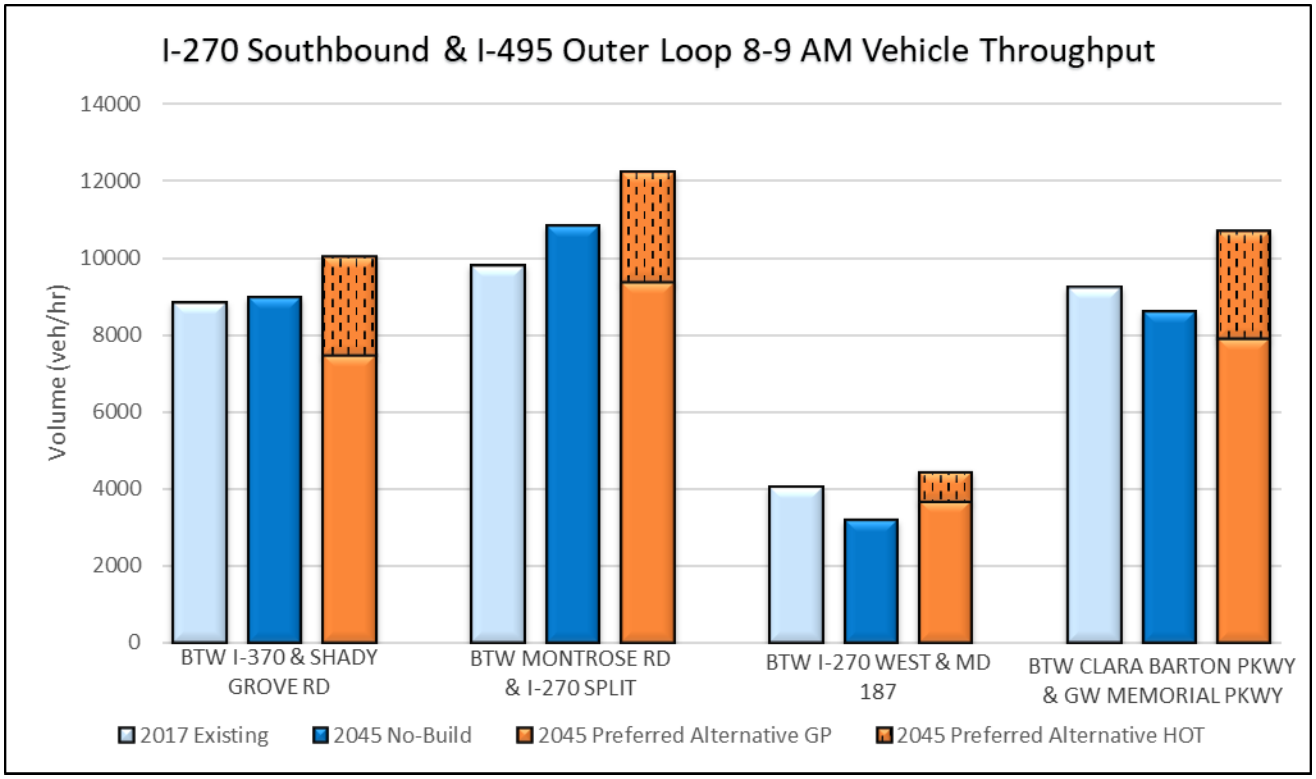


Figure 6-32: 2045 No Build vs Preferred Alternative AM VISSIM Freeway Throughputs (veh/hr) (Continued)



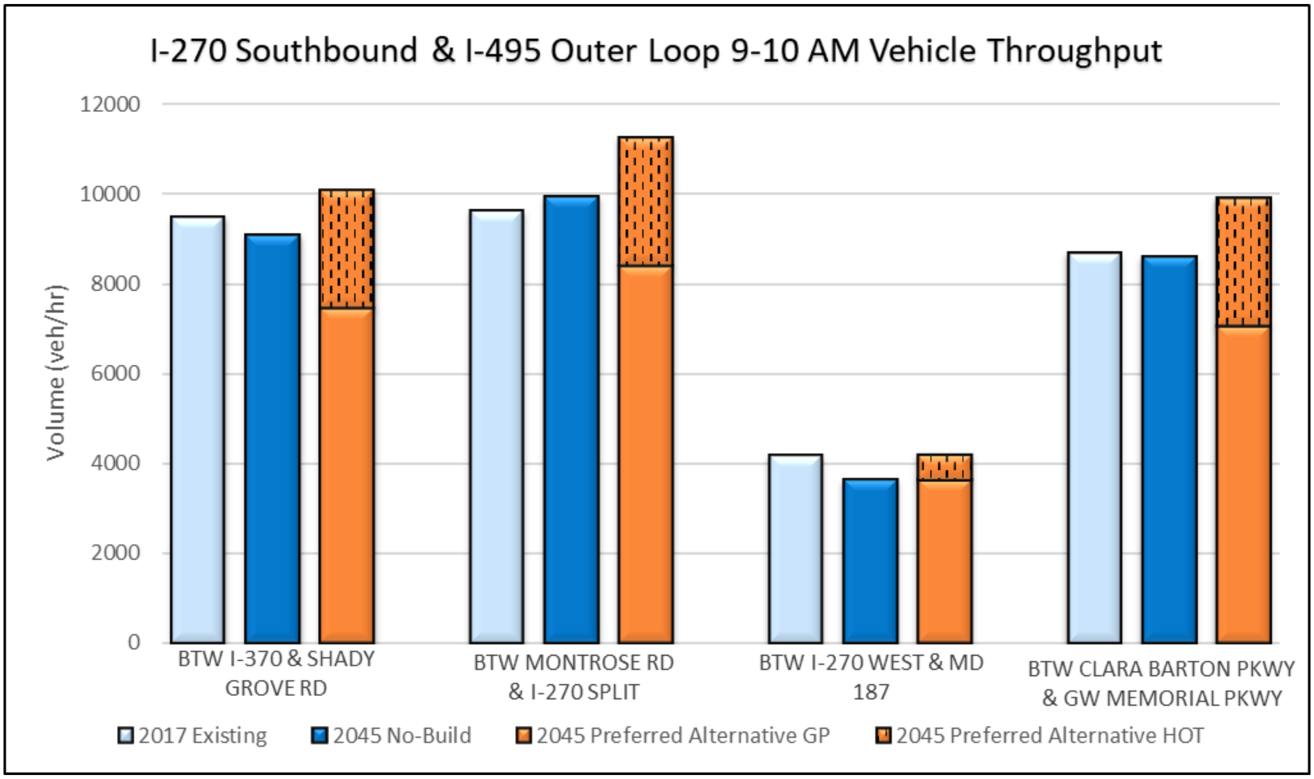
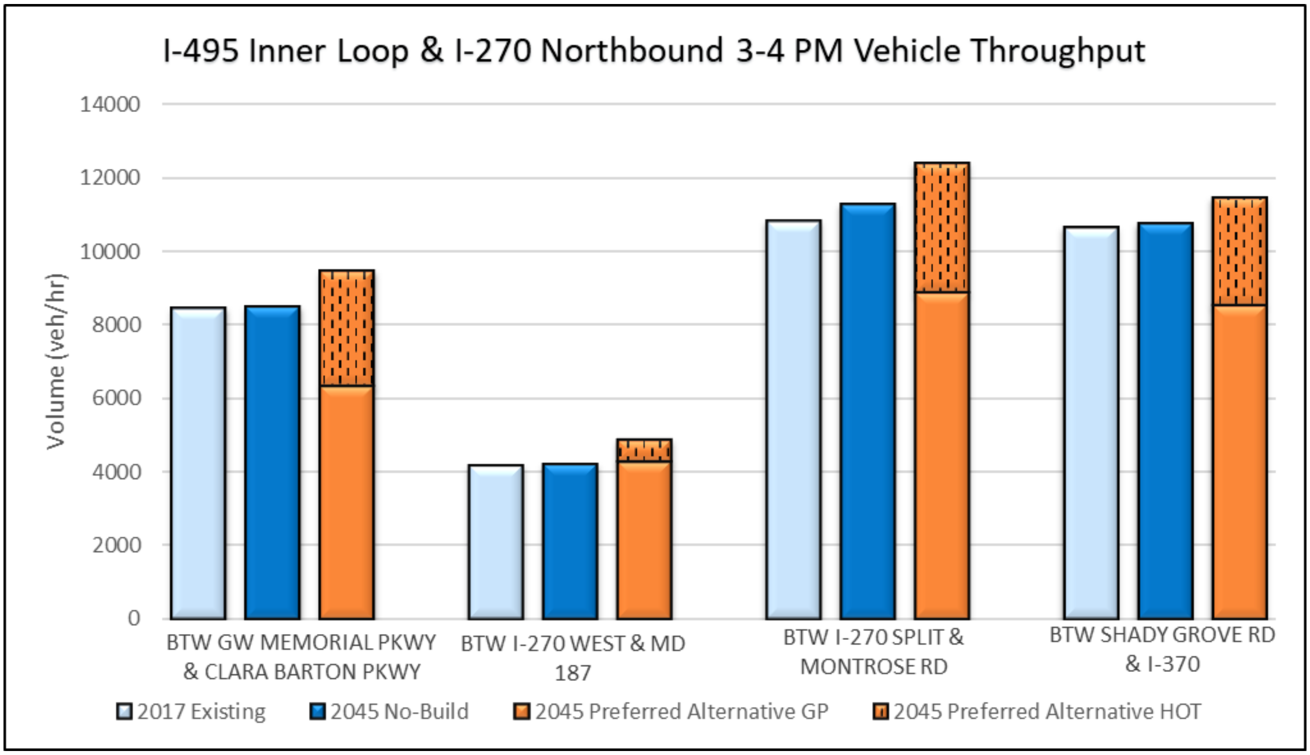


Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr)



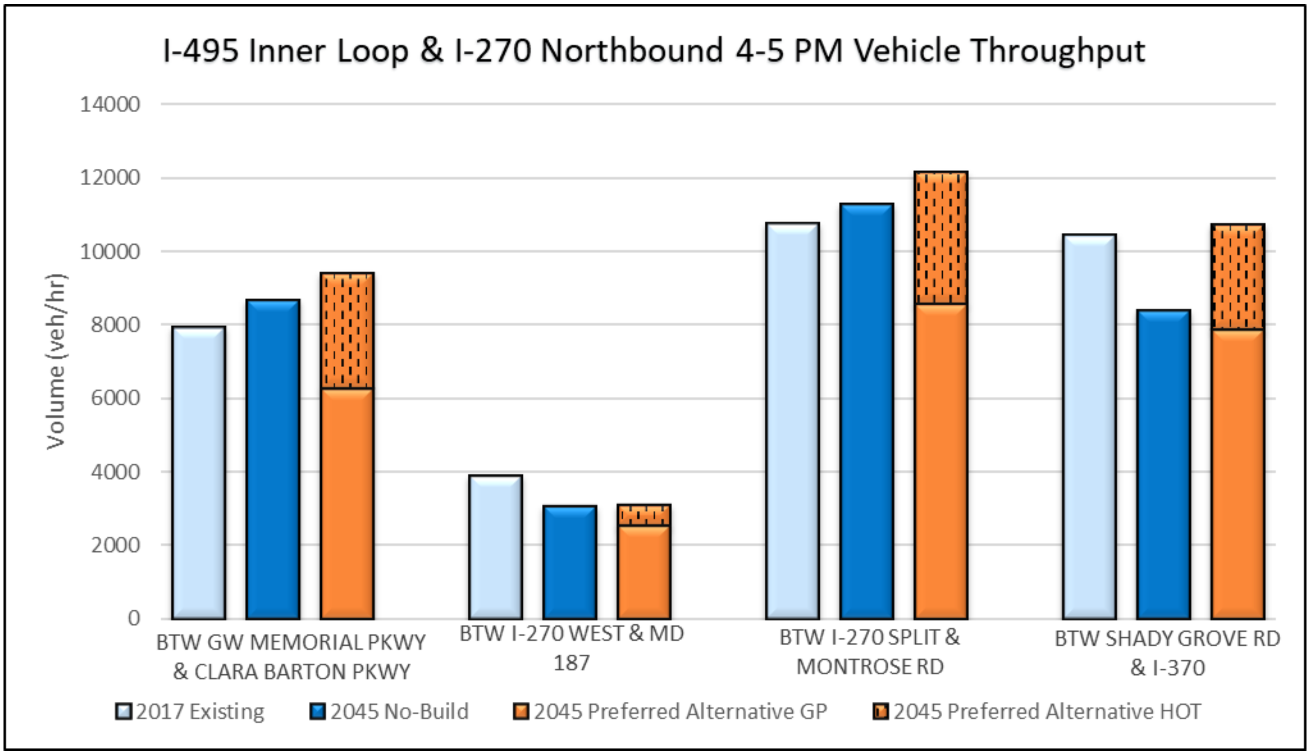
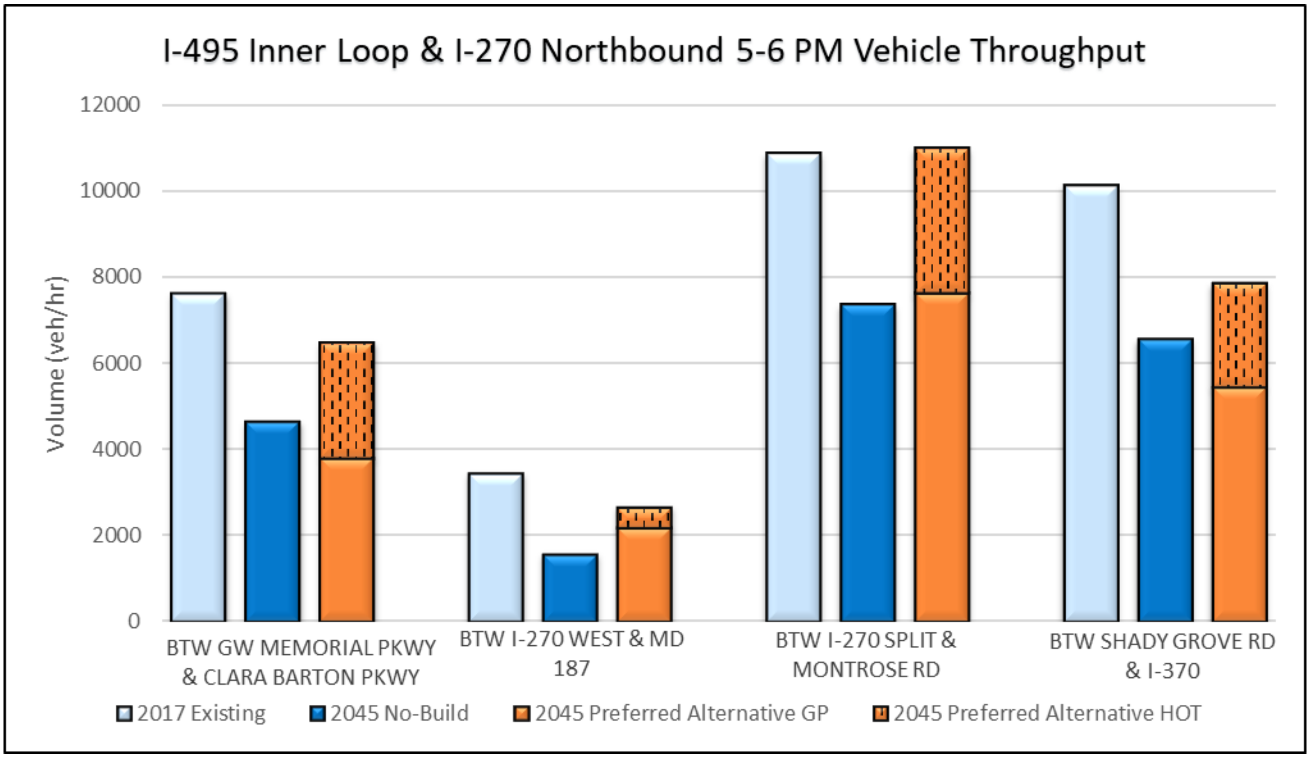


Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)



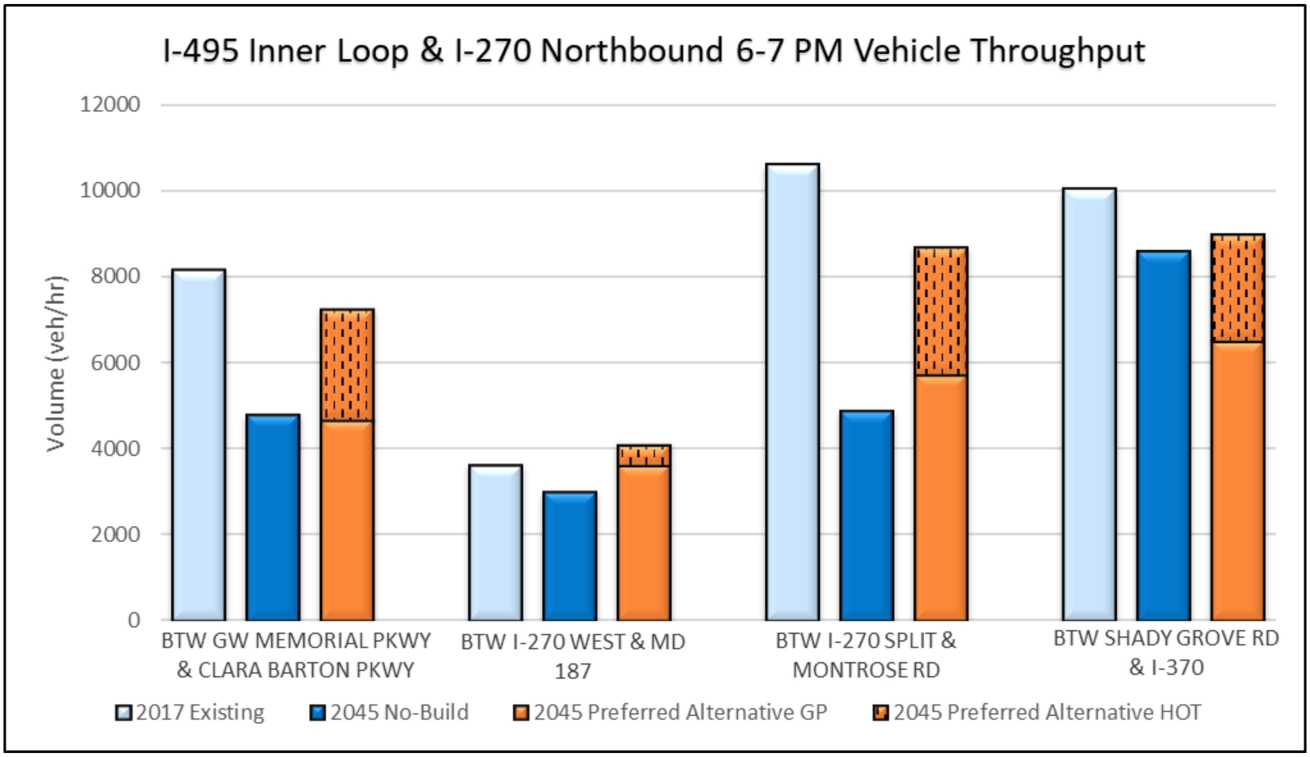
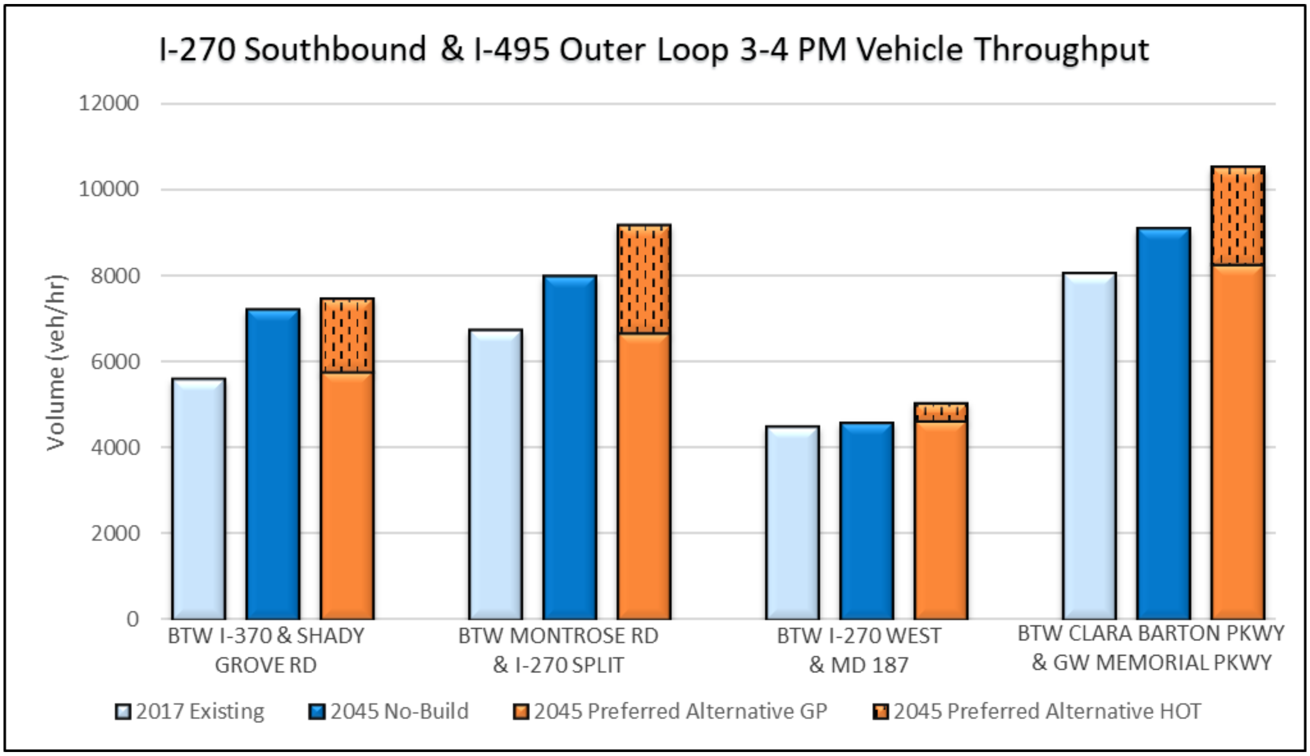


Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)



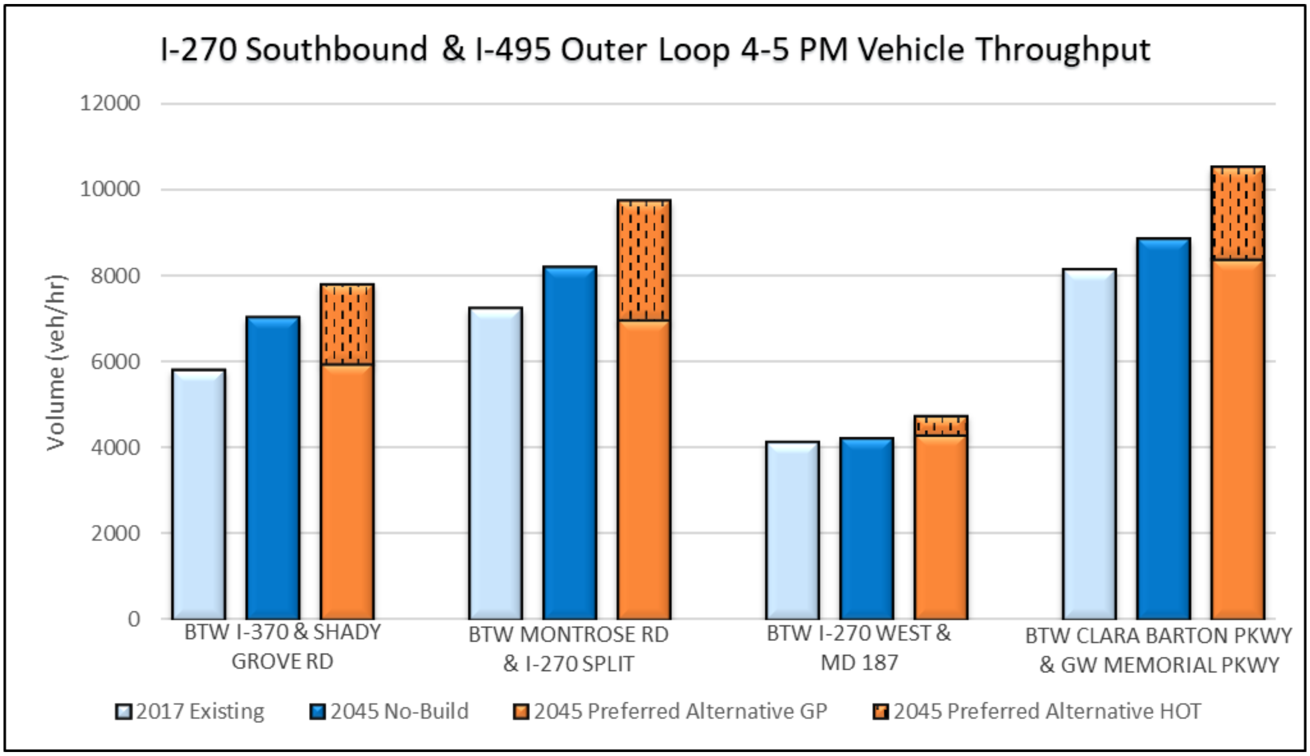
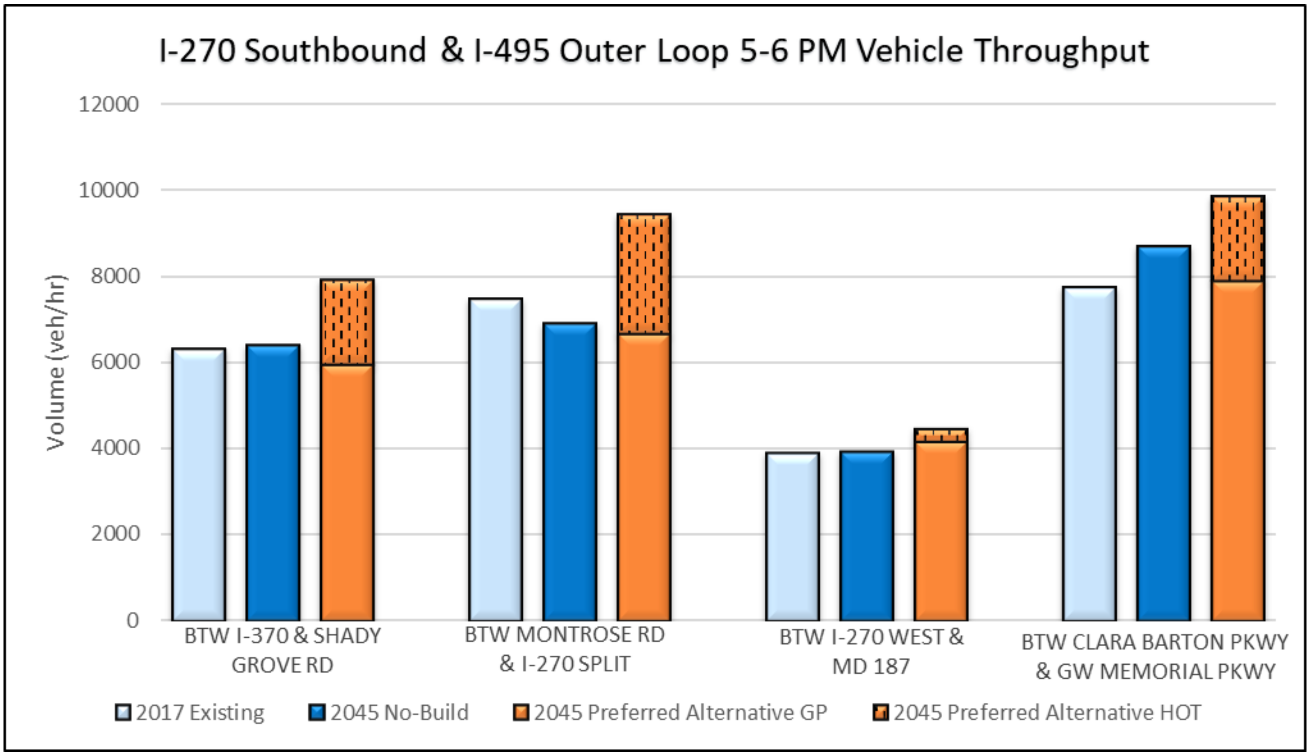
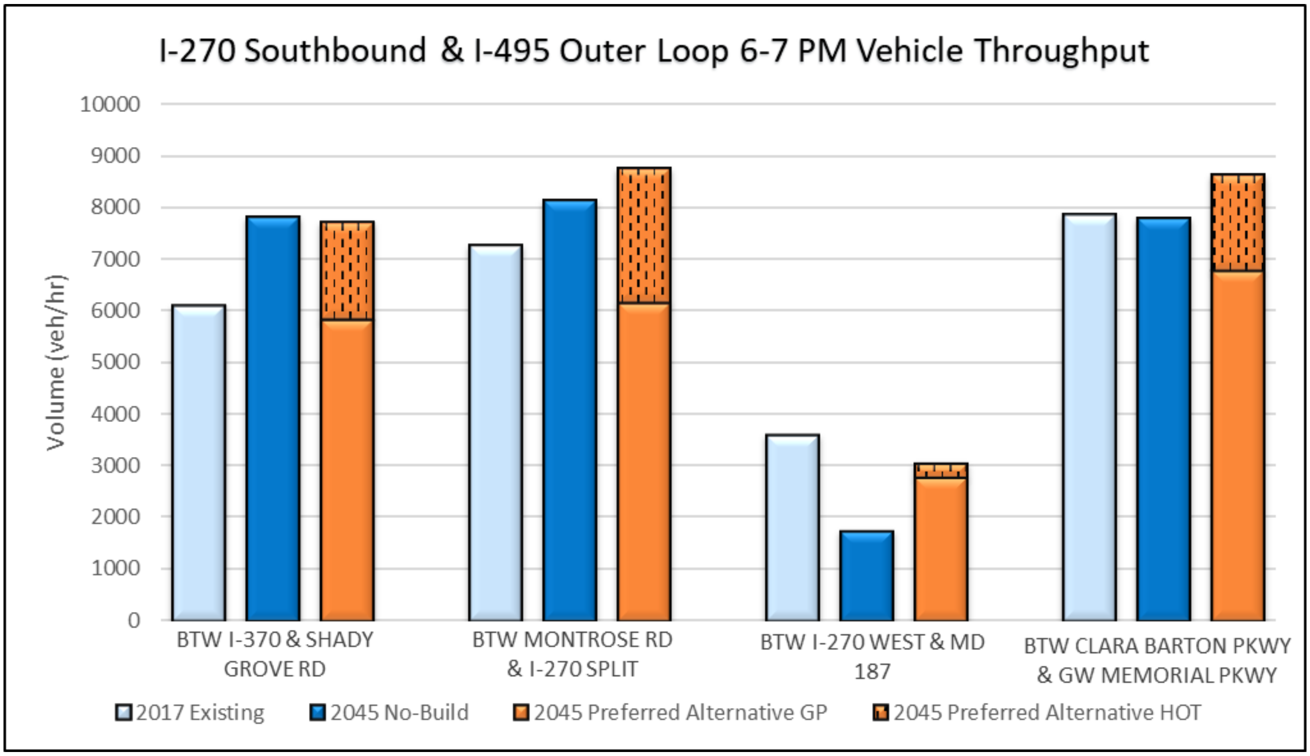


Figure 6-33: 2045 No Build vs Preferred Alternative PM VISSIM Freeway Throughputs (veh/hr) (Continued)





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 55% (approximately 116,000 lane-miles) under No Build conditions to 58% (approximately 120,000 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 but with slight degradation of lane-miles operating at LOS 'F'. Along the I-495 Outer Loop, the lane-miles of LOS 'F' are reduced from 44% (approximately 89,000 lane-miles) under No Build conditions to 2% (approximately 5,000 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 409,000 lane-miles) to 99% (approximately 515,000 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 70% (approximately 280,000 lane-miles) to 87% (approximately 428,000 lane-miles) while reducing those of LOS 'F' from 16% (approximately 65,000 lane-miles) to 6% (approximately 31,000 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

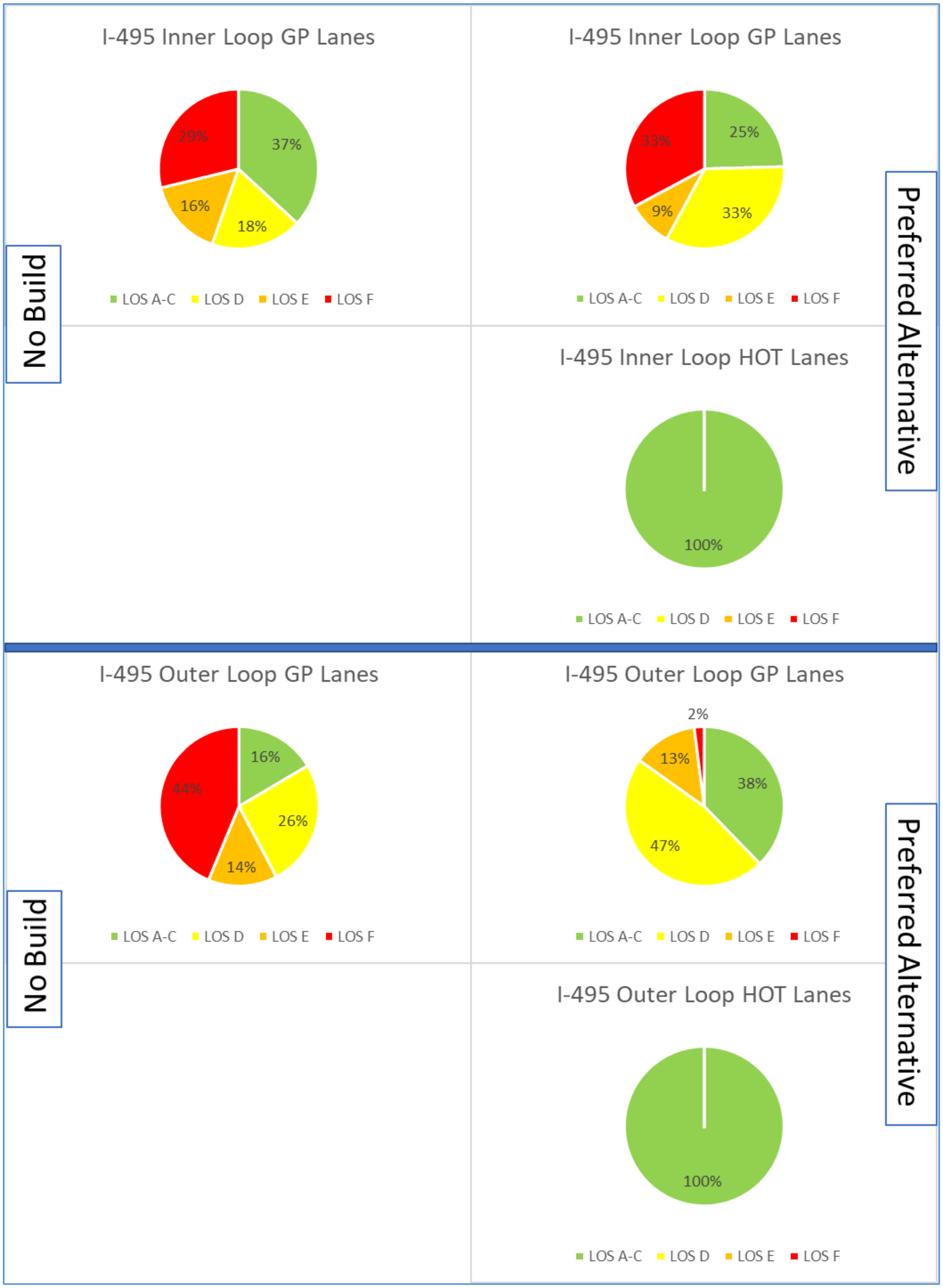


Figure 6-35: 2045 AM I-270 Mainline Segment LOS – No Build vs Preferred Alternative

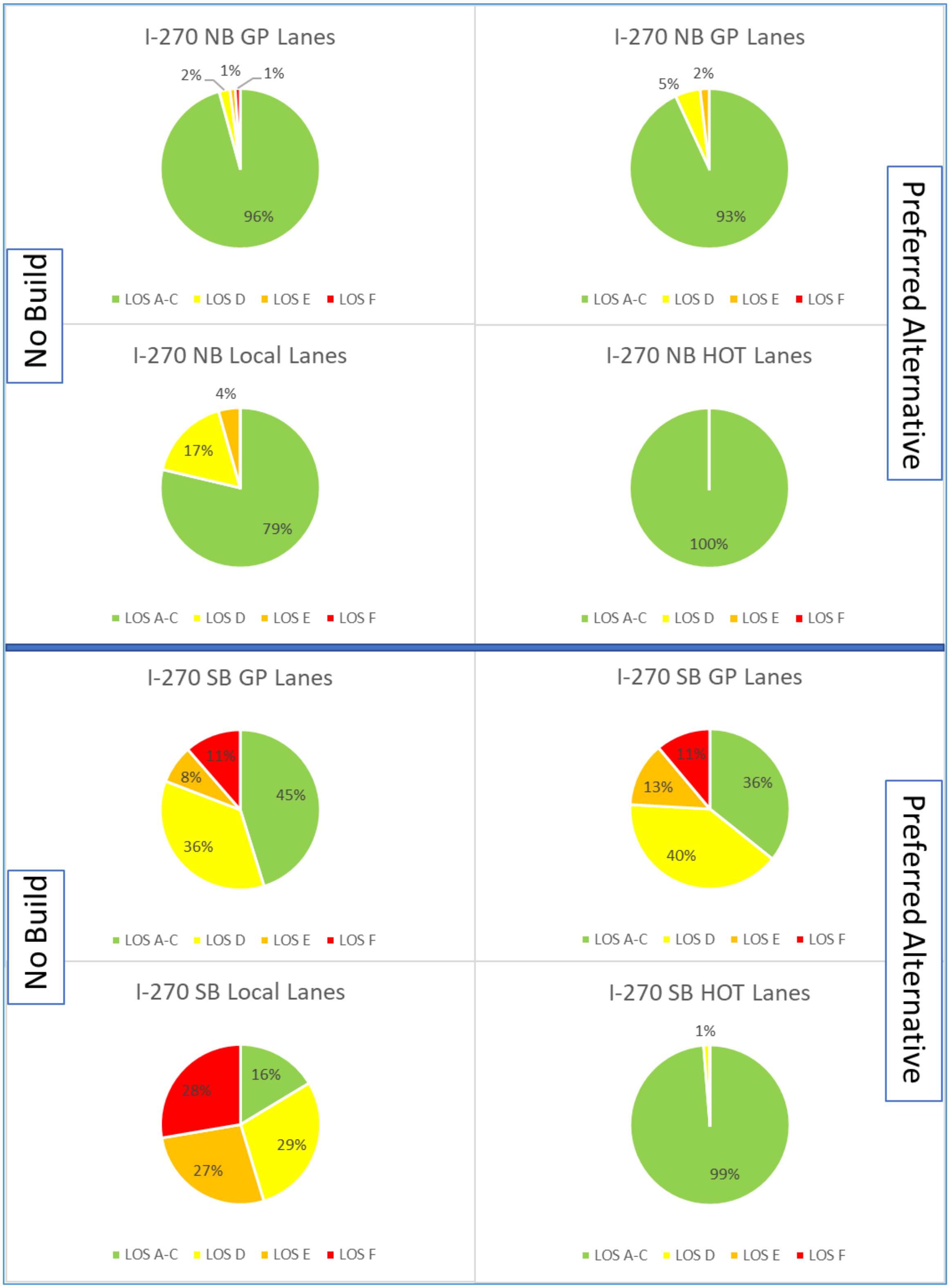


Figure 6-36 and Figure 6-37 compare the percentage of lane-miles operating at each LOS between No Build and Preferred Alternative PM conditions along I-495 and I-270, respectively; the lane-mile percentages are based on density for the entire PM peak period. Because the overall I-270 roadway system is 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 182,000 lane-miles) to 78% (approximately 161,000 lane-miles) along the I-495 Inner Loop and from 45% (approximately 91,000 lane-miles) to 6% (approximately 13,000 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 153,000 lane-miles) to 55% (approximately 285,000 lane-miles) while reducing those of LOS 'F' from 57% (approximately 254,000 lane-miles) to 40% (approximately 206,000 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 93% (approximately 369,000 lane-miles) to 99% (approximately 491,000 lane-miles) while reducing those of LOS 'F' from 7% (approximately 27,000 lane-miles) to 1% (approximately 3,100 lane-miles) 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

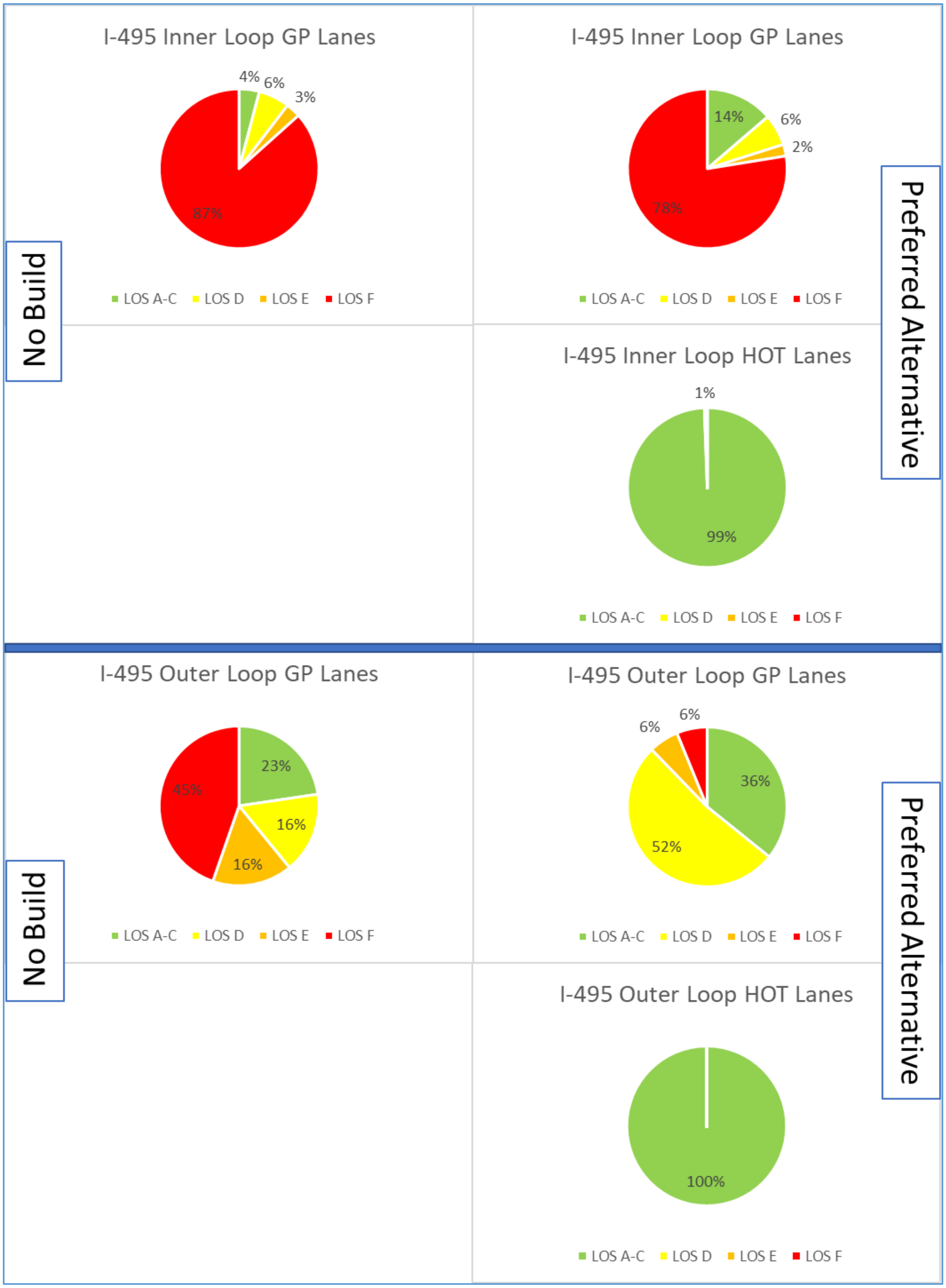


Figure 6-37: 2045 PM I-270 Mainline Segment LOS – No Build vs Preferred Alternative

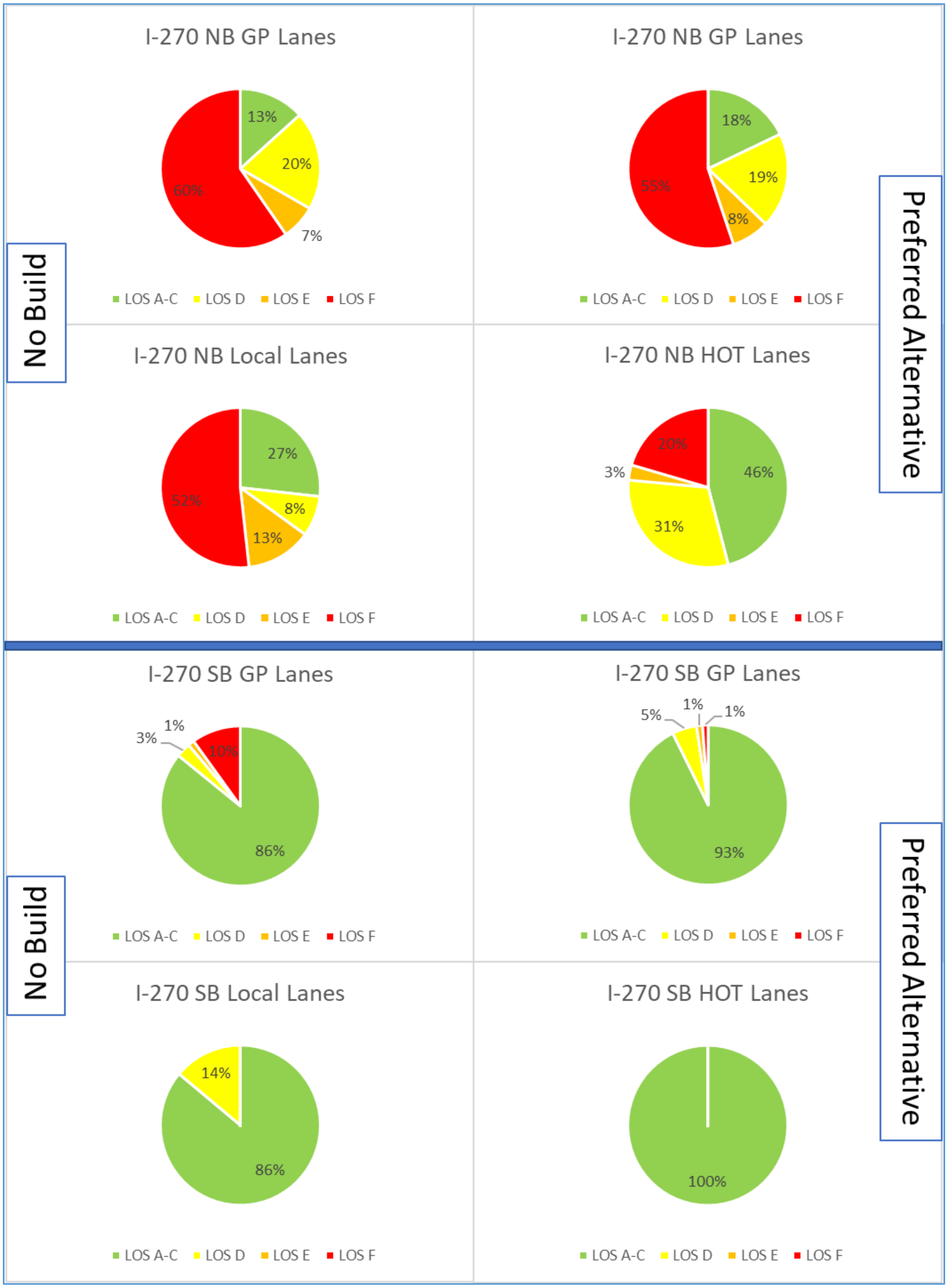


Table 6-18 and Table 6-19 detail freeway density by segment for both No Build and Preferred Alternative conditions, during the AM and PM peak periods, respectively. Refer to **Table 6-1** for LOS thresholds for basic segments and for merge, diverge, and weave segments. **Appendix H** contains a summary 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		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		16		18		17		17
	Merge		11		13		12		12
	Basic		11		13		12		12
Between MD 190 & I-270 West Spur	Merge	N/A	11	N/A	12	N/A	12	N/A	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	
	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	150	19	153	19
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		14		14		15		15
	Basic		19		19		20		18
	Diverge		16		16		17		16
	Basic		16		16		17		16
Between MD 190 & I-270 West Spur	Diverge	N/A	13	N/A	14	N/A	14	N/A	14
	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		14		19		24		22
	Diverge		8		13		17		16
Between I-370 & Shady Grove Road	Weave	N/A	8	N/A	13	N/A	16	N/A	16
Shady Grove Road Interchange	Basic		9		15		19		18
	Merge		8		14		18		18
	Basic	9	9	12	13	14	17	14	17
Between Shady Grove Road & MD 28	Weave	9	N/A	12	N/A	15	N/A	15	N/A
	Diverge		7		12		15		15
	Basic	N/A	9	N/A	13	N/A	17	N/A	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	17	20	17	19

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/ Fernwood Road	Basic	N/A	9	N/A	10	N/A	13	N/A	12
	Merge		6		7		9		8
Westlake Terrace/Fernwood Road 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	N/A	27	N/A	23	N/A	21	N/A	22
Between I-370 & Shady Grove Road	Weave		25		23		21		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	34	45	24	28
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		24		19		15		14
	Basic	29	37	28	32	39	26	20	22
	Diverge	N/A	38	N/A	30	N/A	23	N/A	19
	Basic		33		28		22		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/ 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	23.52	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	N/A	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
Between MD 190 & I-270 West Spur	Diverge		10		10		9		9
	Basic		13		14		12		11
	Merge		13		14		12		11
Between I-270 West Spur & MD 187	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	92	150	21	127
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		54		108		50	
	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	N/A	43	N/A	162	N/A	138	N/A
	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		30		89		127		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	N/A	27	N/A	27	N/A	48	N/A	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/ Fernwood Road	Basic		25		25		23		22
	Merge	N/A	17	N/A	17	N/A	16	N/A	15
Westlake Terrace/Fernwood Road 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	N/A	13	N/A	13	N/A	14	N/A	14
Between I-370 & Shady Grove Road	Weave		14		14		14		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	16	20	18	18
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		14		14		14		14
	Basic	14	18	15	19	12	18	14	18
	Diverge	N/A	14	N/A	14	N/A	14	N/A	14
	Basic		13		14		14		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/ Fernwood Road	Basic	N/A	16	N/A	18	N/A	18	N/A	17
	Diverge		11		12		12		11
Westlake Terrace/Fernwood Road Interchange	Basic		13		15		16		14
	Diverge		10		11		12		10
	Basic		8		9		9		7
Westlake Terrace/Fernwood Road to I-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

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	N/A	64	N/A	64	N/A	64	N/A	64
	Basic	N/A	65	N/A	64	N/A	64	N/A	64
Between MD 190 & I-270 West Spur	Merge	N/A	64	N/A	63	N/A	63	N/A	62
	Basic	N/A	64	N/A	64	N/A	64	N/A	64
	Diverge	N/A	63	N/A	63	N/A	63	N/A	63
Between I-270 West Spur & MD 187	Basic	N/A	59	N/A	58	N/A	53	N/A	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	N/A	52	N/A	51	N/A	52	N/A
	Basic	N/A	53	N/A	52	N/A	52	N/A	53
	Merge	N/A	50	N/A	49	N/A	48	N/A	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	N/A	53	N/A	53	N/A	53	N/A	53
	Merge	53	52	22	52	6	52	6	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
	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
George Washington Memorial Parkway Interchange	Basic	58	63	58	63	58	63	58	62
	Merge		62		63		62		61
	Basic		63		63		63		63
	Diverge		63		63		63		63
	Basic		63		63		63		63
	Diverge	N/A	63	N/A	63	N/A	63	N/A	63
Between MD 190 & I-270 West Spur	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
	Diverge	64	59	63	58	62	56	63	57
Between MD 117 & I-370	Basic	64	59	63	58	62	57	63	58
	Merge	62	59	60	57	60	56	60	57
	Basic	65	59	64	57	64	56	64	57
I-370 Interchange	Merge	52	59	51	58	51	57	51	57
	Basic		61		59		57		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
	Basic		61		59		58		59
Shady Grove Road Interchange	Merge		60		58		57		58
	Basic	65	62	64	60	64	59	64	60
	Weave	64	N/A	64	N/A	63	N/A	63	N/A
	Diverge		61		60		59		59
Between Shady Grove Road & MD 28	Basic	N/A	61	N/A	59	N/A	59	N/A	59
	Basic		62		60		59		59
	Merge		59		57		56		57
	Basic	64	62	64	60	64	58	64	59
MD 28 Interchange	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
	Diverge	64	62	64	60	62	59	62	59
Between MD 189 & Montrose Road	Basic	64	63	64	61	64	59	64	60
	Merge	N/A	61	N/A	59	N/A	52	N/A	56
	Diverge	64	N/A	64	N/A	62	N/A	63	N/A
Montrose Road Interchange	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/ Fernwood Road	Basic	N/A	64	N/A	64	N/A	64	N/A	64
	Merge		64		64		63		64
Westlake Terrace/Fernwood Road 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		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
	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
	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	53	N/A	52	N/A	52	N/A	53	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
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
Between Wootton Parkway and Spur Split	Merge		62		62		62		62
	Basic		63		63		63		63
	Diverge		63		63		63		63
Spur Split through MD 187 Interchange	Basic		64		64		64		63
I-270 West Spur Southbound HOT Managed Lanes									
Spur Split to Westlake Terrace/ 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
	Basic		63		63		63		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 6-21**, 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		63
Between MD 190 & I-270 West Spur	Merge		61		61		61		61
	Basic		63		63		63		63
	Diverge		62		63		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	
	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		53
	Merge	52	52	38	52	38	52	46	53
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		64
	Diverge		64		64		64		64
	Basic		64		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		50		27		16		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/ Fernwood Road	Basic	N/A	62	N/A	62	N/A	62	N/A	62
	Merge		59		60		60		58
Westlake Terrace/Fernwood Road 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
	Diverge		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		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
	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	
	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/ Fernwood Road	Basic	N/A	63	N/A	63	N/A	63	N/A	63
	Diverge		63		63		62		63
Westlake Terrace/Fernwood Road Interchange	Basic		63		63		62		63
	Diverge		57		57		55		55
	Basic		64		64		64		64
Westlake Terrace/Fernwood Road to I-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

	2017 Existing				2045 No Build								2045 Preferred Alternative								
	GP Lanes				GP Lanes				HOT Lanes				GP Lanes				HOT Lanes				
	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	
	59	42	45	59	59	44	47	59					58	32	27	28					
	58	58	56	58	59	53	50	60					59	26	17	19					
MD 355	60	60	61	61	58	57	57	59					57	27	18	21					MD 355
	51	50	52	52	51	51	52	52					49	27	18	21					
	55	52	56	56	55	55	57	57					54	23	13	14					
MD 187	55	54	56	56	56	55	56	57					57	24	9	10					MD 187
	56	56	56	57	56	56	57	57					56	43	11	10	57	45	11	10	
I-270 West Spur	57	57	58	58	56	56	53	50					56	53	20	15	61	61	61	61	I-270 West Spur
	57	56	54	55	57	56	26	15					57	55	32	23	64	63	63	63	
	57	57	56	56	57	57	46	12					57	57	50	38	64	64	64	64	
MD 190	60	60	60	60	57	57	54	14					57	57	53	51	63	63	63	63	MD 190
Cabin John Pkwy	57	57	57	57	57	57	56	18					57	56	55	56	63	63	63	63	Cabin John Pkwy
	56	56	56	56	56	56	55	29					57	56	56	56	63	63	63	63	
Clara Barton Pkwy	53	52	52	52	53	51	52	39					57	55	56	56	63	63	63	63	Clara Barton Pkwy
	38	36	36	35	43	42	43	35					56	54	54	55	62	62	62	63	
American Legion Bridge	33	27	26	25	39	36	37	31					55	51	52	54	63	63	63	63	American Legion Bridge
George Washington Memorial Pkwy	52	21	16	16	50	19	16	15	55	34	34	33	57	54	54	55	64	63	64	63	George Washington Memorial Pkwy
	57	28	10	9	56	20	12	12	64	64	64	64	56	55	54	55	64	63	64	64	
VA-193	58	55	20	12	56	26	12	12	64	64	64	64	54	54	57	57	64	64	64	64	VA-193

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing				2045 No Build								2045 Preferred Alternative							
	GP Lanes				GP Lanes				HOT Lanes				GP Lanes				HOT Lanes			
	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
	26	16	15	15	29	12	8	16					21	16	13	15				
	30	13	12	13	36	9	6	14					18	12	10	13				
MD 355	39	15	13	15	43	10	6	15					21	13	11	16				
	39	15	13	15	42	8	5	13					20	10	8	16				
	47	12	9	12	46	6	3	8					15	7	5	10				
MD 187	53	14	6	10	53	6	2	6					15	5	4	8				
	54	49	20	15	54	13	3	6					28	6	4	9	29	8	6	12
I-270 West Spur	55	55	55	47	54	19	2	6					39	5	3	7	58	59	36	59
	28	23	20	21	29	25	5	6					53	8	5	8	63	63	63	63
	17	14	13	14	14	13	4	5					55	7	4	6	63	63	63	63
MD 190	17	15	13	14	14	13	4	5					55	7	4	6	63	63	63	62
Cabin John Pkwy	15	13	12	13	15	15	5	5					55	9	4	5	63	63	63	63
	20	15	13	15	18	17	6	5					55	19	4	5	63	63	63	63
Clara Barton Pkwy	27	16	14	16	20	18	6	6					56	25	4	5	63	62	63	63
	29	16	14	16	21	18	6	6					55	27	4	5	62	62	63	62
American Legion Bridge	30	17	15	18	23	21	6	6					55	32	5	5	62	62	63	63
George Washington Memorial Pkwy	36	12	11	13	17	13	5	4	32	28	5	5	56	48	6	5	63	63	63	63
	52	10	7	8	23	8	4	2	64	64	9	3	56	56	5	4	63	63	63	63
VA-193	57	18	7	8	52	9	5	3	64	64	30	3	59	59	8	4	63	63	63	64

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing				2045 No Build								2045 Preferred Alternative							
	GP Lanes				GP Lanes				HOT Lanes				GP Lanes				HOT Lanes			
	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM
	53	51	44	50	53	51	12	18					53	51	40	50				
MD 355	53	53	53	53	53	49	10	16					53	53	53	53				
	54	54	54	54	53	42	6	9					53	53	53	53				
	49	49	50	49	50	40	6	8					50	50	50	50				
	53	53	53	53	53	36	7	8					53	53	53	53				
MD 187	53	53	53	53	53	23	5	6					53	53	53	53				
	53	53	53	53	42	16	6	8					53	53	53	53	53	53	53	53
I-270 West Spur	52	51	52	52	23	13	7	10					52	52	52	52	59	59	59	59
	50	42	44	50	39	29	20	22					44	45	49	52	63	63	63	63
	52	52	52	52	49	51	50	51					52	52	53	53	63	63	63	63
MD 190	51	51	51	52	46	51	53	53					53	53	53	53	63	63	63	63
Cabin John Pkwy	53	44	51	53	44	41	52	51					53	53	53	53	63	63	63	63
	48	43	44	49	42	41	49	48					53	52	52	53	63	63	63	63
Clara Barton Pkwy	50	50	49	49	53	53	53	53					52	51	52	52	63	63	63	63
	52	52	51	52	53	53	53	53					53	52	52	53	63	63	63	63
American Legion Bridge	54	53	52	53	53	52	51	52					53	52	52	53	62	62	62	62
	53	52	52	52	52	51	49	50					53	52	52	53	60	61	58	58
George Washington Memorial Pkwy	53	52	52	52	53	52	52	52	59	59	59	59	53	52	51	52	63	63	63	63
	53	53	53	53	53	53	53	53	64	64	64	64	53	53	53	53	63	64	63	63
VA-193	53	53	51	52	53	53	53	53	64	64	64	64	53	53	53	53	63	63	63	63

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing				2045 No Build								2045 Preferred Alternative							
	GP Lanes				GP Lanes				HOT Lanes				GP Lanes				HOT Lanes			
	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
	40	47	44	26	36	39	36	5					37	43	50	15				
MD 355	53	53	41	24	53	46	25	3					53	53	53	11				
	54	54	50	39	53	41	35	32					53	53	53	45				
	49	49	49	48	50	34	29	49					50	50	50	50				
	53	53	53	46	53	32	28	44					53	53	53	54				
MD 187	53	53	45	21	53	25	25	35					53	53	53	54				
	53	43	20	11	45	20	18	39					53	53	53	53	53	53	53	54
I-270 West Spur	51	20	9	9	38	19	21	45					52	52	52	52	59	59	59	60
	41	19	14	13	38	24	23	47					53	53	53	54	64	64	64	64
	27	15	13	13	29	20	19	43					52	53	53	54	64	64	64	64
MD 190	23	13	12	13	26	18	17	42					53	53	53	54	64	64	64	64
Cabin John Pkwy	21	14	13	14	24	18	17	38					53	53	53	54	63	63	63	63
	25	22	21	23	26	22	21	36					52	53	53	53	63	63	63	63
Clara Barton Pkwy	40	37	39	40	32	29	27	38					50	50	51	52	63	63	63	63
	48	44	49	50	34	31	30	39					52	51	52	52	63	63	63	63
American Legion Bridge	47	36	52	53	47	46	46	49					52	52	52	53	63	63	63	63
	44	28	50	55	52	52	52	52					52	52	52	53	62	63	63	63
George Washington Memorial Pkwy	31	21	31	54	53	53	53	54	59	59	59	60	52	52	52	53	64	64	64	64
	17	14	21	54	54	54	54	54	64	64	64	64	53	53	53	53	63	64	64	64
VA-193	15	15	17	22	54	54	54	54	64	64	64	64	53	54	54	54	63	63	64	64

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing								2045 No Build								2045 Preferred Alternative								
	GP Lanes				CD Lanes				GP Lanes				CD Lanes				GP Lanes				HOT Lanes				
	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	
	23	22	21	37					18	17	16	18					21	20	19	21					
MD 117	27	30	31	45					19	18	17	19					22	20	20	22					MD 117
	29	33	34	48					37	40	40	40					34	33	32	33					
I-370	40	27	38	52	41	26	18	41	50	52	53	52	44	45	44	43	52	52	53	53	50	49	50	50	I-370
	30	15	23	46	41	34	33	39	53	53	53	53	41	39	39	41	53	53	53	53	59	57	57	57	
Shady Grove Rd	36	28	28	40	42	42	42	42	46	49	51	52	41	42	42	42	52	53	53	53	63	63	63	62	Shady Grove Rd
	33	26	47	52	40	39	35	40	52	53	53	53	41	41	41	41	52	52	53	53	63	63	63	63	
Gude Dr																									Gude Dr
	33	26	47	52	40	39	35	40	52	53	53	53	41	41	41	41	53	53	53	53	63	62	62	62	
MD 28	36	30	42	51	24	19	14	36	51	52	52	52	38	38	42	42	53	53	53	53	63	63	63	63	MD 28
	41	23	36	52	19	16	13	16	53	53	53	53	23	30	41	41	52	52	53	53	63	63	63	63	
MD 189	38	18	29	53	35	20	15	18	53	53	53	53	38	38	38	38	52	52	53	53	63	63	63	63	MD 189
	33	17	25	53	32	29	29	29	53	53	53	53	36	36	36	36	46	42	49	51	63	63	63	63	
Wootton Pkwy																									Wootton Pkwy
	33	17	25	53	32	29	29	29	53	53	53	53	36	36	36	36	48	50	50	50	63	63	63	63	
Montrose Rd	29	20	26	52	36	35	36	37	53	52	52	53	37	36	37	37	53	42	47	53	63	63	63	63	Montrose Road
	24	28	32	51	35	29	32	38	51	35	37	51	38	35	37	39	49	31	33	49	63	63	63	63	
	21	22	24	53					53	53	29	53					53	53	53	53	63	63	63	63	
Westlake Terrace	29	23	25	54					52	53	28	53					52	53	53	53	63	63	63	63	Westlake Terrace
Democracy Blvd	45	28	28	53					53	50	29	51					52	52	53	53	63	63	63	63	Democracy Blvd
	48	34	38	52					46	42	31	46					51	52	53	53	63	63	63	63	
	58	57	58	60					60	58	58	59					61	59	59	60	64	64	64	64	
Rockledge Blvd MD 187	63	63	63	63					63	62	61	63					63	62	62	63	64	64	64	63	Rockledge Blvd MD 187
	63	62	62	63					63	60	57	60					63	61	61	62	63	62	62	63	
MD 355	63	63	63	63					63	63	63	63					63	43	44	55					MD 355

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing								2045 No Build								2045 Preferred Alternative							
	GP Lanes				CD Lanes				GP Lanes				CD Lanes				GP Lanes				HOT Lanes			
	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
	62	62	61	62					62	62	62	62					62	62	62	62				
MD 117	62	61	61	61					63	63	63	63					63	63	63	63				
	62	61	61	62					62	61	60	61					62	62	61	62				
I-370	64	64	63	63	60	60	60	60	64	64	63	63	60	60	59	60	63	63	63	63	59	59	58	59
	64	64	64	64	53	53	53	53	64	63	64	63	52	53	52	51	63	63	63	63	62	61	60	61
Shady Grove Rd	60	60	59	60	54	54	54	54	60	60	60	59	53	53	54	53	60	60	60	60	63	63	63	63
	60	60	59	60	53	52	51	53	60	61	61	60	53	53	53	52	58	58	57	58	63	63	63	63
Gude Dr																								
	60	60	59	60	53	52	51	53	60	60	61	59	53	53	53	52	58	58	58	58	63	63	63	63
MD 28	60	60	59	60	53	53	53	53	59	60	59	58	53	53	54	53	59	58	58	58	63	63	63	63
	60	60	60	60	52	51	44	51	60	60	60	59	53	53	53	52	57	57	57	57	63	63	63	63
MD 189	60	60	59	60	53	53	53	53	59	60	60	58	53	53	53	53	57	57	57	57	63	63	63	63
	60	60	60	60	49	49	48	49	59	60	60	58	53	52	52	52	57	57	57	57	63	63	63	63
Wootton Pkwy																								
	60	60	60	60	49	49	48	49	59	60	60	58	53	52	52	52	55	55	55	55	63	63	63	63
Montrose Rd	60	60	60	60	53	52	53	53	60	61	61	60	53	53	54	53	57	56	56	57	63	62	62	63
	60	59	59	59	53	53	53	53	59	59	60	59	53	53	53	53	56	56	56	56	63	63	63	63
	59	59	59	59					59	59	59	59					59	58	58	59	63	63	63	63
Westlake Terrace	60	60	60	44					59	58	59	58					59	59	59	59	61	61	60	60
Democracy Blvd	59	59	43	9					59	59	59	59					58	58	58	58	64	64	64	64
	56	34	13	8					56	53	56	58					57	57	57	57	63	63	63	64
	59	59	59	59					59	59	41	52					58	58	58	58	64	64	64	64
Rockledge Blvd MD 187	59	59	59	59					58	56	14	26					58	58	46	58	64	63	63	64
	63	37	23	50					62	22	8	17					61	59	38	63	63	61	46	63
MD 355	54	15	15	24					59	14	9	19					48	32	25	53				

Travel Speed (mph)

10 20 30 40 50

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

Interchange	2017 Existing GP Lanes 6:00 AM	2017 Existing GP Lanes 7:00 AM	2017 Existing GP Lanes 8:00 AM	2017 Existing GP Lanes 9:00 AM	2017 Existing CD Lanes 6:00 AM	2017 Existing CD Lanes 7:00 AM	2017 Existing CD Lanes 8:00 AM	2017 Existing CD Lanes 9:00 AM	2045 No Build GP Lanes 6:00 AM	2045 No Build GP Lanes 7:00 AM	2045 No Build GP Lanes 8:00 AM	2045 No Build GP Lanes 9:00 AM	2045 No Build CD Lanes 6:00 AM	2045 No Build CD Lanes 7:00 AM	2045 No Build CD Lanes 8:00 AM	2045 No Build CD Lanes 9:00 AM	2045 Preferred Alternative GP Lanes 6:00 AM	2045 Preferred Alternative GP Lanes 7:00 AM	2045 Preferred Alternative GP Lanes 8:00 AM	2045 Preferred Alternative GP Lanes 9:00 AM	2045 Preferred Alternative HOT Lanes 6:00 AM	2045 Preferred Alternative HOT Lanes 7:00 AM	2045 Preferred Alternative HOT Lanes 8:00 AM	2045 Preferred Alternative HOT Lanes 9:00 AM
	63	63	63	63	44	44	44	44	64	64	64	64	43	43	42	42	59	59	58	58				
MD 117	63	63	63	63	41	41	41	41	64	63	63	63	43	42	40	41	59	59	58	58				
	64	63	63	63	43	43	42	42	64	63	62	63	42	42	42	42	58	57	55	56				
I-370	64	64	64	64	44	43	43	43	64	64	64	64	44	44	43	43	60	58	57	58	59	59	59	59
	64	64	64	64	46	45	44	44	64	64	64	64	48	45	44	44	61	59	58	59	63	64	63	63
Shady Grove Rd	64	64	63	63	43	43	43	42	64	64	63	63	43	43	43	43	61	59	58	58	64	64	63	63
	64	64	64	64	43	42	42	42	64	64	63	63	43	42	42	42	61	60	59	59	64	64	64	64
Gude Dr																								
	64	64	64	64	43	42	42	42	64	64	64	64	43	42	42	42	61	59	58	59	63	63	63	63
MD 28	64	63	61	62	43	43	42	42	64	63	63	63	43	42	41	41	62	60	58	59	63	64	63	63
	63	63	63	63	42	42	40	40	64	63	62	62	43	42	41	42	61	59	57	58	63	64	63	63
MD 189	64	63	63	63	42	42	41	41	64	63	63	63	42	42	42	42	62	61	60	60	63	63	63	63
	63	63	63	63	42	42	41	41	64	64	63	63	42	42	41	41	62	61	59	60	64	64	63	63
Wootton Pkwy																								
	63	63	63	63	42	42	41	41	64	63	63	63	42	42	41	41	62	60	58	59	64	64	63	63
Montrose Rd	63	63	63	63	43	42	42	42	64	63	63	63	43	42	42	42	64	63	63	63	64	64	63	63
	64	63	62	63	45	45	43	44	64	63	63	63	45	44	43	44	64	64	63	63	64	64	63	63
	63	63	63	63					64	64	64	63					64	63	63	63	64	64	64	64
Westlake Terrace	64	64	63	63					64	64	63	63					63	63	63	63	62	62	61	61
Democracy Blvd	63	63	63	63					64	63	63	63					64	63	63	62	64	64	64	64
	60	60	53	56					60	58	39	36					61	60	46	39	64	64	63	63
	63	63	62	62					63	63	61	61					64	63	63	63	64	64	64	64
Rockledge Blvd MD 187	64	64	63	64					64	64	63	63					64	63	62	62	64	64	64	64
	63	63	62	63					63	62	59	61					63	62	52	58	64	63	58	61
MD 355	61	61	60	61					60	59	42	49					60	60	57	60				

Travel Speed (mph)

10 20 30 40 50

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

	2017 Existing								2045 No Build								2045 Preferred Alternative							
	GP Lanes				CD Lanes				GP Lanes				CD Lanes				GP Lanes				HOT Lanes			
	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
	21	20	19	21	46	46	46	46	18	12	10	16	46	47	47	46	23	18	12	14				
MD 117	20	19	18	21	43	42	43	42	20	12	10	19	38	44	44	36	24	17	12	14				
	23	21	21	24	53	52	39	45	29	14	11	32	42	24	22	36	28	14	9	11				
I-370	31	26	23	25	54	54	27	31	35	11	9	38	34	6	4	11	37	11	6	9	47	17	13	13
	42	29	23	26	50	29	22	21	43	11	9	43	51	9	5	17	48	15	7	9	61	21	11	11
Shady Grove Rd	51	40	25	28	52	21	7	9	50	14	11	48	53	6	1	9	51	17	5	8	62	31	12	11
	53	51	37	30	52	47	38	52	53	20	9	29	53	30	3	6	53	20	5	7	63	38	10	8
Gude Dr	53	51	37	30	52	47	38	52	52	32	13	40	53	30	3	6	52	35	7	8	63	62	18	9
MD 28	52	50	50	50	52	52	52	52	53	36	11	39	50	45	4	7	48	46	7	7	63	63	30	12
	52	52	52	52	47	49	50	51	46	40	11	22	51	33	6	9	35	35	10	7	63	63	39	15
MD 189	53	52	52	52	47	51	52	52	45	33	8	8	53	47	3	5	51	49	10	6	62	62	45	19
	52	51	51	51	50	51	51	52	52	44	8	7	47	44	6	5	53	53	12	7	63	63	57	19
Wootton Pkwy	52	51	51	51	50	51	51	52	52	51	7	6	47	44	6	5	51	51	14	8	63	63	63	29
Montrose Rd	50	48	49	46	53	53	53	53	52	51	8	5	53	53	8	3	52	52	21	7	63	63	63	53
	49	47	47	47	52	52	52	53	51	51	12	4	52	52	42	15	53	53	36	6	62	62	63	63
	37	34	33	34					53	52	23	6.2					53	53	44	14	62	62	62	62
Westlake Terrace	31	27	25	26					53	53	37	6					54	54	52	16	63	63	63	59
Democracy Blvd	24	16	14	15					53	54	47	11					55	55	55	22	63	62	63	61
	46	29	25	27					52	51	45	16					54	45	36	36	63	63	63	63
	46	24	19	20					38	25	11	2					56	56	50	3	63	63	63	64
Rockledge Blvd MD 187	58	28	17	16					57	25	11	3					58	57	57	4	64	64	64	64
	58	51	26	20					57	48	17	3					57	56	57	5	61	61	61	17
MD 355	58	58	30	16					57	56	14	2					57	57	57	5				

Travel Speed (mph)

10 20 30 40 50

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)

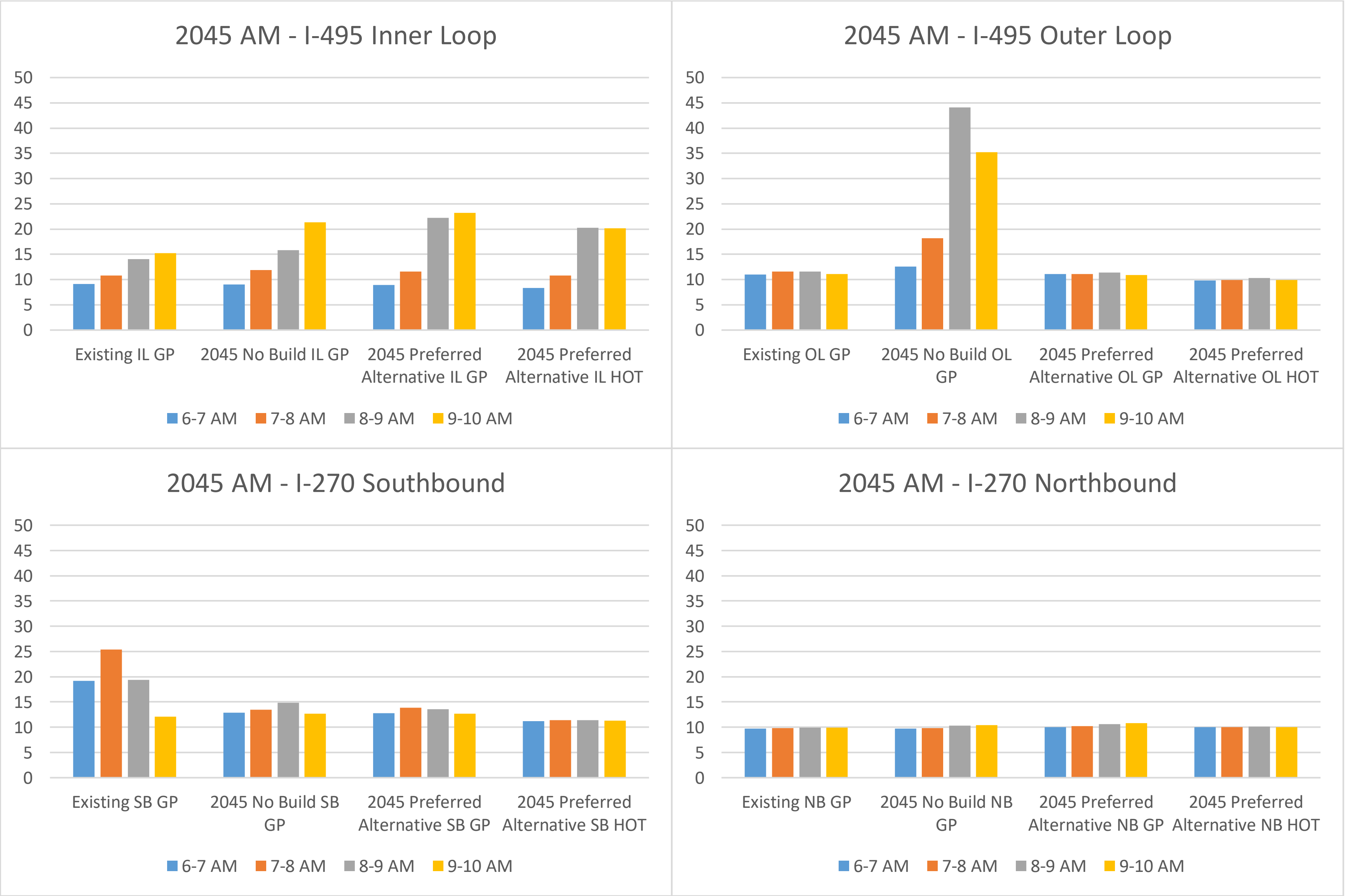


Figure 6-47: I-495 Inner Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period

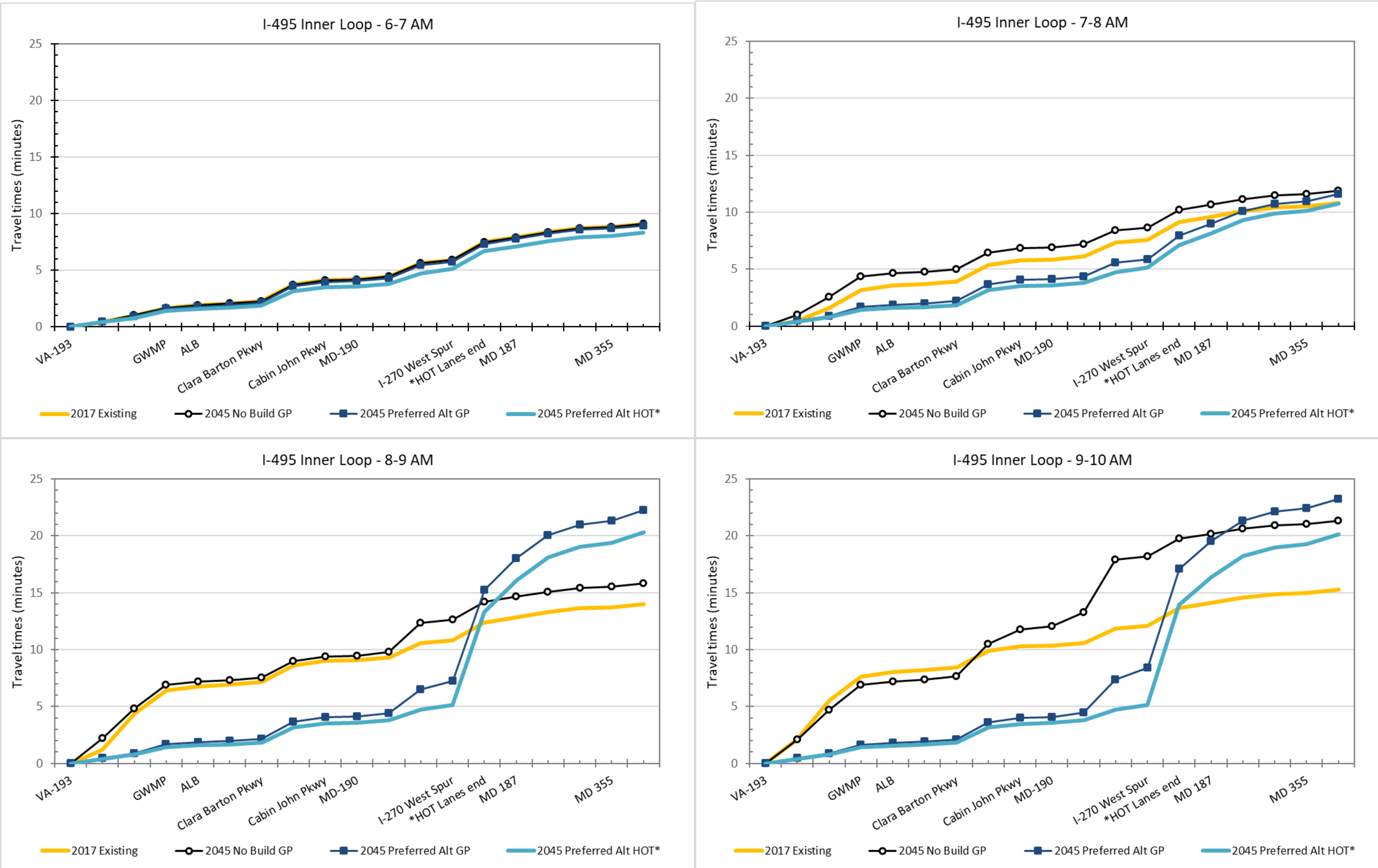


Figure 6-48: I-495 Outer Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period

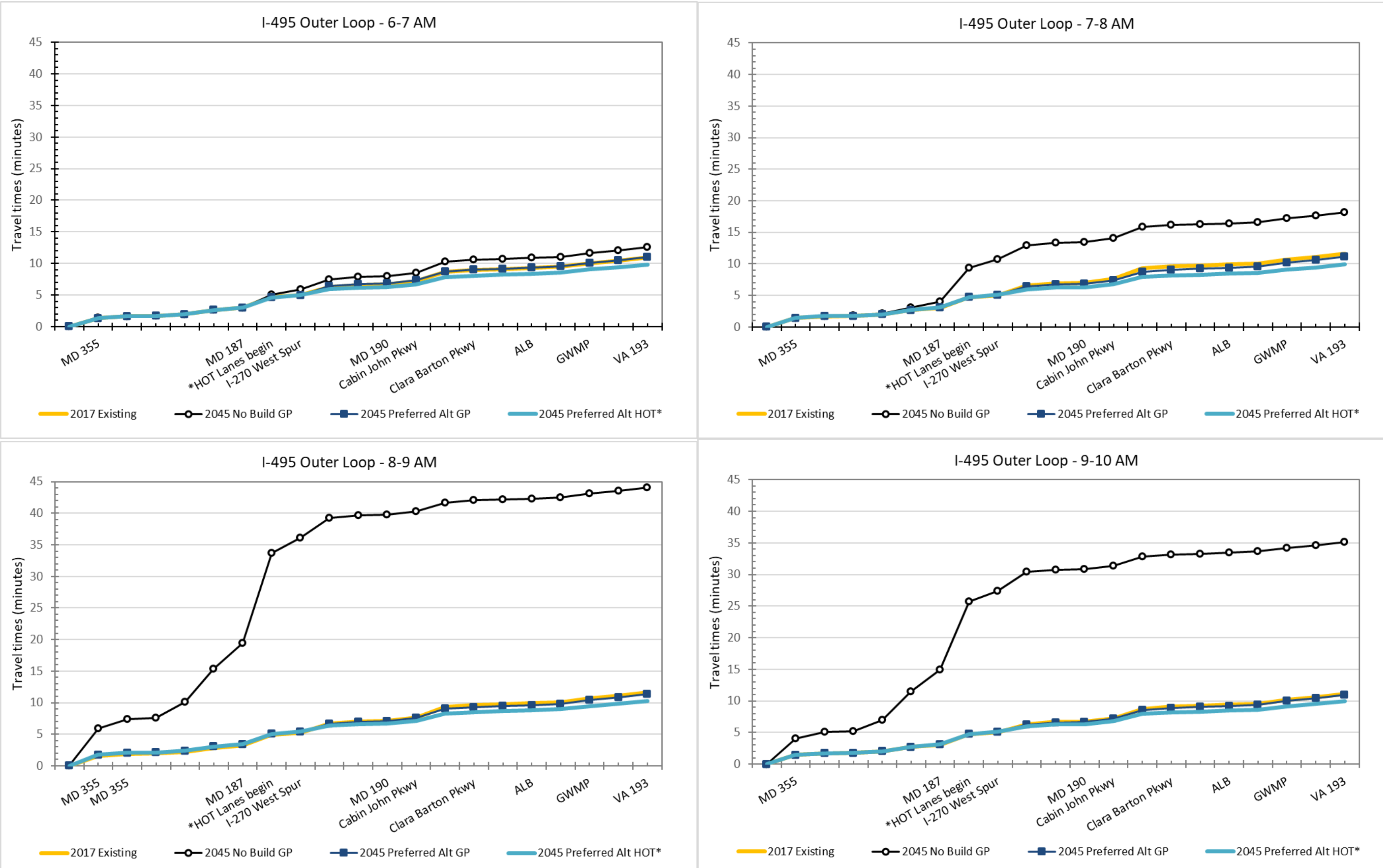


Figure 6-49: I-270 Southbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period

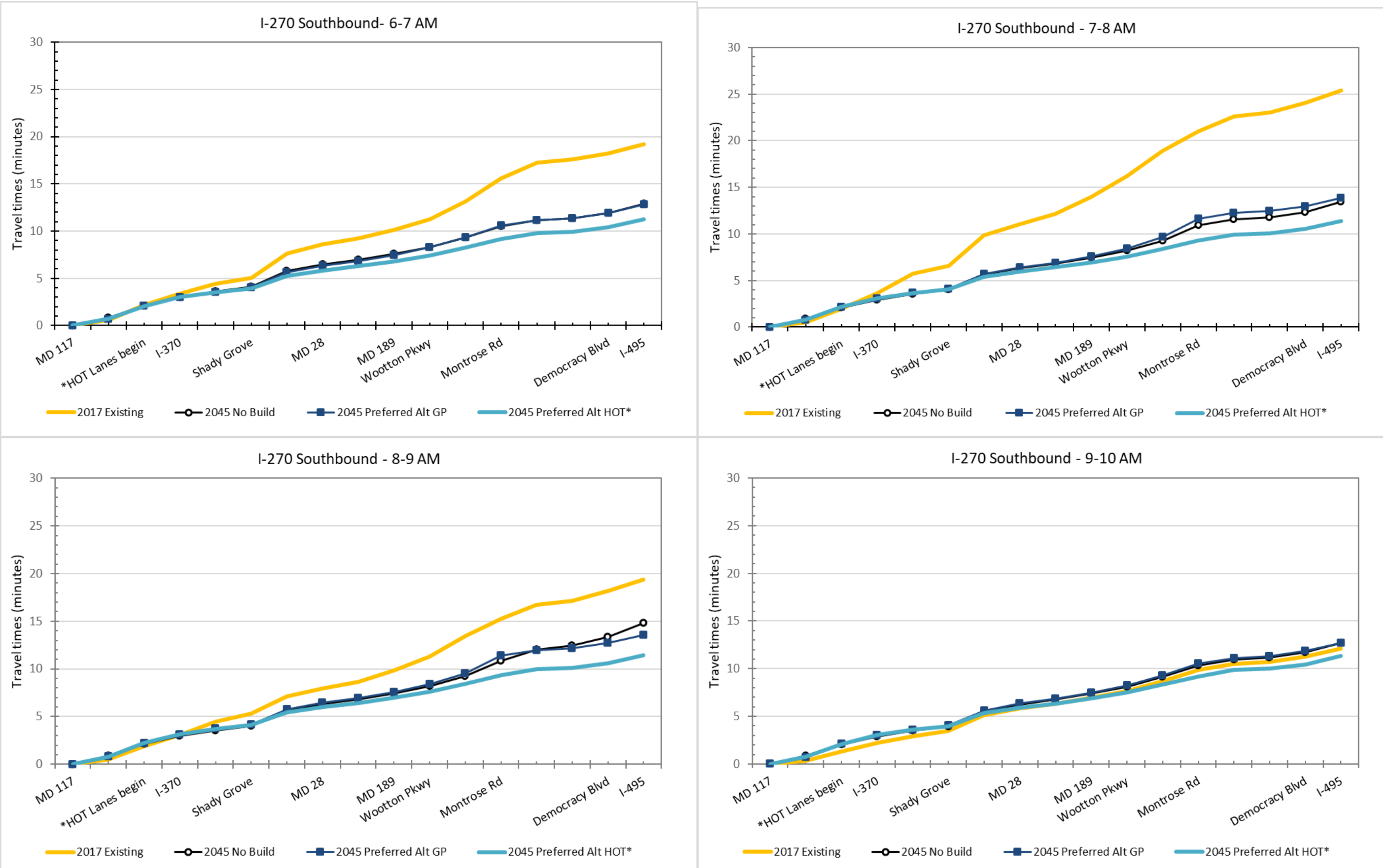
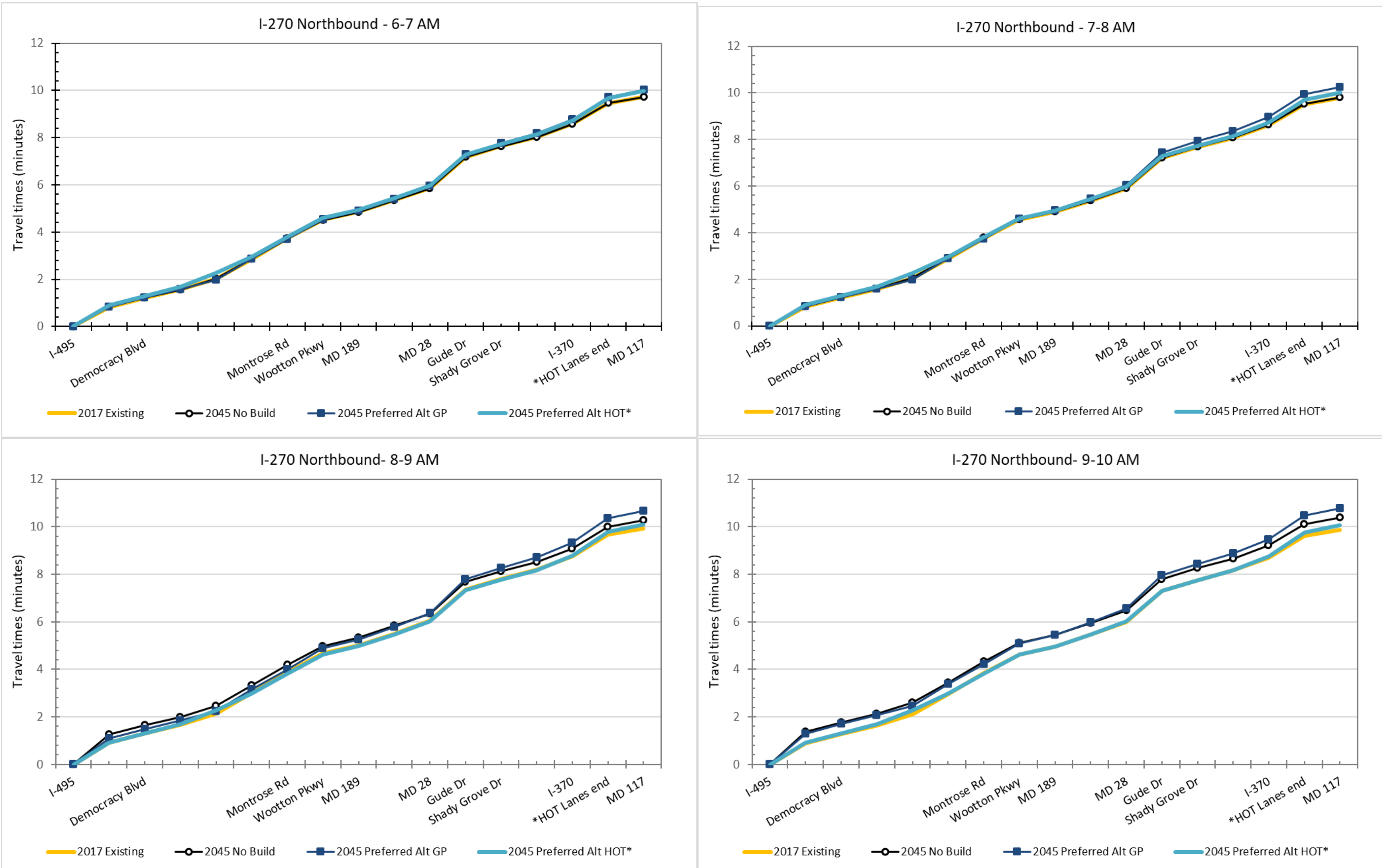


Figure 6-50: I-270 Northbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – AM Peak Period



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)

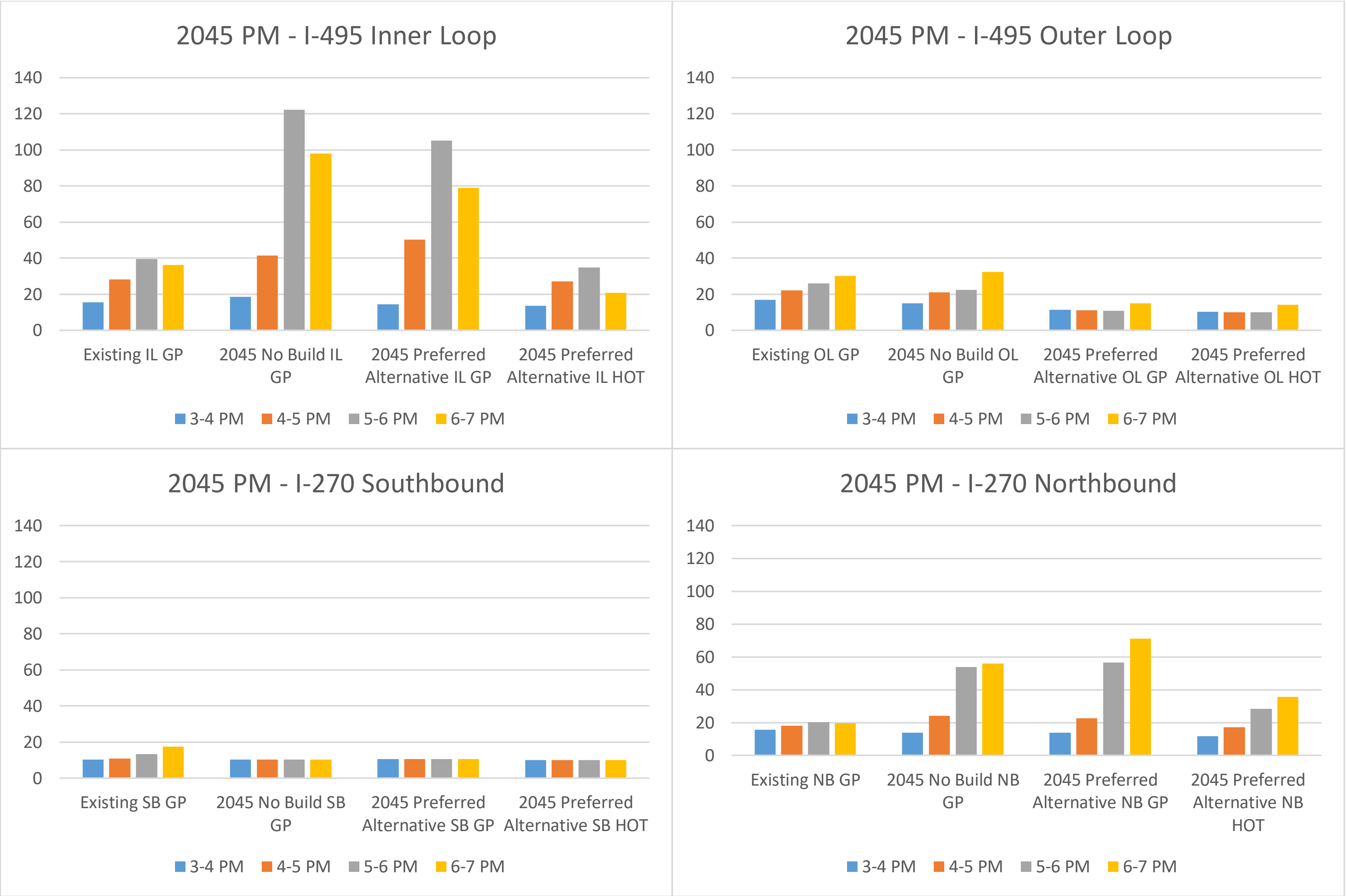


Figure 6-52: I-495 Inner Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period

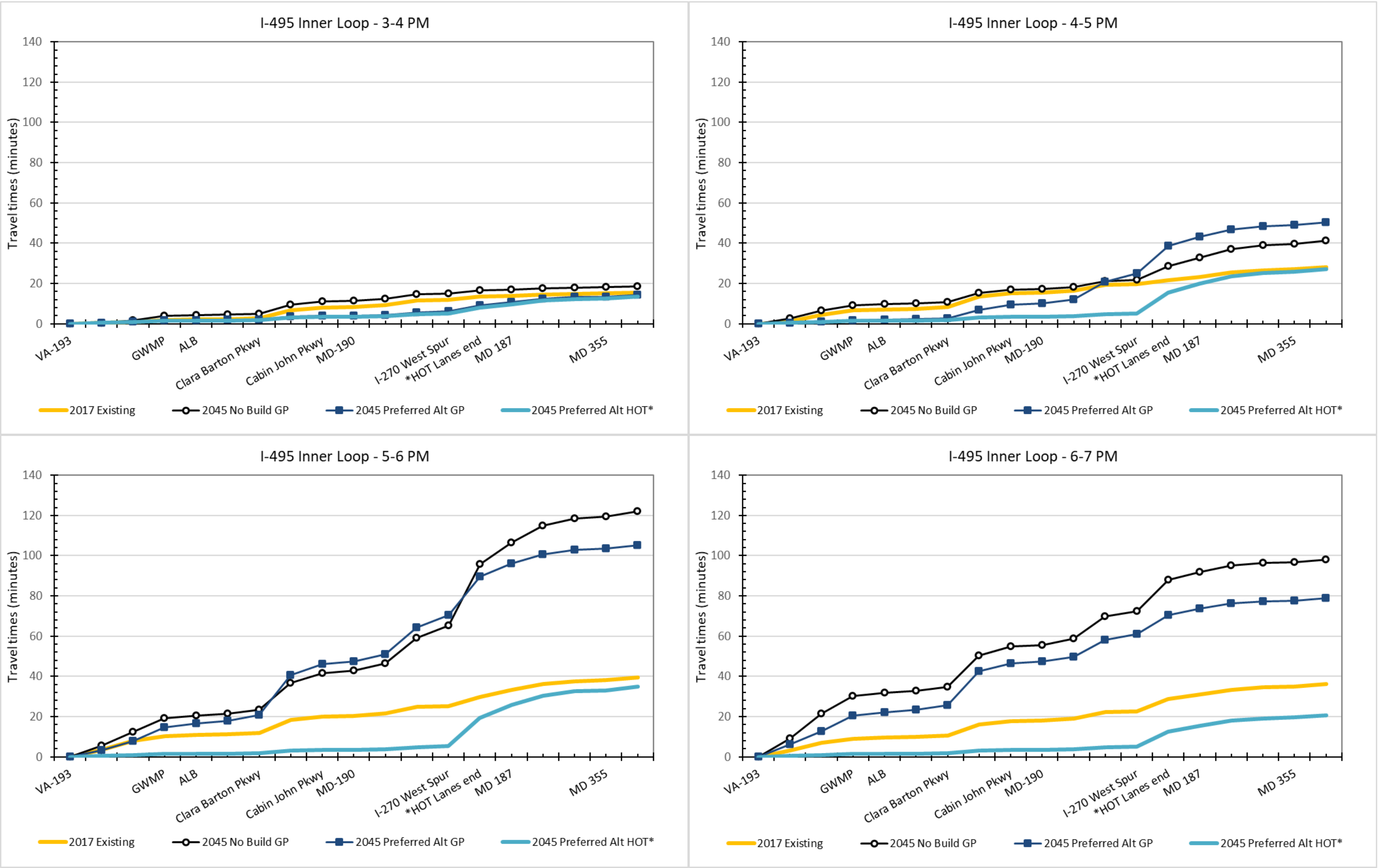


Figure 6-53: I-495 Outer Loop 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period

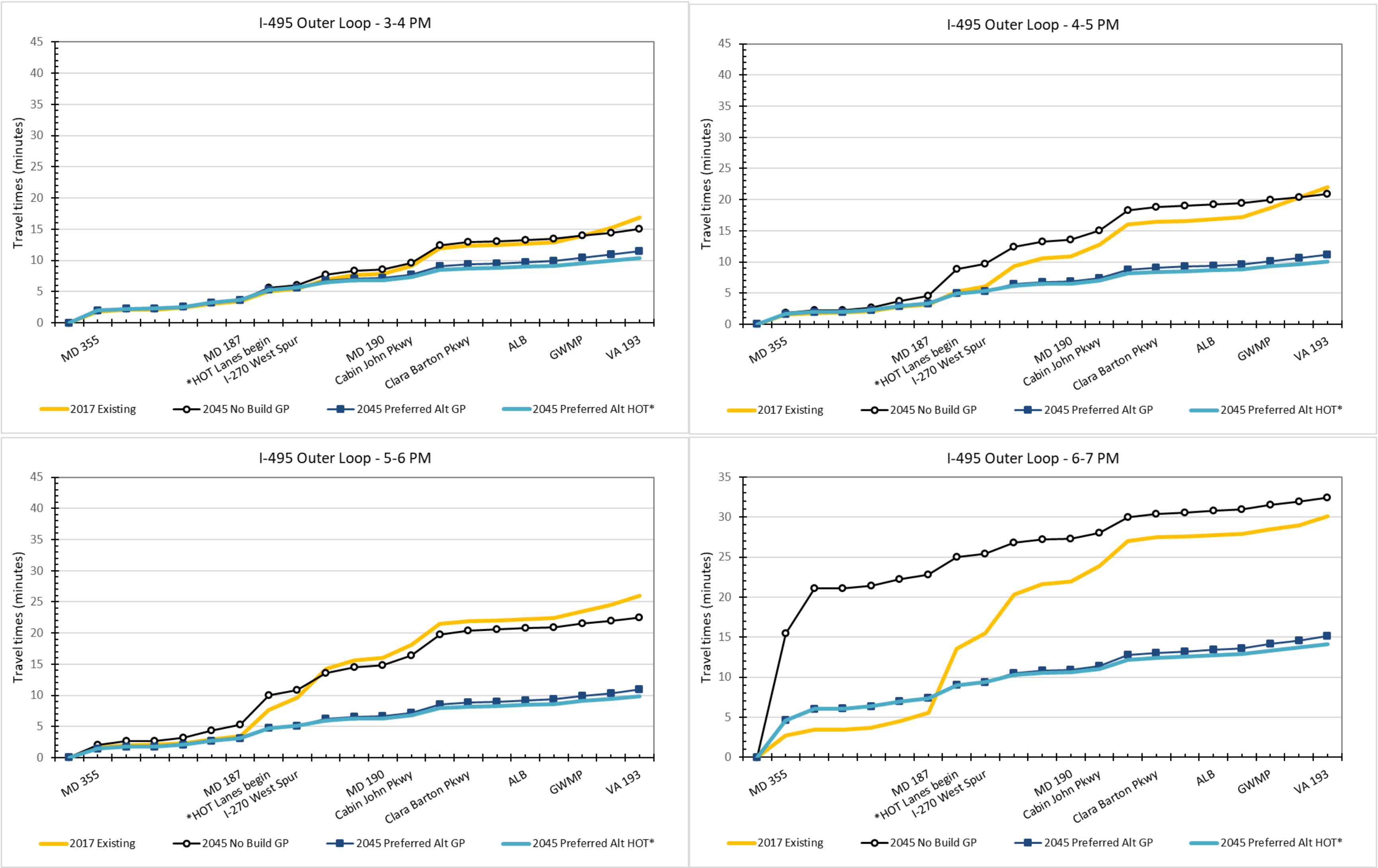


Figure 6-54: I-270 Southbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period

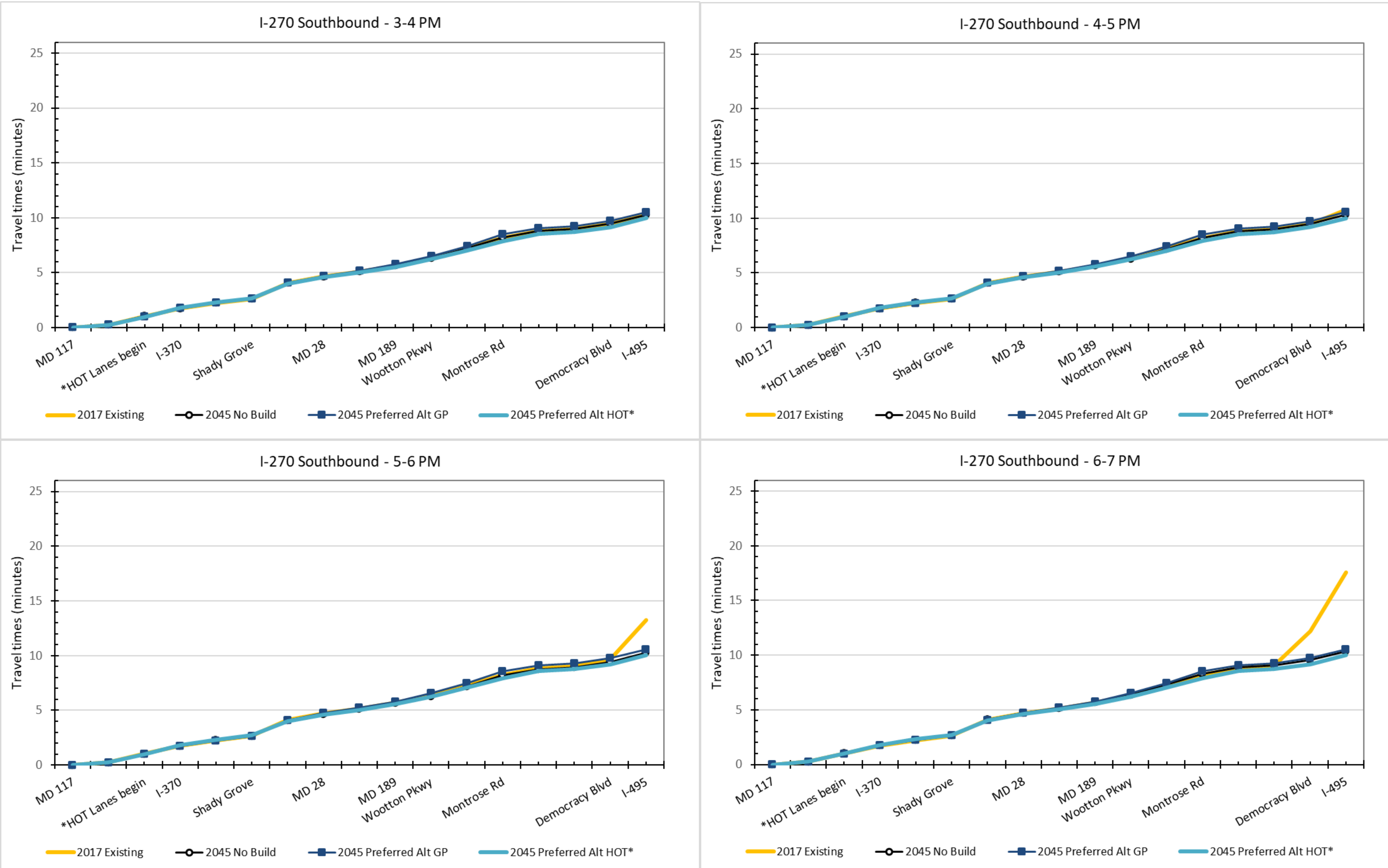
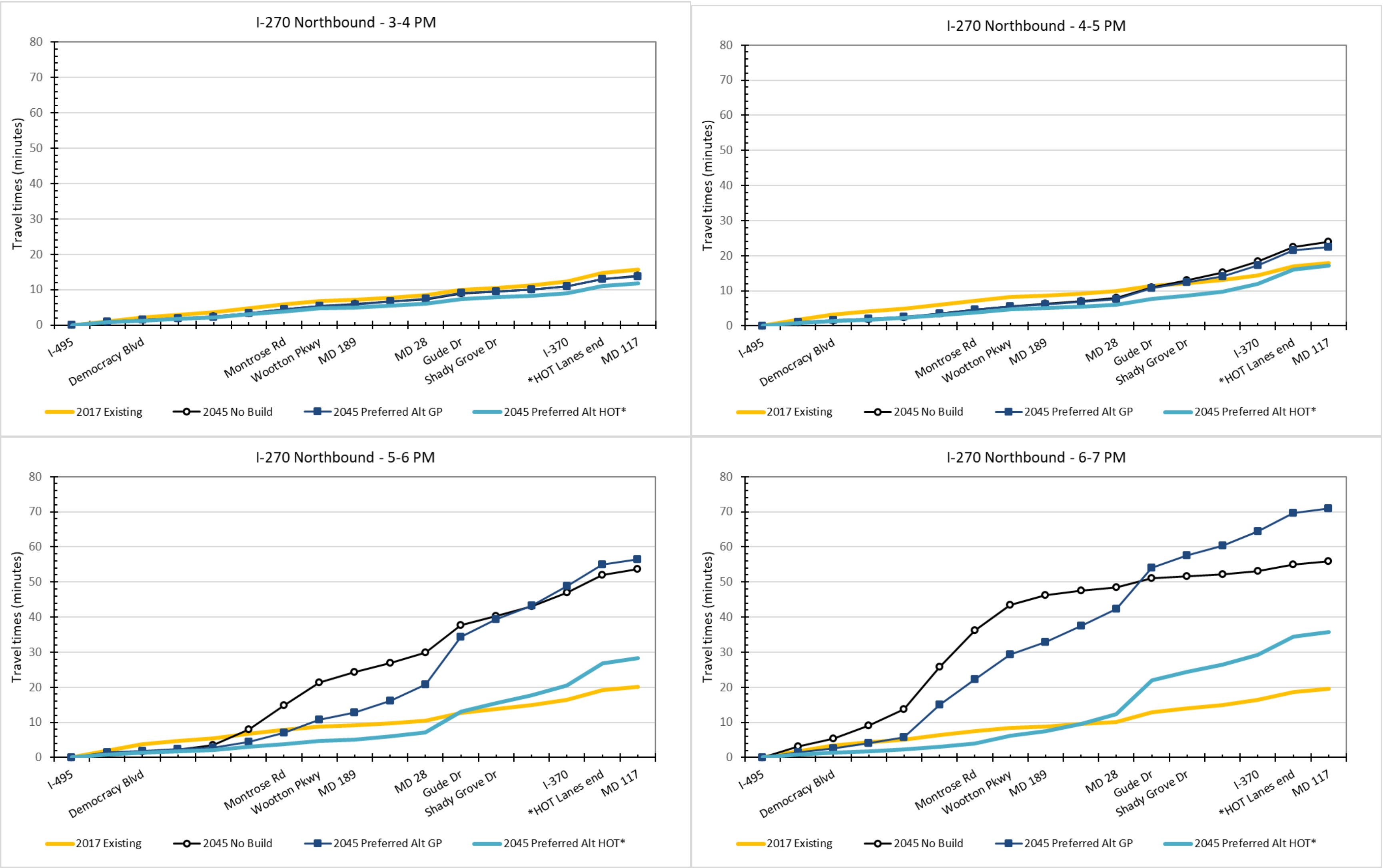


Figure 6-55: I-270 Northbound 2045 No Build vs Preferred Alternative Cumulative Travel Times – PM Peak Period



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 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 6-23**, 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 GP:* 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 GP:* 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 GP:* 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.
- *Montrose Road EB On-Ramp to I-270 NB GP:* 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 GP:* 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 outside the study area along I-495 Inner Loop east of MD 355.
- *MD 190 EB & WB On-Ramps to I-495 Inner Loop GP:* 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 5-7 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 GP:* 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 GP:* 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 3-4 PM Avg. (ft)	3-4 PM Max. (ft)	4-5 PM Avg. (ft)	4-5 PM Max. (ft)	5-6 PM Avg. (ft)	5-6 PM Max. (ft)	6-7 PM Avg. (ft)	6-7 PM Max. (ft)	Available Storage (feet)	2045 Preferred Alternative 3-4 PM Avg. (ft)	3-4 PM Max. (ft)	4-5 PM Avg. (ft)	4-5 PM Max. (ft)	5-6 PM Avg. (ft)	5-6 PM Max. (ft)	6-7 PM Avg. (ft)	6-7 PM 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
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
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	100	12	94	7	92	7	127	1,130	10	90	11	93	12	108	9	142
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
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	26	203	33	263	44	312	29	270	900	38	277	36	267	44	283	40	300

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

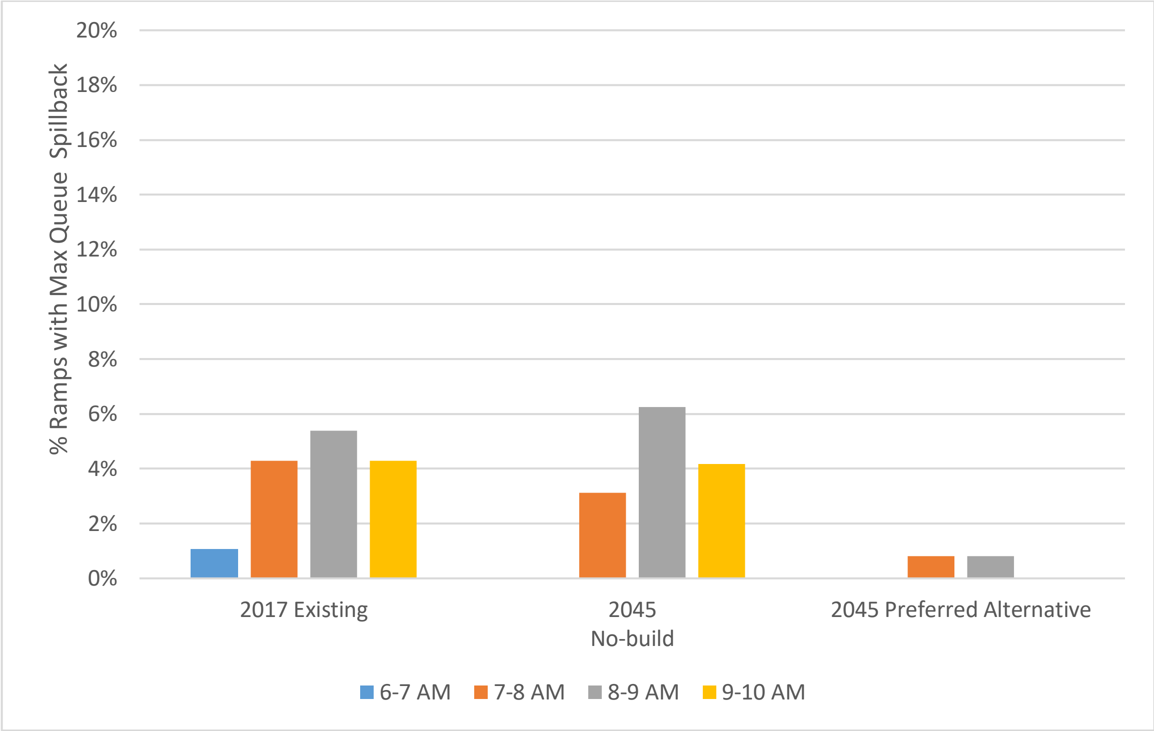
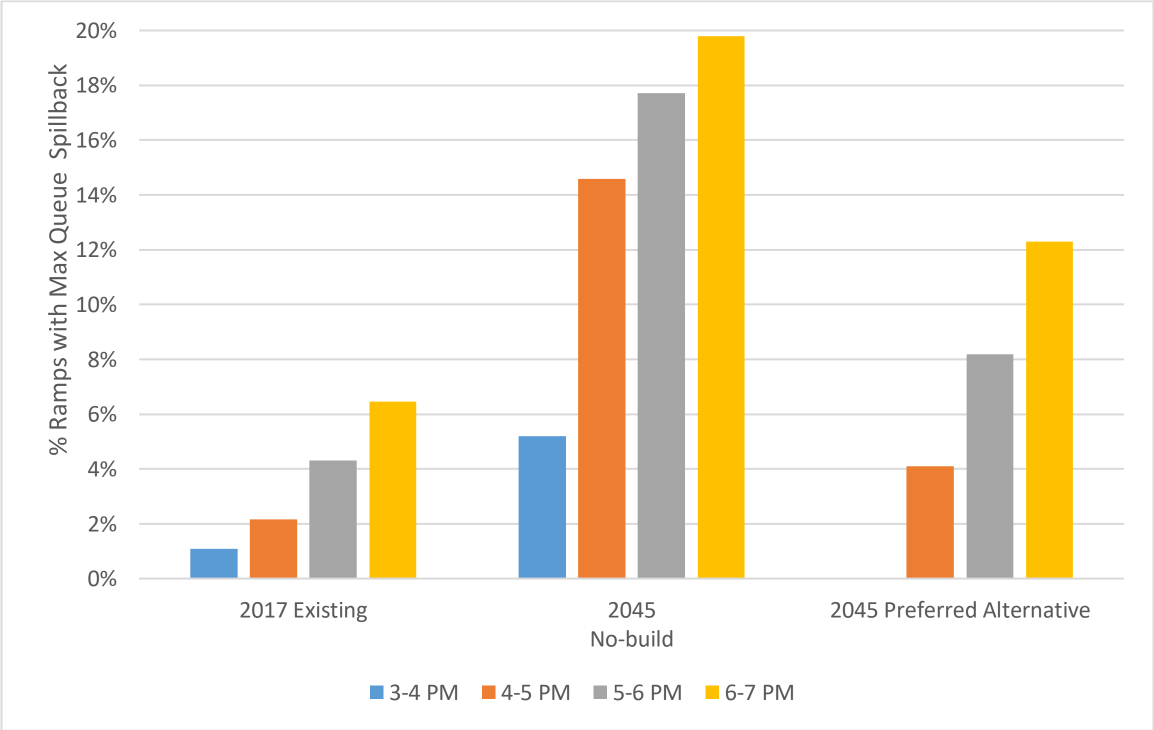


Figure 6-57: 2045 PM No Build vs Preferred Alternative Ramp Queue Spillback



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 44% (approximately 89,000 lane-miles) under No Build conditions to 2% (approximately 5,000 lane-miles) with the Preferred Alternative; and the I-270 Southbound lane-miles with LOS ‘D’ or better increasing from 70% (approximately 280,000 lane-miles) to 87% (approximately 428,000 lane-miles) while reducing those of LOS ‘F’ from 16% (approximately 65,000 lane-miles) to 6% (approximately 29,000 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 45% (approximately 91,000 lane-miles) under No Build conditions to 6% (approximately 13,000 lane-miles) with the Preferred Alternative; and the I-270 Northbound lane-miles with LOS ‘D’ or better increasing from 34% (approximately 153,000 lane-miles) to 55% (approximately 285,000 lane-miles) while reducing those of LOS ‘F’ from 57% (approximately 254,000 lane-miles) to 40% (approximately 206,000 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 throughput at all key locations during the AM peak period. Like the AM, all four I-495 Outer Loop and I-270 Southbound key locations have increased throughput during the 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. 50th and 95th 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 6th 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

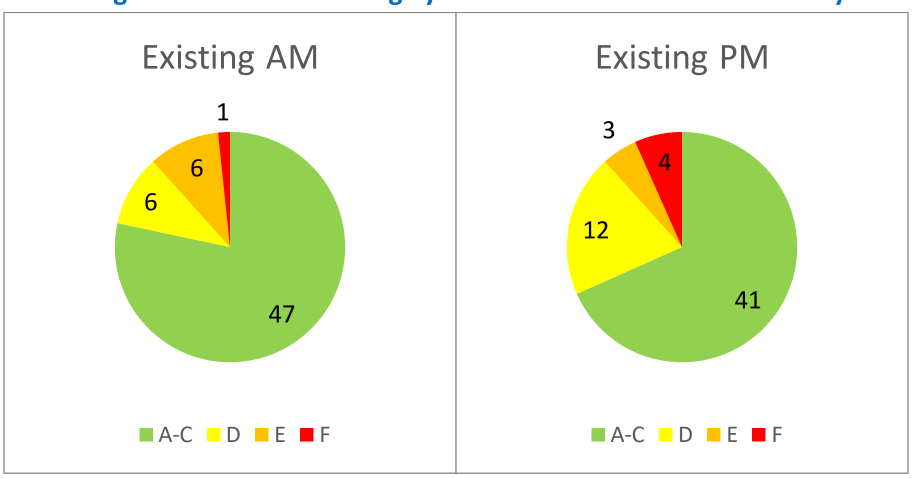


Table 6-24: 2017 Existing Synchro Intersection Delay and LOS Results

Intersection	2017 Existing	
	AM Delay (LOS)	PM Delay (LOS)
I-270 at I-370 (Sam Eig Hwy)		
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)
I-270 at Shady Grove Rd		
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)
I-270 at Gude Dr		
Gude Dr at Research Blvd	61.1 (E)	93.0 (F)
Gude Dr at Piccard Dr	8.9 (A)	18.3 (B)
I-270 at MD 28 (Montgomery Ave)		
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)
I-270 at MD 189 (Falls Rd)		
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)
I-270 at Wootton Pkwy		
Wootton Pkwy at Seven Locks Rd	49.6 (D)	31.3 (C)
Wootton Pkwy at Tower Oaks Rd	21.3 (C)	15.2 (B)
I-270 at Montrose Rd		
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)
I-270 West Spur at Westlake Terrace		
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)

I-270 West Spur at Democracy Blvd		
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)
I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)		
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)
I-495 at MD 190 (River Rd)		
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)
I-495 at MD 187 (Old Georgetown Rd)		
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)
I-495 at MD 355 (Rockville Pk)/I-270 East Spur		
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.

- 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.
- 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
  - 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
  - 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.
  - 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.
  - 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

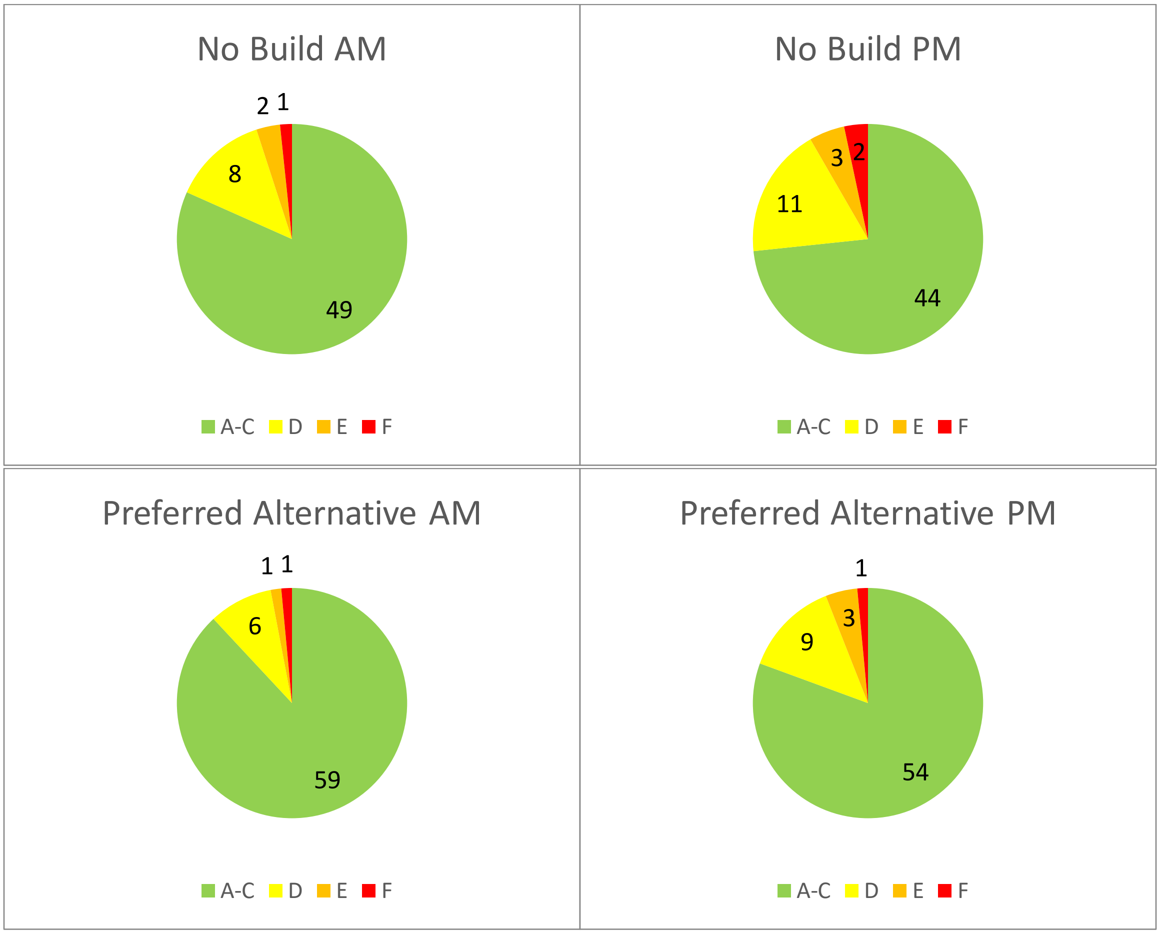


Table 6-25: 2027 No Build and Preferred Alternative Synchro Intersection Delay and LOS Results

Intersection	No Build		Preferred Alternative	
	AM Delay (LOS)	PM Delay (LOS)	AM Delay (LOS)	PM Delay (LOS)
I-270 at I-370 (Sam Eig Hwy)				
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)
I-270 at Shady Grove Rd				
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)
I-270 at Gude Dr				
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)
I-270 at MD 28 (Montgomery Ave)				
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)
I-270 at MD 189 (Falls Rd)				
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)
I-270 at Wootton Pkwy				
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)
I-270 at Montrose Rd				
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)
I-270 West Spur at Westlake Terrace				
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)
I-270 West Spur at Democracy Blvd				
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)
I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)				
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)
I-495 at MD 190 (River Rd)				
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 Managed Lanes Access	N/A	N/A	13.8 (B)	22.0 (C)
I-495 at MD 187 (Old Georgetown Rd)				
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)
I-495 at MD 355 (Rockville Pk)/I-270 East Spur				
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 95th %ile Queue (ft)	PM 95th %ile Queue (ft)	Issue?
I-270 at Shady Grove Rd			
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
I-270 at Gude Dr			
I-270 ML SB Off-Ramp to Gude Dr	189	217	No
I-270 ML NB Off-Ramp to Gude Dr	407	330	No
I-270 at MD 28 (Montgomery Ave)			
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
I-270 at MD 189 (Falls Rd)			
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
I-270 at Wootton Pkwy			
I-270 ML SB Off-Ramp to Wootton Pkwy	139	184	No
I-270 ML NB Off-Ramp to Wootton Pkwy	198	196	No
I-270 at Montrose Rd			
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
I-270 West Spur at Westlake Terrace			
I-270 Spur ML SB Off-Ramp to Westlake Terrace	437	283	No
I-270 Spur ML NB Off-Ramp to Westlake Terrace	111	70	No
I-270 West Spur at Democracy Blvd			
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
I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)			
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
I-495 at MD 190 (River Rd)			
I-495 OL Off-Ramp to MD 190	156	140	No
I-495 OL ML Off-Ramp to MD 190	72	122	No
I-495 IL ML Off-Ramp to MD 190	17	160	No
I-495 IL Off-Ramp to MD 190	252	189	No
I-495 at MD 187 (Old Georgetown Rd)			
I-495 OL Off-Ramp to MD 187	431	459	No
I-495 IL Off-Ramp to MD 187	166	357	No
I-495 at MD 355 (Rockville Pk)/I-270 East Spur			
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

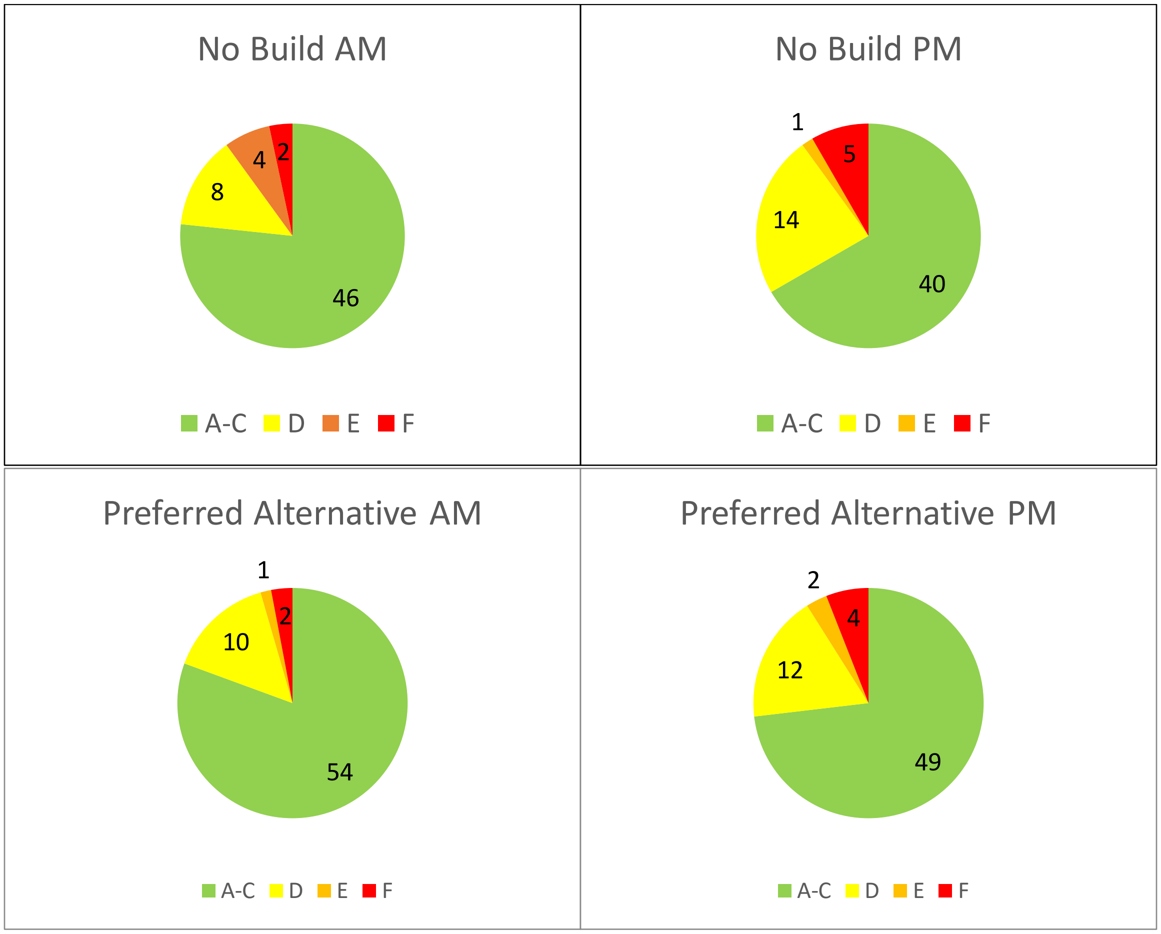


Table 6-27: 2045 No Build and Preferred Alternative Synchro Intersection Delay and LOS Results

Intersection	No Build		Preferred Alternative	
	AM Delay (LOS)	PM Delay (LOS)	AM Delay (LOS)	PM Delay (LOS)
I-270 at I-370 (Sam Eig Hwy)				
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)
I-270 at Shady Grove Rd				
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)
I-270 at Gude Dr				
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)
I-270 at MD 28 (Montgomery Ave)				
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)
I-270 at MD 189 (Falls Rd)				
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)
I-270 at Wootton Pkwy				
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 Delay (LOS)	PM Delay (LOS)	AM Delay (LOS)	PM Delay (LOS)
I-270 at Montrose Rd				
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)
I-270 West Spur at Westlake Terrace				
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)
I-270 West Spur at Democracy Blvd				
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)
I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)				
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)
I-495 at MD 190 (River Rd)				
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 Managed Lanes Access	N/A	N/A	13.6 (B)	23.0 (C)
I-495 at MD 187 (Old Georgetown Rd)				
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)
I-495 at MD 355 (Rockville Pk)/I-270 East Spur				
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 95th %ile Queue (ft)	PM 95th %ile Queue (ft)	Issue?
I-270 at Shady Grove Rd			
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
I-270 at Gude Dr			
I-270 ML SB Off-Ramp to Gude Dr	205	281	No
I-270 ML NB Off-Ramp to Gude Dr	507	408	No
I-270 at MD 28 (Montgomery Ave)			
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
I-270 at MD 189 (Falls Rd)			
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
I-270 at Wootton Pkwy			
I-270 ML SB Off-Ramp to Wootton Pkwy	156	203	No
I-270 ML NB Off-Ramp to Wootton Pkwy	254	248	No
I-270 at Montrose Rd			
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
I-270 West Spur at Westlake Terrace			
I-270 Spur ML SB Off-Ramp to Westlake Terrace	497	327	No
I-270 Spur ML NB Off-Ramp to Westlake Terrace	115	90	No
I-270 West Spur at Democracy Blvd			
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
I-270 East Spur at Rockledge Dr/MD 187 (Old Georgetown Rd)			
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
I-495 at MD 190 (River Rd)			
I-495 OL Off-Ramp to MD 190	163	145	No
I-495 OL ML Off-Ramp to MD 190	78	132	No
I-495 IL ML Off-Ramp to MD 190	17	194	No
I-495 IL Off-Ramp to MD 190	268	194	No
I-495 at MD 187 (Old Georgetown Rd)			
I-495 OL Off-Ramp to MD 187	434	285	No
I-495 IL Off-Ramp to NB MD 187	107	425	No
I-495 at MD 355 (Rockville Pk)/I-270 East Spur			
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[10] and VDOT Tableau-Crash Analysis Tool (T-CAT)[11]. 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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[10] 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.

[11] 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; crossroad ramp terminals and intersections; and crossroad segments 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[12] 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.

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 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.

[12] 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".

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[13]. 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.

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

FACILITY	Facility	Length in miles[1]	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**

[1]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.

[13] 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>.

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

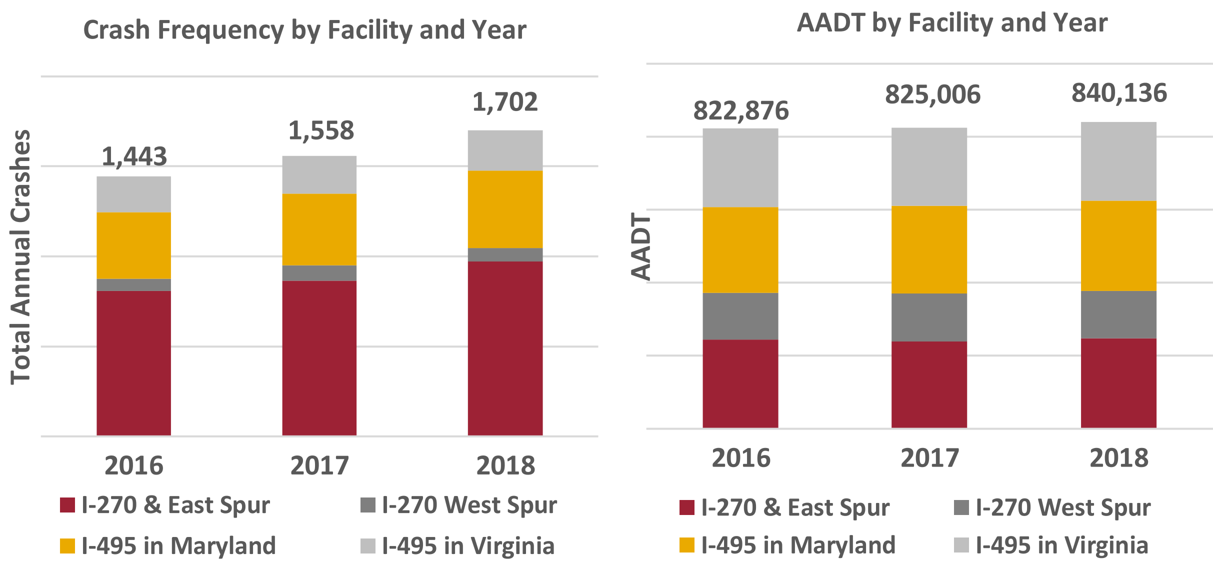
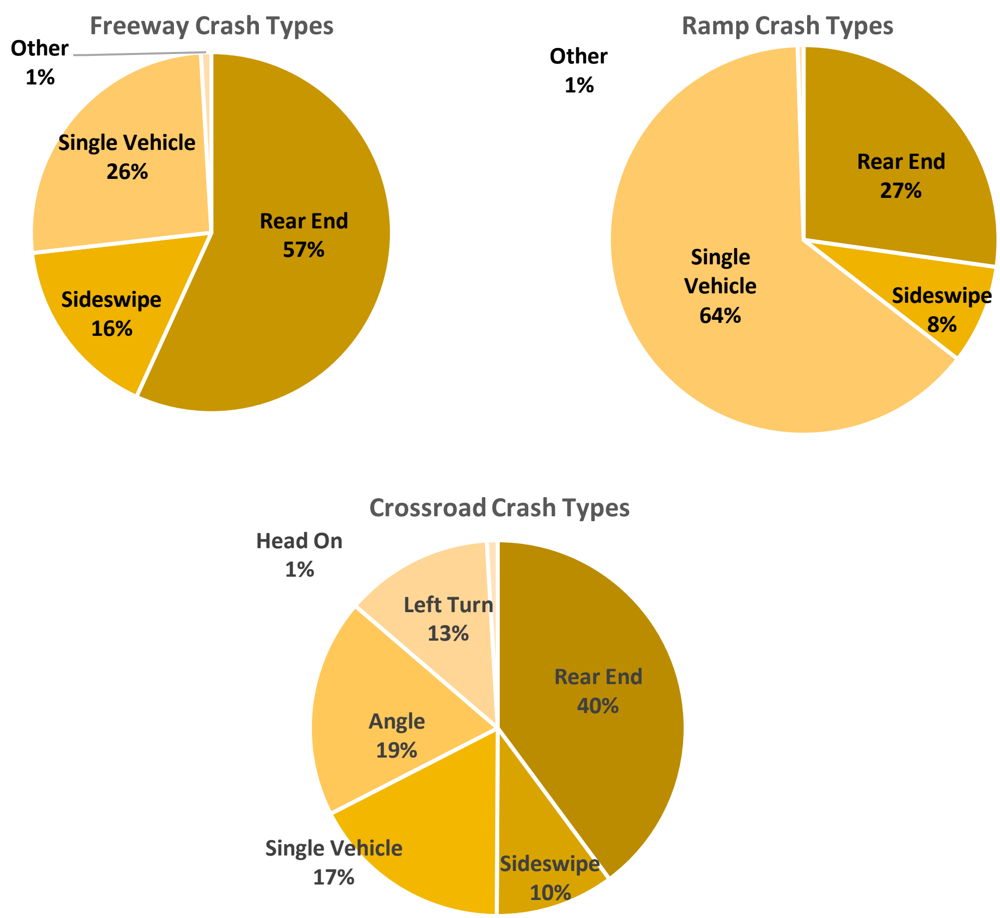


Figure 7-3: Crash Type Distribution for Freeways, Ramps, and Crossroads



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

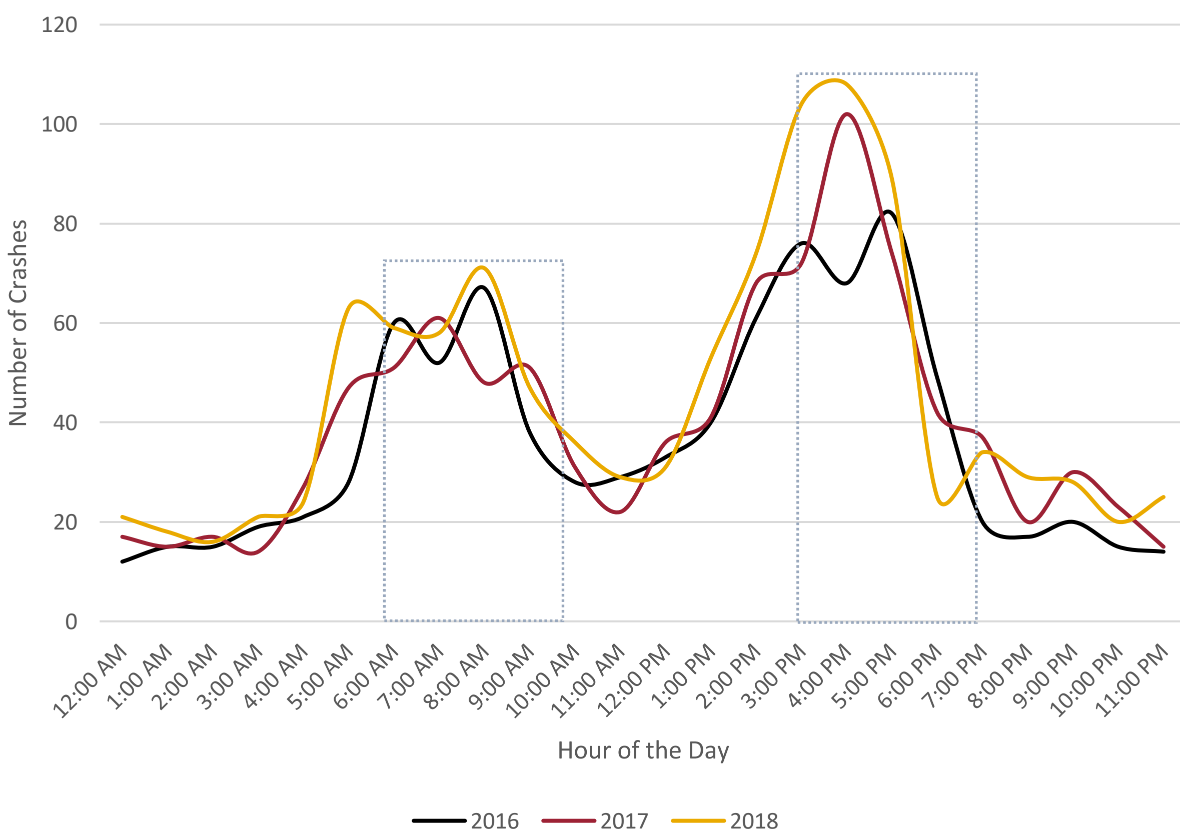
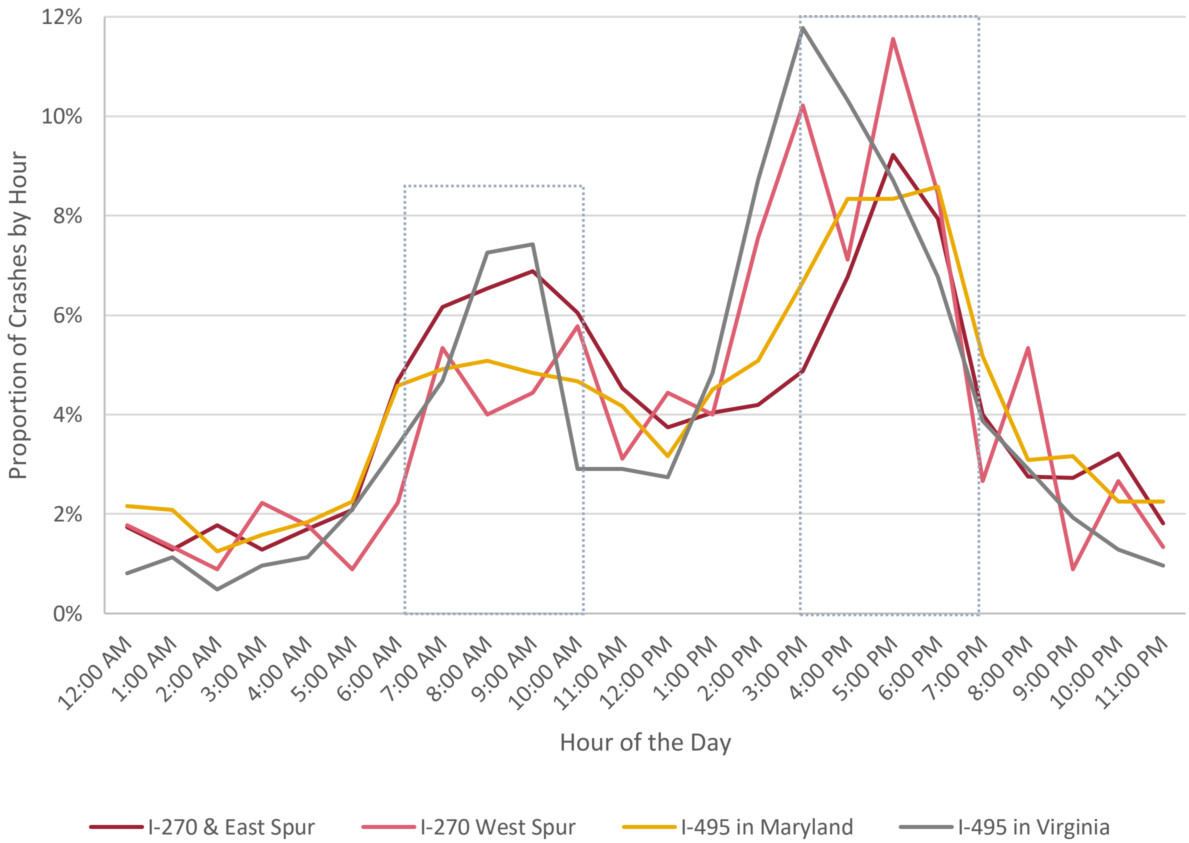


Figure 7-5 shows the proportion of crashes occurring by hour by facility accounting for all crashes occurring within the three-year crash study period.

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.

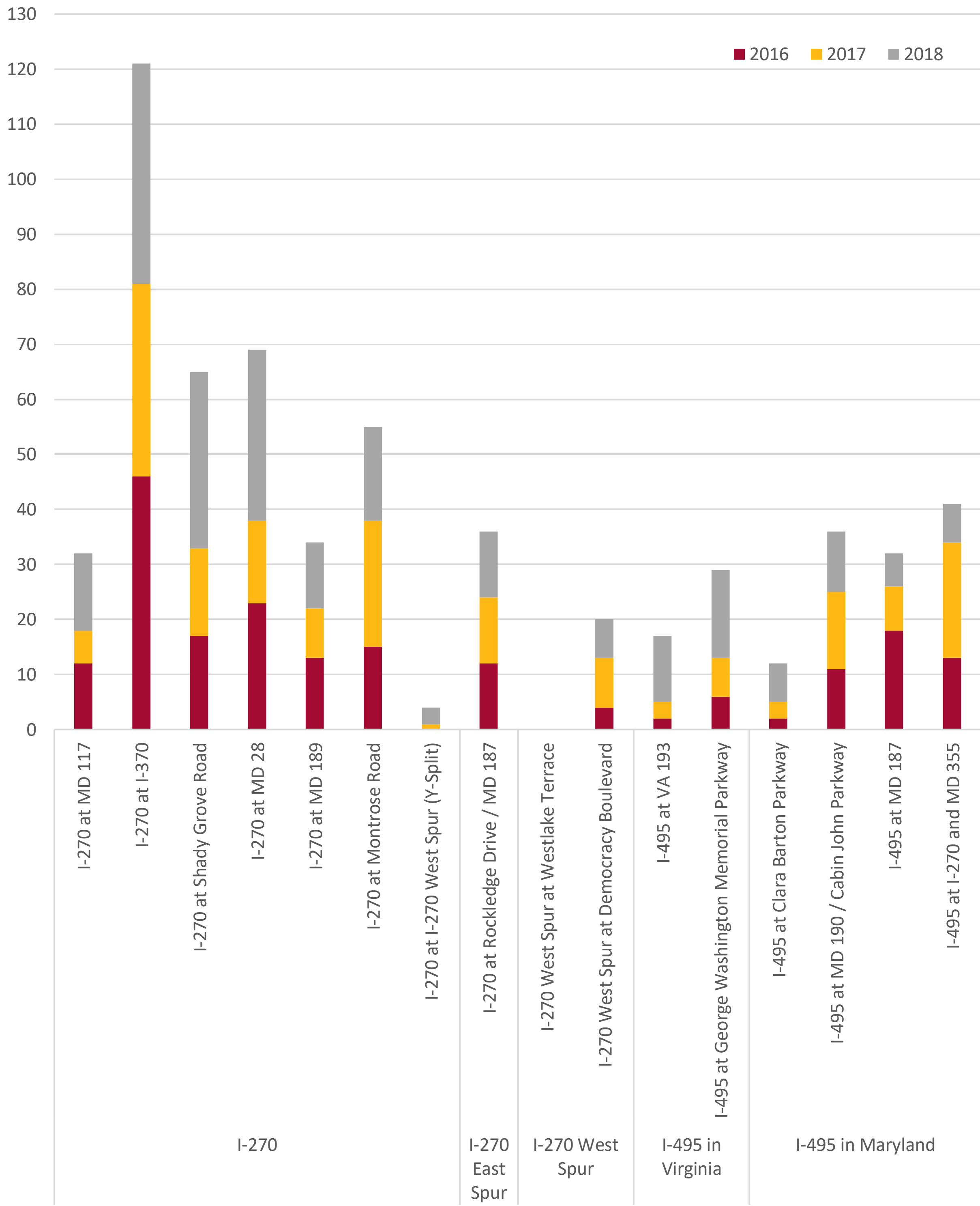
Figure 7-5: Crash Frequency Distribution by Time of Day by Facility



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

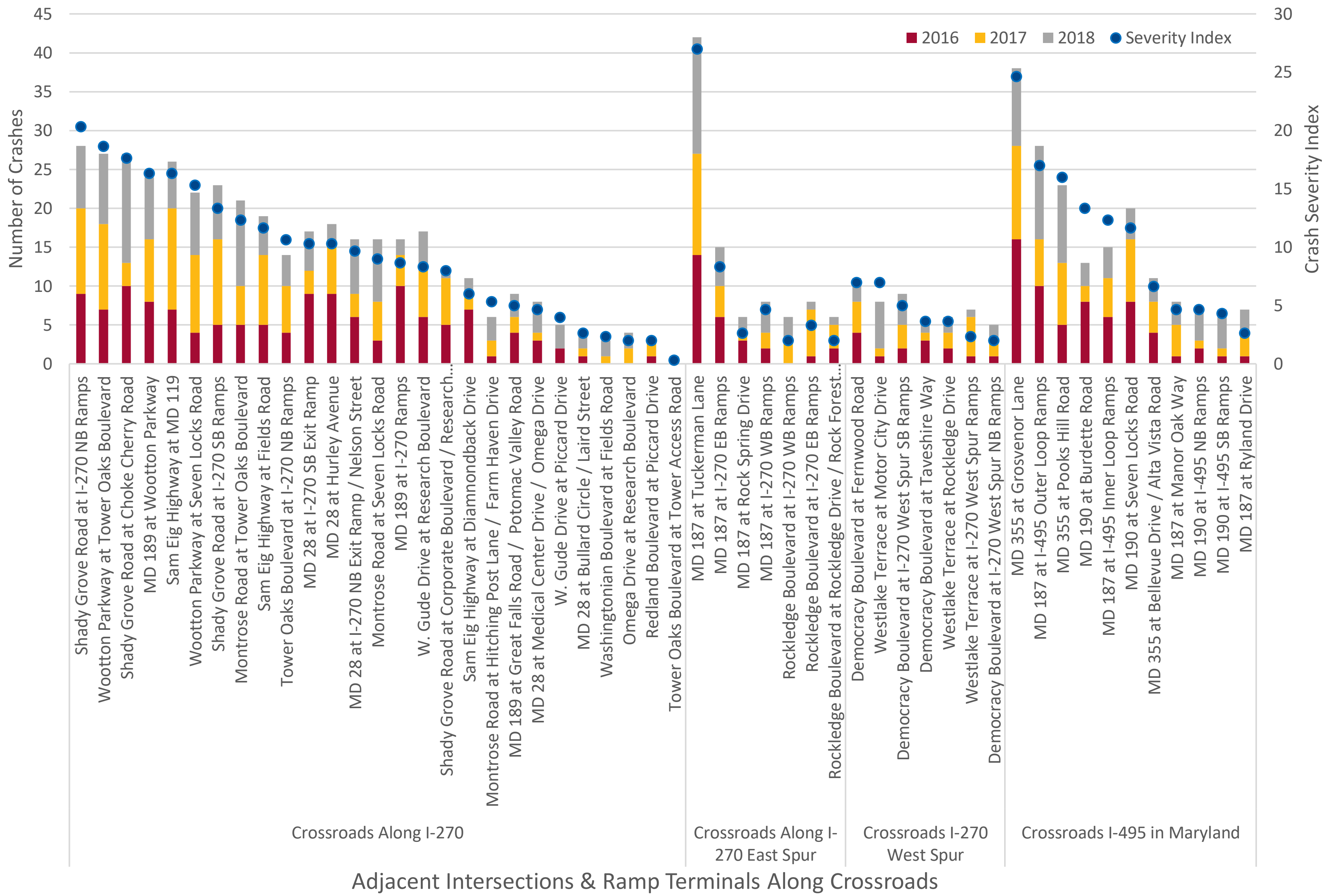


7.3.4 Intersection Crash Trends

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[14] 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 CSII 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.

[14] 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 throughFigure** 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
	Rates shown in crashes per year per 100 million vehicle miles traveled		
I-270 & East Spur I-270 West Spur I-495 in Maryland[1]	*16.1*	*28.2*	*44.3*
I-495 in Virginia[2]	*22.5*	*58.6*	*81.0*

[1]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.

[2]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%
Total		**37.66**	**41**	**10.25**	**27%**

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

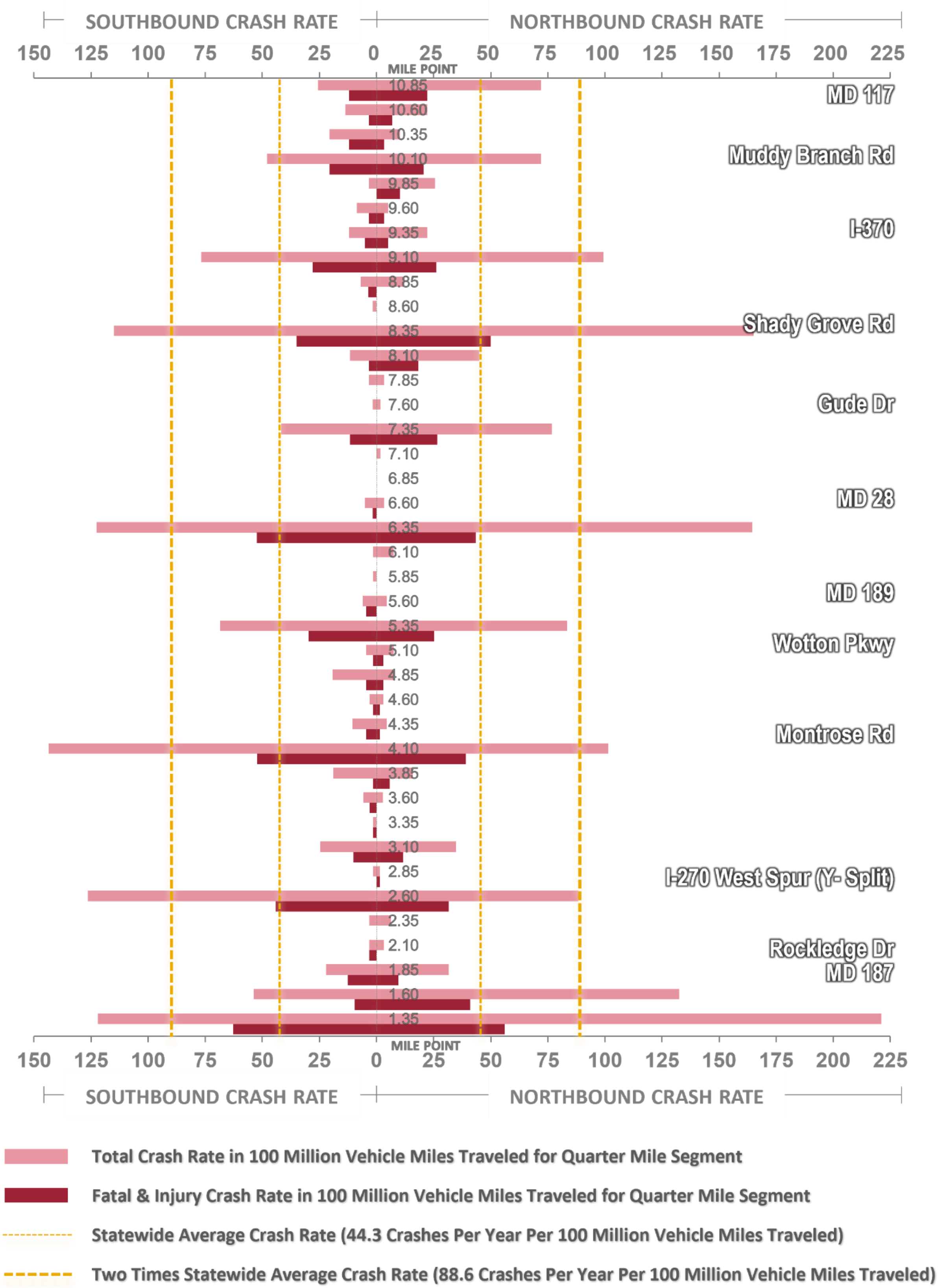
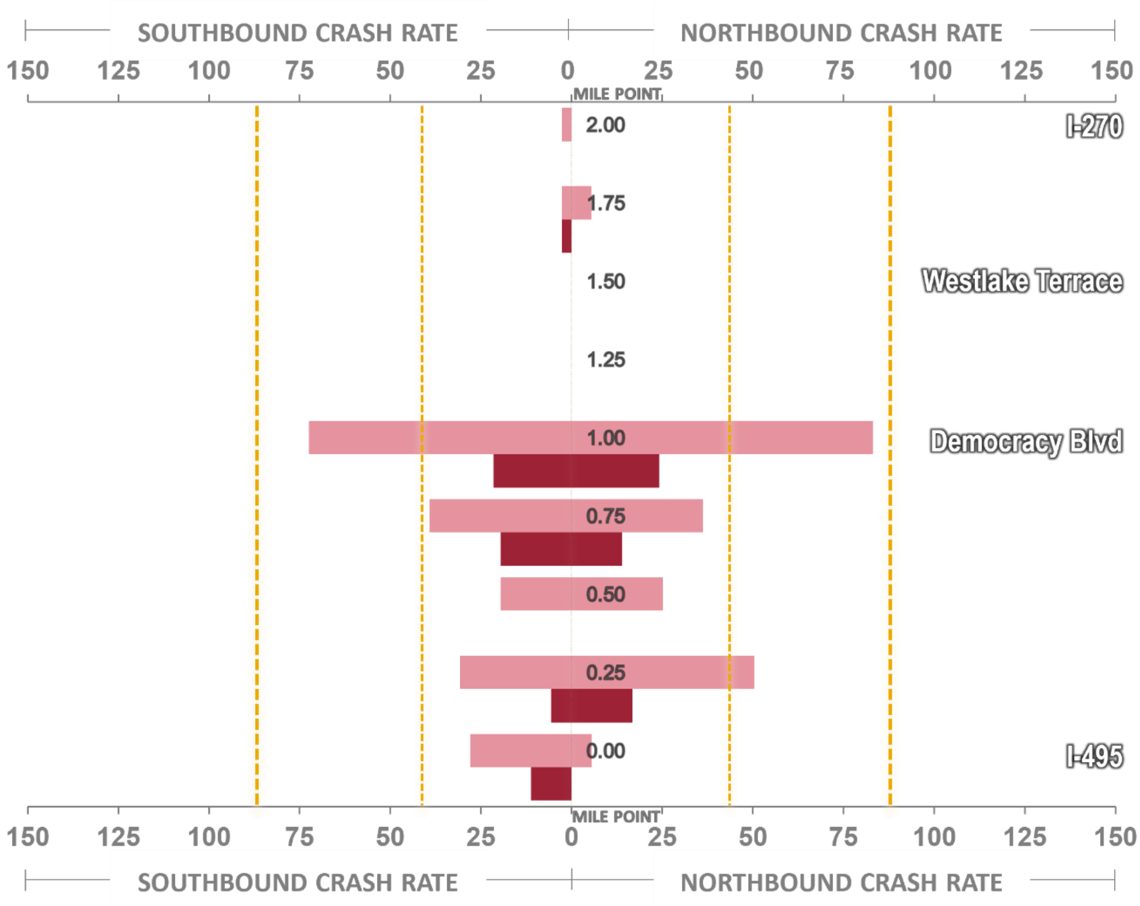


Figure 7-9: Freeway Crash Rates by Quarter Mile Segments for I-270 West Spur



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 (44.3 Crashes Per Year Per 100 Million Vehicle Miles Traveled)

Two Times Statewide Average Crash Rate (88.6 Crashes Per Year Per 100 Million Vehicle Miles Traveled)

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

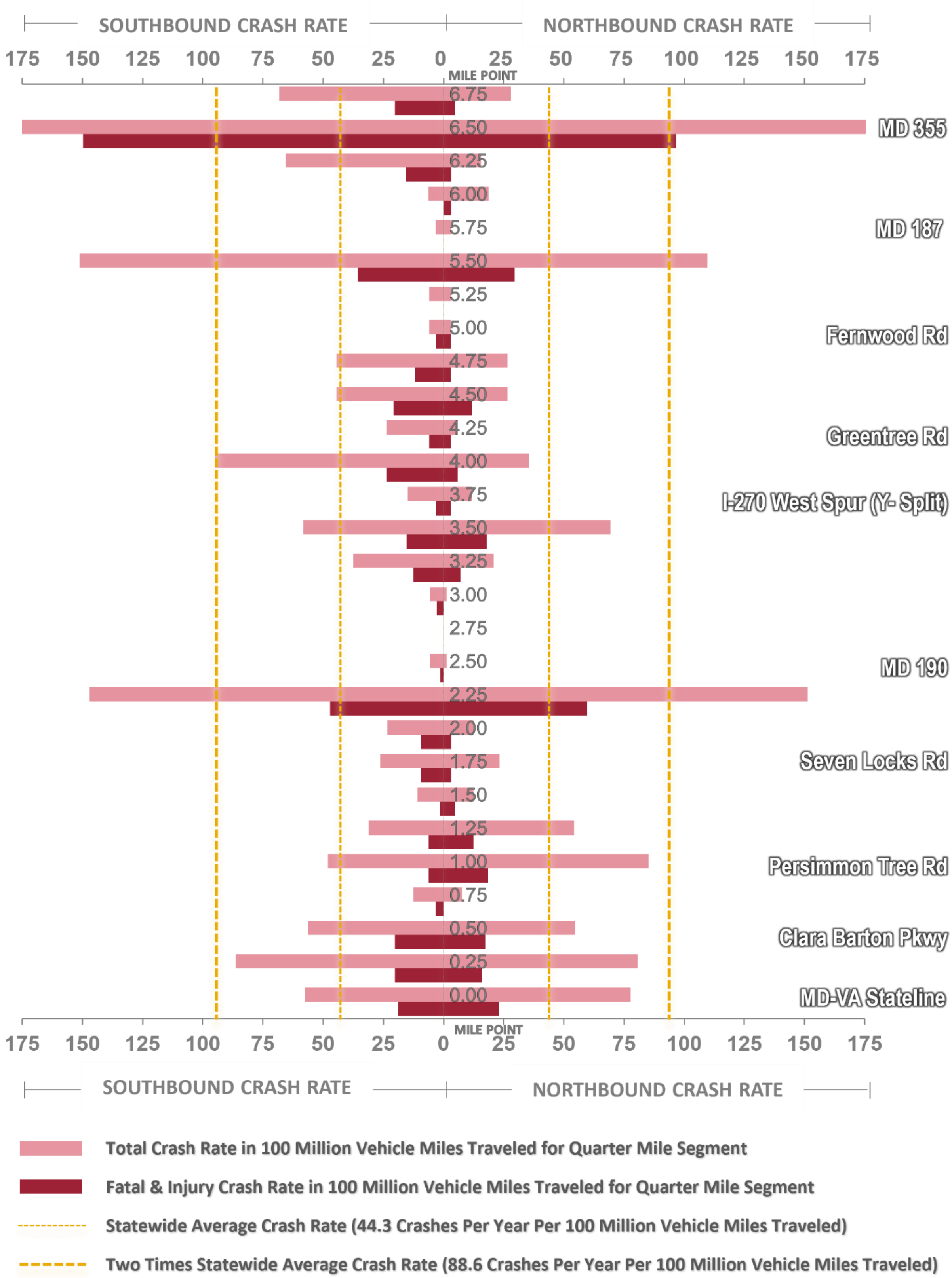


Figure 7-11: Freeway Crash Rates by Quarter- Mile Segments for I-495 in Virginia

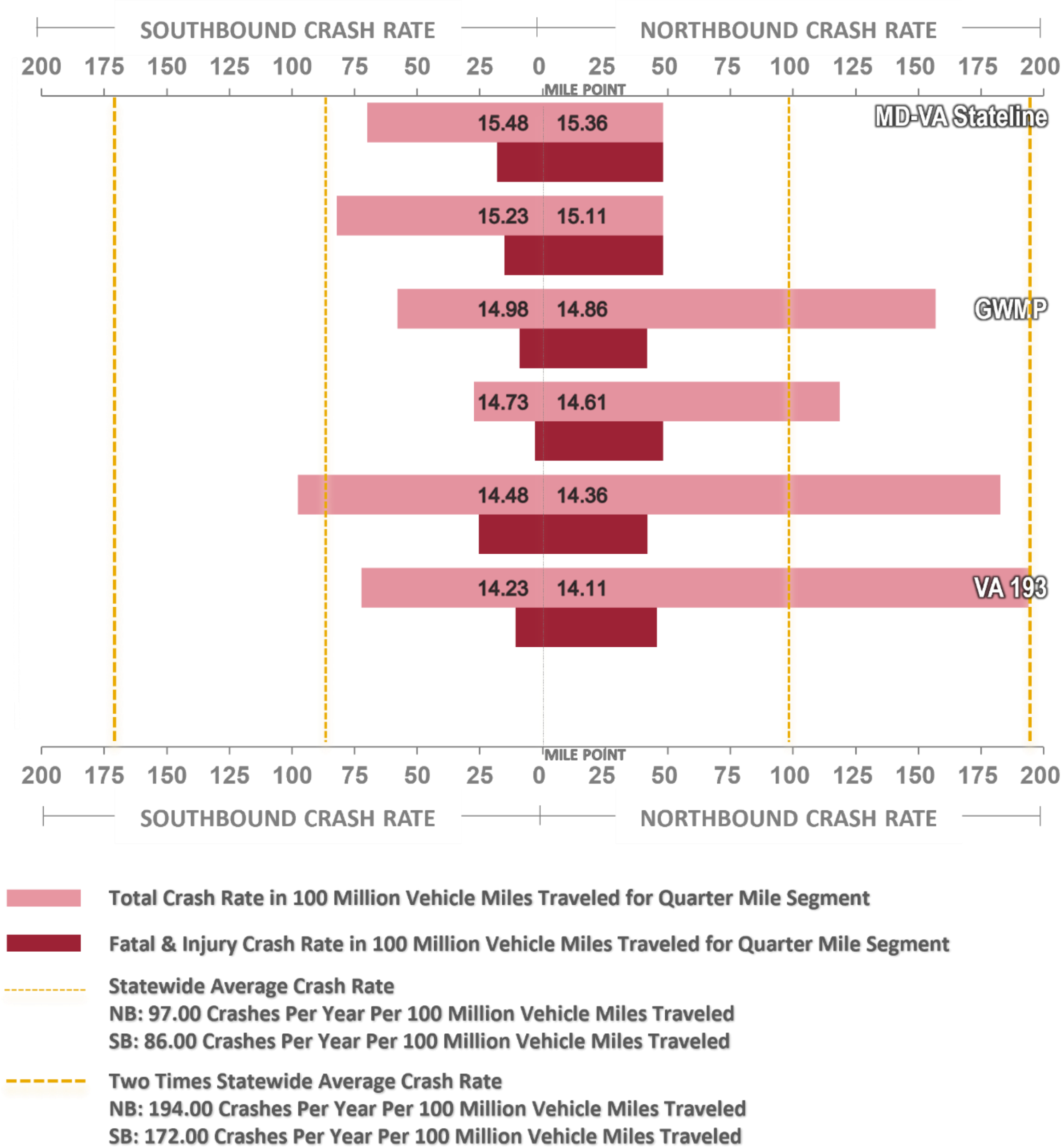


Table 7-4: Quarter-Mile Freeway Segments with a Crash Rate Two Times Above the Statewide Average

Facility	Reference Interchange / Cross Street	Direction	Start Mile Point	End Mile Point	Crash Rate *Number of crashes per year per 100 million vehicle miles traveled*		
					Fatal & Injury	Property Damage Only	Total
I-270 & East Spur	MD 187	NB	1.35	1.60	**56.1**	**165.1**	**221.2**
		SB			**62.7**	**59.4**	**122.1**
		NB	1.60	1.85	**41.1**	**91.6**	**132.7**
	I-270 merge/split Tuckerman Lane	NB	2.60	2.85	31.6	**56.8**	88.4
		SB			**44.2**	**82.1**	**126.3**
	Montrose Road	NB	4.10	4.35	**39.2**	**62.4**	**101.6**
		SB			**52.2**	**91.4**	**143.6**
	MD 189	NB	5.35	5.60	25.3	**58.1**	83.4
	MD 28	NB	6.35	6.60	**43.4**	**121.2**	**164.6**
		SB			**52.4**	**70.3**	**122.7**
	Shady Grove Road	NB	8.35	8.60	**50.0**	**115.0**	**165.0**
		SB			**35.0**	**80.0**	**115.0**
	I-370	NB	9.10	9.35	26.1	**73.2**	**99.3**
I-270 West Spur	Democracy Boulevard	NB	1.00	1.25	24.1	**59.0**	**83.1**
I-495 in Maryland	MD 190 / Cabin John Parkway	Inner Loop	2.25	2.50	**59.7**	**91.6**	**151.3**
		Outer Loop			**47.2**	**99.9**	**147.1**
	Greentree Road Bridge	Outer Loop	4.00	4.25	**23.7**	**71.1**	**94.8**
	MD 187	Inner Loop	5.50	5.75	**29.6**	**80.0**	**109.6**
		Outer Loop			**35.6**	**115.6**	**151.2**
I-495 in Virginia	VA 193	Inner Loop	13.86	14.11	45.7	**148.4**	194.1
			14.11	14.36	41.9	**140.8**	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-270 East Spur	*MD 187*	*1.39*	*1.89*	*82*	*114*
I-270	*Shady Grove Road*	*8.20*	*8.70*	*81*	*110*
I-495 in Maryland	*MD 190 / Cabin John Parkway*	*1.90*	*2.40*	*86*	*123*

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

¼ Mile Freeway Segments with High Crash Rates	
A	I-270 C-D lanes entrance south of I-370
B	I-270 at Shady Grove Road Interchange (CSIS)
C	I-270 at MD 28 Interchange
D	I-270 at MD 189 Interchange
E	I-270 at Montrose Road Interchange
F	I-270 West Spur over Tuckerman Lane & I-270 Y-Spilt
G	I-270 East Spur at MD 187 Interchange (CSIS)
H	I-270 West Spur at Democracy Boulevard
I	I-495 at MD 187 Interchange
J	I-495 at Greentree Road Overpass
K	I-495 at MD 190/CJP Interchange (CSIS)
L	I-495 at VA 193 Interchange

Ramps with High Crash Frequencies	
1	I-270 NB Exit Ramp to I-370
2	I-270 SB Exit Ramp to Shady Grove Road / Omega Drive
3	I-270 NB Exit Ramp to Shady Grove Road / Redland Boulevard
4	I-270 NB Exit Ramp to MD 28 WB
5	I-270 SB Exit Ramp to Montrose Road EB

Adjacent Intersections and Ramp Terminals along Crossroads With High Crash Frequencies	
1	MD 119 at Sam Eig Highway Intersection
2	I-270 NB Ramp Terminal at Shady Grove Road
3	Shady Grove Road at Choke Cherry Road Intersection
4	Wootton Parkway at Seven Locks Road Intersection
5	Wootton Parkway at Tower Oaks Boulevard Intersection
6	Montrose Road at Tower Oaks Boulevard Intersection
7	MD 187 at Tuckerman Lane Intersection
8	MD 355 at Grosvenor Lane

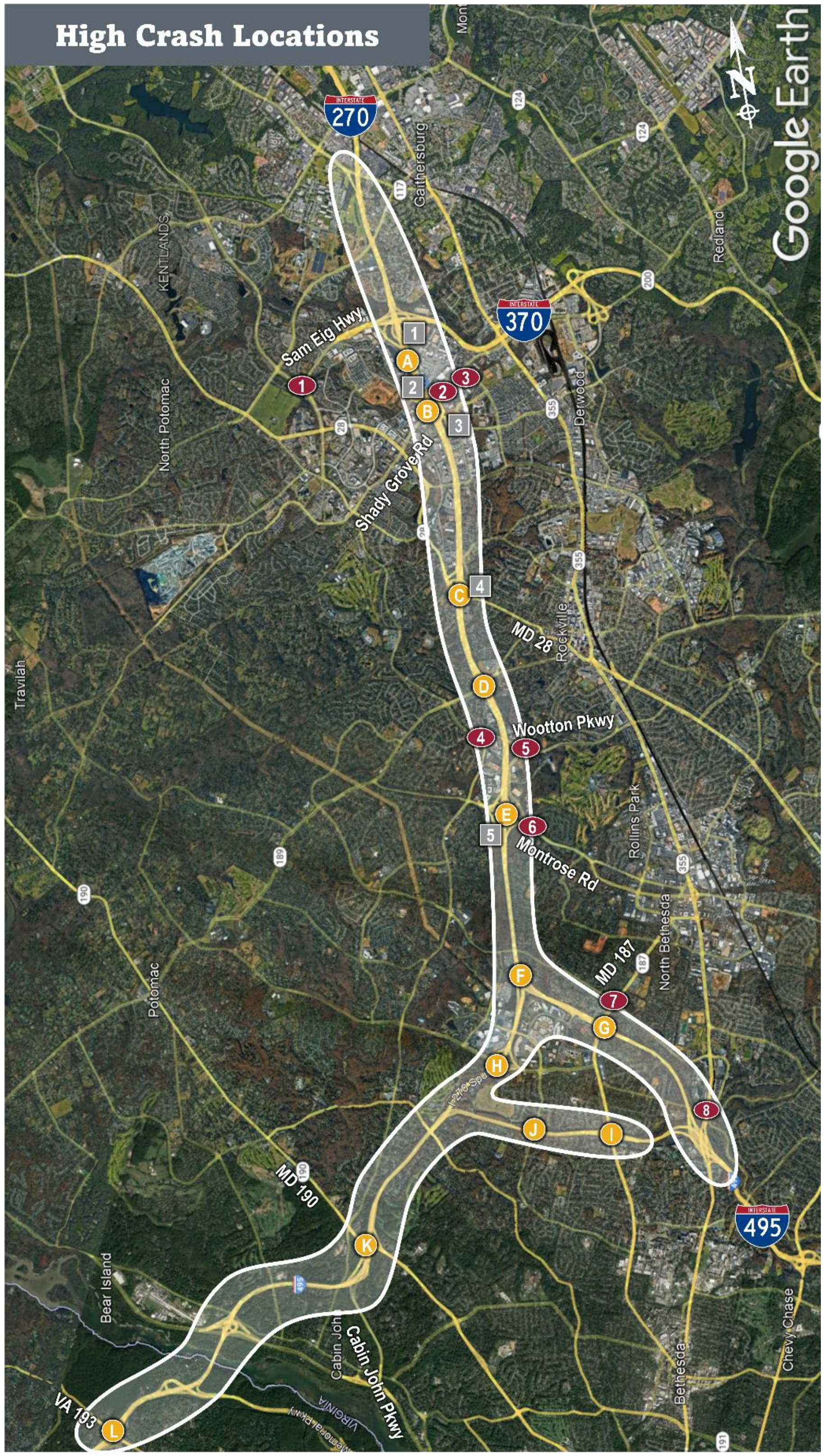


Table 7-6: High-Crash Locations, Major Contributing Factors & Potential Impacts Associated with Preferred Alternative

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	• NB rear-end crashes at slip ramp entrance from local lanes to the express lanes south of I-370	• High-volume merge at ramp from local lanes	• 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. • 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.

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)	• PM peak period rear-end crashes at merge from loop ramp from EB Shady Grove Road to I-270 NB local lanes • Rear-end & single-vehicle crashes along I-270 Northbound local lanes immediately downstream of exit ramp to EB and WB Shady Grove Road	• High volume of traffic diverging and merging • Congestion	• 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. • 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. • 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.

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**
C	I-270 at MD 28 Interchange	• Single-vehicle & rear-end crashes at I-270 NB local lanes slip ramp merge to the express lanes south of MD 28 interchange • Rear-end crashes at slip ramp from I-270 NB General Purpose lanes to local lanes north of MD 28	• High volume traffic merges • Left-hand merge condition	• 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. • 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. • 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.

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**
D	I-270 at MD 189 Interchange	• NB PM peak period rear-end crashes	• Basic freeway segment • Congestion	• 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. • 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. • 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.

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**
E	I-270 at Montrose Road Interchange	• SB rear-end crashes	• Cloverleaf interchange with short weaving sections along local lanes between loop ramps • Congestion	• 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. • 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.

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	• Single-vehicle wet pavement crashes involving vehicles striking traffic barrier along I-270 SB over I-270 West Spur • Rear-end crashes in both directions north of Tuckerman Lane	• Horizontal curve on bridge along I-270 SB over I-270 West Spur • Potentially poor surface friction • Potential speeding during uncongested times • Congestion during peak periods	• The Preferred Alternative proposes increased shoulder widths and addresses variations in superelevation to make them AASHTO compliant. • The surface friction will improve due to resurfacing proposed throughout the Preferred Alternative. • 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. • 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.
G	I-270 East Spur at MD 187 Interchange (CSIS)	• Off-peak rear-end crashes along I-270 East Spur WB upstream of MD 187 interchange	• Diverge for right-side exit ramp	• No geometric changes are proposed as part of the Preferred Alternative at this diverge location. • 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.

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	• NB rear-end crashes throughout the day approaching the exit ramp to Democracy Boulevard	• Beginning of HOV lane • High volume non-HOV2 vehicles and trucks from left-most lane merge right to avoid a $500 fine & 1 point on license	• 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. • 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.
I	I-495 at MD 187 Interchange	• Inner Loop rear-end crashes	• Diverge for right-side exit ramp • Congestion	• No geometric changes are proposed at this interchange which is outside the limits of the Preferred Alternative. • 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. • 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.

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**
J	I-495 at Greentree Road Bridge	• AM and PM peak period Outer Loop rear-end crashes	• Rightmost lane reduction on the Outer Loop requiring vehicles to merge left • Congestion	• 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. • 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.

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)	• Outer Loop, rear-end, PM peak period crash cluster at diverge to Cabin John Parkway • Inner Loop, rear-end crash clusters at merges from Cabin John Parkway & at entrance ramp from MD 190 WB	• Multiple, closely spaced merges and diverges • Congestion	• 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. • 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. • With less General Purpose lane mainline and ramp volumes, less merging friction during the AM and PM peak periods is expected to be reduced. • The duration that maximum ramp queues exceed their storage capacity will be reduced during the afternoon peak period (compared to the No Build). • 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.

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	• Inner Loop peak period rear-end crashes upstream of diverge to VA 193 and downstream of diverge to GWMP	• High volume diverges and left-hand merge from shoulder lane • Congestion	• 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.[15]

[15] 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	• 58 crashes including 49 wet pavement crashes (38 fixed object, 4 sideswipes, 1 rear-end, & 6 other) which resulted in 1 fatality & 12 persons injured	• Weaving conditions approaching the ramp diverge • Reverse curve • Potentially high speeds • Overhead guide signing • Potentially poor surface friction	• 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. • 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. • 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.

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	• 30 crashes including 21 wet pavement crashes (20 fixed object & 1 other) which resulted in 1 injury	• Tight horizontal curvature • Lane drop along I-270 SB onto Shady Grove Road • Potentially poor surface friction • Congestion • Split within ramp to Omega Drive may be contrary to driver's expectations • Vegetation overgrowth may limit horizontal sight distance during certain seasons	• 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. • The surface friction will improve due to resurfacing proposed throughout the project.
3	I-270 NB exit ramp to Shady Grove Road/Redland Boulevard	• 17 crashes including 7 wet pavement crashes (6 fixed object & 1 sideswipe) which resulted in 1 injury	• Tight horizontal curvature • Potentially poor surface friction • Congestion • Split within ramp to Redland Boulevard may be contrary to driver's expectations	• The Preferred Alternative widens this ramp and provides additional deceleration length for the movement from I-270 Southbound to Redland Boulevard. • The surface friction will improve due to resurfacing proposed throughout the project.
4	I-270 NB exit ramp to MD 28 WB	• 39 crashes all wet pavement crashes (1 rear-end, 35 fixed object & 3 other) which resulted in 4 persons injured	• Tight horizontal curvature (loop ramp) • Short deceleration lane • Potentially poor surface friction • Congestion • Vegetation overgrowth may limit horizontal sight distance during certain seasons	• 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. • 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.

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	• 24 crashes, 20 of which were wet pavement crashes (all fixed object PDO)	• Tight horizontal curve (loop ramp) • Potentially poor friction • Congestion	• 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. • 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.

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	• 19 rear-end crashes with concentrations along the WB right-turn lane and the PM peak period	• Double right-turn with signal control • Congestion • Vegetation overgrowth obstructing ground-mounted signs	• 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.
2	I-270 NB ramp terminal at Shady Grove Road	• 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)	• Ramp terminal • Far side span wire mounted signal heads are difficult to see as they fade out into the background • Vegetation overgrowth limits corner sight distance	• 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.
3	Shady Grove Road at Choke Cherry Road Intersection	• 14 NB left-turn crashes into Home Depot entrance (6 in 2016, 2 in 2017, 6 in 2018) which resulted in 7 persons injured	• Signalized intersection • Blocked sightline for left-turning movements • Protected-permissive signal phasing	• 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.
4	Wootton Parkway at Seven Locks Road Intersection	• 13 left-turn crashes all involving EB & WB left-turns (5 in 2018, 6 in 2017, 2 in 2016) which resulted in 15 persons injured	• Signalized intersection • High volume EB left-turns with permissive-only signal phasing • WB left-turn protected-permissive signal phasing	• 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.
5	Wootton Parkway at Tower Oaks Boulevard Intersection	• 15 left-turn crashes involving left-turns from Wootton Parkway	• Signalized intersection • Protected-permissive signal phasing • WB Wootton Parkway double-left movement recently converted to protected-only signal phasing	• 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.

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	• 3 angle crashes (1 injury, 2 PDO) involving SB left-turns from Tower Oaks Boulevard & WB through Montrose Road resulting in 1 person injured • 10 rear-end crashes (4 WB, 6 EB) which resulted in 5 persons injured	• Signalized intersection • Signal head visibility is restricted	• 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.
7	MD 187 at Tuckerman Lane Intersection	• 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 • 6 SB MD 187 rear-end crashes	• Signalized intersection • Left-turn lanes do not have a positive offset • NB left-turn protected-permissive signal phasing	• 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.
8	MD 355 at Grosvenor Lane	• 8 angle crashes for the Grosvenor Lane WB and MD 355 SB movement • 6 rear-end crashes for MD 355 NB and 5 for SB movement • 3 angle crashes related to the illegal MD 355 NBL movement	• Signalized intersection • Signal head visibility is restricted • Driver confusion may contribute towards illegal left turning movements	• 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.

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 (vehicles/day) = ADT (vehicles/day) x 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}.

  - 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** ***HSM 1st Edition, Volume 2, Chapter 12*** *Applied to Arterial with Five or Less Lanes*	**Safety Prediction Models for Six-Lane and One-Way Urban and Suburban Arterials** ***NCHRP Project 17-58*** *Applied to Arterial with Six or More Lanes*
Arterial Crossroad	MD 117	Sam Eig Highway
	Shady Grove Road (Omega Drive from MD 28 to I-270 SB Ramp Terminal)	Shady Grove Road (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:

$$e^{0.011022579+0.987113593*\ln(\mathrm{L})+0.141283034*\ln(\mathrm{AADT})}$$

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:

$$\mathrm{AADT}_{\mathrm{Adjusted}} = \mathrm{AADT}_{\mathrm{Actual}} * \left(\frac{2}{\text{Actual Number of Lanes}}\right)$$

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 SPFs 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 (Also includes Ramps and Crossroads)[1]	2045 No Build Predicted Annual Crash Frequency			2045 Preferred Alternative Predicted Annual Crash Frequency			Change in Predicted Annual Crash Frequency		
	Fatal and Injury	PDO	Total	Fatal and Injury	PDO	Total	Fatal and Injury	PDO	Total
I-270 & East Spur[2]	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[3]	50	119	169	53	129	182	3	10	13
Total	**828**	**1,424**	**2,252**	**693**	**1,426**	**2,119**	**-135**	**2**	**-133**

[1] Predicted crashes for each study freeway include predicted crashes along all facility types including freeways, HOT managed lanes, and crossroads.
[2] Predicted crashes shown for I-270 & East Spur include predicted crashes along I-370.
[3] 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.

<u>I-270 and East Spur and I-370</u>

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.

<u>I-270 West Spur</u>

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.

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.

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[16], 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,

[16] The predicted crash frequency results shown in this Draft 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.

a 26% increase in property damage only crash frequency, and a 25% increase in total crash frequency in the 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 Draft 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 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.[17] The ATM system incorporates intelligent lane control signals (ILCS) placed over selected lanes at half-mile increments. The ILCS units dis-played 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.[18]
- 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%.[19]

[17] https://trid.trb.org/view/1759599
[18] https://mntransportationresearch.org/2017/07/26/atm-queue-warning-systems-can-reduce-freeway-crashes/
[19] 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 Draft Application for Interstate Access Point Approval meets these two considerations and requirements.

<u>Consideration and Requirement 1: Operational and Safety Analysis</u>

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 milage 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**.

<u>Consideration and Requirement 2: Connects to Public Road and Provides for All Movements</u>

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 show in **Table 4-1**.

Appendix A
IAPA Framework Document (December 2020)

495 270 MANAGED LANES STUDY

IAPA FRAMEWORK DOCUMENT

December 2020

U.S. Department of Transportation

Federal Highway Administration

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

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Appendices

1 INTRODUCTION

The Maryland Department of Transportation State Highway Administration (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.

I-495 and I-270 in Maryland are the two most heavily traveled freeways in the National Capital Region, each with Average Annual Daily Traffic (AADT) volume up to 260,000 vehicles per day in 2018 (MDOT SHA, 2019). I-495 is the only circumferential route in the region that provides interregional connections to many radial routes in the region, such as I-270, US 29 (Colesville Road), I-95, the Baltimore-Washington Parkway, US 50 (John Hanson Highway), and MD 5 (Branch Avenue). 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. (Figure 1).

This Study is considering alternatives 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.

Due to the magnitude of the Study, MDOT SHA intends to construct the improvements in phases, if a Build Alternative is selected. The I-495 & I-270 Managed Lanes Study Phase 1 (Figure 2) 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 and I-270 from its interchange with I-495 to north of I-370.

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[1]. The Final Environmental Impact Statement (FEIS) will be developed from the Fall 2020 to Spring 2021[2].

[1] https://495-270-p3.com/deis/

[2] https://495-270-p3.com/environmental/study-timeline/

Figure 1: I-495 and I-270 MLS Corridors

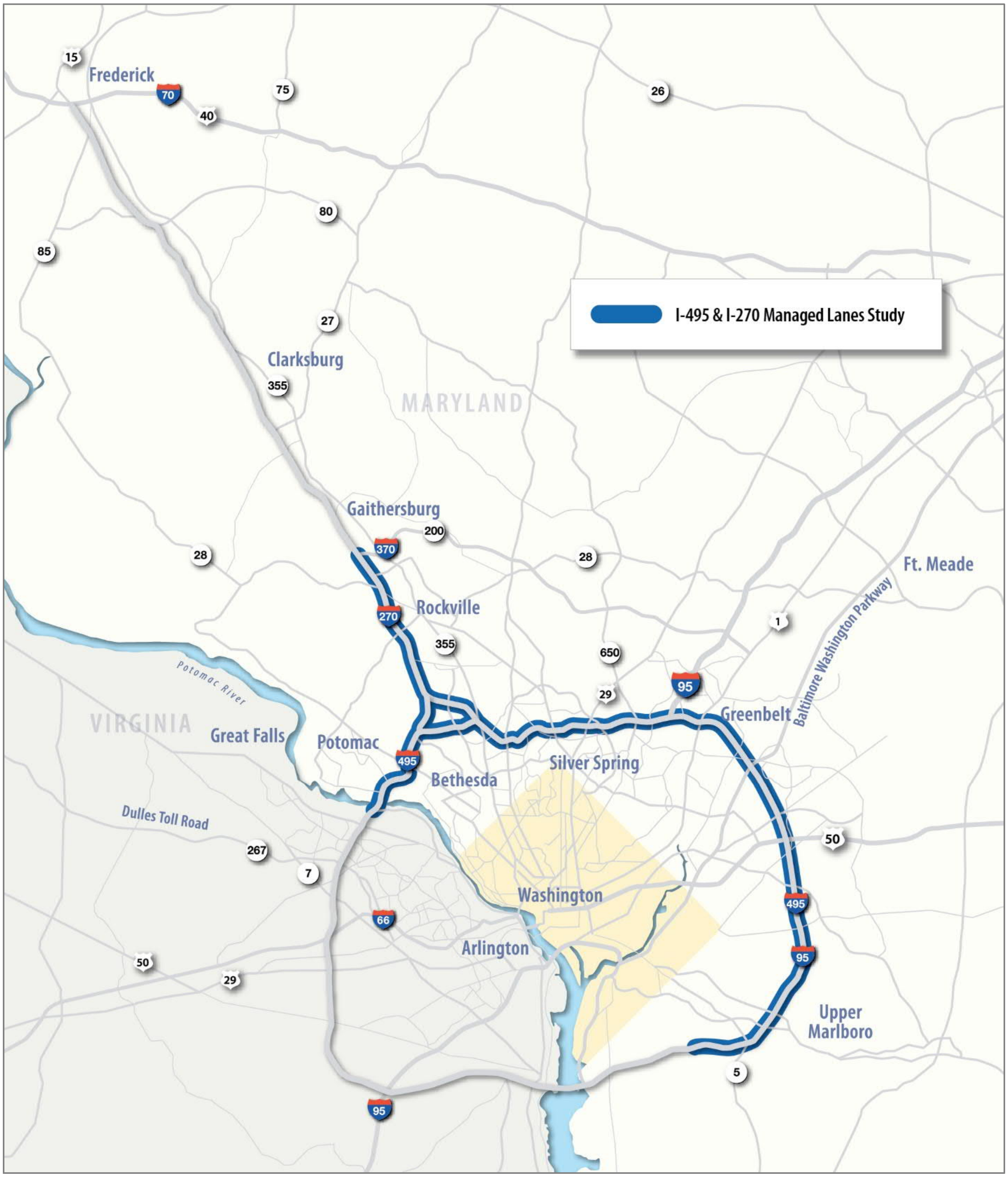
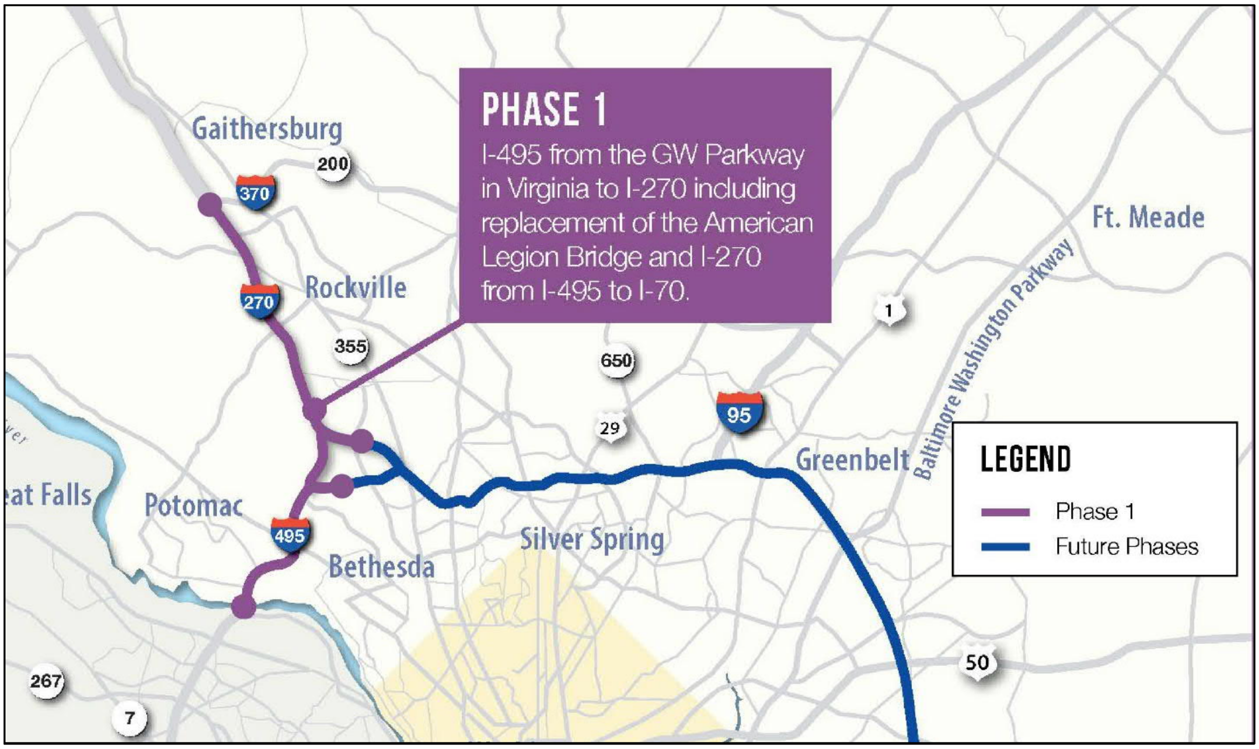


Figure 2: I-495 and I-270 MLS Phase 1 Limits



2 FRAMEWORK DOCUMENT PURPOSE

MDOT SHA is now beginning the development of an Interstate Access Point Approval (IAPA) report for the I-495 & I-270 Managed Lanes Study that will document information necessary to allow MDOT SHA to make informed decisions and to be acceptable to the Federal Highway Administration (FHWA) for safety, operations and engineering. This document and its analysis will use and build upon the traffic modeling and analysis completed for the Draft Environmental Impact Statement (DEIS), but will provide a more in-depth evaluation of operations and safety of the Recommended Preferred Alternative (RPA), which is expected to be identified in early 2021. The IAPA report will be reflective of the future design year of 2045 (while the design year for the DEIS reflected 2040), interim year (2027) analysis for the opening year of Phase 1, and revisions to the proposed managed lanes access points. The proposed managed lane access points continue to be refined as more detailed analyses are completed.

The IAPA for the MLS will document the information necessary to allow FHWA to make an informed decision regarding the potential impacts of a change in access. This document outlines the scope of work and assumptions for the traffic forecasting and analysis work in support of the IAPA.

3 SCOPE

As noted in the DEIS, the purpose of the MLS is to develop a travel demand management solution(s) that addresses congestion and improves trip reliability on I-495 and I-270 within the Study limits and enhances existing and planned multimodal mobility and connectivity. The Study's purpose is to address the following needs:

- Accommodate Existing Traffic and Long-Term Traffic Growth – High travel demand from commuter, business, and recreational trips results in severe congestion from 7 to 10 hours per day on the Study corridors, which is expected to deteriorate further by the planning horizon year of 2040. Additional roadway capacity is needed to address existing and future travel demand and congestion, reduce travel times, and allow travelers to use the facilities efficiently.

- Enhance Trip Reliability – Congestion on I-495 and I-270 results in unpredictable travel times. Travelers and freight commodities place a high value on reaching their destinations in a timely and safe manner, and in recent years, the Study corridors have become so unreliable that uncertain travel times are experienced daily. More dependable travel times are needed to ensure trip reliability.

- Provide Additional Roadway Travel Choices – Travelers on I-495 and I-270 do not have enough roadway options for efficient travel during extensive periods of congestion. Additional roadway management options are needed to improve travel choices, while retaining the general-purpose (GP) lanes.

- Accommodate Homeland Security – The National Capital Region is considered the main hub of government, military, and community installations related to homeland security. These agencies and installations rely on quick, unobstructed roadway access during a homeland security threat. Additional capacity would assist in accommodating a population evacuation and improving emergency response access should an event related to homeland security occur.

- Improve Movement of Goods and Services – I-495 and I-270 are major regional transportation networks that support the movement of passenger and freight travel within the National Capital Region. Existing congestion along both corridors increases the cost of doing business due to longer travel times and unreliable trips. The effects of this congestion on the movement of goods and services is a detriment to the health of the local, regional, and national economy. Efficient and reliable highway movement is necessary to accommodate passenger and freight travel, moving goods and services through the region.

Additional roadway capacity and improvements to enhance reliability must be financially viable. MDOT's traditional funding sources would be unable to effectively finance, construct, operate, and maintain improvements of this magnitude. Revenue sources that provide adequate funding, such as pricing options, are needed to achieve congestion relief and address existing high travel demand.

The preparation of the Environmental Impact Statement is being closely coordinated among MDOT SHA, FHWA, and the following agencies:

- US Army Corp of Engineers (USACE) Baltimore District
- US Environmental Protection Agency (EPA)
- National Park Service (NPS)
- National Capital Planning Commission (NCPC)
- Maryland Department of the Environment (MDE)
- Maryland Department of Natural Resources (MDNR)
- Virginia Department of Transportation (VDOT)
- Maryland-National Capital Park and Planning Commission (M-NCPPC)

The DEIS, published in July 2020, considered six Build alternatives and the No Build alternative. The RPA is expected in early 2021 after completion of and consideration of comments received from the DEIS comment period.

4 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.*

The IAPA will address both policy points. Traffic operational analyses will be performed and documented in the IAPA. Details of the scope of the operational analyses are summarized in Section 7. Existing crash data will be summarized and both a qualitative and quantitative safety analysis will be performed to document the anticipated safety impacts of the proposed interchange. Details of the scope of the safety analyses are summarized in Section 8.

The MLS maintains all existing traffic movements at all existing interchanges. The MLS also adds managed lanes access to multiple interchanges, including three new proposed interchanges that will provide access to the managed lanes only (Figure 3). The methodology and assumptions for the operational analyses of these interchanges are summarized in Section 7. A conceptual signing plan depicting all major guide signs will be prepared and included in the IAPA. Design exceptions will be identified and provided in the IAPA.

The IAPA will comply with MDOT SHA's "Interstate Access Point Approval Process for the Maryland Department of Transportation State Highway Administration" (July 2017).

5 STUDY ASSUMPTIONS

During the NEPA process, a model was developed with defined geographical limits. As the MLS is considering improvements along I-495, I-270, and its interchanges, the model development began with determining the limits of these freeways to be included. This model will be used in the IAPA.

The Existing and No Build interchange locations are shown in Figure 4. Existing lane configurations for I-495 and I-270 are described in Tables 1 and 2, respectively. This list includes the Existing locations of HOV lanes and CD lanes. The Existing locations of the HOV lanes, as well as CD lanes, are shown in Figure 5. A list of interchanges with proposed Managed Lane access and proposed changes to General Purpose Lane access is included in Table 3.

VISSIM models will be used to provide operational analysis results for freeways, ramps, and ramp junction intersections. Synchro will be used to develop the signal timing and phasing for input into the future-year VISSIM models. This analysis will be supplemented with Synchro analysis of the ramp junction intersections and their adjacent intersections.

Figure 3: I-495 and I-270 MLS Access Locations

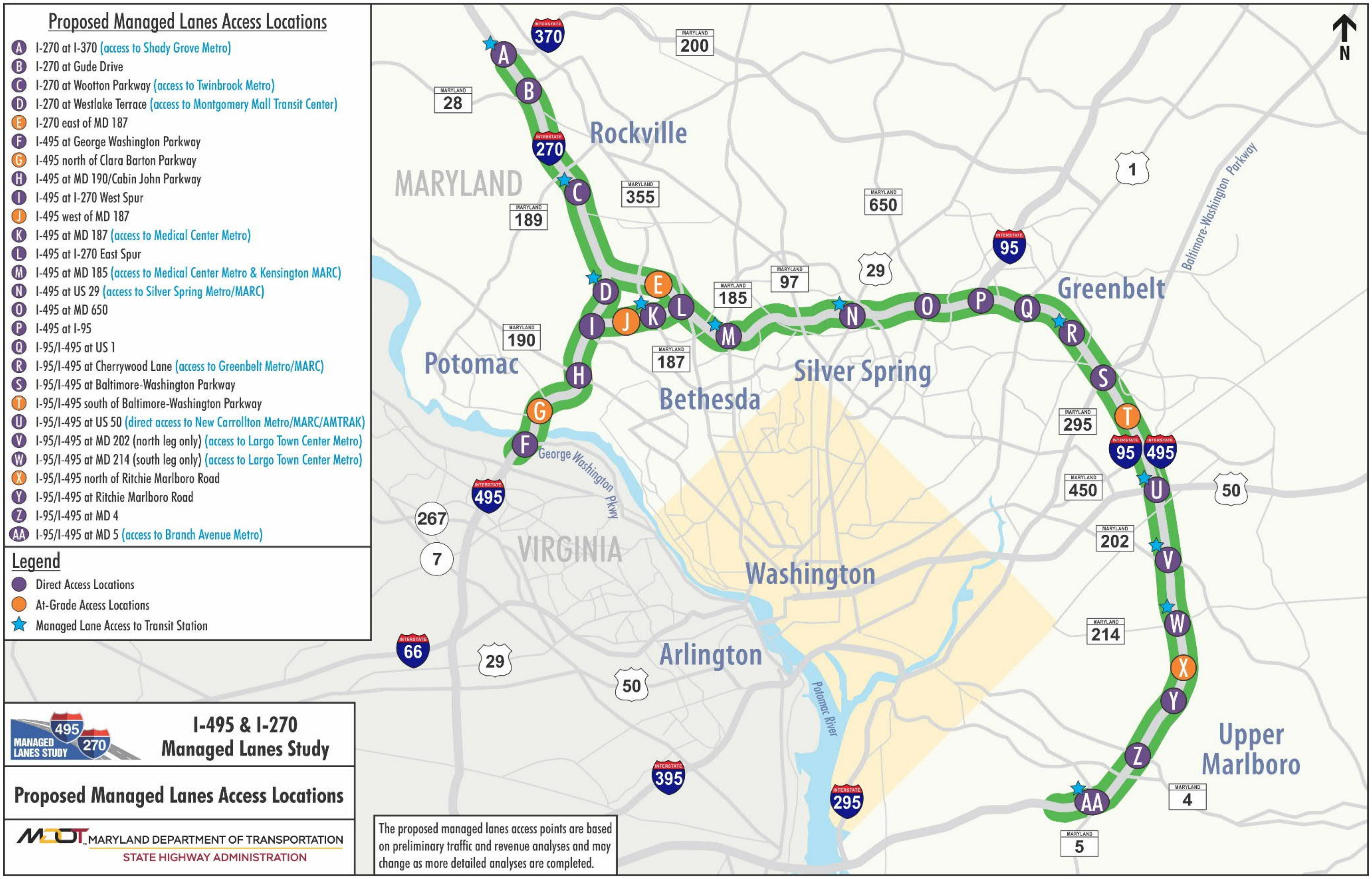


Figure 4: Limits of Traffic Model Network and Interchange Locations Included along I-495 and I-270 (Existing and No Build)

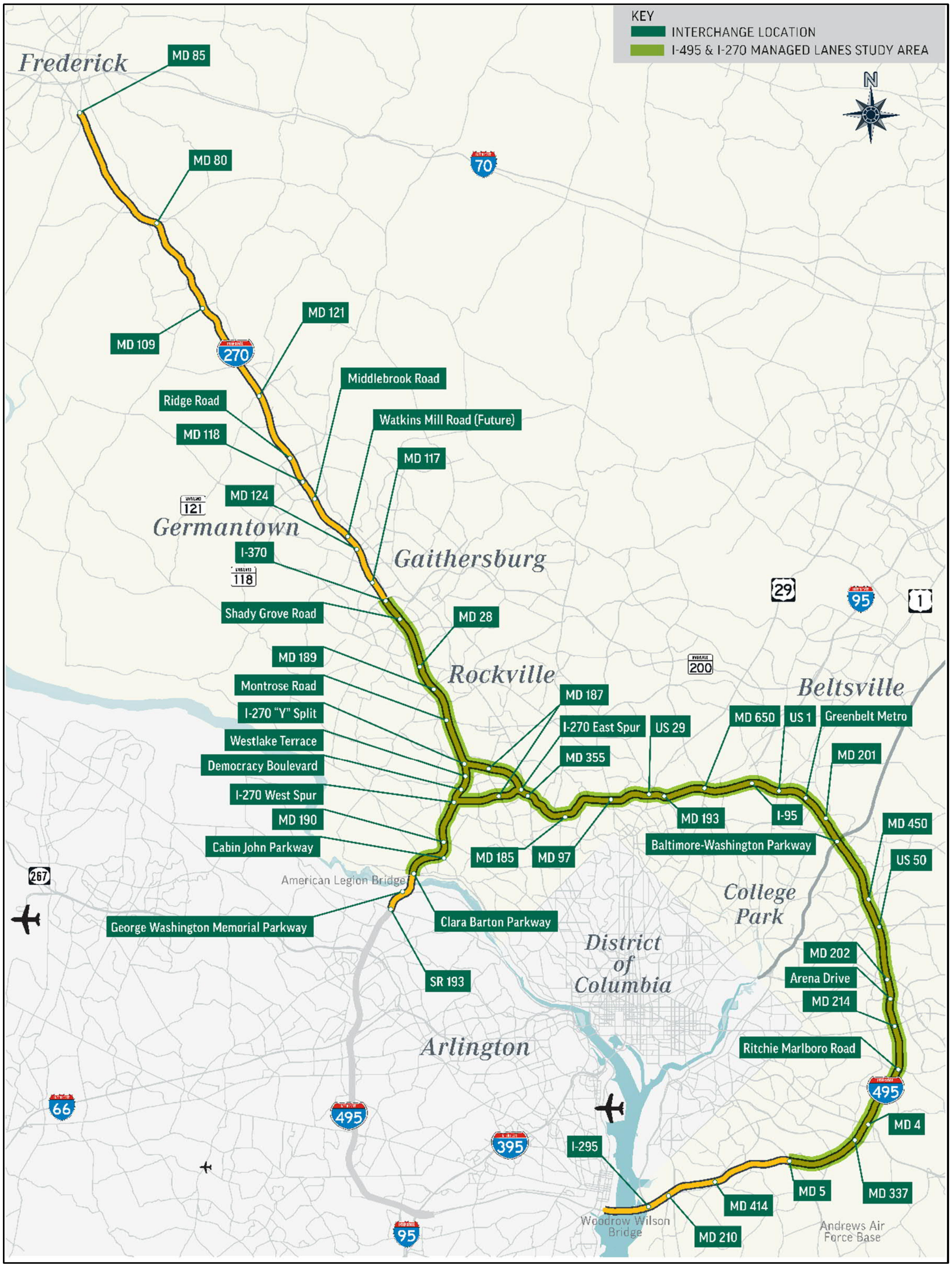


Table 1: I-495 Interchanges and Lane Configurations Included in Model (Existing)

Segment		# Lanes	
From	To	Inner Loop	Outer Loop
VA 193	George Washington Memorial Pkwy	4 + 1 aux	4 + 3 CD
George Washington Memorial Pkwy	Clara Barton Pkwy	4 + 1 aux	4 + 1 aux
Clara Barton Pkwy	Cabin John Pkwy	4	4
Cabin John Pkwy	MD 190	4	4
MD 190	I-270 West Spur	5	5
I-270 West Spur	MD 187	3	3
MD 187	I-270 East Spur/MD 355	3	3
I-270 East Spur/MD 355	MD 185	4	4
MD 185	MD 97	4	4
MD 97	US 29	4	4
US 29	MD 193	4 + 1 aux	4
MD 193	MD 650	4	4 to 5
MD 650	I-95	4 + 1 aux	5 + 1 aux
I-95	US 1	4 + 2 CD	4 + 2 aux
US 1	Greenbelt Metro	4	4
Greenbelt Metro	MD 201	4	4
MD 201	Baltimore-Washington Pkwy	4	4 + 1 aux
Baltimore-Washington Pkwy	MD 450	4	4
MD 450	US 50	4	4 + 1 aux
US 50	MD 202	4 to 3 + 2 CD + 1 aux	4 to 3 + 2 CD + 1 aux
MD 202	Arena Drive	3 + 2 CD + 1 aux	3 + 2 CD + 1 aux
Arena Drive	MD 214	4 + 1 aux	4 + 1 aux
MD 214	Ritchie Marlboro Road	4	4
Ritchie Marlboro Road	MD 4	4	4
MD 4	MD 337	4	4
MD 337	MD 5	4	4
MD 5	MD 414	4	4
MD 414	MD 210	4	4
MD 210	I-295	2 + 3 CD	2 + 3 CD
I-295	Woodrow Wilson Bridge	2 + 3 CD	2 + 3 CD

Table 2: I-270 Interchanges and Lane Configurations Included in Model (Existing)

Segment		# Lanes	
From	To	Southbound	Northbound
North of Split			
MD 85	MD 80	2	2
MD 80	MD 109	2	2
MD 109	MD 121	2	2
MD 121	Father Hurley Boulevard	3	2 + 1 HOV*
Father Hurley Boulevard	MD 118	3 + 1 aux	2 + 1 HOV* + 1 aux
MD 118	Middlebrook Road	3	3 + 1 HOV*
Middlebrook Road	Watkins Mill Road (Future)	4	3 + 1 HOV*
Watkins Mill Road (Future)	MD 124	4	3 + 1 HOV*
MD 124	MD 117	4	3 + 1 HOV* + 2 CD
MD 117	I-370	5 to 4 + 2 CD	3 + 1 HOV* + 3 CD
I-370	Shady Grove Road	3 + 1 HOV* + 3 CD	3 + 1 HOV* + 3 CD
Shady Grove Road	MD 28	3 + 1 HOV* + 2 CD	3 + 1 HOV* + 3 CD
MD 28	MD 189	3 + 1 HOV* + 2 CD	3 + 1 HOV* + 2 CD
MD 189	Montrose Road	3 + 1 HOV* + 2 CD	3 + 1 HOV* + 2 CD
Montrose Road	I-270 Split	5 + 1 HOV*	5 + 1 HOV*
East Spur			
I-270 Split	MD 187	3 to 2 + 1 HOV*	3 to 2 + 1 HOV*
MD 187	I-495	2 + 1 HOV*	2 + 1 HOV*
West Spur			
I-270 Split	Westlake Terrace	2 + 1 HOV*	2 + 1 HOV*
Westlake Terrace	Democracy Boulevard	2 + 1 HOV*	2 + 1 HOV*
Democracy Boulevard	I-495	3	3

**HOV lanes are in service from 6:00-9:00 AM Southbound and 3:30-6:30 PM Northbound on weekdays; lanes are for general purpose during other times*

Figure 5: Locations of High Occupancy Vehicle (HOV) and Collector-Distributor (CD) Lanes (Existing)

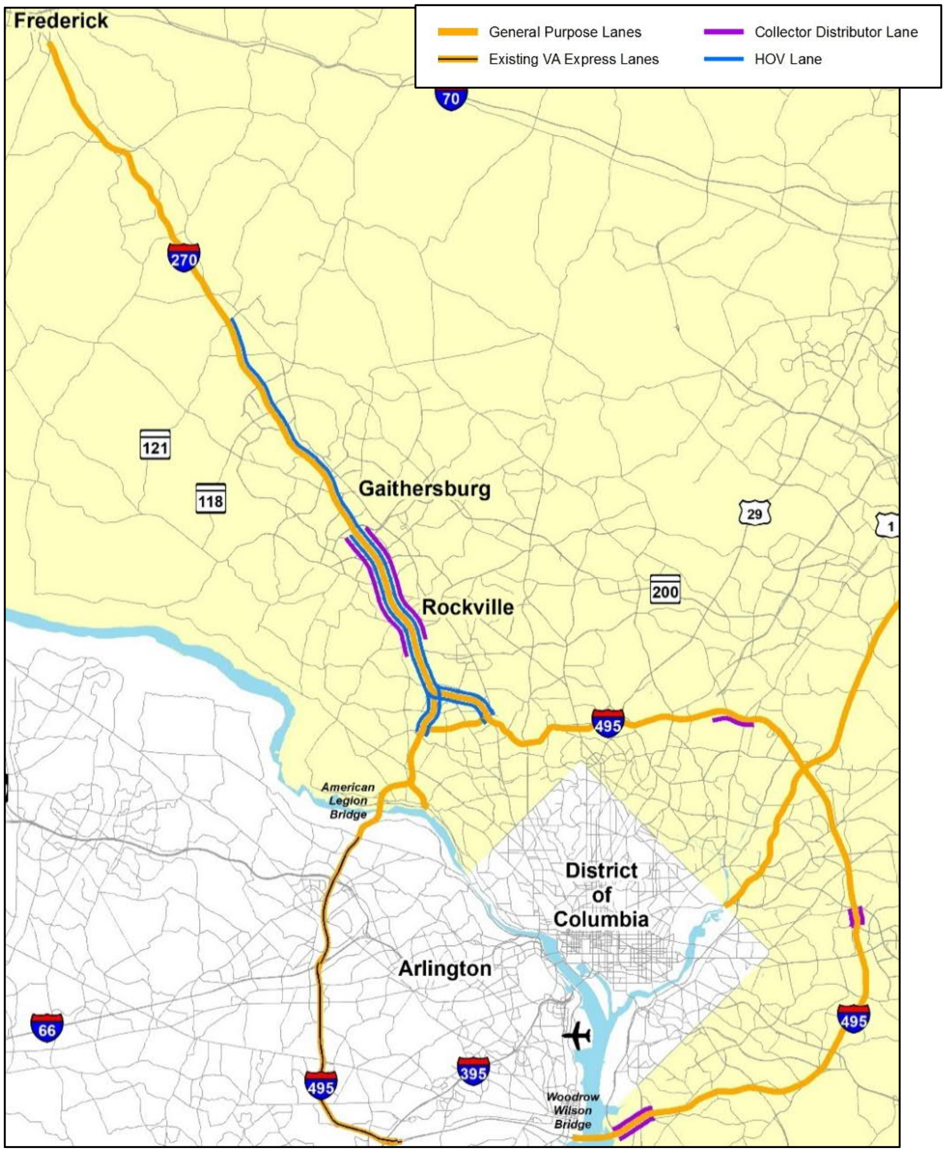


Table 3: Proposed Managed Lane Access and General Purpose Lane Access Changes

Interchange No.	Interchange Description	Proposed Managed Lanes Access	Proposed General Purpose Lanes Access
1	I-270 at MD 117	None	No change
2	I-270 at I-370	Full	No change
3	I-270 at Shady Grove Road	None	No change
4	I-270 at Gude Drive (new interchange)	Full	No change (no GPL access provided)
5	I-270 at MD 28	None	No change
6	I-270 at MD 189	None	No change
7	I-270 at Wootton Parkway (new interchange)	Full	No change (no GPL access provided)
8	I-270 at Montrose Road	None	No change
9	I-270 at I-270 Spur (Y-Split)	Full	No change
10	I-270 at Westlake Terrace	Full	Existing ramps to/from HOV lanes to/from the North replaced by ramps to/from MLs
11	I-270 at Democracy Boulevard	None	No change
12	I-270 at Rockledge Drive / MD 187	None	No change
13	I-270 east of MD 187	At-grade ramps from ML to GP EB and from GP to ML WB	No change
14	I-495 at VA 193	None	No change
15	I-495 at George Washington Memorial Parkway	Full	No change
16	I-495 with Clara Barton Parkway	None	No change
17	I-495 at MD 190 / Cabin John Parkway	Full	Replace loop ramp from MD 190 WB to I-495 Outer Loop with directional ramp and relocate directional ramp from MD 190 EB to I-495 Outer Loop to signal
18	I-495 at I-270 West Spur	Full	No change
19	I-495 west of MD 187	At-grade ramps from ML to GP EB and from GP to ML WB	No change
20	I-495 at MD 187	Full	Interchange reconfigured to a SPUI to provide access to/from GPLs and MLs via the same ramps

Table 3: Proposed Managed Lane Access and General Purpose Lane Access Changes (Continued)

Interchange No.	Interchange Description	Proposed Managed Lanes (ML) Access	Proposed General Purpose Lanes (GPL) Access
21	I-495 at I-270 East Spur / MD 355	Full access between I-495 and the I-270 East Spur; no direct ML access to MD 355	Convert ramp from NB MD 355 GP to I-495 Outer Loop GP from left-side on-ramp to right-side on-ramp
22	I-495 at MD 185	Full	No change
23	I-495 at MD 97	None	Replace all three loop ramps with directional ramps
24	I-495 at US 29	Full	Replace all three loop ramps with directional ramps; add movement from I-495 Outer Loop to US 29 NB
25	I-495 at MD 193	None	Replace both loop ramps with directional ramps; add movement from MD 193 SB to I-495 Outer Loop
26	I-495 at MD 650	Full	Replace loop ramps from MD 650 SB to I-495 Inner Loop and from I-495 Inner Loop to MD 650 NB with directional ramps and signalize, relocate directional ramp from MD 650 NB to I-495 Inner Loop to signal
27	I-495 at I-95	Full	Convert flyover ramp NB from Park and Ride to I-495 Outer Loop to loop ramp
28	I-495 at US 1	Full	No change
29	I-495 at Greenbelt Station / Cherrywood Lane	Full	Add ramps from I-495 Outer Loop to Greenbelt Metro Dr and from Greenbelt Metro Dr to I-495 Inner Loop (included in the No Build)
30	I-495 at MD 201	None	No change
31	I-495 at Baltimore Washington Parkway (MD 295)	Full	No change

Table 3: Proposed Managed Lane Access and General Purpose Lane Access Changes (Continued)

Interchange No.	Interchange Description	Proposed Managed Lanes (ML) Access	Proposed General Purpose Lanes (GPL) Access
32	I-495 south of Baltimore Washington Parkway (MD 295)	At-grade ramps (ML to GPL access on the inner loop; GPL to ML access on the outer loop)	No change
33	I-495 at MD 450	None	No change
34	I-495 at US 50/Pennsy Drive	Full	No change
35	I-495 at MD 202	To/from north	No change
36	I-495 at Arena Drive	None	No change
37	I-495 at MD 214	To/from south	No change
38	I-495 north of Ritchie Marlboro	At-grade ramps (GPL to ML access on the inner loop; ML to GPL access on the outer loop)	No change
39	I-495 at Ritchie Marlboro	Full	No change
40	I-495 at MD 4	Full	Replace all four loop ramps with directional ramps
41	I-495 at MD 337 / Suitland Road	None	No change
42	I-495 at MD 5	To/from east	No change
43	I-495 at MD 414	None	No change

5.1 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. Collector-Distributor (CD) lanes are present along the Inner Loop from I-95 to US 1, 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.

5.2 I-270 DESCRIPTION

I-270 is a 35-mile freeway (including the I-270 Spur) that runs from I-495 to the southeast of 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. 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 CD 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 CD 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 CD 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.

5.3 CORRIDOR MODELING LIMITS

While the MLS limits extend 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, as previously shown in Figure 1, 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 Study area. 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.

5.4 TRAFFIC DATA COLLECTION

5.4.1 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 IAPA, 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.

5.4.2 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.

5.4.3 Travel Times and Speeds

INRIX speed and travel time data was provided by the Regional Integrated Transportation Information System (RITIS) for segments along both I-495 and I-270 for the month of May 2017 on Tuesdays, Wednesdays, and Thursdays. The speed and travel time data were averaged across all days, and any outliers caused by atypical issues were excluded.

5.4.4 Field Observations

Field observations were conducted during the peak periods along the adjacent arterials. 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.

5.5 ANALYSIS YEARS AND BACKGROUND PROJECTS

The opening year for Phase 1 of the MLS is anticipated to be 2027, and the design year for full MLS Build is 2045. The IAPA will include analysis of both Phase 1 and the full MLS. Traffic analysis will be performed for No Build and Phase 1 Build for 2027 within the Phase 1 limits. Traffic analysis will be performed for No Build, Phase 1, and full MLS Build for 2045.

The 2027 and 2045 analysis years assume completion of the following projects that are proposed or under construction in the area:

- I-270 Innovative Congestion Management (ICM) Improvements[3]: 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. Some of these improvements were completed in 2019, with the remaining improvements scheduled to be completed by Summer 2021. The proposed improvements of the I-270 ICM initiative are shown in Figure 6.
- I-270 at Watkins Mill Road Interchange[4]: a new interchange along I-270 at Watkins Mill Road, located north of the interchange at MD 124. Construction of this interchange was completed in June 2020.
- Greenbelt Metro Station Access Improvements: an MDOT SHA-proposed access improvements project at the Greenbelt Metro Station along I-495. The plans for these improvements are shown in Figure 7.
- VDOT I-495 Express Lanes Northern Extension (NEXT) Study[5]: VDOT is performing 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 has completed a draft Environmental Assessment which was released for public comment. Construction is anticipated to begin in 2021 and be completed by 2025.

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[3] https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=80
[4] https://mdot-sha-i270-watkins-mill-intrc-mo3515172r-maryland.hub.arcgis.com/
[5] http://www.495northernextension.org/

Figure 6: I-270 Innovative Congestion Management (ICM) Improvements

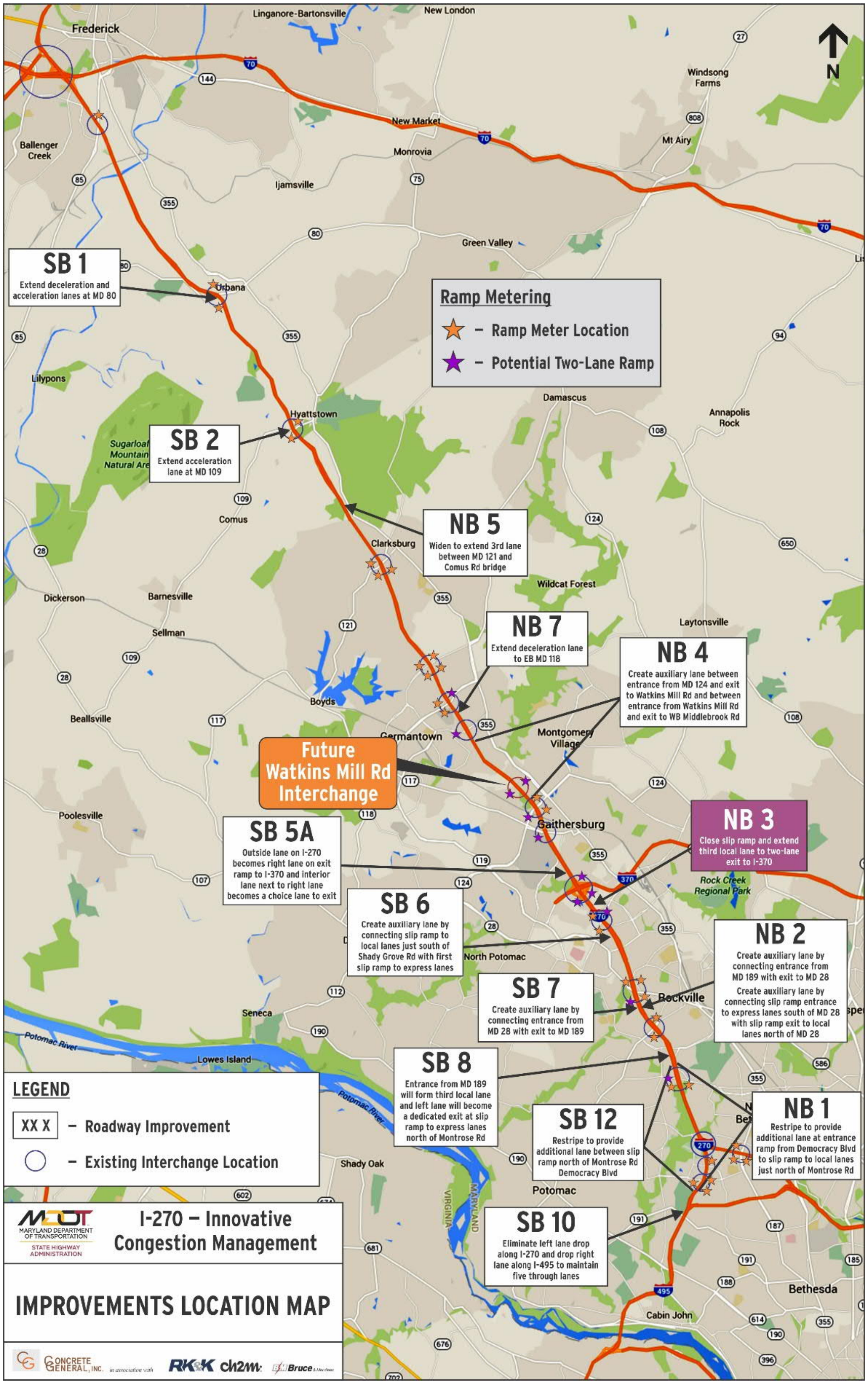
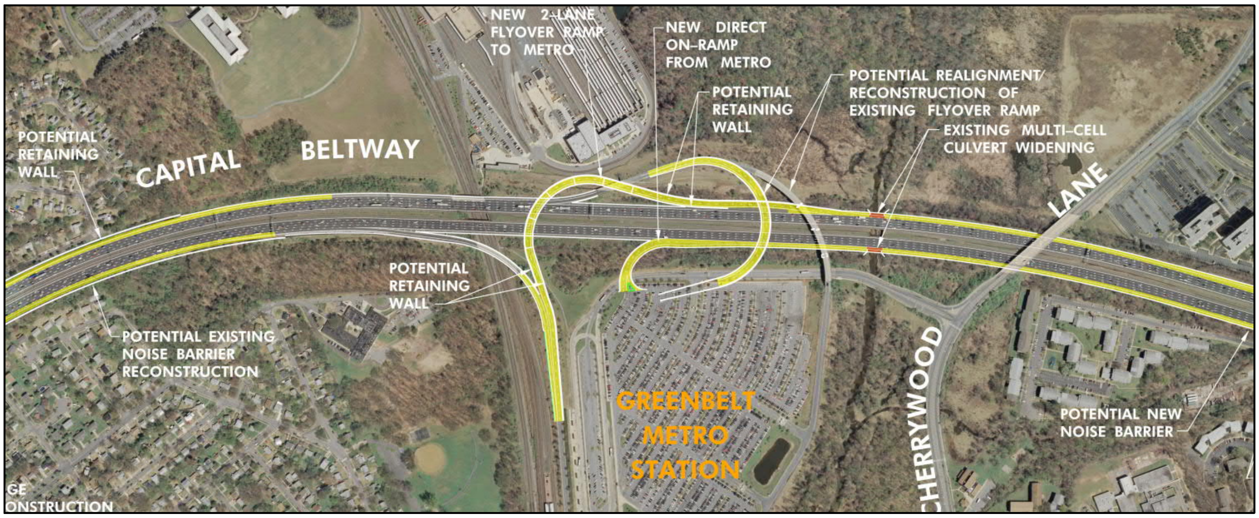


Figure 7: Greenbelt Metro Station Access Improvements



5.6 ANALYSIS SCENARIOS

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

- Existing Conditions (Year 2017)
- No Build Conditions (Year 2027 and Year 2045): This scenario will include VDOT NEXT and all projects included in the Washington region's Visualize 2045 – Financially Constrained Long-Range Plan (CLRP), adopted by the Metropolitan Washington Council of Governments (MWCOG) – Transportation Planning Board (TPB) in 2018 that are planned to be constructed by 2027 and 2045, including those listed above.
- Phase 1 Build Conditions (Year 2027): This scenario includes the No Build improvements plus Phase 1 of the I-495 & I-270 MLS and assumes No Build conditions outside the MLS and Phase 1 limits.
- Phase 1 Build Conditions (Year 2045): This scenario includes the No Build improvements plus Phase 1 of the I-495 & I-270 MLS and assumes No Build conditions outside the MLS and Phase 1 limits.
- Full MLS RPA Build Conditions (Year 2045): This scenario includes the No Build improvements plus the I-495 & I-270 MLS RPA for the limits of the Study.

Lane diagrams for the proposed Phase 1 and Full MLS RPA Build Conditions are included in Appendix A.

5.7 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 will be 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. The operational analysis results will be summarized onto diagrams for these two peak hours.

6 TRAVEL DEMAND FORECASTING

The following is an overview of the methodology for the development of project forecasts for the I-495 & I-270 MLS. Forecasts are being developed for each of the scenarios listed in Section 5.6.

6.1 MWCOG MODEL

Regional travel demand models provide valuable insights and big-picture perspectives, helping to identify areas with anticipated growth, traffic impacts due to network changes and tolling policies, and corridors that will potentially require congestion mitigation. Since I-495 and I-270 in Maryland are the two most heavily traveled freeways in the National Capital Region, the study area's regional travel demand model will be used as the first step of the forecasting process.

6.1.1 MWCOG Model Assumptions

To provide consistency with regional planning efforts, the Metropolitan Washington Council of Governments (MWCOG) Travel Demand Forecasting Model, Version 2.3 Travel Model, Build 75 (adopted on October 17, 2018), also known as the Version 2.3.75 Travel Model Round 9.1 Cooperative Forecasts, will be used as the basis for the development of traffic forecasts for the IAPA. MWCOG previously conducted study area calibration and developed a modified model (Version 2.3.71) that was used for the analysis to support the DEIS. Modeling documentation confirmed that modifications and revisions from Version 2.3.71 were carried over into Version 2.3.75, which is the version of the model that will be used to develop traffic forecasts for the IAPA.

The official MWCOG model will be used, which MWCOG validates based on the user guide. The MWCOG validation memo is included in Appendix B. Validation is based upon the percent difference between estimated and observed volumes at the screenline level, and between link-level model estimates and observed counts.

For this reason, no further calibration will be conducted to maintain consistency with MWCOG practices and previous NEPA forecasting assumptions. Link and period level volumes from the MWCOG model will not be used directly for volume development. The regional travel demand model will be used solely to develop seed information and growth rates for input to the operational analysis.

6.1.2 MWCOG Base and Future Year Model Development

The MWCOG model will be used as a two-part process. First, core model runs will be conducted to capture regional behavior and impacts to the study area. Second, a post processor will be developed for the subarea extraction process to produce input data that reflected necessary details for the VISUM model analyses. Results from both the core model and post processor will be reviewed to ensure that results of the subarea extraction process reflected traffic assignment and trends of the core model runs.

Due to the magnitude and intricacy of the study area network, base year 2017 network adjustments will be made to improve the subarea extraction process and provide consistency with VISUM model details. These network changes will include interchange geometry refinements to improve traffic assignment and centroid connector placement to ensure proper trip loading to/from the traffic analysis zones (TAZs). For future year conditions, the same level of detail will be included. Additional network reviews will be conducted to confirm that future committed projects are reflected in the No Build models, as defined by the Constrained Long-Range Plan (CLRP) for the interim and design years. The Build modes will be developed by coding in the Recommended Preferred Alternative (RPA), which will include access point assumptions and expansion of the toll process to account for new links and connections outside of the CLRP assumptions.

Toll diversion for the build scenarios will be analyzed using a series of MWCOG origin-destination matrices results. These model results will distinguish toll eligible trips from non-toll eligible trips for each of the six vehicle classes. Toll eligible trips represent vehicles that are expected to access the managed lanes at some point during their trip, while non-toll eligible trips represent vehicles that are expected to conduct travels solely in general purpose lanes. MWCOG travel demand modeling accounts for many driver-related decisions during peak hour travels (e.g. toll costs, speed, capacity, distance, congestion, etc.), which will be reflected in the origin-destination matrices. After applying the appropriate calibration and growth adjustments, the MWCOG origin-destination matrices will be assigned to the VISUM network.

Through this process, input networks and trip tables will be produced for 2017 Existing, 2027 No Build, 2027 Phase 1 Build, 2045 No Build, 2045 Phase 1 Build, and 2045 RPA Build conditions for the VISUM analysis. Additional details will include:

- Subarea networks will reflect proper interchange configurations along the study corridors, including directional lanes, turn penalties, and ramp configurations
- Trip tables will be provided for four periods (i.e., AM, MID, PM, NT) for six different vehicle classes (i.e., SOV, HOV2, HOV3+, CMV, TRK, AIR)
- Trip tables will differentiate “toll eligible trips” for all six classes (i.e., those trips that would use one or more toll facilities for a portion of their trip)

6.2 VISUM MODEL DEVELOPMENT

A VISUM model (using PTV Visum 18) will be established to produce the daily, AM, and PM traffic volumes to streamline the process of reassigning traffic to the study roadway network at a more detailed and refined level than the MWCOG model that will be needed for the VISSIM microscopic operations analysis. The VISUM study area is extended beyond the VISSIM traffic analysis study area to account for potential shifts in traffic between competing roadways. The following sections provide further details regarding the development, calibration, and validation of the VISUM model.

6.2.1 VISUM Base Year Model Development

To develop the base year model, the Metropolitan Washington Council of Governments (MWCOG) model subarea network will be imported into VISUM and refined to include the detailed geometry of all roadways and intersections within the study area, including signalized intersections and key unsignalized intersections. Existing signal timing data provided by MDOT SHA will be coded into VISUM. Traffic Analysis Zones (TAZs) that serve multiple driveways/developments will be subdivided to ensure an accurate traffic assignment at the peak hour level. The MWCOG subarea origin-destination (O-D) matrices will be exported as AM and PM peak period matrices and used as a seed matrix for the initial VISUM traffic assignment, the starting point of the VISUM model development. The MWCOG matrices will be exported to align with the peak hour time periods. The MWCOG matrices will be aggregated appropriately for all vehicle classes to produce individual AM and PM peak hour assignments in VISUM.

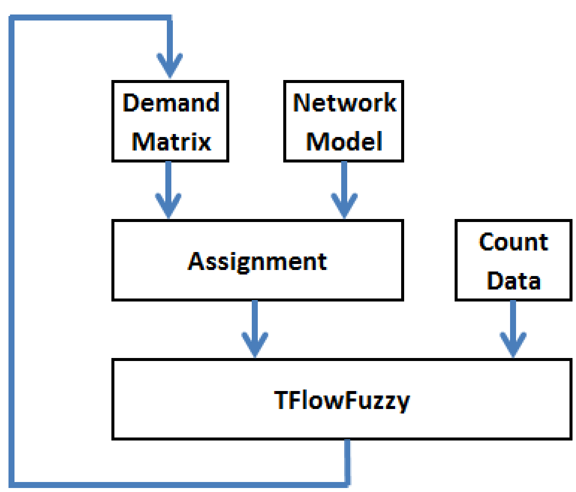
6.2.2 VISUM Model Calibration and Validation

Model calibration and validation refers to the process that confirms the model provides a reasonable approximation of reality (validation) and makes any adjustments to the model to bring it within desired validation targets (calibration). This ensures that the model accurately represents existing traffic conditions. Existing traffic count data will be the primary data used to assess the validity of the VISUM trip assignment. Field data, such as traffic control, signal timing, lane configurations, and travel speeds will be used as inputs into the model. All of these factors will be taken into consideration to produce a model that reflected realistic conditions and driver tendencies.

VISUM will be calibrated to match the existing link and turning movement volumes using its matrix estimation tool, TflowFuzzy. This built-in procedure adjusts the demand matrix so that its assignment results match observed traffic counts. The iterative process shown in Figure 8 will be used to estimate the peak hour O-D matrices using TflowFuzzy for the AM and PM peak periods.

For calibration purposes, target values will be established using industry standards in order to establish a calibrated model. The three main standards will include RMSE (root-mean-square-error), GEH (Geoffrey E. Havers statistic formula), and R^2 values. All three standards measure the differences between the traffic volumes predicted by a model and the traffic volumes that are observed and collected in the field. After calibration efforts are complete, all measures will fall within the acceptable targets.

Figure 8: VISUM Trip Assignment Iterative Process



6.2.3 VISUM Future Year Model Development

Following the validation of the base year 2017 VISUM model for the AM and PM peak hours, the future year VISUM model will be developed to establish the AM and PM peak hour forecasts for both 2045 No Build and Build conditions. To generate the future year VISUM model, the adjustments required for calibration of the base year scenario will also be applied to the future year trip tables generated from the MWCOG model. The peak hour correction matrices developed from the base year validation process will be applied to the future year trip tables. This process will be repeated for each of the six classes (i.e., SOV, HOV2, HOV3+, TRK, CMV, AIR) and all eight peak hours (i.e., 6 AM – 10 AM and 3 PM – 7 PM). The VISUM model network will be modified to reflect future committed projects as defined for the design year to establish the No Build models.

The 2045 forecasts will include a series of adjustments to maintain consistency with MDOT SHA volume projections and other studies provided by MDOT SHA Travel Forecasting and Analysis Division. Since the 2040 forecasts developed for the MLS modeling efforts reflect anticipated growth in key areas, the 2040 volume projections for the following arterials/interchanges will be taken into consideration: Watkins Mill, MD 124, MD 117, Middlebrook Road, MD 118, Greenbelt Metro, MD 201, US 1, and MD 121.

The No Build models will then be modified to incorporate the RPA lane configurations. A toll lane capacity of 1,700 vehicles/hour/lane will be assumed for the build scenarios to maintain consistency with previous 2040 forecasts developed for the DEIS. This threshold assumption was established since tolling prices are expected to be adjusted during the peak hours to maintain acceptable operating speeds on the toll lanes. Using a cost function to represent toll pricing in VISUM, toll volume refinements will be completed via an iterative process. Forecasts will be reviewed and adjusted to ensure that traffic projections in the general purpose and toll lanes generally align with MWCOG model trends without exceeding the established toll lane capacity. These finalized traffic volumes became the basis for VISSIM modeling efforts.

After coordination between MDOT and VDOT representatives, further volume adjustments will be made as necessary to ensure that future year forecasts are within an acceptable margin of error for travel demand forecasting at the American Legion Bridge (ALB) and the links immediately adjacent to the ALB. Forecasting efforts for MDOT and VDOT differed in terms of the starting-point (existing conditions volumes) and travel demand models. Therefore, the forecasting efforts will ensure that the 2045 traffic volumes in the vicinity of the ALB are consistent with VDOT 2045 forecasts, within 10 percent of throughputs at the ALB.

7 TRAFFIC OPERATIONAL ANALYSIS

7.1 VISSIM ANALYSIS

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

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

As part of the traffic analysis to support the DEIS, VISSIM models were developed using Version 10. These models include the peak periods of 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM and are reflective of existing geometry, traffic volumes, and 2017 speeds across all lanes, including High Occupancy Vehicle (HOV) and Collector-Distributor (CD) 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, a portion of the ICM improvements were implemented in 2019; however, many other ICM improvements, including ramp metering, will not be fully implemented until 2021. The MLS Traffic Technical Report provides the modeling methodologies and assumptions in detail[6].

Using the DEIS 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. 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 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. 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 C. Using the calibrated existing models as a base, the future (2027 and 2045) No Build and Build models will be developed to account for changes to the network that occur between the baseline and future years.

The AM and PM VISSIM microsimulation models both include 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 will be performed for each model scenario.

7.2 SYNCHRO CORRIDOR ANALYSIS

The VISSIM microsimulation model used in the Traffic Technical Report, which is part of the DEIS, did not include all of 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 cross streets were developed and calibrated to evaluate operations on the cross streets and to ensure operations along

[6] https://495-270-p3.com/wp-content/uploads/2020/07/APP-C_MLS_Traffic-Tech-Report-Appendices.pdf

cross streets 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 models were developed using Version 10.3. Arterial analysis including the adjacent intersections will be performed using Synchro for one adjacent intersection on arterials (on both sides) beyond service interchanges that are modified by the MLS, when within one mile. Additional intersections will be included where needed, such as where requested by FHWA, or where signals are closely spaced. Intersection delays and Level of Service (LOS) will be reported using the Highway Capacity Manual (HCM) 6th edition reports from Synchro in most cases, which are based on Chapter 19 of the HCM.

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 phasings were confirmed in the field and adjusted where needed to match field-recorded signal timings and phasings.

7.3 MEASURES OF EFFECTIVENESS

Analysis will be based on microsimulation results and HCM methodologies. Figure 9 and Table 4 show LOS criteria for freeways and ramps. Figure 10 shows an example of the Synchro analysis results for one interchange and its adjacent signals. Table 5 shows LOS criteria for signalized intersections, which is based on overall intersection delay. Table 6 shows LOS criteria for unsignalized intersections, which is based on the delay for the worst approach. Queues will be 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, will be provided. Per Federal Highway Administration's (FHWA) *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software (July 2004)*,

- Delay:
  - "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."
  - *Control delay from Synchro will be 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 will be 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, LOS will only be included with Synchro results.*
- Density
  - "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."

  - *As VISSIM does not report HCM-based LOS for density, LOS will be 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
  - "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."
  - *Average and maximum simulated queues from VISSIM will be reported. 50th and 95th percentile queue lengths from Synchro will be reported. It will be noted that 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 to be documented include the following:

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

Figure 9: Freeway Level of Service (LOS) (VISSIM) – Per HCM Exhibit 12-15

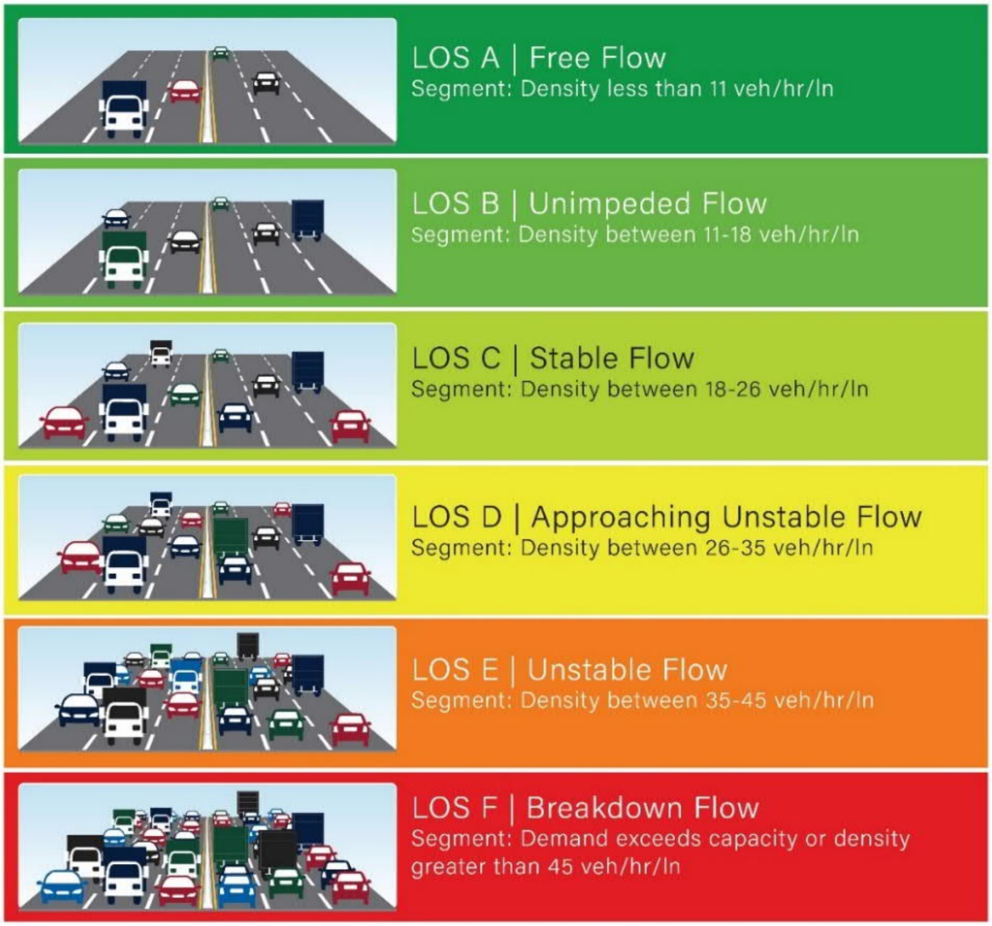


Table 4: Level of Service (LOS) Criteria – Freeways and Ramps (pc/hr/ln)

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 roadways.

Figure 10: Example Synchro Corridor Analysis Results

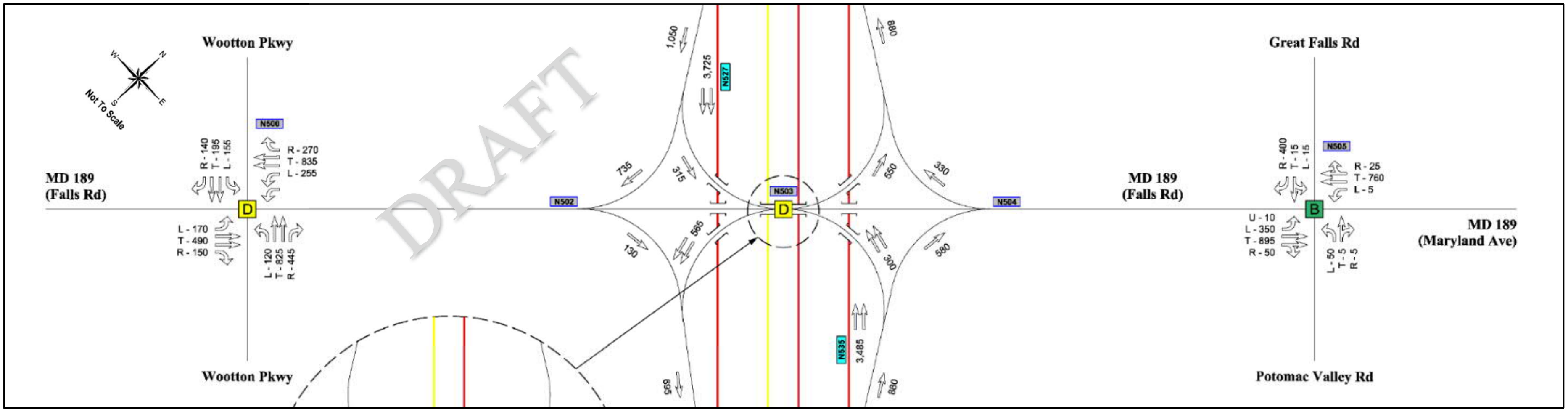


Table 5: Level of Service (LOS) Criteria for Signalized Intersections – Per HCM Exhibit 19-8

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

Table 6: 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 (slight delay)
C	> 15 – 25	Stable flow (acceptable delay)
D	> 25 – 35	Approaching unstable (tolerable delay)
E	> 35 – 50	Unstable flow (intolerable delay)
F	> 50	Forced flow (jammed)

8 SAFETY ANALYSIS

Both a qualitative and quantitative safety analysis will be performed to document the anticipated safety impacts of the proposed improvements in the RPA. The section will include evaluating existing crash data and performing predictive safety analysis. The safety analysis results will be presented in a tabular format for comparison of the existing crash data, and the expected crashes for the future (2027 and 2045) No Build, Phase 1 Build, and RPA Build scenarios.

8.1 EXISTING CRASH DATA REVIEW AND QUALITATIVE ANALYSIS

A review of the existing crash history (including frequency and rates per 100 million vehicle miles) will identify existing traffic safety concerns and evaluate qualitatively whether the RPA will help address these traffic safety concerns. The existing safety analysis will consist of the following:

- Obtaining historical crash data for a 3-year period (2016, 2017, 2018) on all freeway segments, ramps, ramp terminals, and crossing roadways from MDOT SHA's Office of Traffic and Safety (OOTS).
- Identifying general crash patterns (severity, type, etc.), Candidate Safety Improvement Locations (CSIL), and segments with crash rates that exceed the statewide average crash rates.
- Reviewing conceptual plans and identifying potential safety concerns and mitigation measures.
- Performing a qualitative assessment of the relative level of safety and potential safety impacts of the proposed improvements, using the existing crash data as a point for comparison.

8.2 QUANTITATIVE SAFETY ANALYSIS

Predictive safety analyses will be performed to quantitatively compare the total, fatal and injury, and Property Damage Only (PDO) crashes in the future No Build, Phase 1 Build, and RPA Build scenarios based on Part C of the Highway Safety Manual (HSM). This analysis will be completed for all freeway segments ramps along I-495, I-270, and the I-270 spurs, and ramp terminals and crossing roadways with direct access to the MLS. A brief summary of the assumptions for the predictive analysis is provided below.

Predictive safety analysis for freeway sections along I-270 and I-495 will consist of the following activities:

- General purpose sections and collector-distributor lanes will be evaluated using the Interstate Safety Analysis Tool enhanced (ISATe). It should be noted that the HSM Chapter 18 predictive analysis for freeways does not account for HOV Lanes. Also, the historical crash data available does not provide the level of detail needed to determine within which lane a crash occurred (for example: the HOV or GP lane on I-270). Therefore, it will be assumed that the HOV lanes operate similar to a GP lane in order to use the HSM predictive methods for the freeway sections. In addition, the proposed ramp metering along I-270 as part of the ICM project is anticipated to be in operation in the near future. This condition is assumed to be part of all the future No Build and Build scenarios. While Ramp Metering will likely have an overall influence on the future crash experiences, ramp metering is not included in the methodologies of Chapters 18 and 19 of the Highway Safety Manual.
- Sufficient crash data on managed lane operations relevant to the current study in Maryland is not available. Due to the similar characteristics of the I-495 Express Lanes in Northern Virginia, and

the close proximity to the Maryland MLS, it is assumed that the proposed managed lanes along I-270 and I-495 in Maryland will operate in a similar manner to the Express Lanes in Virginia, with the exception that the Maryland managed lanes will allow access to heavy vehicles. Therefore, MDOT SHA will be submitting a request to VDOT for their approval to obtain and use the Safety Performance Function (SPF) models developed for 495 NEXT project to compute the expected number of crashes for the managed lanes in MDOT's MLS. If used, consideration will be given to account for the potential difference in expected crashes due to the presence of heavy vehicles. If MDOT SHA is not able to obtain approval from VDOT to use the SPFs they developed for the Express Lanes, the MLS safety analysis for the managed lanes will be primarily qualitative.

Predictive safety analysis for ramps, ramp terminal intersections, crossing roadway sections, and adjacent intersections along crossing roadways with new or modified access to I-270, I-495, or the proposed managed lanes facilities will consist of the following activities:

- The Interchange Safety Analysis Tool (ISATe) will be used to develop crash predictions for the proposed ramps and ramp terminals at the new direct access ramps to and from the managed lanes and where existing general-purpose access is being modified. ISATe tool will not be used for analyzing the ramp terminals where no improvements are proposed.
- HSM Chapter 12 Computation Spreadsheets will be used to evaluate arterials and adjacent intersections. The Highway Safety Manual Part C – Chapter 12 spreadsheet cannot be used to analyze roadway sections and adjacent intersections for arterials that have six or more through travel lanes.
- For situations where the ISATe tool and the HSM Chapter 12 Computation Spreadsheets cannot be used due to the limitations associated with specific geometric conditions (such as those mentioned above), a ratio-based equation will be utilized to best estimate a proportional increase in crashes based on traffic volume shifts caused by the proposed MLS.

9 SCHEDULE

The current schedule is summarized below including major milestones; however, the schedule is subject to further revisions as the MLS proceeds.

- Notice of Intent to Initiate NEPA Study: Spring 2018
- Preliminary Range of Alternatives: Summer 2018
- Alternatives Analysis & Environmental Technical Analysis: Fall 2018 – Spring 2019
- Public Workshops: Spring 2019
- Development of Draft Environmental Impact Statement (DEIS): Summer 2019-Summer 2020
- DEIS Issuance: July 10, 2020
- Virtual and in-person public hearings: August/September 2020
- Draft IAPA: February 2021
- Publish Final Environmental Impact Statement (FEIS): Spring 2021
- Final IAPA: July 2021
- Public Record of Decision (ROD): Fall 2021

10 FUNDING PLAN

The I-495 & I-270 MLS is being delivered through multiple public-private partnership (P3) agreements. All P3 agreements will be revenue risk where the P3 Developer will provide all up-front equity and debt necessary to deliver the improvements and will be repaid by future toll revenues. While MDOT is funding the ongoing studies and development, no State funding contribution is expected to the delivery of Phase 1 of the MLS.

11 PROPOSED GEOMETRIC DESIGN STANDARDS AND ANTICIPATED DESIGN EXCEPTIONS OR WAIVERS

All elements of the MLS will be designed in accordance with AASHTO standards to the extent practical. As the RPA is developed, the need for design exceptions to the 10 controlling criteria will be identified and documented.

12 FINAL DESIGN APPROACH

It is anticipated that the P3 Developer, once selected and on-board with MDOT SHA, will need to revise and/or supplement the IAPA for MDOT SHA and FHWA approval to reflect the final design that may have modifications/refinements to the RPA – as routinely done under typical projects that have advanced from the preliminary to final design phase. In addition, the P3 Developer will establish the construction phasing and schedule to better inform the IAPA. This may include:

- Opening year analysis for subsequent phases of the MLS
- Refined safety and operational analyses
- Design exceptions
- Conceptual signing plans

MDOT SHA will complete any needed environmental documentation to support any revisions to the IAPA.

13 PROPOSED IAPA CONTENT

The IAPA content will satisfy the requirements of the FHWA guidelines set forth in FHWA's Policy on Access to the Interstate System (May 2017). The proposed report organization and table of contents for the IAPA will follow the following outline:

I. Executive Summary
II. Introduction
III. Methodology
IV. Existing Conditions
V. Alternatives Considered
VI. Roadway Geometry
VII. Traffic Volumes
VIII. Traffic Analysis
IX. Safety Analysis
X. Appendices

Accepted and agreed upon by the Maryland Department of Transportation State Highway Administration and Federal Highway Administration:

Jeffrey T. Folden

12/18/2020

Jeffrey T. Folden, P.E., DBIA
Deputy Director, I-495 & I-270 P3 Office
Maryland Department of Transportation State Highway Administration

Date

12/21/20

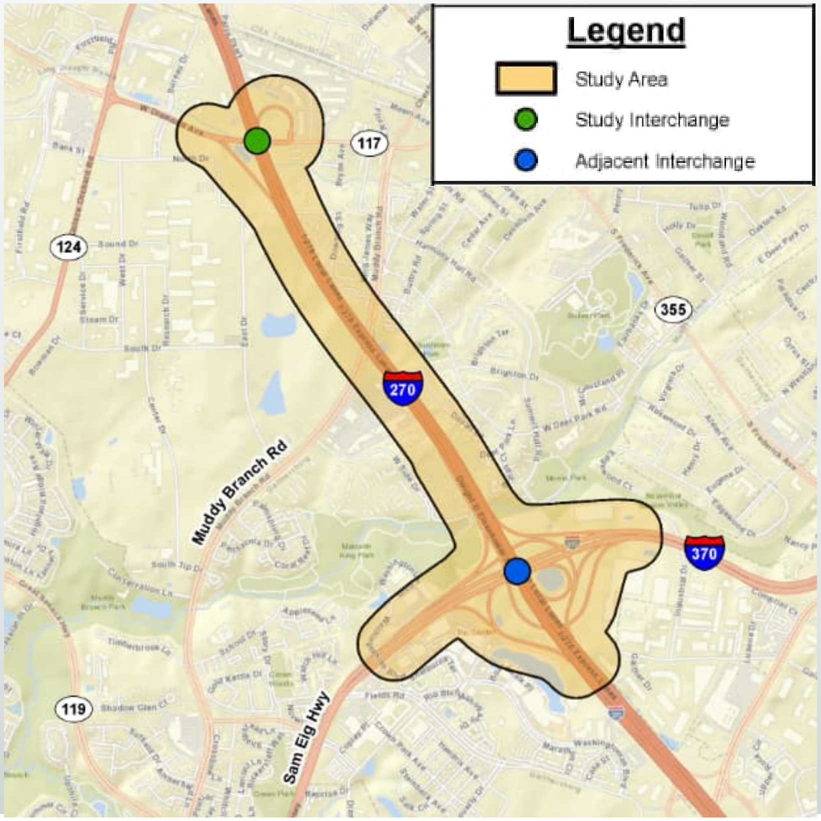
Keilyn Perez
Area Engineer (District 3 and LPA Coordinator)
Federal Highway Administration, Maryland Division

Date

MLS Areas of Influence

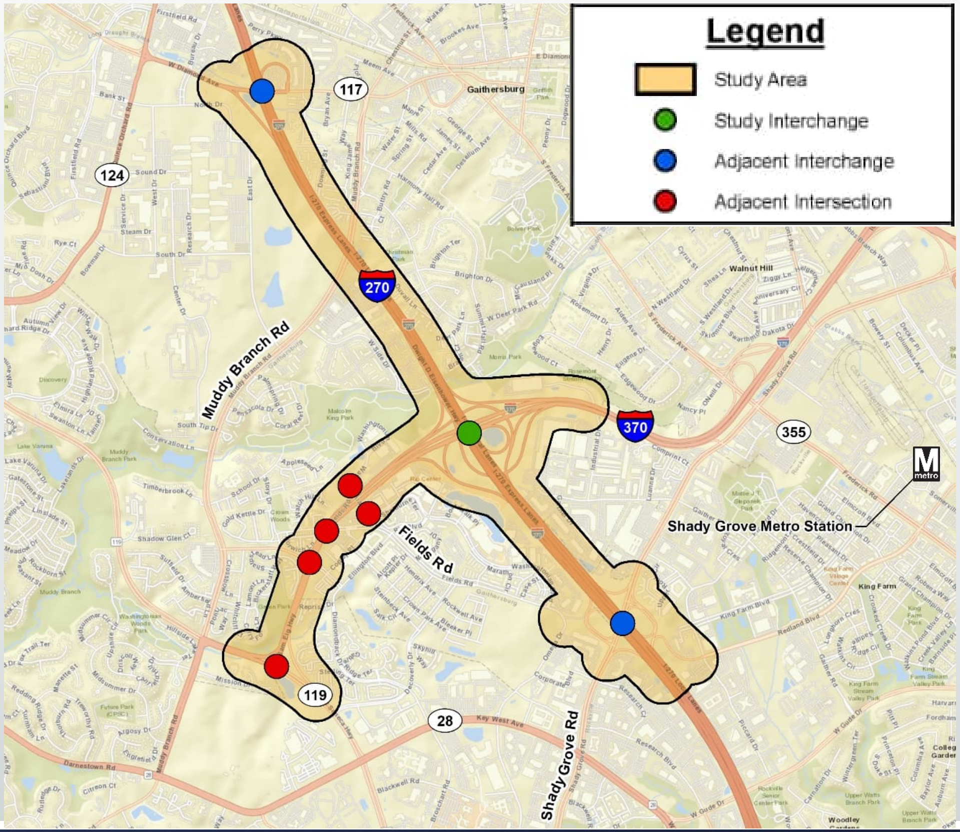
Area of Influence – I-270 at MD 117 Interchange

- One interchange north of MLS limits
- Adjacent I-270 Interchanges:
  - I-270 at I-370
  - No interchange to the north as Managed Lanes end south of MD 117



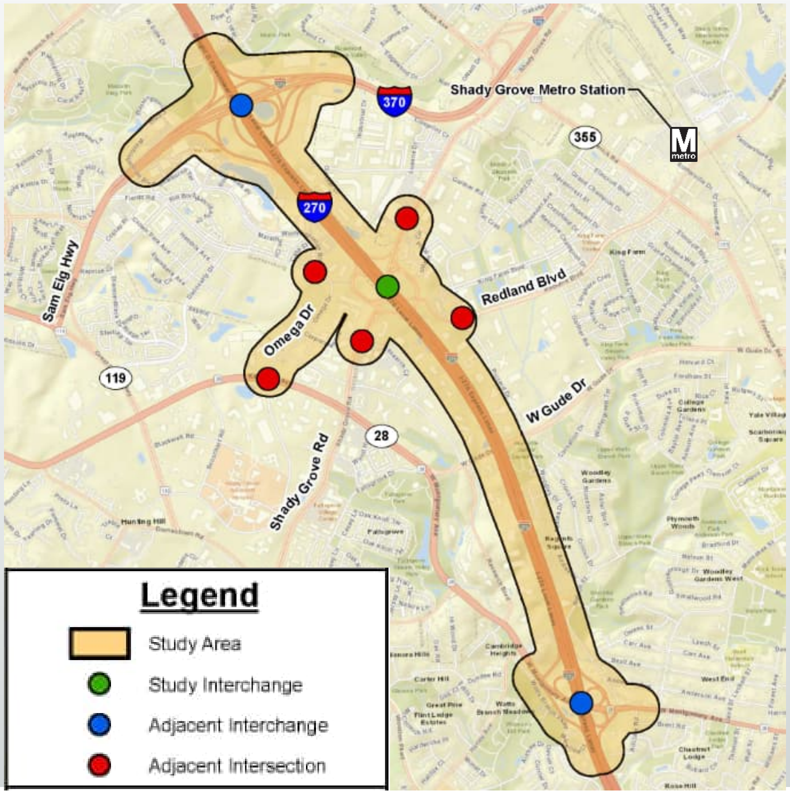
Area of Influence – I-270 at I-370 Interchange

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 117
  - I-270 at Shady Grove Rd
- Adjacent I-370 Intersections:
  - I-370 at Fields Rd
  - Washingtonian Blvd at I-370 EB Ramps
  - Washingtonian Blvd at I-270 EB Ramp
  - Sam Eig Hwy at Diamondback Dr
  - Sam Eig Hwy at MD 119



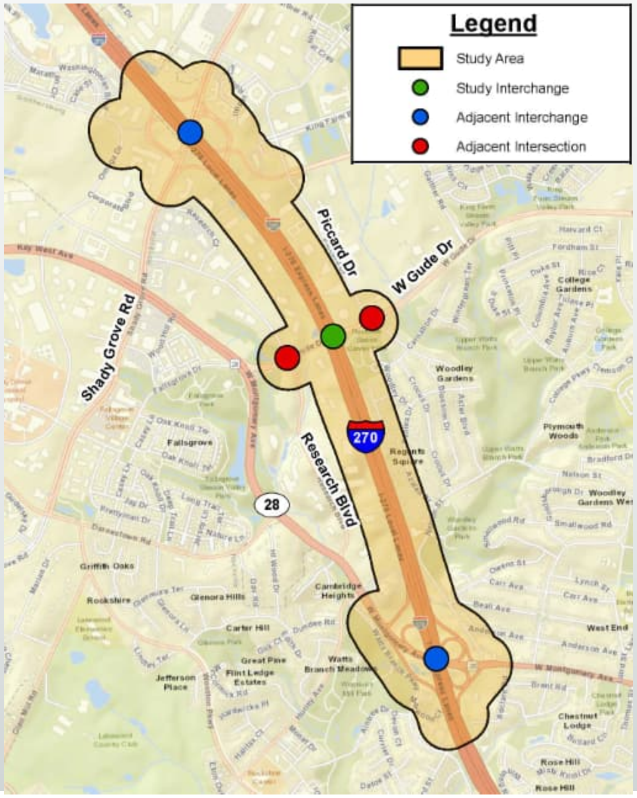
Area of Influence – I-270 at Shady Grove Rd Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at I-370
  - I-270 at MD 28
- Adjacent Shady Grove Rd Intersections:
  - Shady Grove Rd and Choke Cherry Rd
  - Shady Grove Rd and Corporate Blvd
  - Redland Blvd and Piccard Dr
  - Fields Rd and Washingtonian Blvd
  - Omega Dr and MD 28



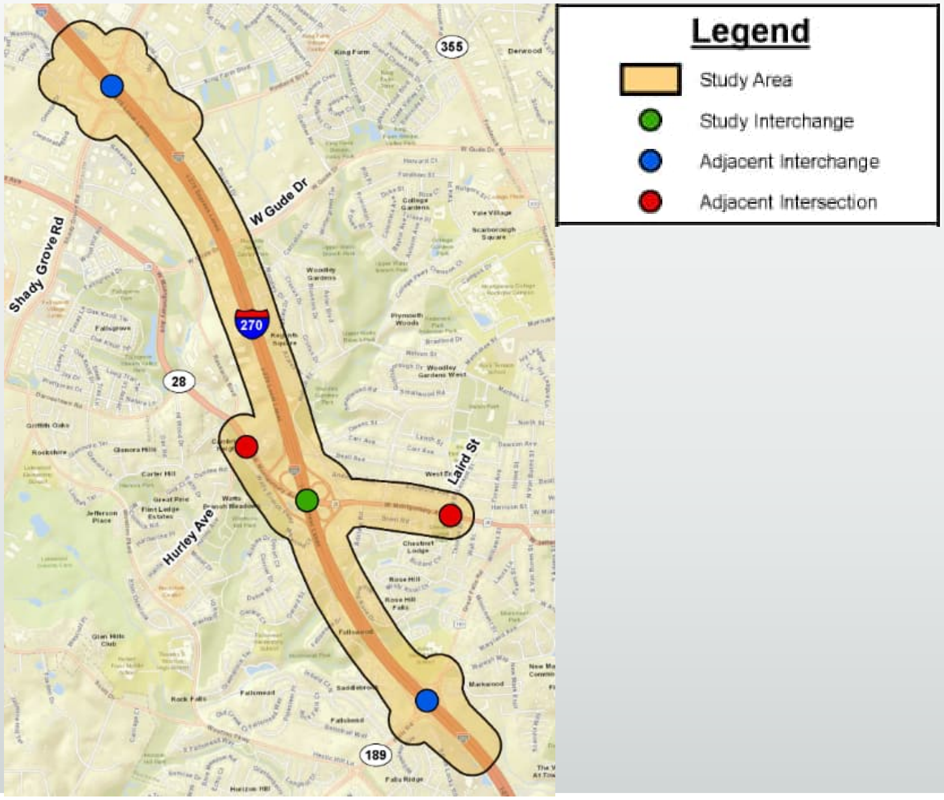
Area of Influence – I-270 at Gude Dr Interchange (future)

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at Shady Grove Rd
  - I-270 at MD 28
- Adjacent Gude Dr Intersections:
  - Gude Dr and Research Blvd
  - Gude Dr and Piccard Dr



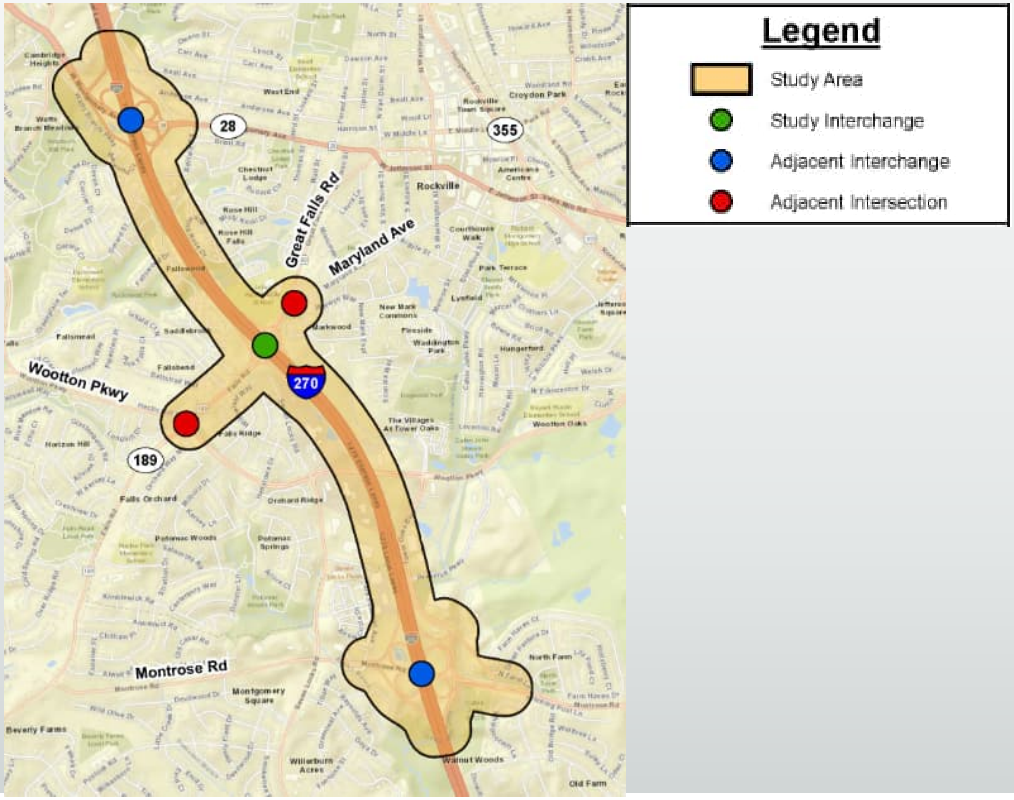
Area of Influence – I-270 at MD 28 Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at Shady Grove Rd
  - I-270 at MD 189
- Adjacent MD 28 Intersections:
  - MD 28 and Hurley Ave
  - MD 28 and Bullard Cir/Laird St



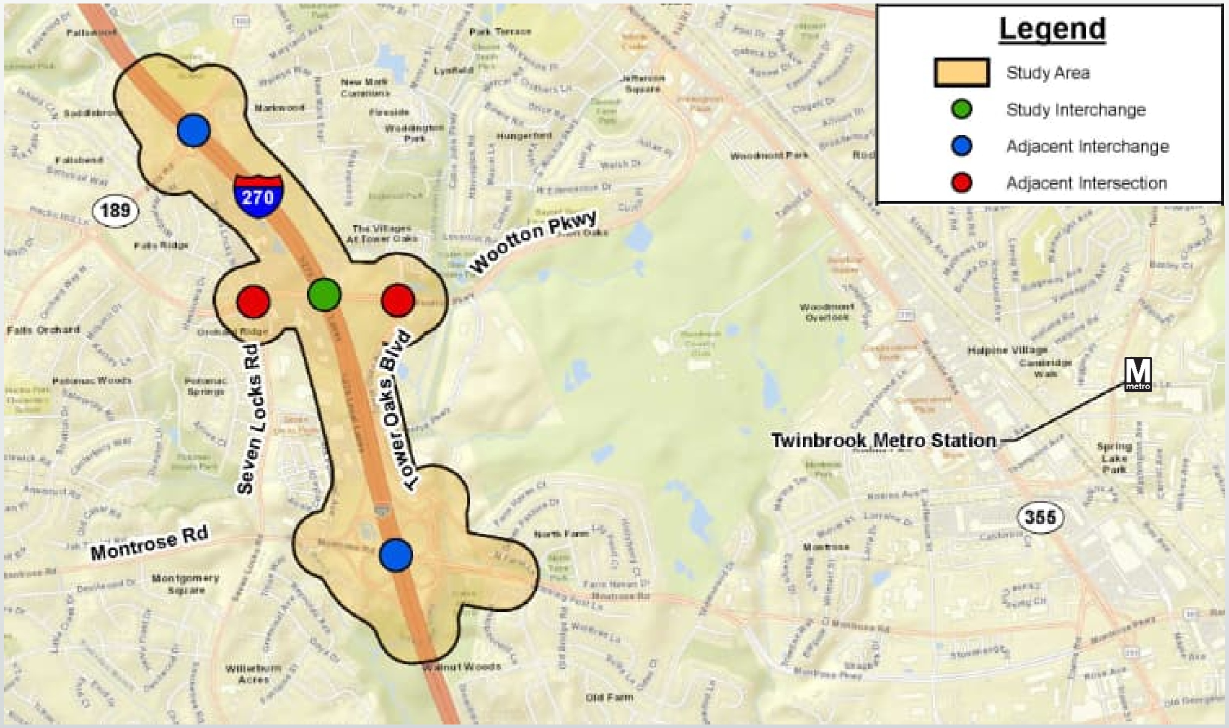
Area of Influence – I-270 at MD 189 Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 28
  - I-270 at Montrose Rd
- Adjacent MD 189 Intersections:
  - MD 189 and Wootton Pkwy
  - MD 189 and Great Falls Rd/Potomac Valley Rd



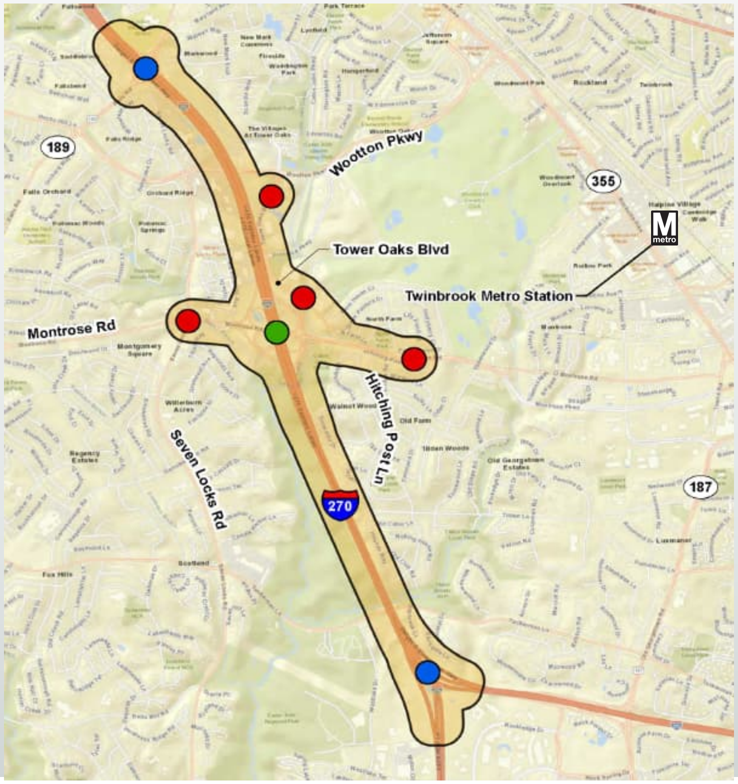
Area of Influence – I-270 at Wootton Pkwy Interchange (future)

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 189
  - I-270 at Montrose Rd
- Adjacent MD 189 Intersections:
  - Wootton Pkwy and Seven Locks Rd
  - Wootton Pkwy and Tower Oaks Blvd



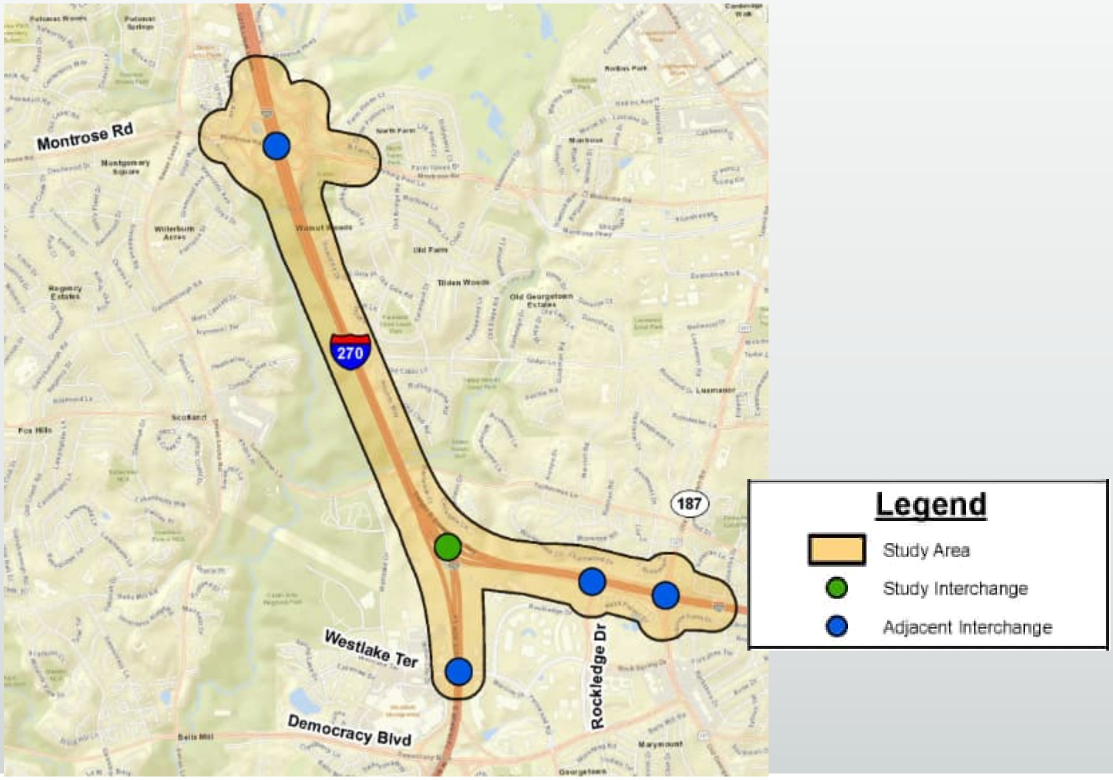
Area of Influence – I-270 at Montrose Rd Interchange

- No direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at MD 189
  - I-270 at I-270 Spur
- Adjacent Montrose Rd Intersections:
  - Montrose Rd and Seven Locks Rd
  - Montrose Rd and Hitching Post Ln/Farm Haven Dr
  - Tower Oaks Blvd and I-270 Northbound Ramps
  - Tower Oaks Blvd and Tower Oaks Tower Access Rd



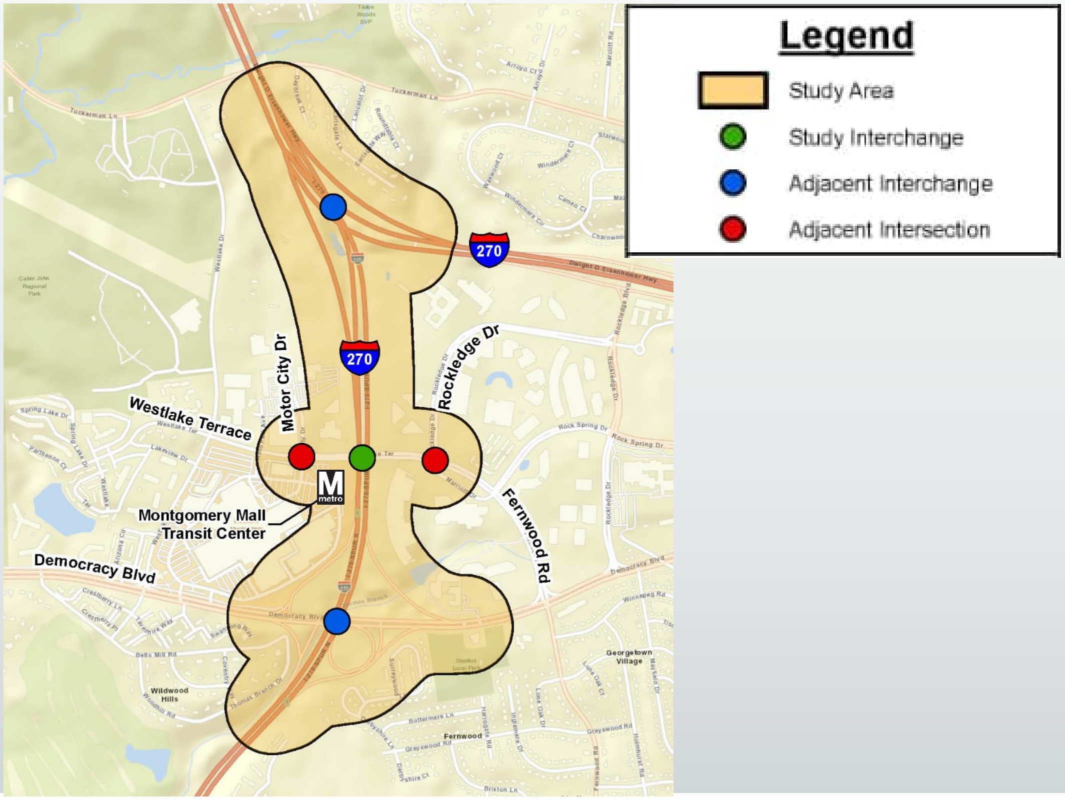
Area of Influence – I-270 at I-270 Spur ("Y Split")

- Direct access to managed lanes
- Adjacent I-270 Interchange:
  - I-270 at Montrose Rd
- Adjacent I-270 West Spur Interchange:
  - I-270 at Westlake Terrace
- Adjacent I-270 East Spur Interchange:
  - I-270 Spur at Rockledge Dr



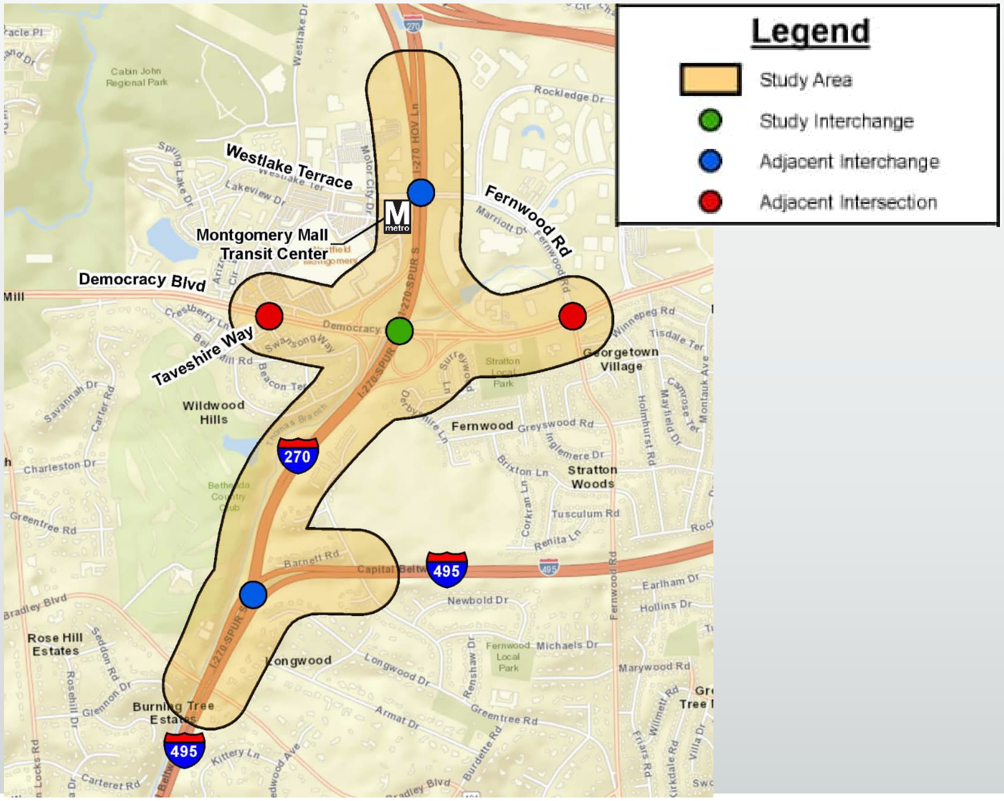
Area of Influence – I-270 (West Spur) at Westlake Terrace Interchange

- Direct access to managed lanes
- Adjacent I-270 Interchanges:
  - I-270 at I-270 Spur
  - I-270 West Spur at Democracy Blvd
- Adjacent Westlake Terrace Intersections:
  - Westlake Terrace and Motor City Dr
  - Westlake Terrace and Rockledge Dr



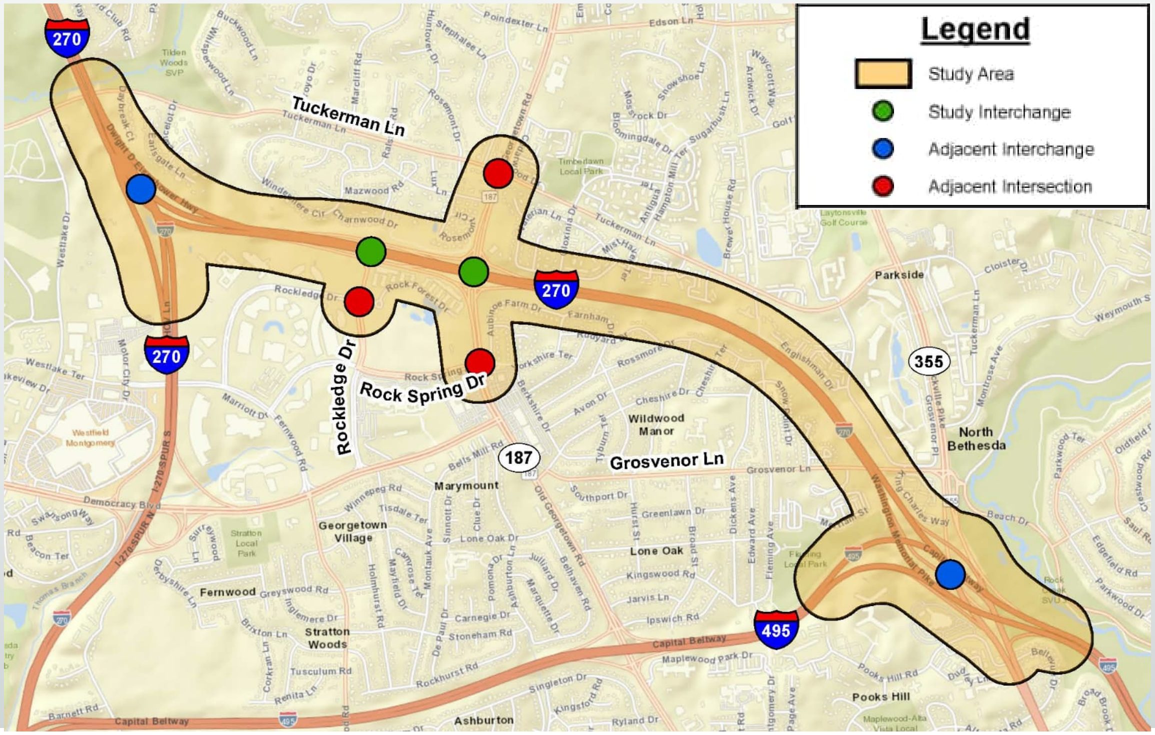
Area of Influence – I-270 West Spur at Democracy Blvd Interchange

- No direct access to managed lanes
- Adjacent I-270 West Spur Interchanges:
  - I-270 West Spur at Westlake Terrace
  - I-270 West Spur at I-495
- Adjacent Westlake Terrace Intersections:
  - Democracy Blvd and Taveshire Way
  - Democracy Blvd and Fernwood Rd



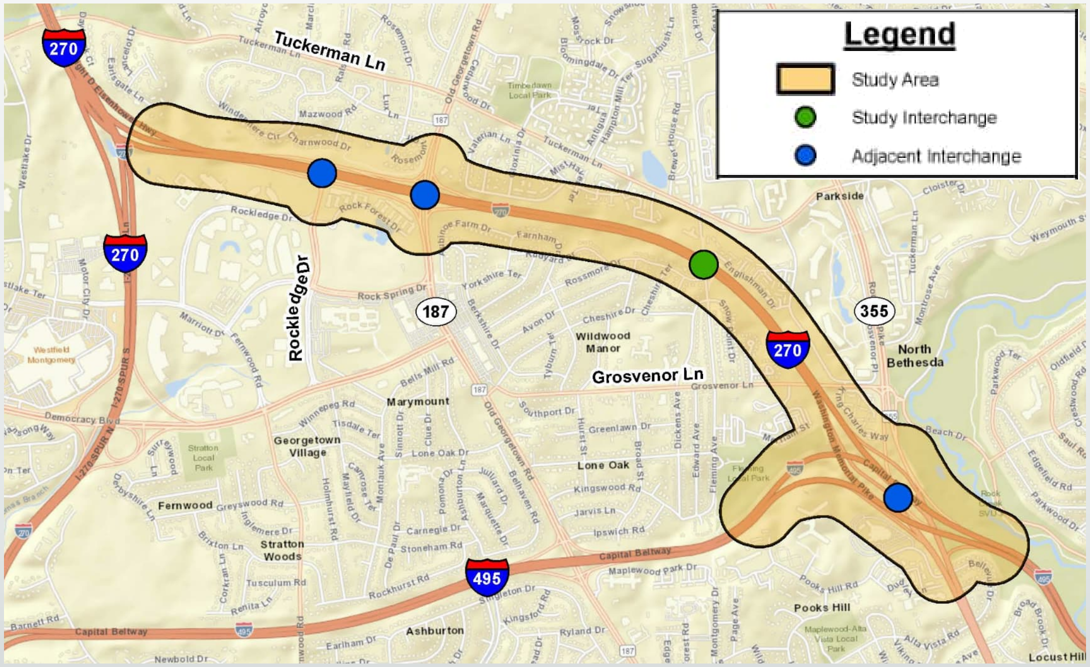
Area of Influence – I-270 East Spur at Rockledge Dr / MD 187 Interchange

- No direct access to managed lanes
- Adjacent I-270 East Spur Interchanges:
  - I-270 at I-270 Spur
  - I-270 East Spur / I-495 at MD 355
- Adjacent Intersections:
  - Rockledge Dr and Rockledge Blvd
  - MD 187 and Tuckerman Ln
  - MD 187 and Rock Spring Dr



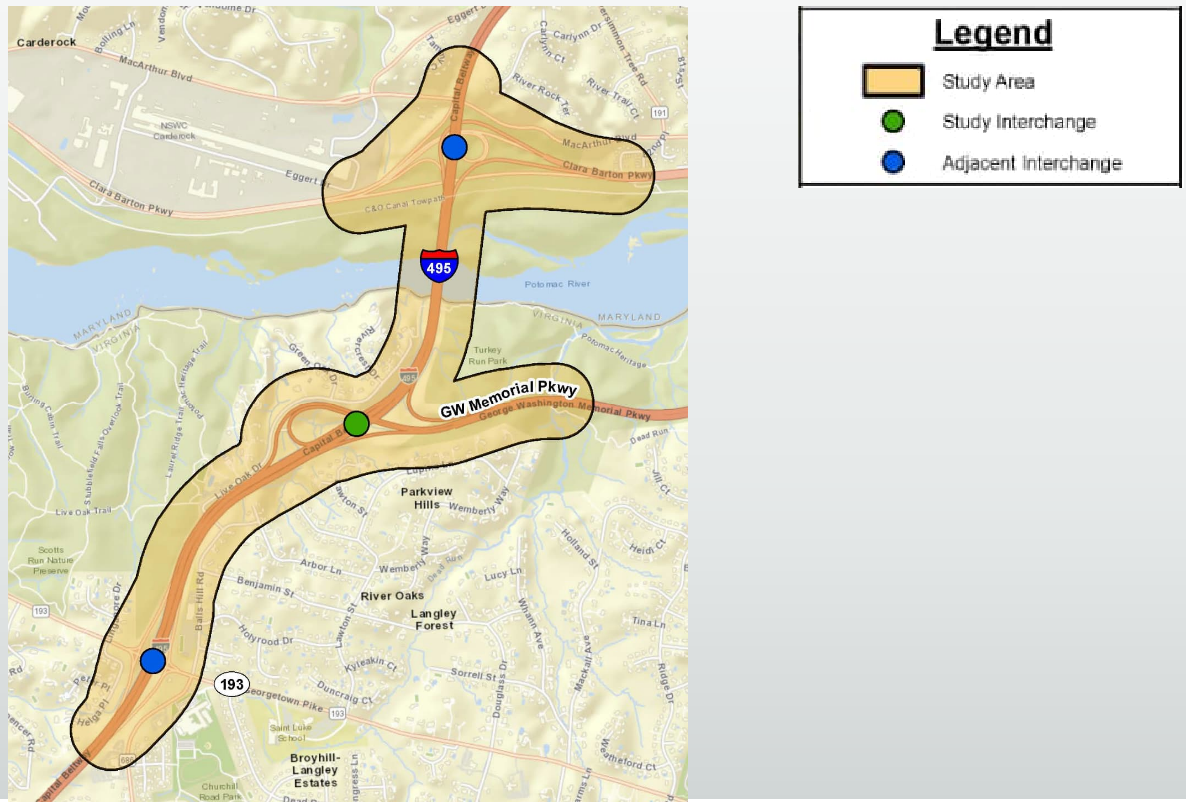
Area of Influence – I-270 East Spur east of MD 187

- Tie-in location
- Direct access to managed lanes
- Adjacent I-270 East Spur Interchanges:
  - I-270 East Spur at MD 187
  - I-270 East Spur / I-495 at MD 355



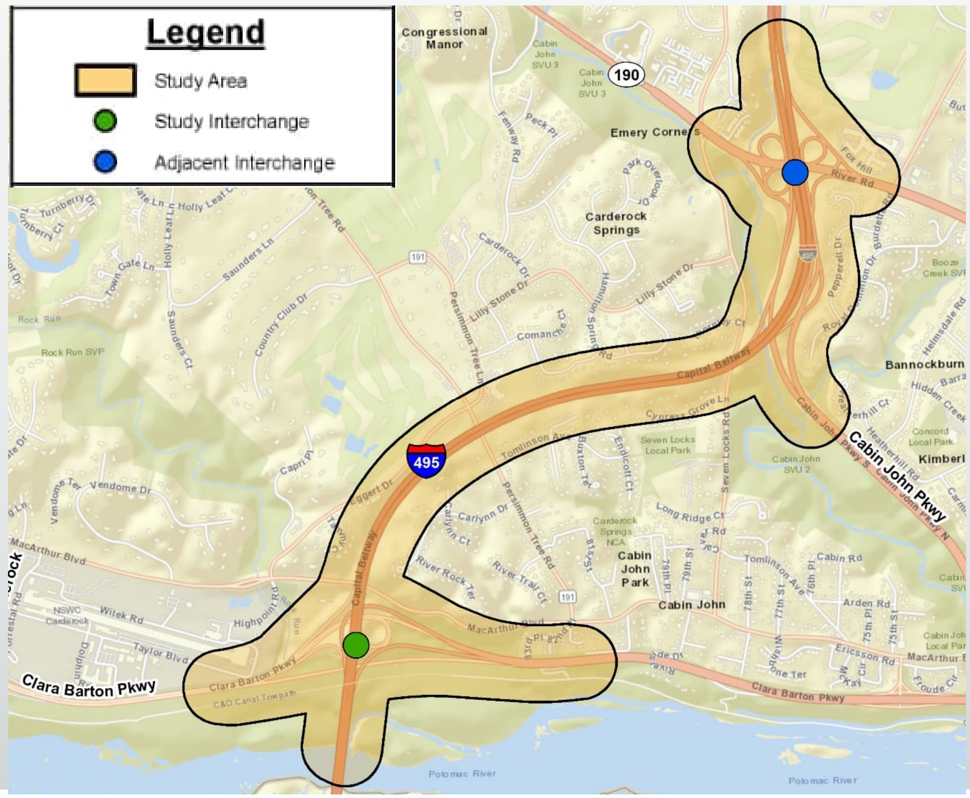
Area of Influence – I-495 at George Washington Pkwy Interchange

- Direct access to managed lanes
- Included in VDOT’s Interchange Modification Report (IMR)
- Adjacent I-495 Interchanges:
    - I-495 at Clara Barton Pkwy
    - I-495 at VA 193



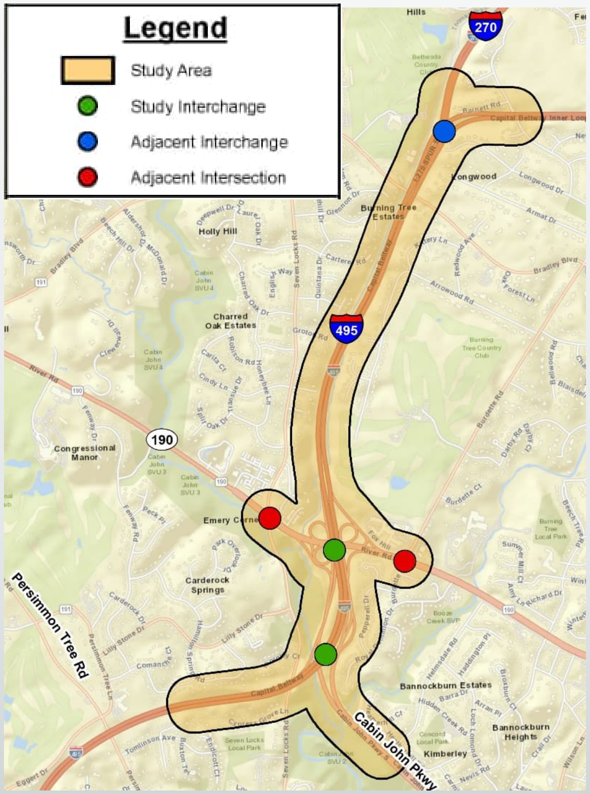
Area of Influence – I-495 at Clara Barton Pkwy Interchange

- No direct access to managed lanes
- Adjacent I-495 Interchanges:
  - I-495 at MD 190/Cabin John Pkwy
  - I-495 at VA George Washington Pkwy



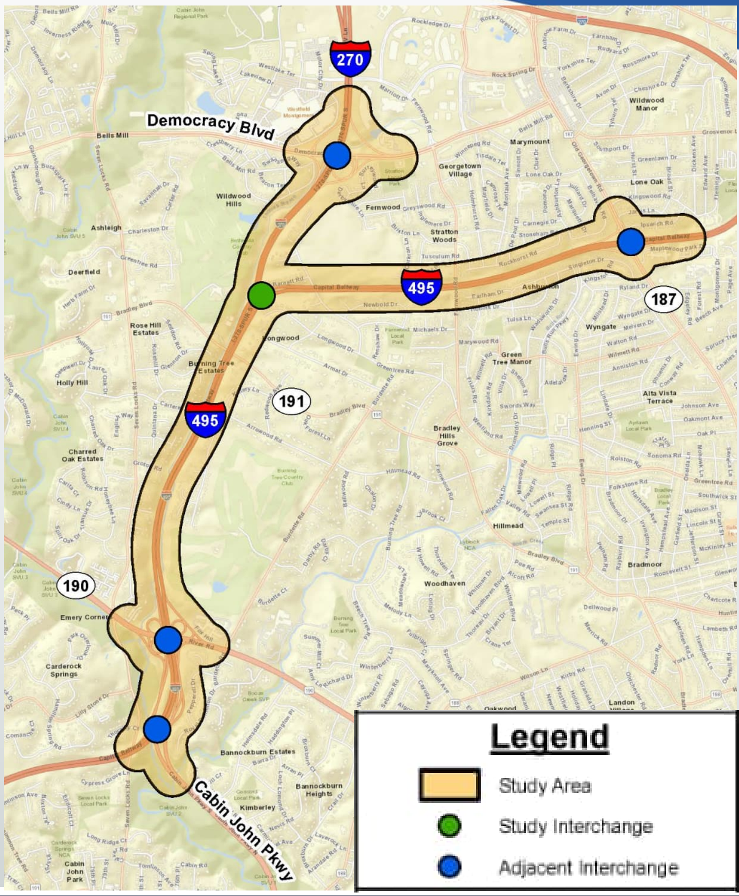
Area of Influence – I-495 at MD 190/Cabin John Pkwy Interchange

- Direct access to managed lanes
  - Includes access from General Purpose Lanes to Managed Lanes and access from Managed Lanes to General Purpose Lanes
- Adjacent I-495 Interchanges:
  - I-495 at I-270 West Spur
  - I-495 at Clara Barton Pkwy
- Adjacent MD 190 Intersections:
  - MD 190 and Seven Locks Rd
  - MD 190 and Burdette Rd



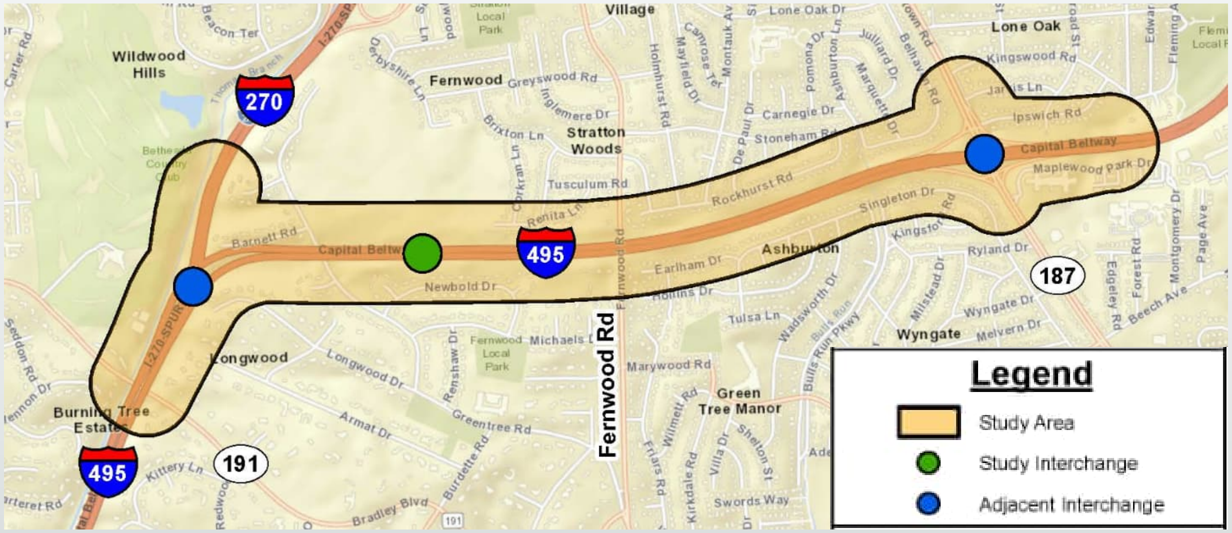
Area of Influence – I-495 at I-270 (West Spur)

- Direct access to managed lanes
- Adjacent I-495 Interchanges:
  - I-495 at MD 190/Cabin John Pkwy
  - I-495 at MD 187
- Adjacent I-270 Interchanges:
  - I-270 at Democracy Blvd

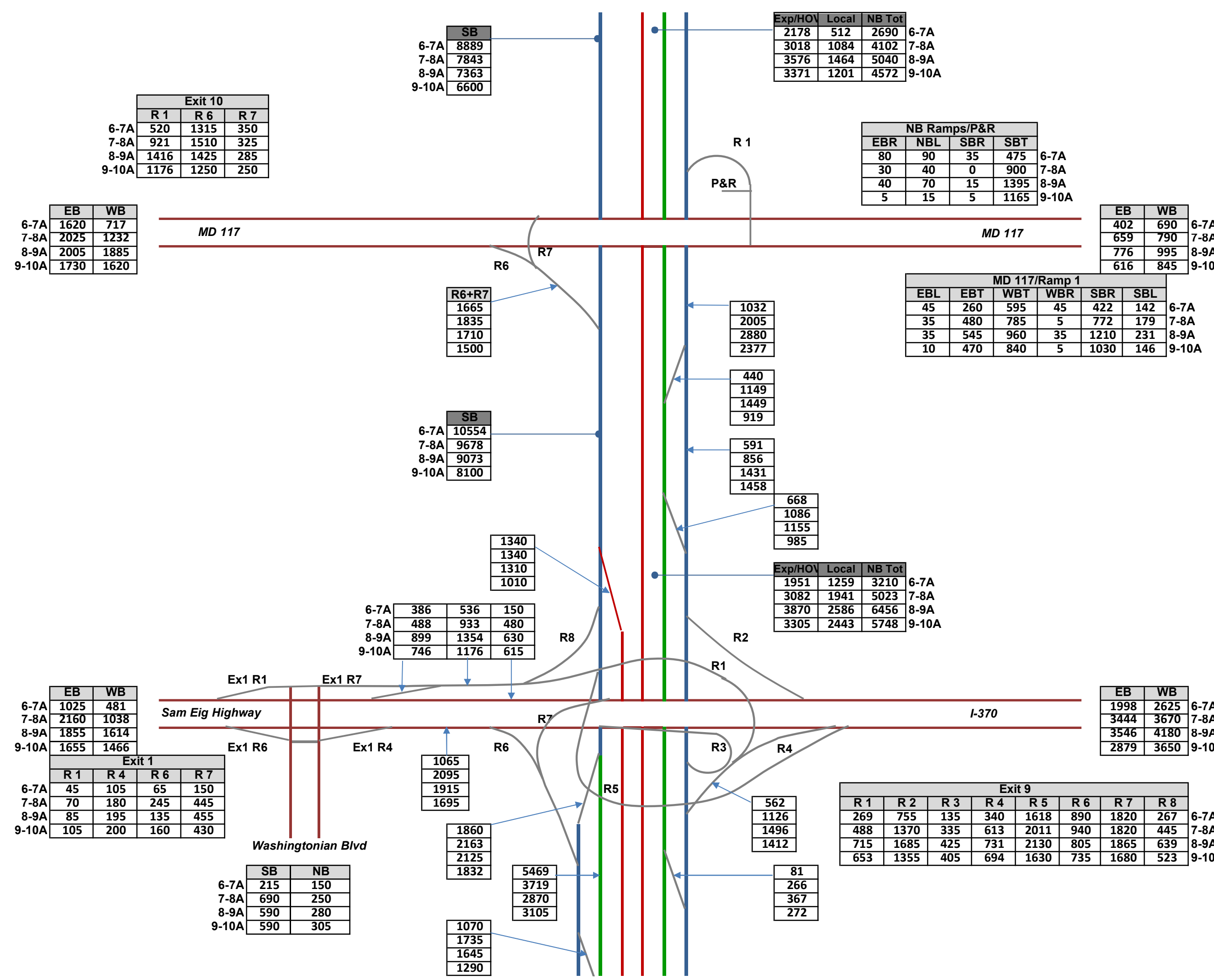


Area of Influence – I-495 West of MD 187

- At-grade access to managed lanes
- Adjacent I-495 Interchanges:
  - I-495 at I-270 West Spur
  - I-495 at MD 187

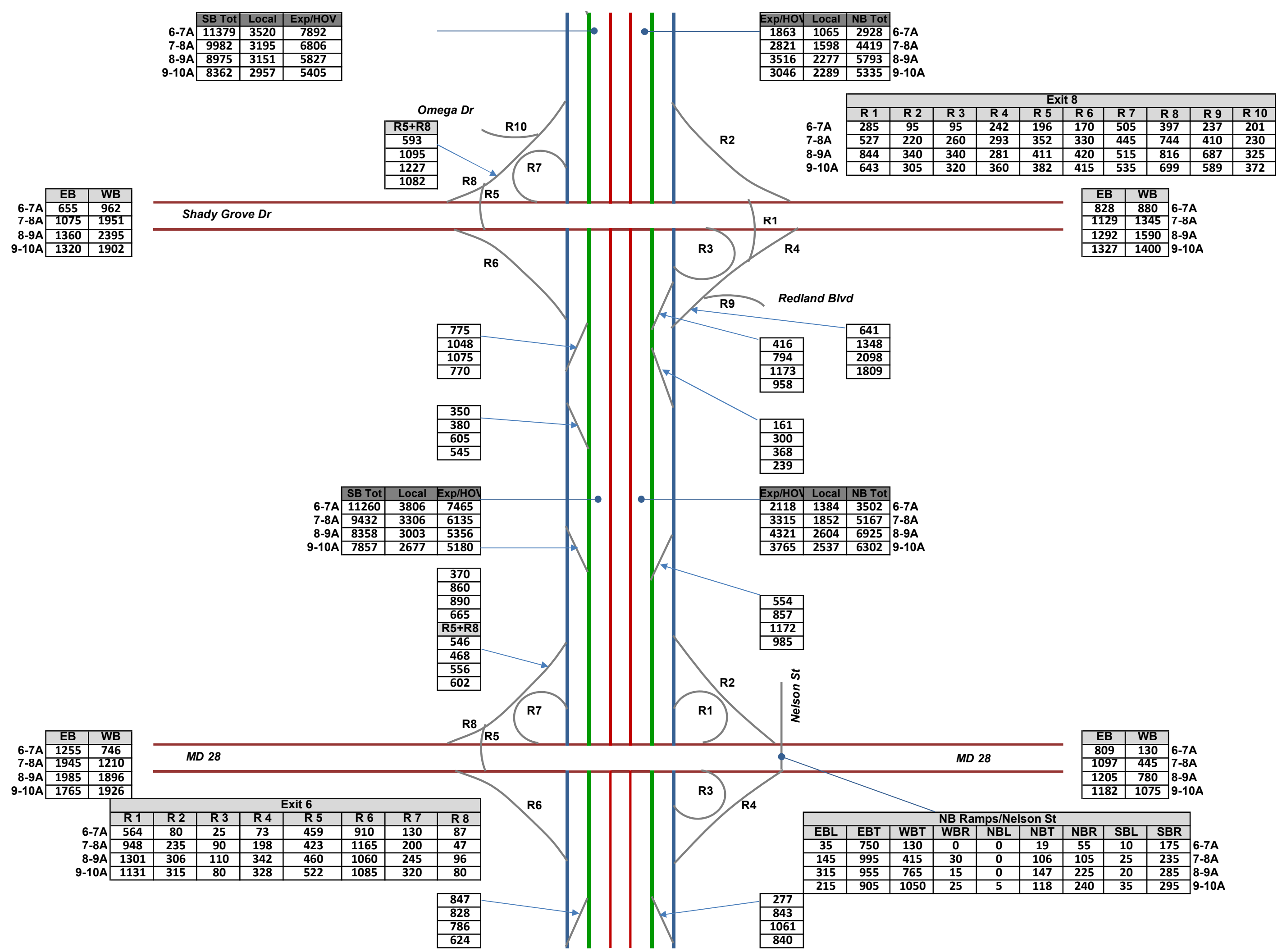


Appendix B
Traffic Volume Diagrams



Existing Hourly AM Volume Diagram

Existing Hourly AM Volume Diagram



	SB Tot	Local	Exp/HOV
6-7A	11379	3520	7892
7-8A	9982	3195	6806
8-9A	8975	3151	5827
9-10A	8362	2957	5405

Exp/HOV	Local	NB Tot	
1863	1065	2928	6-7A
2821	1598	4419	7-8A
3516	2277	5793	8-9A
3046	2289	5335	9-10A

	Exit 8									
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
6-7A	285	95	95	242	196	170	505	397	237	201
7-8A	527	220	260	293	352	330	445	744	410	230
8-9A	844	340	340	281	411	420	515	816	687	325
9-10A	643	305	320	360	382	415	535	699	589	372

R5+R8
593
1095
1227
1082

	EB	WB
6-7A	655	962
7-8A	1075	1951
8-9A	1360	2395
9-10A	1320	1902

EB	WB	
828	880	6-7A
1129	1345	7-8A
1292	1590	8-9A
1327	1400	9-10A

641
1348
2098
1809

775
1048
1075
770

416
794
1173
958

350
380
605
545

161
300
368
239

	SB Tot	Local	Exp/HOV
6-7A	11260	3806	7465
7-8A	9432	3306	6135
8-9A	8358	3003	5356
9-10A	7857	2677	5180

Exp/HOV	Local	NB Tot	
2118	1384	3502	6-7A
3315	1852	5167	7-8A
4321	2604	6925	8-9A
3765	2537	6302	9-10A

370
860
890
665
R5+R8
546
468
556
602

554
857
1172
985

	EB	WB
6-7A	1255	746
7-8A	1945	1210
8-9A	1985	1896
9-10A	1765	1926

EB	WB	
809	130	6-7A
1097	445	7-8A
1205	780	8-9A
1182	1075	9-10A

	Exit 6							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	564	80	25	73	459	910	130	87
7-8A	948	235	90	198	423	1165	200	47
8-9A	1301	306	110	342	460	1060	245	96
9-10A	1131	315	80	328	522	1085	320	80

NB Ramps/Nelson St									
EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR	
35	750	130	0	0	19	55	10	175	6-7A
145	995	415	30	0	106	105	25	235	7-8A
315	955	765	15	0	147	225	20	285	8-9A
215	905	1050	25	5	118	240	35	295	9-10A

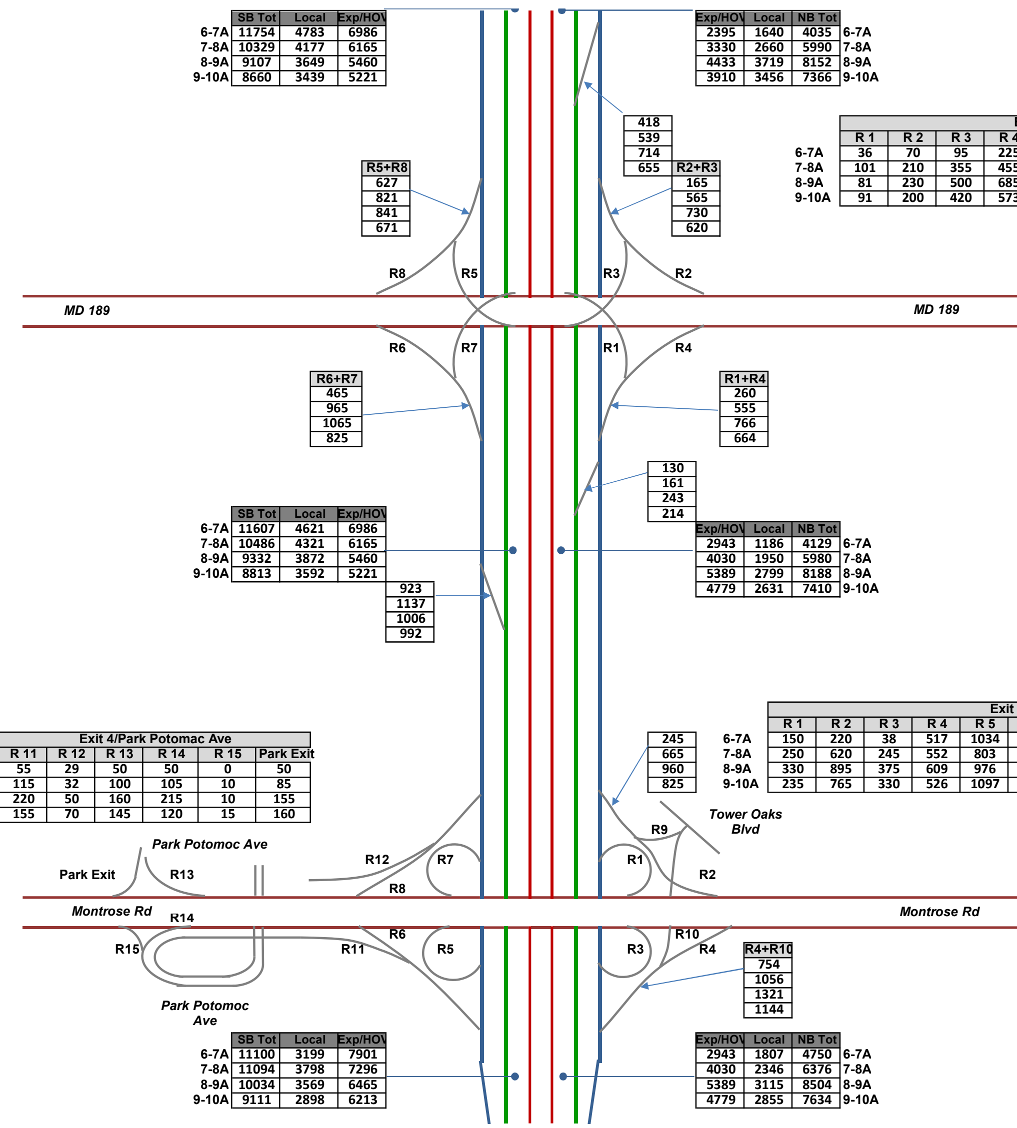
847
828
786
624

277
843
1061
840

N

Existing Hourly AM Volume Diagram

Existing Hourly AM Volume Diagram



	SB Tot	Local	Exp/HOV
6-7A	11754	4783	6986
7-8A	10329	4177	6165
8-9A	9107	3649	5460
9-10A	8660	3439	5221

Exp/HOV	Local	NB Tot	
2395	1640	4035	6-7A
3330	2660	5990	7-8A
4433	3719	8152	8-9A
3910	3456	7366	9-10A

418
539
714
655

Exit 5								
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	36	70	95	225	165	195	270	460
7-8A	101	210	355	455	192	460	505	628
8-9A	81	230	500	685	181	515	550	660
9-10A	91	200	420	573	165	390	435	506

R5+R8
627
821
841
671

R2+R3
165
565
730
620

	EB	WB
6-7A	420	355
7-8A	1155	990
8-9A	1370	995
9-10A	1170	885

EB	WB	
465	340	6-7A
1045	1010	7-8A
1250	1035	8-9A
1125	920	9-10A

R6+R7
465
965
1065
825

R1+R4
260
555
766
664

130
161
243
214

	SB Tot	Local	Exp/HOV
6-7A	11607	4621	6986
7-8A	10486	4321	6165
8-9A	9332	3872	5460
9-10A	8813	3592	5221

Exp/HOV	Local	NB Tot	
2943	1186	4129	6-7A
4030	1950	5980	7-8A
5389	2799	8188	8-9A
4779	2631	7410	9-10A

923
1137
1006
992

Exit 4										
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
6-7A	150	220	38	517	1034	112	650	249	25	237
7-8A	250	620	245	552	803	595	936	191	45	504
8-9A	330	895	375	609	976	725	940	156	65	712
9-10A	235	765	330	526	1097	645	845	180	60	619

Exit 4/Park Potomac Ave						
	R 11	R 12	R 13	R 14	R 15	Park Exit
6-7A	55	29	50	50	0	50
7-8A	115	32	100	105	10	85
8-9A	220	50	160	215	10	155
9-10A	155	70	145	120	15	160

245
665
960
825

	EB	WB
6-7A	100	399
7-8A	845	425
8-9A	1265	661
9-10A	1380	780

EB	WB	
1550	870	6-7A
1454	1555	7-8A
1954	2015	8-9A
2133	1960	9-10A

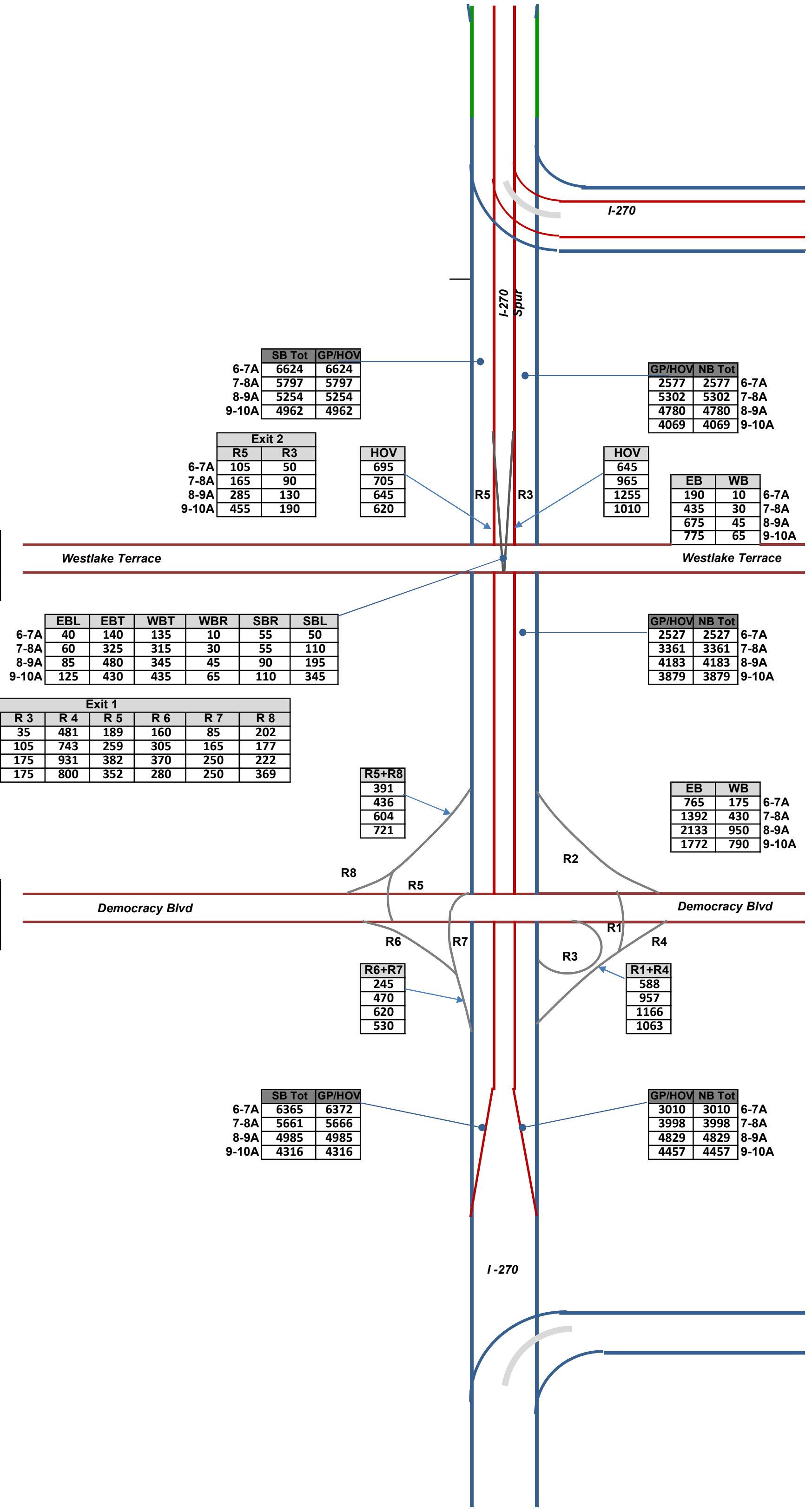
R4+R10
754
1056
1321
1144

	SB Tot	Local	Exp/HOV
6-7A	11100	3199	7901
7-8A	11094	3798	7296
8-9A	10034	3569	6465
9-10A	9111	2898	6213

Exp/HOV	Local	NB Tot	
2943	1807	4750	6-7A
4030	2346	6376	7-8A
5389	3115	8504	8-9A
4779	2855	7634	9-10A

Existing Hourly AM Volume Diagram

Existing Hourly AM Volume Diagram



	SB Tot	GP/HOV
6-7A	6624	6624
7-8A	5797	5797
8-9A	5254	5254
9-10A	4962	4962

GP/HOV	NB Tot	
2577	2577	6-7A
5302	5302	7-8A
4780	4780	8-9A
4069	4069	9-10A

	Exit 2	
	R5	R3
6-7A	105	50
7-8A	165	90
8-9A	285	130
9-10A	455	190

HOV
695
705
645
620

HOV
645
965
1255
1010

EB	WB	
190	10	6-7A
435	30	7-8A
675	45	8-9A
775	65	9-10A

	EB	WB
6-7A	180	190
7-8A	385	370
8-9A	565	435
9-10A	555	545

	EBL	EBT	WBT	WBR	SBR	SBL
6-7A	40	140	135	10	55	50
7-8A	60	325	315	30	55	110
8-9A	85	480	345	45	90	195
9-10A	125	430	435	65	110	345

GP/HOV	NB Tot	
2527	2527	6-7A
3361	3361	7-8A
4183	4183	8-9A
3879	3879	9-10A

	Exit 1							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	107	70	35	481	189	160	85	202
7-8A	214	215	105	743	259	305	165	177
8-9A	235	345	175	931	382	370	250	222
9-10A	263	310	175	800	352	280	250	369

R5+R8
391
436
604
721

EB	WB	
765	175	6-7A
1392	430	7-8A
2133	950	8-9A
1772	790	9-10A

	EB	WB
6-7A	290	329
7-8A	800	441
8-9A	1365	812
9-10A	1075	862

R6+R7
245
470
620
530

R1+R4
588
957
1166
1063

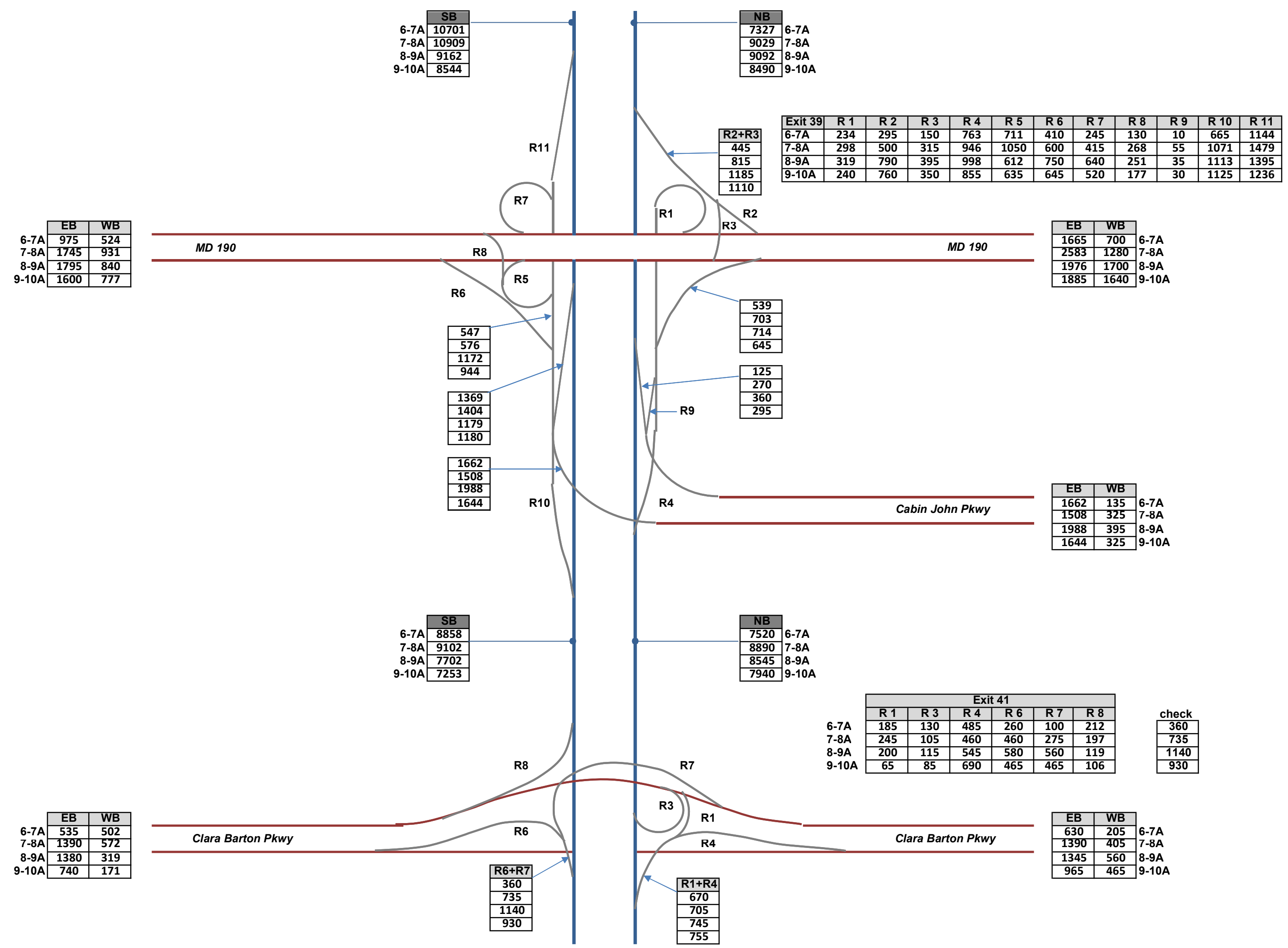
	SB Tot	GP/HOV
6-7A	6365	6372
7-8A	5661	5666
8-9A	4985	4985
9-10A	4316	4316

GP/HOV	NB Tot	
3010	3010	6-7A
3998	3998	7-8A
4829	4829	8-9A
4457	4457	9-10A

N

Existing Hourly AM Volume Diagram

Existing Hourly AM Volume Diagram

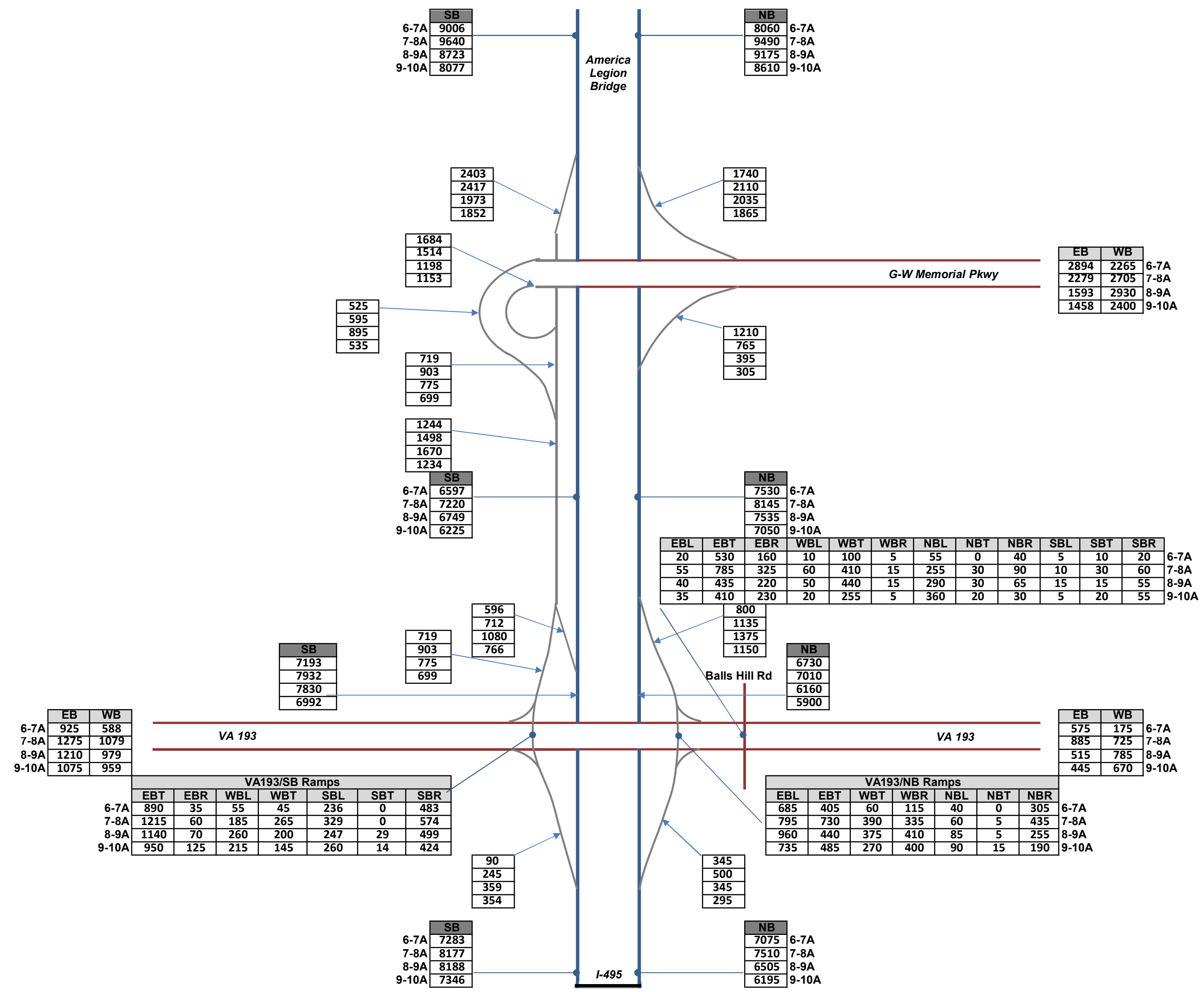


Exit 39	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
6-7A	234	295	150	763	711	410	245	130	10	665	1144
7-8A	298	500	315	946	1050	600	415	268	55	1071	1479
8-9A	319	790	395	998	612	750	640	251	35	1113	1395
9-10A	240	760	350	855	635	645	520	177	30	1125	1236

	Exit 41							check
	R 1	R 3	R 4	R 6	R 7	R 8		
6-7A	185	130	485	260	100	212		360
7-8A	245	105	460	460	275	197		735
8-9A	200	115	545	580	560	119		1140
9-10A	65	85	690	465	465	106		930

Existing Hourly AM Volume Diagram

Existing Hourly AM Volume Diagram



	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
	20	530	160	10	100	5	55	0	40	5	10	20	6-7A
	55	785	325	60	410	15	255	30	90	10	30	60	7-8A
	40	435	220	50	440	15	290	30	65	15	15	55	8-9A
	35	410	230	20	255	5	360	20	30	5	20	55	9-10A

VA193/SB Ramps

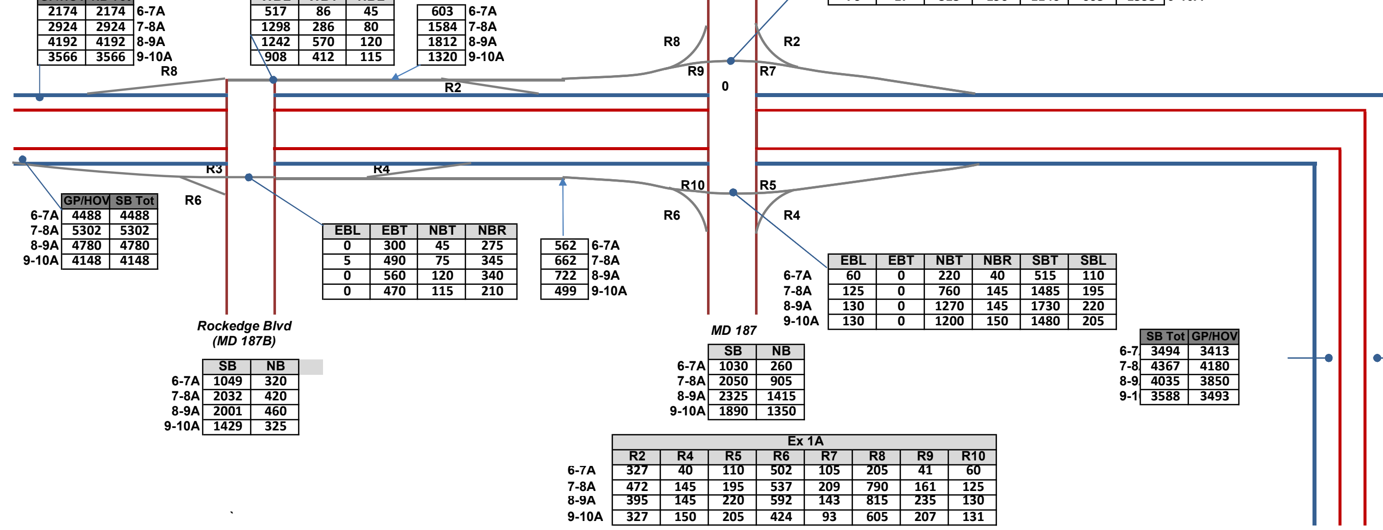
	EBT	EBR	WBL	WBT	SBL	SBT	SBR
6-7A	890	35	55	45	236	0	483
7-8A	1215	60	185	265	329	0	574
8-9A	1140	70	260	200	247	29	499
9-10A	950	125	215	145	260	14	424

VA193/NB Ramps

EBL	EBT	WBT	WBR	NBL	NBT	NBR	
685	405	60	115	40	0	305	6-7A
795	730	390	335	60	5	435	7-8A
960	440	375	410	85	5	255	8-9A
735	485	270	400	90	15	190	9-10A

Existing Hourly AM Volume Diagram

Existing Hourly AM Volume Diagram



	Ex 1B				
	R2	R3	R4	R6	R8
6-7	357	371	85	532	131
7-8	633	512	190	734	366
8-9	762	567	185	759	690
9-1	508	480	135	521	527

GP/HOV	NB Tot	
2174	2174	6-7A
2924	2924	7-8A
4192	4192	8-9A
3566	3566	9-10A

WBL	WBT	NBL
517	86	45
1298	286	80
1242	570	120
908	412	115

603	6-7A
1584	7-8A
1812	8-9A
1320	9-10A

	SB	NB
6-7A	745	572
7-8A	2295	1202
8-9A	2635	1570
9-10A	2200	1468

WBL	WBT	WBR	NBL	NBT	SBR	SBT	
99	6	265	35	245	205	540	6-7A
203	6	395	155	730	790	1505	7-8A
133	10	360	225	1175	815	1820	8-9A
76	17	315	190	1140	605	1595	9-10A

	GP/HOV	SB Tot
6-7A	4488	4488
7-8A	5302	5302
8-9A	4780	4780
9-10A	4148	4148

EBL	EBT	NBT	NBR
0	300	45	275
5	490	75	345
0	560	120	340
0	470	115	210

562	6-7A
662	7-8A
722	8-9A
499	9-10A

	EBL	EBT	NBT	NBR	SBT	SBL
6-7A	60	0	220	40	515	110
7-8A	125	0	760	145	1485	195
8-9A	130	0	1270	145	1730	220
9-10A	130	0	1200	150	1480	205

	SB	NB
6-7A	1049	320
7-8A	2032	420
8-9A	2001	460
9-10A	1429	325

	SB	NB
6-7A	1030	260
7-8A	2050	905
8-9A	2325	1415
9-10A	1890	1350

	SB Tot	GP/HOV
6-7	3494	3413
7-8	4367	4180
8-9	4035	3850
9-1	3588	3493

GP/HOV	NB Tot	
2832	2832	6-7A
3872	3872	7-8A
4801	4801	8-9A
3967	3967	9-10A

	Ex 1A							
	R2	R4	R5	R6	R7	R8	R9	R10
6-7A	327	40	110	502	105	205	41	60
7-8A	472	145	195	537	209	790	161	125
8-9A	395	145	220	592	143	815	235	130
9-10A	327	150	205	424	93	605	207	131

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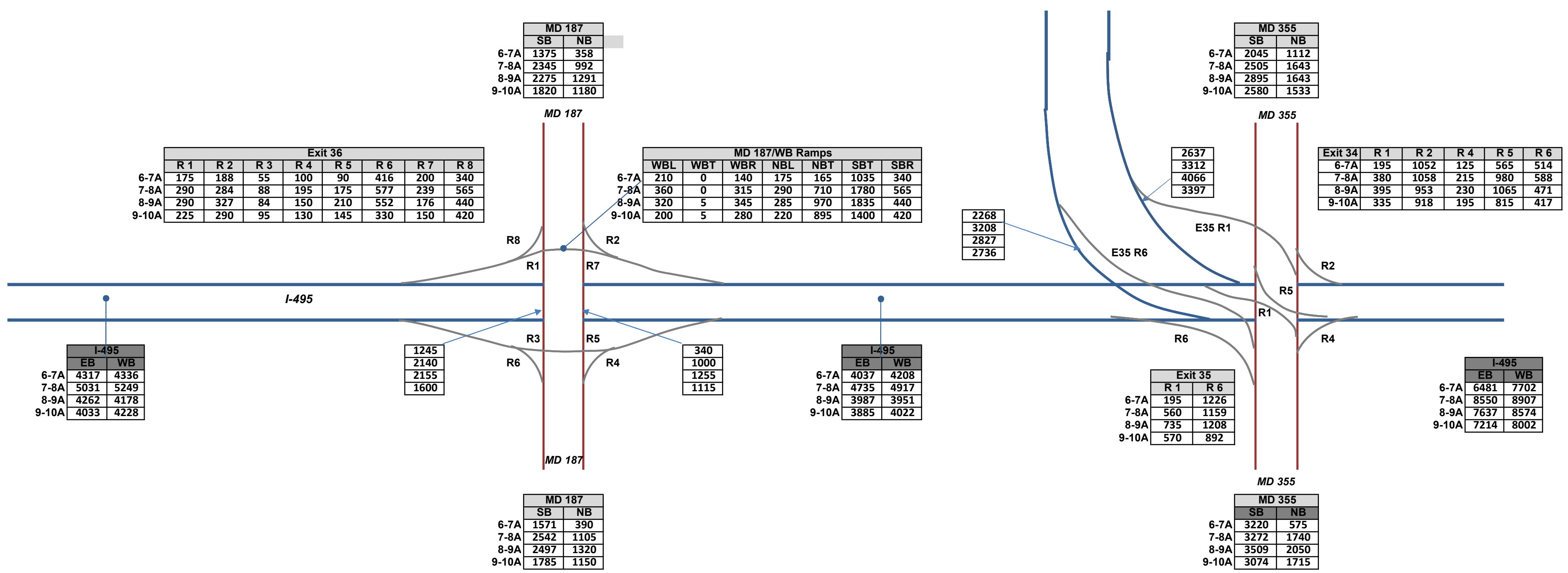
Existing Hourly AM Volume Diagram

Existing Hourly AM Volume Diagram



MD 187	SB	NB
6-7A	1375	358
7-8A	2345	992
8-9A	2275	1291
9-10A	1820	1180

Exit 36	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	175	188	55	100	90	416	200	340
7-8A	290	284	88	195	175	577	239	565
8-9A	290	327	84	150	210	552	176	440
9-10A	225	290	95	130	145	330	150	420

MD 187/WB Ramps	WBL	WBT	WBR	NBL	NBT	SBT	SBR
6-7A	210	0	140	175	165	1035	340
7-8A	360	0	315	290	710	1780	565
8-9A	320	5	345	285	970	1835	440
9-10A	200	5	280	220	895	1400	420

2268
3208
2827
2736

2637
3312
4066
3397

MD 355	SB	NB
6-7A	2045	1112
7-8A	2505	1643
8-9A	2895	1643
9-10A	2580	1533

Exit 34	R 1	R 2	R 4	R 5	R 6
6-7A	195	1052	125	565	514
7-8A	380	1058	215	980	588
8-9A	395	953	230	1065	471
9-10A	335	918	195	815	417

I-495	EB	WB
6-7A	4317	4336
7-8A	5031	5249
8-9A	4262	4178
9-10A	4033	4228

1245
2140
2155
1600

340
1000
1255
1115

I-495	EB	WB
6-7A	4037	4208
7-8A	4735	4917
8-9A	3987	3951
9-10A	3885	4022

Exit 35	R 1	R 6
6-7A	195	1226
7-8A	560	1159
8-9A	735	1208
9-10A	570	892

I-495	EB	WB
6-7A	6481	7702
7-8A	8550	8907
8-9A	7637	8574
9-10A	7214	8002

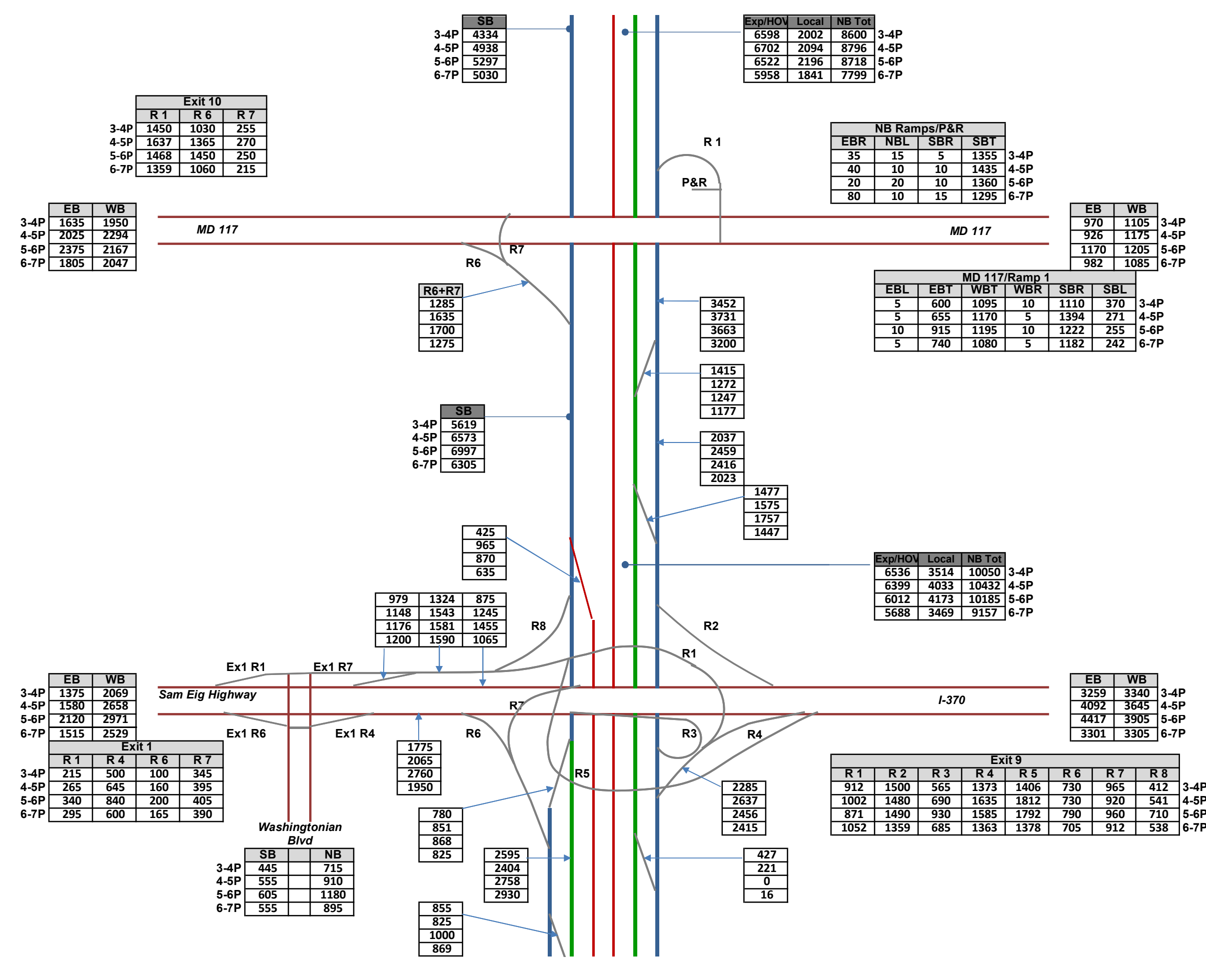
MD 187	SB	NB
6-7A	1571	390
7-8A	2542	1105
8-9A	2497	1320
9-10A	1785	1150

MD 355	SB	NB
6-7A	3220	575
7-8A	3272	1740
8-9A	3509	2050
9-10A	3074	1715

N

Existing Hourly PM Volume Diagram

Existing Hourly PM Volume Diagram



Existing Hourly PM Volume Diagram

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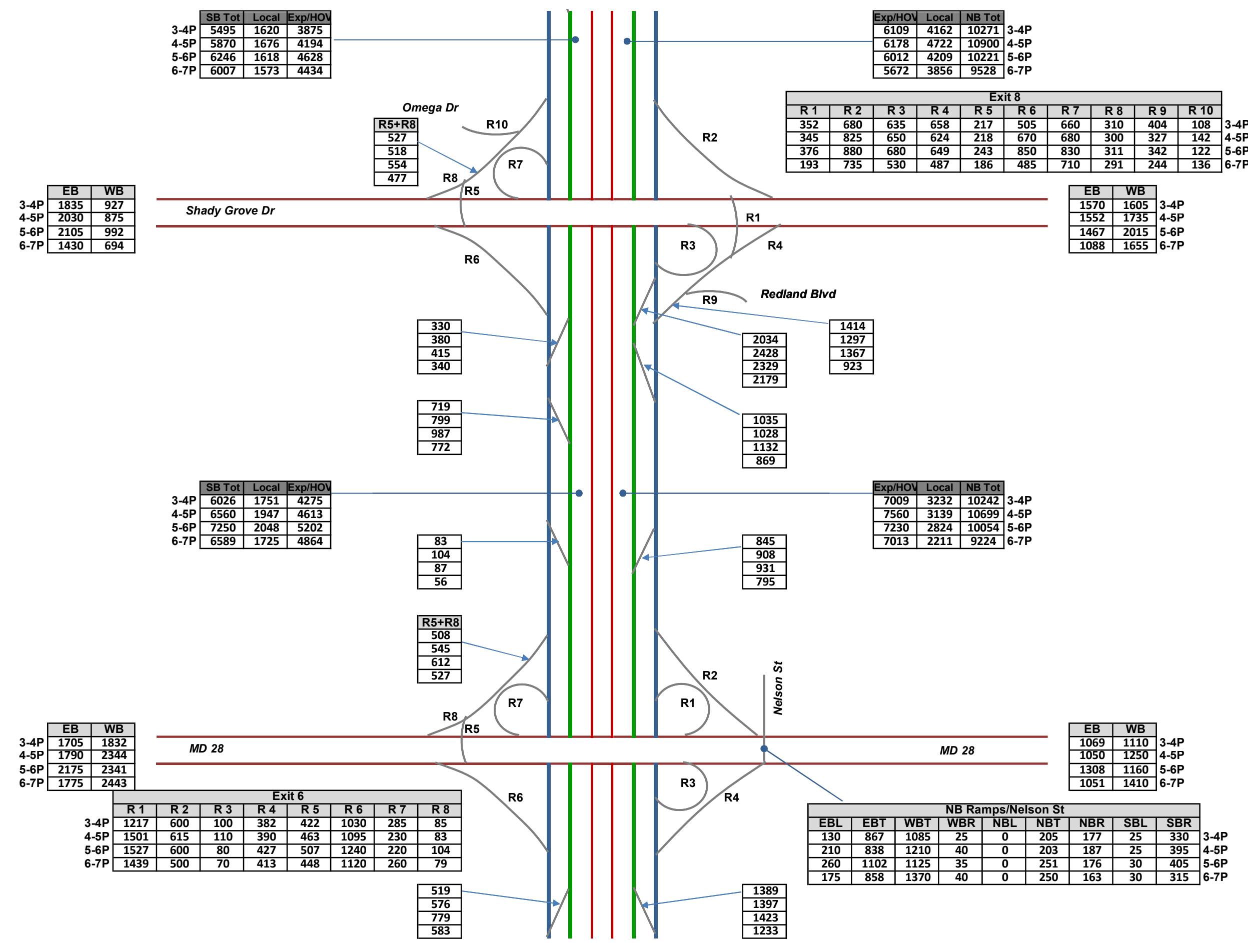
Existing Hourly PM Volume Diagram



	SB Tot	Local	Exp/HOV
3-4P	5495	1620	3875
4-5P	5870	1676	4194
5-6P	6246	1618	4628
6-7P	6007	1573	4434

Exp/HOV	Local	NB Tot	
6109	4162	10271	3-4P
6178	4722	10900	4-5P
6012	4209	10221	5-6P
5672	3856	9528	6-7P

Exit 8										
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	
352	680	635	658	217	505	660	310	404	108	3-4P
345	825	650	624	218	670	680	300	327	142	4-5P
376	880	680	649	243	850	830	311	342	122	5-6P
193	735	530	487	186	485	710	291	244	136	6-7P

	EB	WB
3-4P	1835	927
4-5P	2030	875
5-6P	2105	992
6-7P	1430	694

EB	WB	
1570	1605	3-4P
1552	1735	4-5P
1467	2015	5-6P
1088	1655	6-7P

	SB Tot	Local	Exp/HOV
3-4P	6026	1751	4275
4-5P	6560	1947	4613
5-6P	7250	2048	5202
6-7P	6589	1725	4864

Exp/HOV	Local	NB Tot	
7009	3232	10242	3-4P
7560	3139	10699	4-5P
7230	2824	10054	5-6P
7013	2211	9224	6-7P

	EB	WB
3-4P	1705	1832
4-5P	1790	2344
5-6P	2175	2341
6-7P	1775	2443

EB	WB	
1069	1110	3-4P
1050	1250	4-5P
1308	1160	5-6P
1051	1410	6-7P

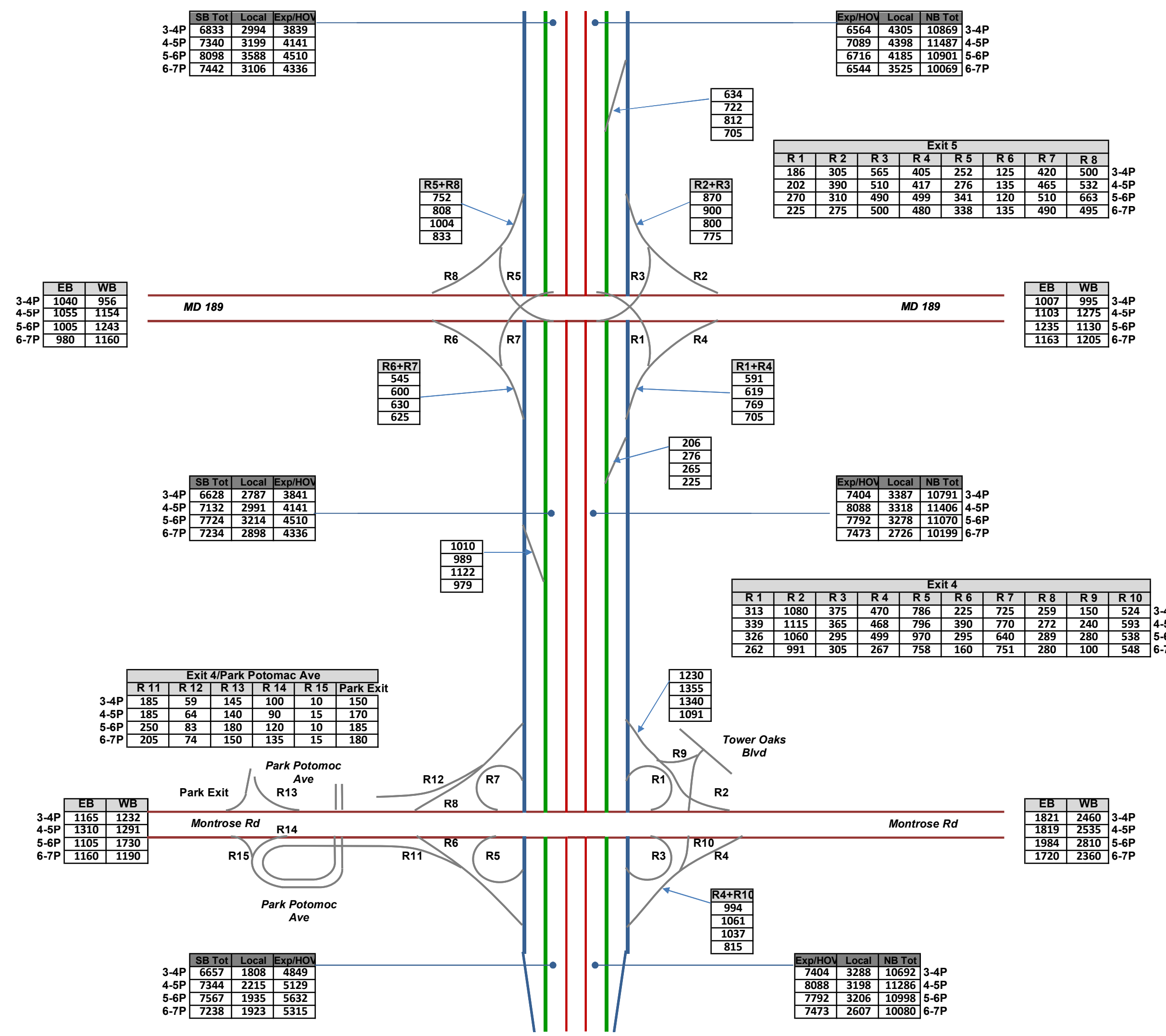
	Exit 6							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P	1217	600	100	382	422	1030	285	85
4-5P	1501	615	110	390	463	1095	230	83
5-6P	1527	600	80	427	507	1240	220	104
6-7P	1439	500	70	413	448	1120	260	79

NB Ramps/Nelson St									
EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR	
130	867	1085	25	0	205	177	25	330	3-4P
210	838	1210	40	0	203	187	25	395	4-5P
260	1102	1125	35	0	251	176	30	405	5-6P
175	858	1370	40	0	250	163	30	315	6-7P

Existing Hourly PM Volume Diagram

N

Existing Hourly PM Volume Diagram



	SB Tot	Local	Exp/HOV
3-4P	6833	2994	3839
4-5P	7340	3199	4141
5-6P	8098	3588	4510
6-7P	7442	3106	4336

Exp/HOV	Local	NB Tot	
6564	4305	10869	3-4P
7089	4398	11487	4-5P
6716	4185	10901	5-6P
6544	3525	10069	6-7P

634
722
812
705

Exit 5								
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	
186	305	565	405	252	125	420	500	3-4P
202	390	510	417	276	135	465	532	4-5P
270	310	490	499	341	120	510	663	5-6P
225	275	500	480	338	135	490	495	6-7P

R5+R8
752
808
1004
833

R2+R3
870
900
800
775

	EB	WB
3-4P	1040	956
4-5P	1055	1154
5-6P	1005	1243
6-7P	980	1160

EB	WB	
1007	995	3-4P
1103	1275	4-5P
1235	1130	5-6P
1163	1205	6-7P

R6+R7
545
600
630
625

R1+R4
591
619
769
705

206
276
265
225

	SB Tot	Local	Exp/HOV
3-4P	6628	2787	3841
4-5P	7132	2991	4141
5-6P	7724	3214	4510
6-7P	7234	2898	4336

Exp/HOV	Local	NB Tot	
7404	3387	10791	3-4P
8088	3318	11406	4-5P
7792	3278	11070	5-6P
7473	2726	10199	6-7P

1010
989
1122
979

Exit 4										
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	
313	1080	375	470	786	225	725	259	150	524	3-4P
339	1115	365	468	796	390	770	272	240	593	4-5P
326	1060	295	499	970	295	640	289	280	538	5-6P
262	991	305	267	758	160	751	280	100	548	6-7P

	Exit 4/Park Potomac Ave					
	R 11	R 12	R 13	R 14	R 15	Park Exit
3-4P	185	59	145	100	10	150
4-5P	185	64	140	90	15	170
5-6P	250	83	180	120	10	185
6-7P	205	74	150	135	15	180

1230
1355
1340
1091

	EB	WB
3-4P	1165	1232
4-5P	1310	1291
5-6P	1105	1730
6-7P	1160	1190

EB	WB	
1821	2460	3-4P
1819	2535	4-5P
1984	2810	5-6P
1720	2360	6-7P

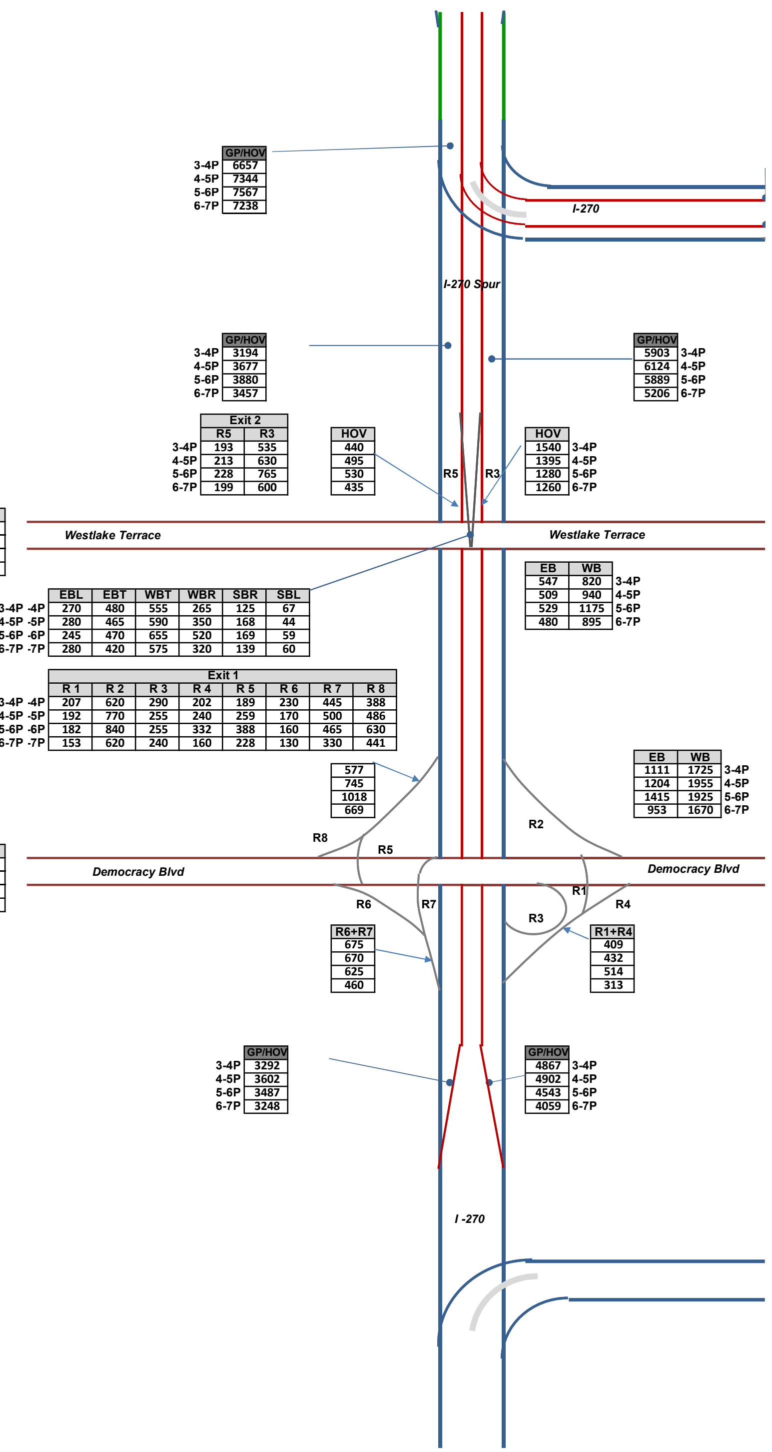
R4+R10
994
1061
1037
815

	SB Tot	Local	Exp/HOV
3-4P	6657	1808	4849
4-5P	7344	2215	5129
5-6P	7567	1935	5632
6-7P	7238	1923	5315

Exp/HOV	Local	NB Tot	
7404	3288	10692	3-4P
8088	3198	11286	4-5P
7792	3206	10998	5-6P
7473	2607	10080	6-7P

Existing Hourly PM Volume Diagram

Existing Hourly PM Volume Diagram



	GP/HOV
3-4P	6657
4-5P	7344
5-6P	7567
6-7P	7238

	GP/HOV
3-4P	3194
4-5P	3677
5-6P	3880
6-7P	3457

GP/HOV	
5903	3-4P
6124	4-5P
5889	5-6P
5206	6-7P

	Exit 2	
	R5	R3
3-4P	193	535
4-5P	213	630
5-6P	228	765
6-7P	199	600

HOV
440
495
530
435

HOV	
1540	3-4P
1395	4-5P
1280	5-6P
1260	6-7P

	EB	WB
3-4P -4P	750	680
4-5P -5P	745	758
5-6P -6P	715	824
6-7P -7P	700	714

EB	WB	
547	820	3-4P
509	940	4-5P
529	1175	5-6P
480	895	6-7P

	EBL	EBT	WBT	WBR	SBR	SBL
3-4P -4P	270	480	555	265	125	67
4-5P -5P	280	465	590	350	168	44
5-6P -6P	245	470	655	520	169	59
6-7P -7P	280	420	575	320	139	60

	Exit 1							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P -4P	207	620	290	202	189	230	445	388
4-5P -5P	192	770	255	240	259	170	500	486
5-6P -6P	182	840	255	332	388	160	465	630
6-7P -7P	153	620	240	160	228	130	330	441

577
745
1018
669

EB	WB	
1111	1725	3-4P
1204	1955	4-5P
1415	1925	5-6P
953	1670	6-7P

	EB	WB
3-4P -4P	1240	1255
4-5P -5P	1130	1363
5-6P -6P	1110	1432
6-7P -7P	935	1314

R6+R7
675
670
625
460

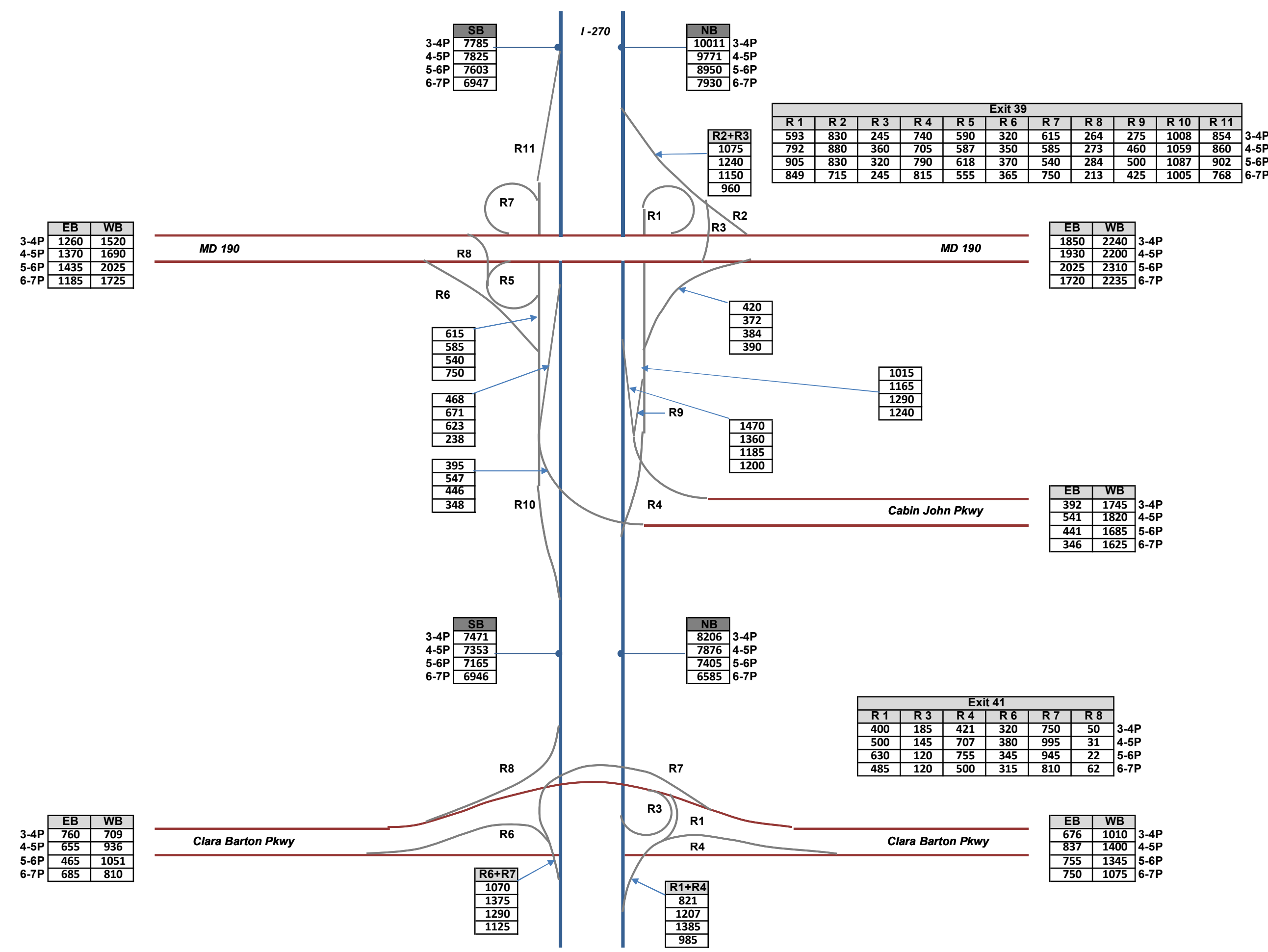
R1+R4
409
432
514
313

	GP/HOV
3-4P	3292
4-5P	3602
5-6P	3487
6-7P	3248

GP/HOV	
4867	3-4P
4902	4-5P
4543	5-6P
4059	6-7P

Existing Hourly PM Volume Diagram

Existing Hourly PM Volume Diagram



Existing Hourly PM Volume Diagram

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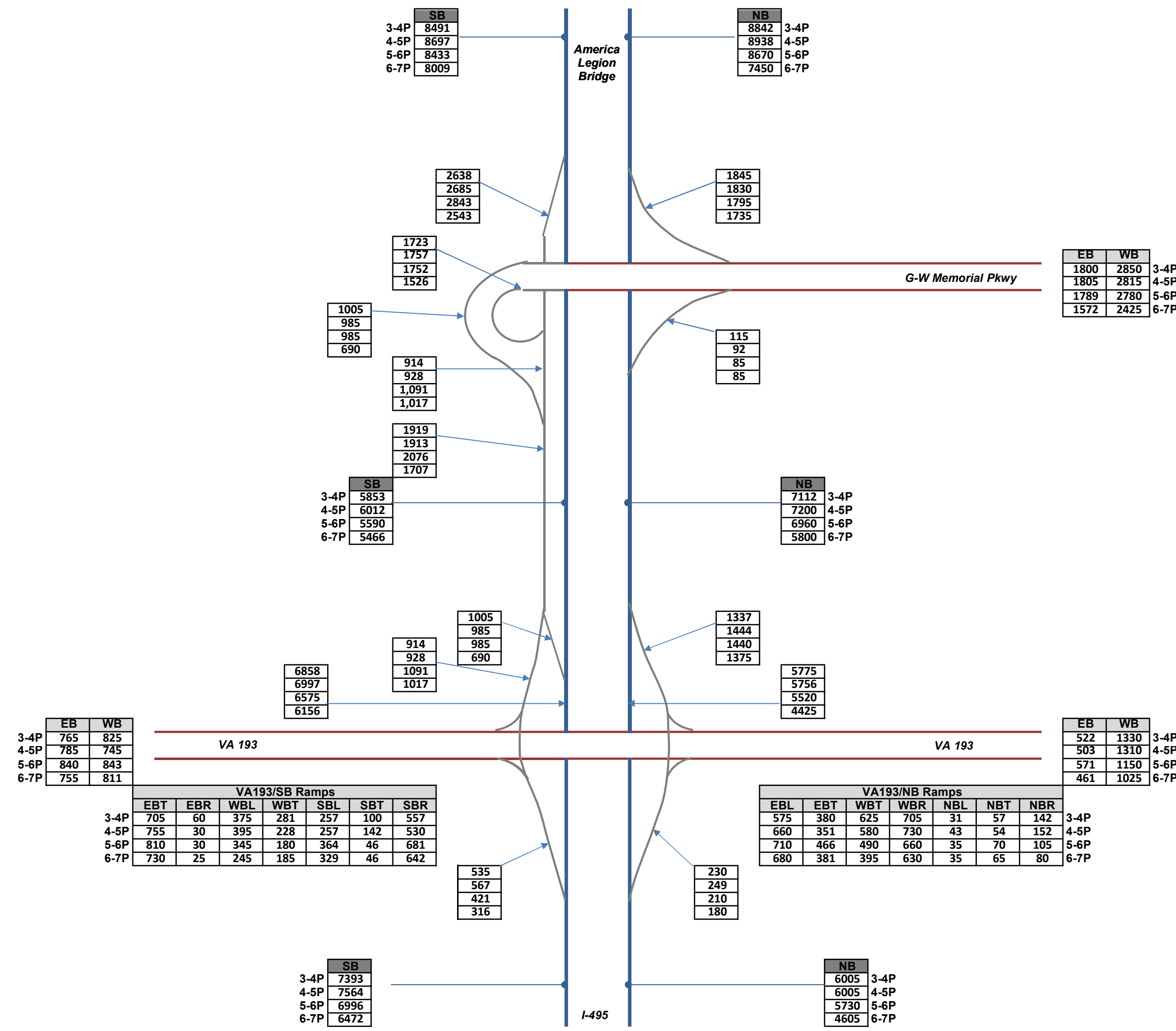
Existing Hourly PM Volume Diagram

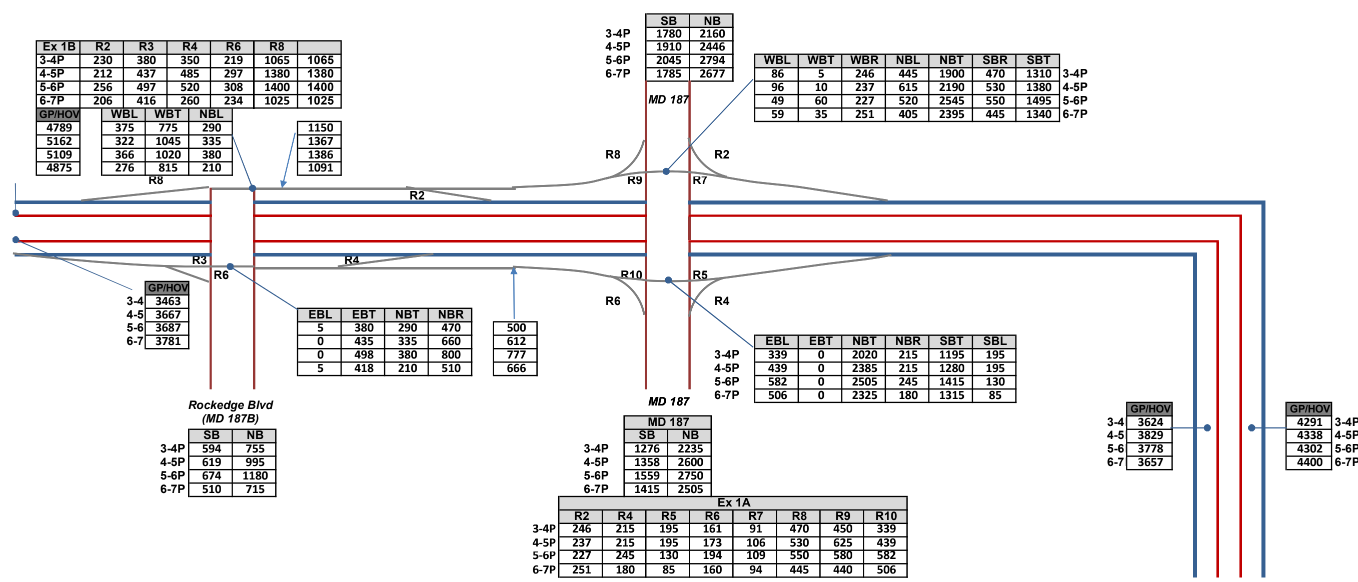


VA193/SB Ramps	EBT	EBR	WBL	WBT	SBL	SBT	SBR
3-4P	705	60	375	281	257	100	557
4-5P	755	30	395	228	257	142	530
5-6P	810	30	345	180	364	46	681
6-7P	730	25	245	185	329	46	642

VA193/NB Ramps	EBL	EBT	WBT	WBR	NBL	NBT	NBR
3-4P	575	380	625	705	31	57	142
4-5P	660	351	580	730	43	54	152
5-6P	710	466	490	660	35	70	105
6-7P	680	381	395	630	35	65	80

Existing Hourly PM Volume Diagram

Existing Hourly PM Volume Diagram



Ex 1B	R2	R3	R4	R6	R8	
3-4P	230	380	350	219	1065	1065
4-5P	212	437	485	297	1380	1380
5-6P	256	497	520	308	1400	1400
6-7P	206	416	260	234	1025	1025

GP/HOV
4789
5162
5109
4875

WBL	WBT	NBL
375	775	290
322	1045	335
366	1020	380
276	815	210

1150
1367
1386
1091

	SB	NB
3-4P	1780	2160
4-5P	1910	2446
5-6P	2045	2794
6-7P	1785	2677

WBL	WBT	WBR	NBL	NBT	SBR	SBT	
86	5	246	445	1900	470	1310	3-4P
96	10	237	615	2190	530	1380	4-5P
49	60	227	520	2545	550	1495	5-6P
59	35	251	405	2395	445	1340	6-7P

	GP/HOV
3-4	3463
4-5	3667
5-6	3687
6-7	3781

EBL	EBT	NBT	NBR
5	380	290	470
0	435	335	660
0	498	380	800
5	418	210	510

500
612
777
666

	EBL	EBT	NBT	NBR	SBT	SBL
3-4P	339	0	2020	215	1195	195
4-5P	439	0	2385	215	1280	195
5-6P	582	0	2505	245	1415	130
6-7P	506	0	2325	180	1315	85

Rockedge Blvd (MD 187B)

	SB	NB
3-4P	594	755
4-5P	619	995
5-6P	674	1180
6-7P	510	715

	MD 187	
	SB	NB
3-4P	1276	2235
4-5P	1358	2600
5-6P	1559	2750
6-7P	1415	2505

	Ex 1A							
	R2	R4	R5	R6	R7	R8	R9	R10
3-4P	246	215	195	161	91	470	450	339
4-5P	237	215	195	173	106	530	625	439
5-6P	227	245	130	194	109	550	580	582
6-7P	251	180	85	160	94	445	440	506

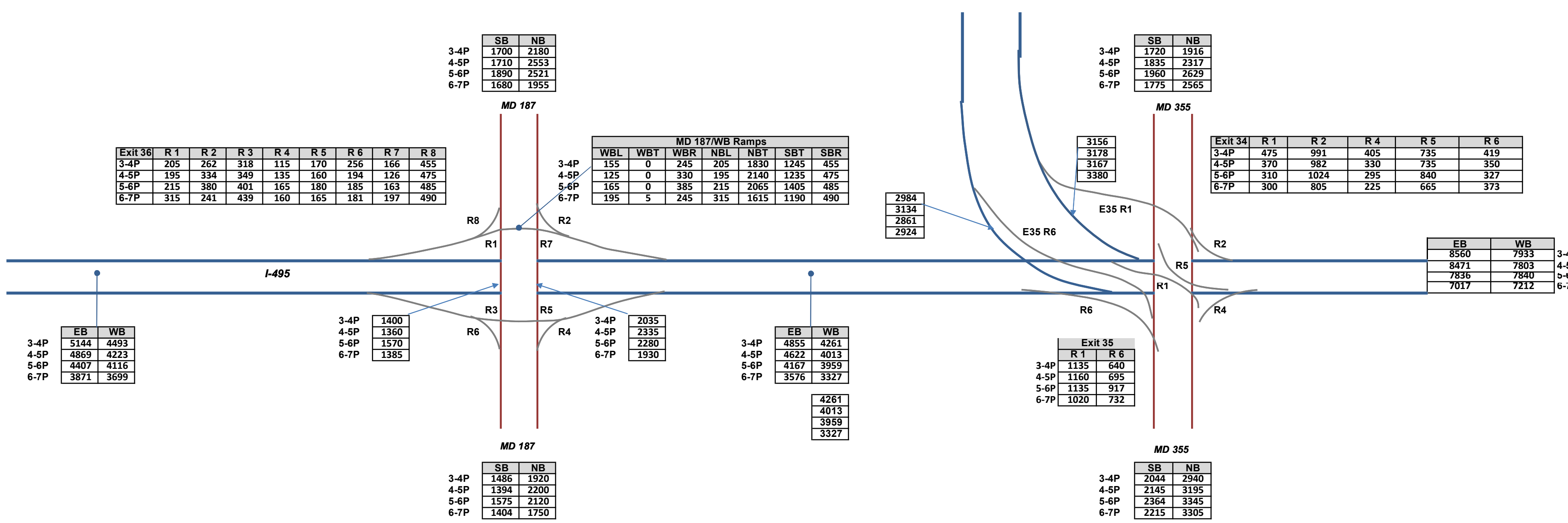
	GP/HOV
3-4	3624
4-5	3829
5-6	3778
6-7	3657

GP/HOV	
4291	3-4P
4338	4-5P
4302	5-6P
4400	6-7P

Existing Hourly PM Volume Diagram

N

Existing Hourly PM Volume Diagram



MD 187 (north)

	SB	NB
3-4P	1700	2180
4-5P	1710	2553
5-6P	1890	2521
6-7P	1680	1955

Exit 36	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P	205	262	318	115	170	256	166	455
4-5P	195	334	349	135	160	194	126	475
5-6P	215	380	401	165	180	185	163	485
6-7P	315	241	439	160	165	181	197	490

	MD 187/WB Ramps						
	WBL	WBT	WBR	NBL	NBT	SBT	SBR
3-4P	155	0	245	205	1830	1245	455
4-5P	125	0	330	195	2140	1235	475
5-6P	165	0	385	215	2065	1405	485
6-7P	195	5	245	315	1615	1190	490

2984
3134
2861
2924

MD 355 (north)

	SB	NB
3-4P	1720	1916
4-5P	1835	2317
5-6P	1960	2629
6-7P	1775	2565

3156
3178
3167
3380

Exit 34	R 1	R 2	R 4	R 5	R 6
3-4P	475	991	405	735	419
4-5P	370	982	330	735	350
5-6P	310	1024	295	840	327
6-7P	300	805	225	665	373

	EB	WB
3-4P	8560	7933
4-5P	8471	7803
5-6P	7836	7840
6-7P	7017	7212

	EB	WB
3-4P	5144	4493
4-5P	4869	4223
5-6P	4407	4116
6-7P	3871	3699

3-4P	1400
4-5P	1360
5-6P	1570
6-7P	1385

3-4P	2035
4-5P	2335
5-6P	2280
6-7P	1930

	EB	WB
3-4P	4855	4261
4-5P	4622	4013
5-6P	4167	3959
6-7P	3576	3327

4261
4013
3959
3327

	Exit 35	
	R 1	R 6
3-4P	1135	640
4-5P	1160	695
5-6P	1135	917
6-7P	1020	732

MD 187 (south)

	SB	NB
3-4P	1486	1920
4-5P	1394	2200
5-6P	1575	2120
6-7P	1404	1750

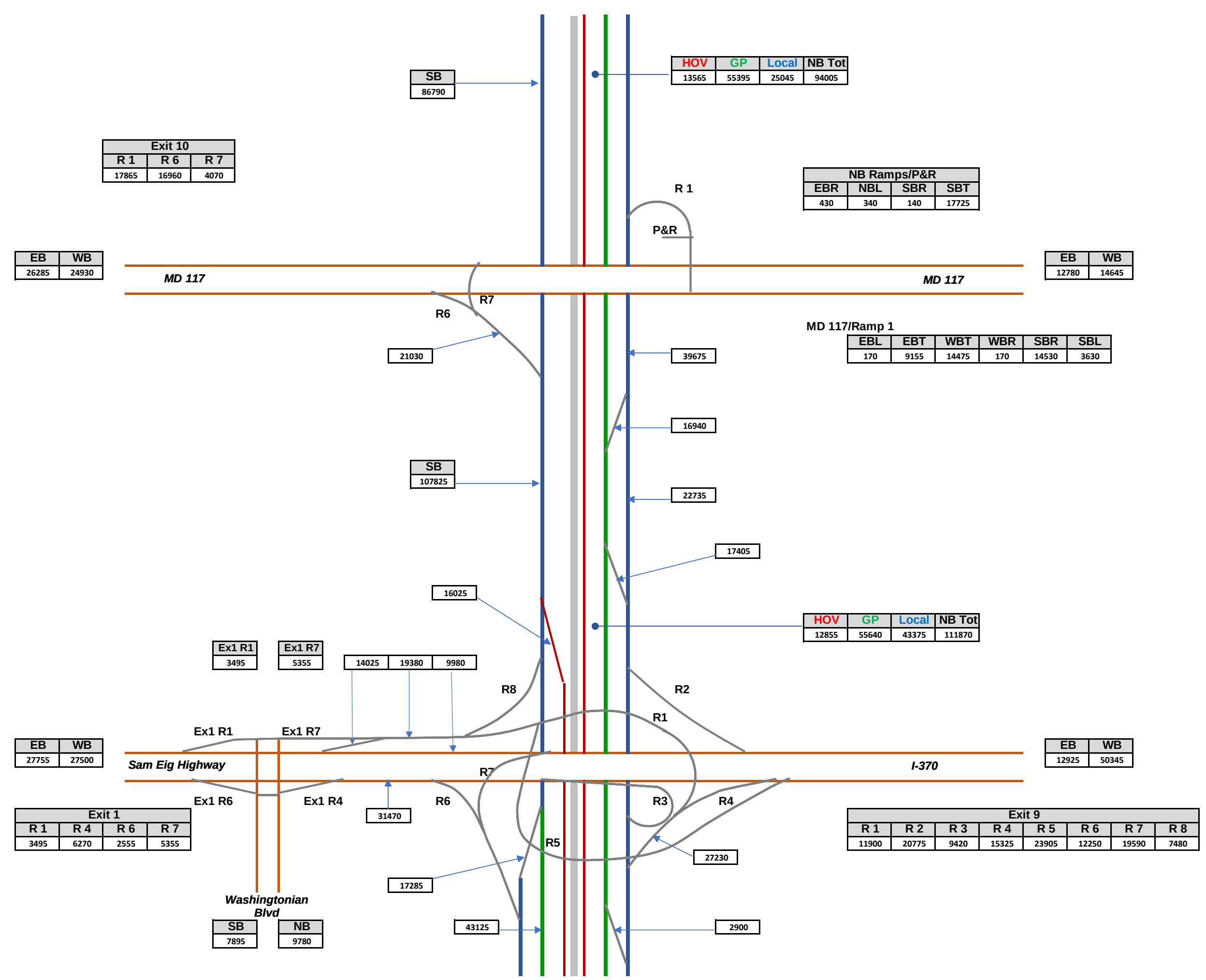
MD 355 (south)

	SB	NB
3-4P	2044	2940
4-5P	2145	3195
5-6P	2364	3345
6-7P	2215	3305

Existing Hourly PM Volume Diagram

N

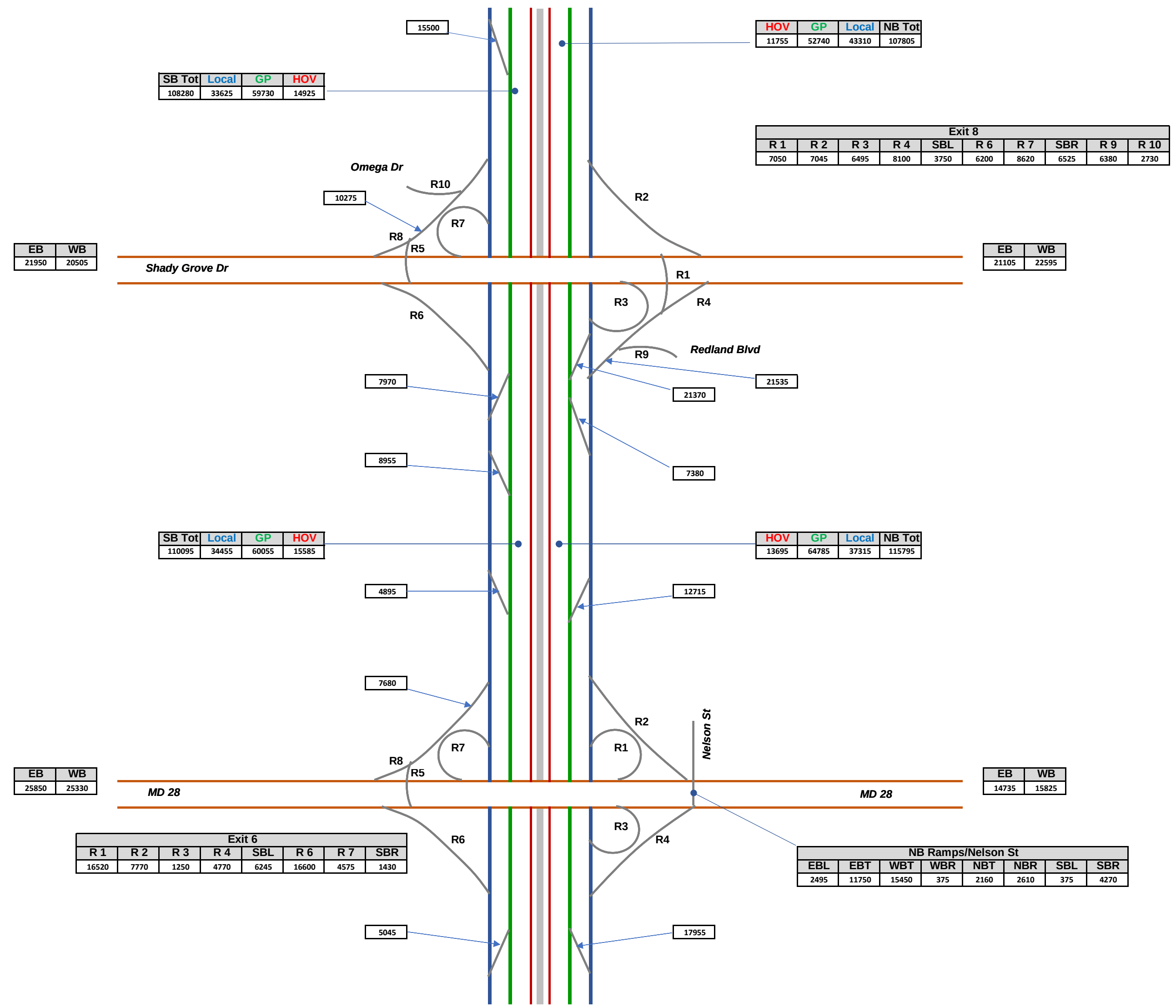
Existing ADT Volume Diagram



Existing ADT Volume Diagram

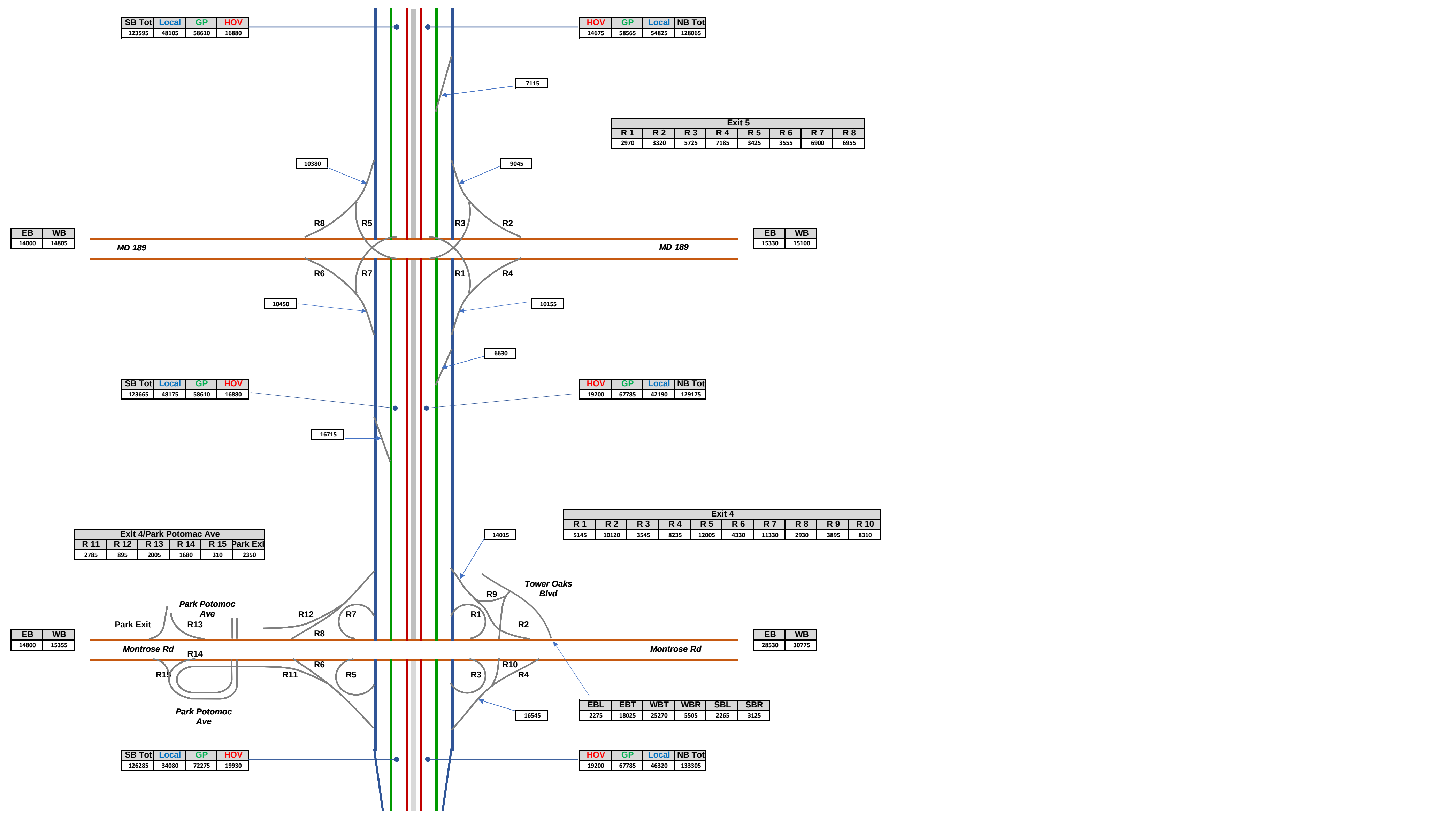
N

Existing ADT Volume Diagram



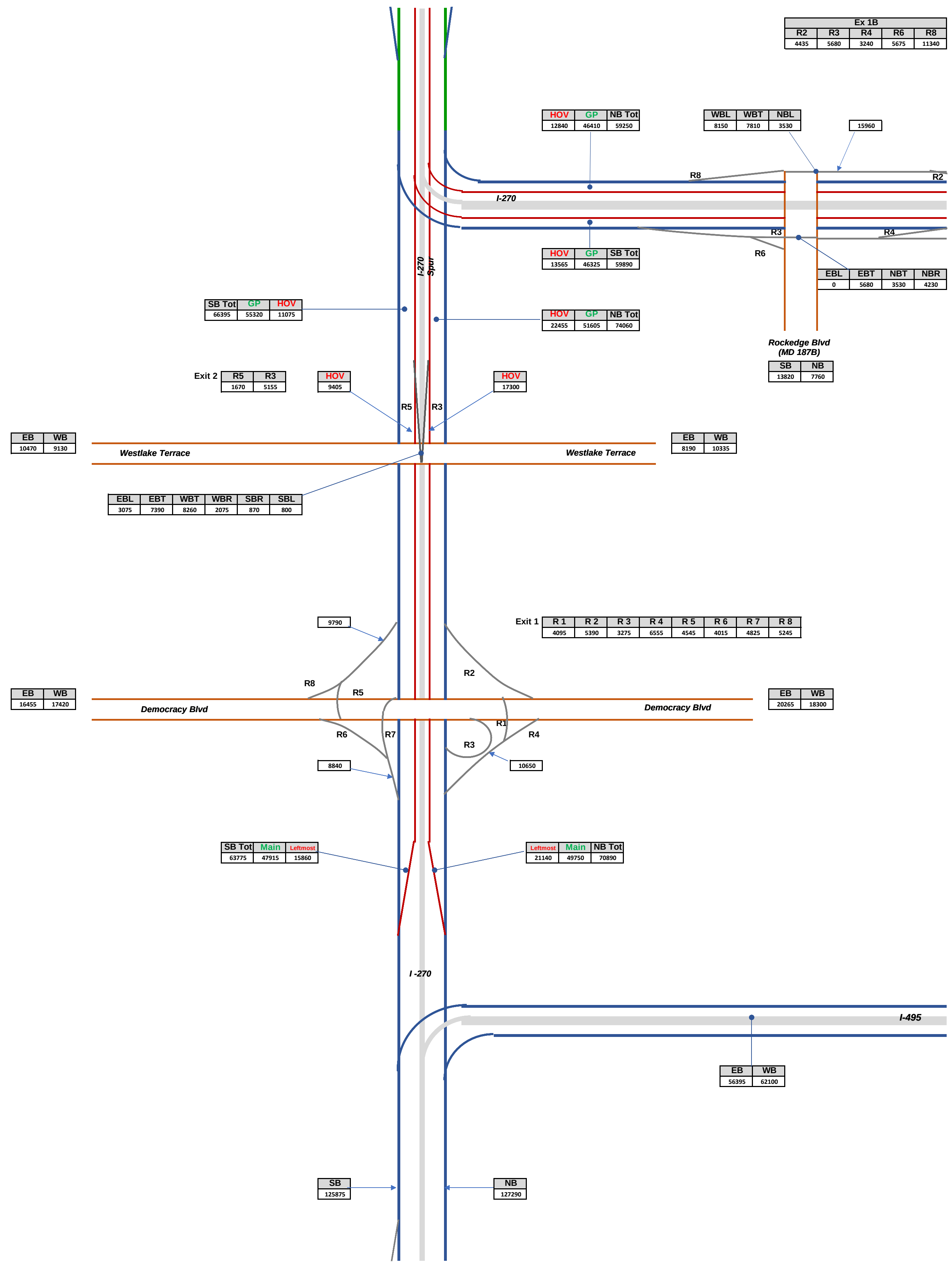
Existing ADT Volume Diagram

Existing ADT Volume Diagram



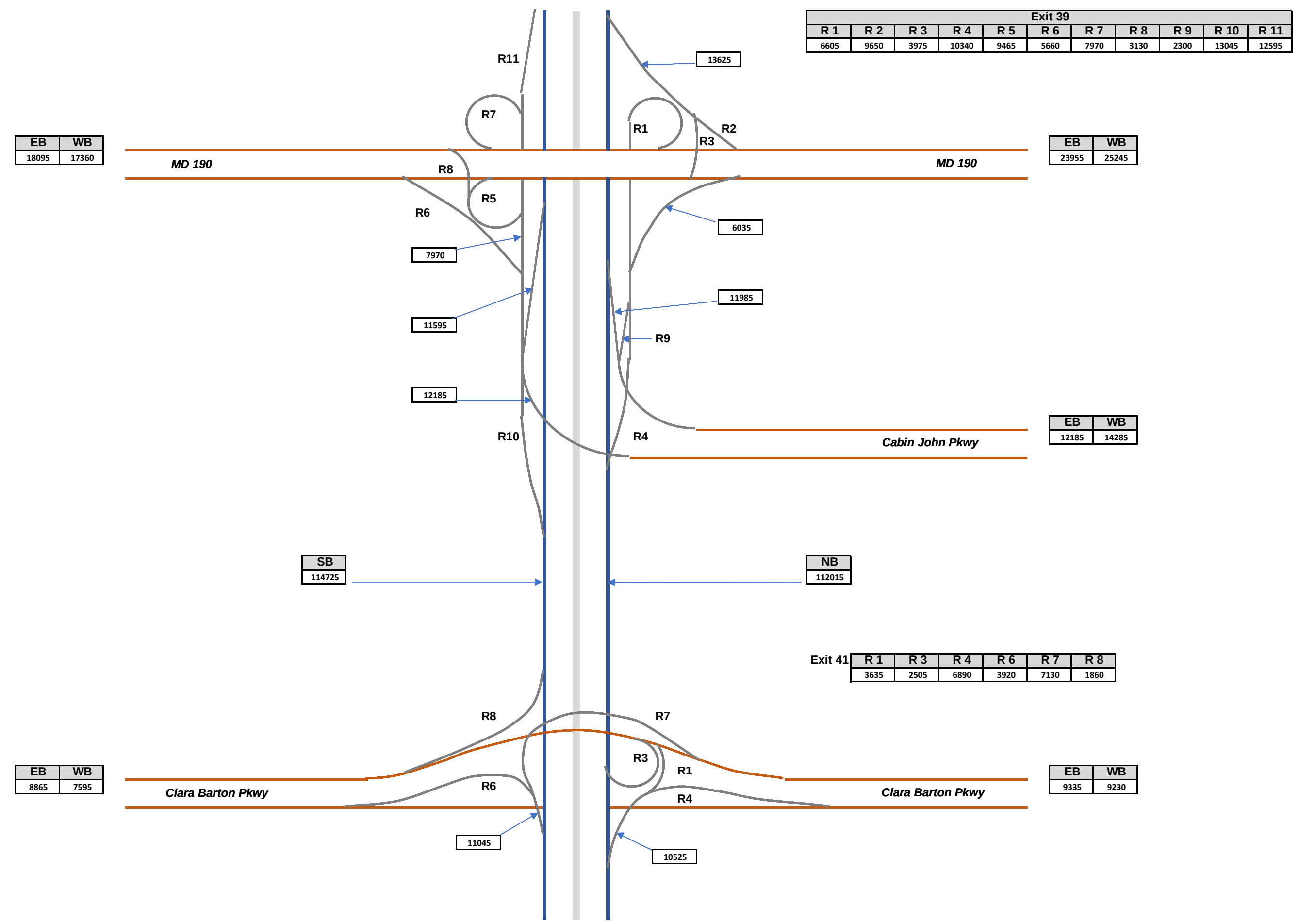
Existing ADT Volume Diagram

Existing ADT Volume Diagram



Existing ADT Volume Diagram

Existing ADT Volume Diagram

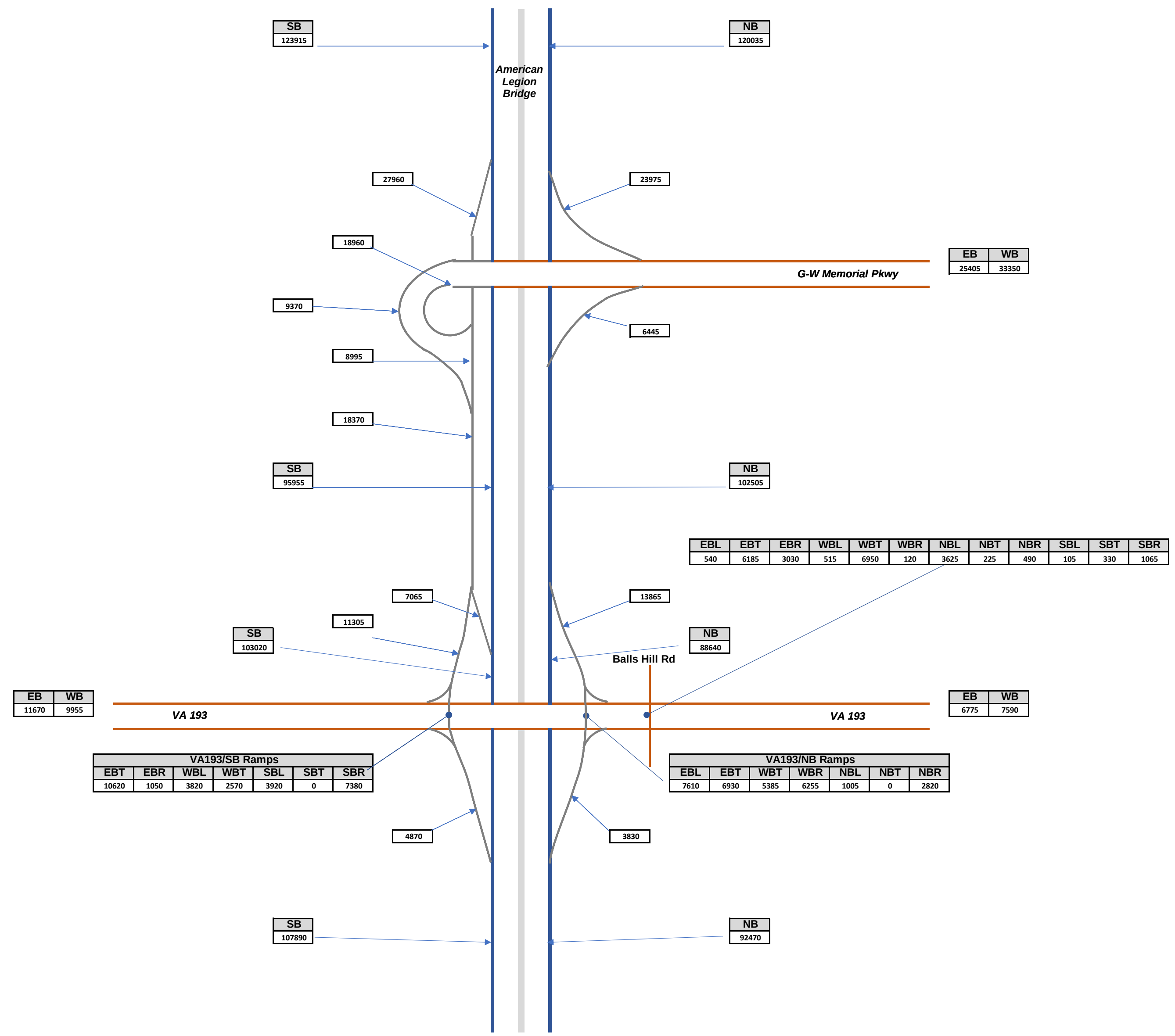


Exit 39										
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
6605	9650	3975	10340	9465	5660	7970	3130	2300	13045	12595

Exit 41	R 1	R 3	R 4	R 6	R 7	R 8
	3635	2505	6890	3920	7130	1860

Existing ADT Volume Diagram

Existing ADT Volume Diagram

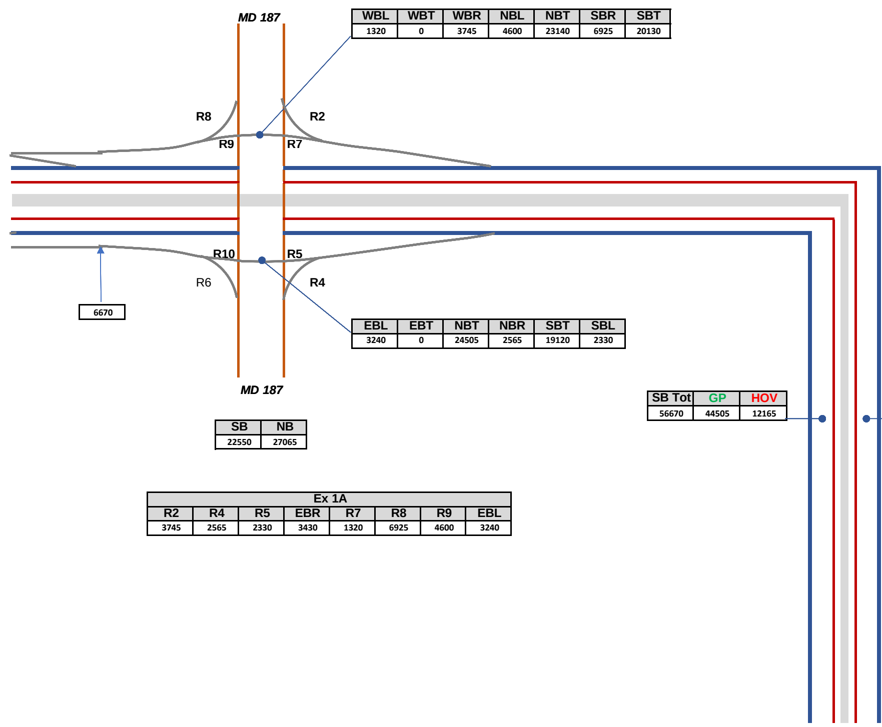


Existing ADT Volume Diagram

Existing ADT Volume Diagram

SB	NB
27055	26885

WBL	WBT	WBR	NBL	NBT	SBR	SBT
1320	0	3745	4600	23140	6925	20130



EBL	EBT	NBT	NBR	SBT	SBL
3240	0	24505	2565	19120	2330

SB Tot	GP	HOV
56670	44505	12165

HOV	GP	NB Tot
10125	47285	57410

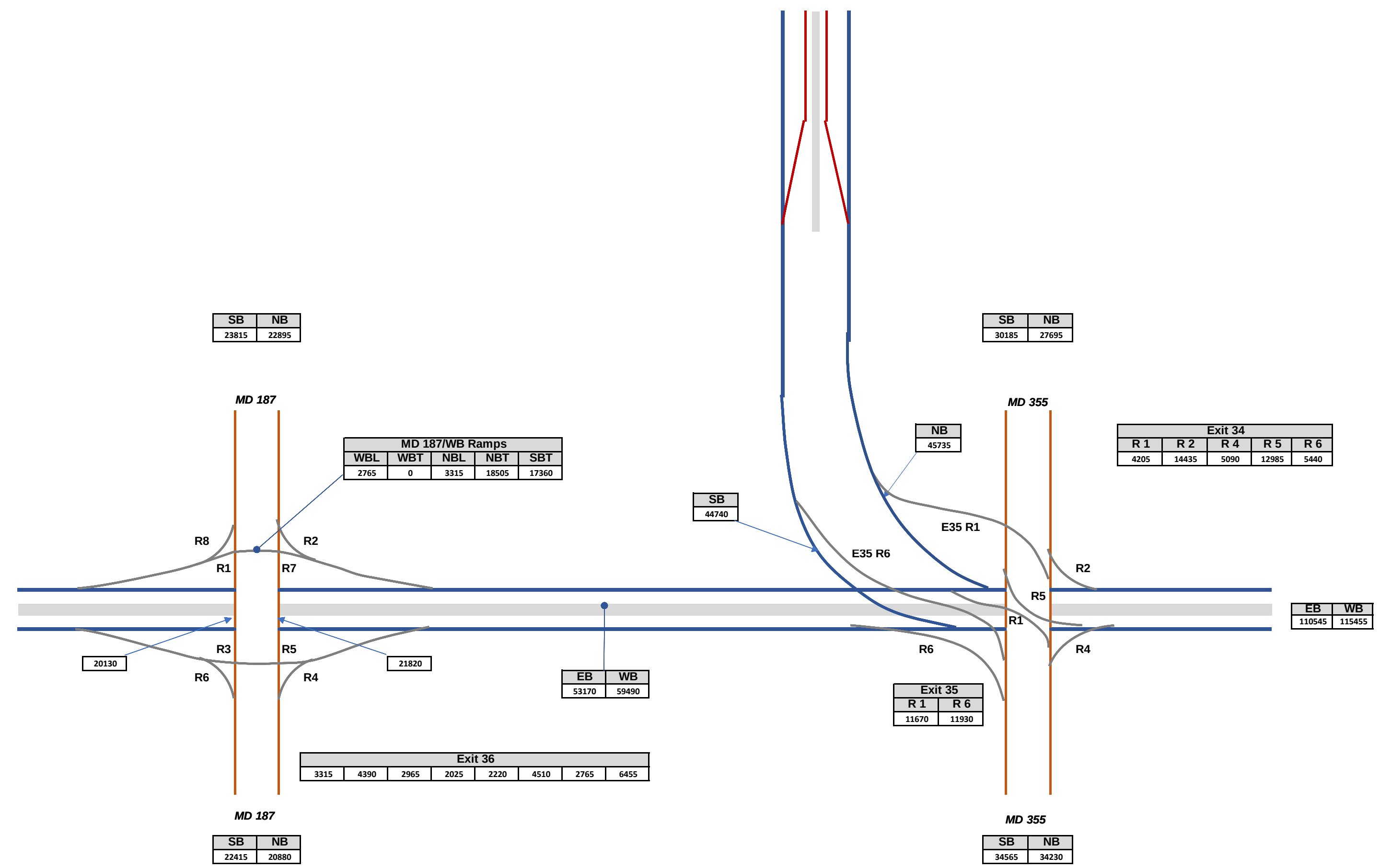
SB	NB
22550	27065

Ex 1A							
R2	R4	R5	EBR	R7	R8	R9	EBL
3745	2565	2330	3430	1320	6925	4600	3240

N

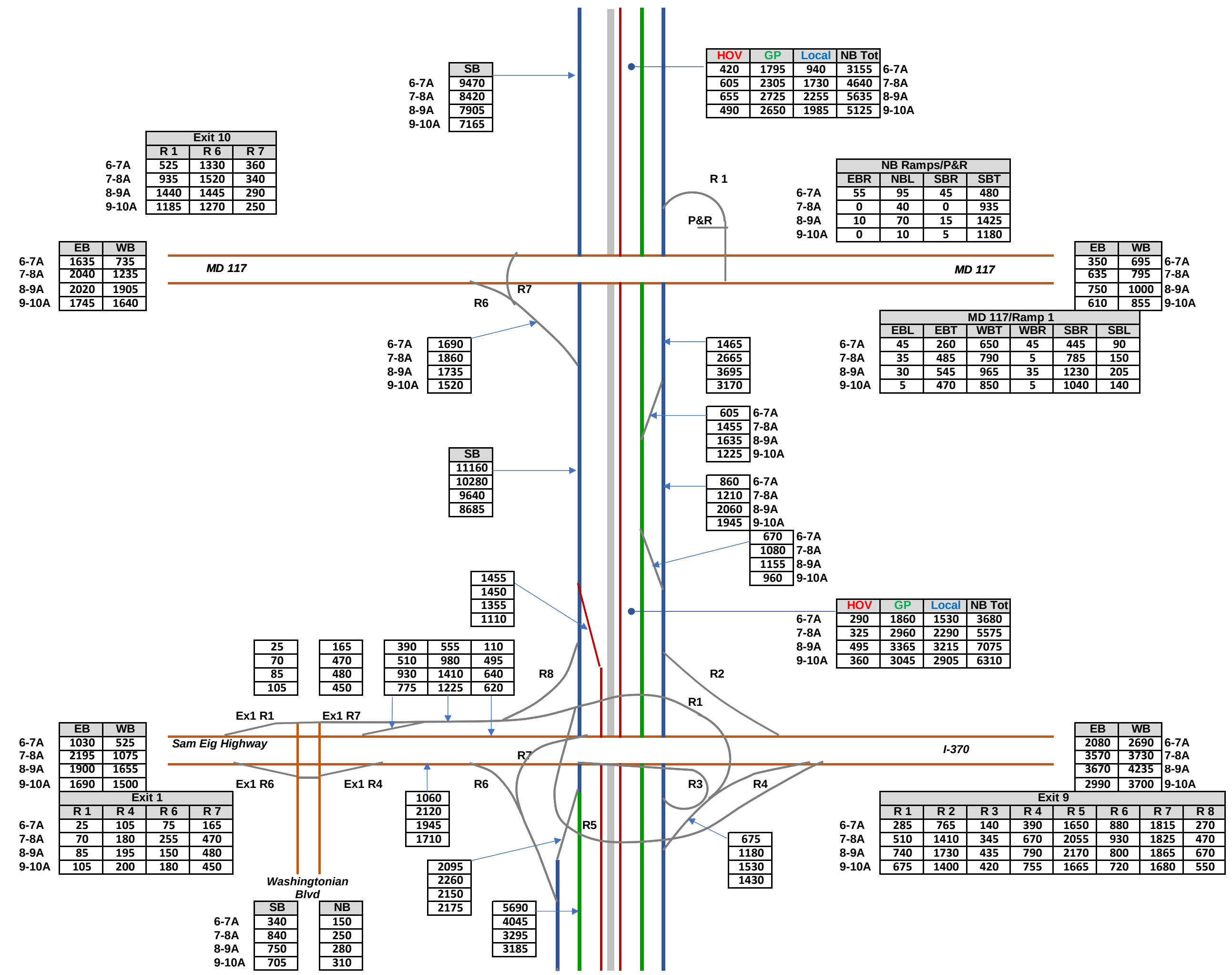
Existing ADT Volume Diagram

Existing ADT Volume Diagram



Existing ADT Volume Diagram

2027 No-Build Hourly AM Volume Diagram



2027 No-Build Hourly AM Volume Diagram

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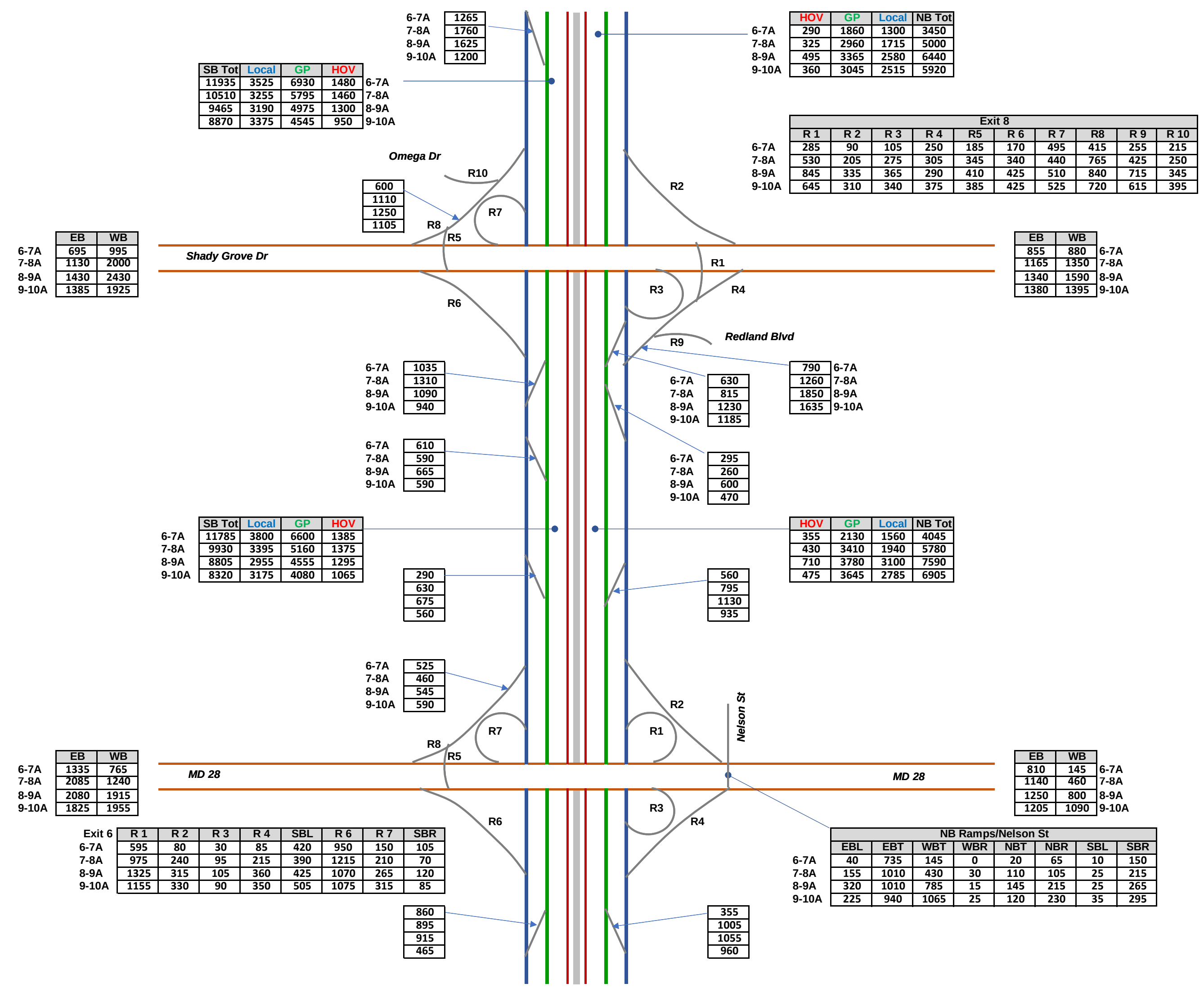
2027 No-Build Hourly AM Volume Diagram



6-7A	1265
7-8A	1760
8-9A	1625
9-10A	1200

SB Tot	Local	GP	HOV	
11935	3525	6930	1480	6-7A
10510	3255	5795	1460	7-8A
9465	3190	4975	1300	8-9A
8870	3375	4545	950	9-10A

	HOV	GP	Local	NB Tot
6-7A	290	1860	1300	3450
7-8A	325	2960	1715	5000
8-9A	495	3365	2580	6440
9-10A	360	3045	2515	5920

	Exit 8									
	R 1	R 2	R 3	R 4	R5	R 6	R 7	R8	R 9	R 10
6-7A	285	90	105	250	185	170	495	415	255	215
7-8A	530	205	275	305	345	340	440	765	425	250
8-9A	845	335	365	290	410	425	510	840	715	345
9-10A	645	310	340	375	385	425	525	720	615	395

600
1110
1250
1105

	EB	WB
6-7A	695	995
7-8A	1130	2000
8-9A	1430	2430
9-10A	1385	1925

EB	WB	
855	880	6-7A
1165	1350	7-8A
1340	1590	8-9A
1380	1395	9-10A

6-7A	1035
7-8A	1310
8-9A	1090
9-10A	940

6-7A	630
7-8A	815
8-9A	1230
9-10A	1185

790	6-7A
1260	7-8A
1850	8-9A
1635	9-10A

6-7A	610
7-8A	590
8-9A	665
9-10A	590

6-7A	295
7-8A	260
8-9A	600
9-10A	470

	SB Tot	Local	GP	HOV
6-7A	11785	3800	6600	1385
7-8A	9930	3395	5160	1375
8-9A	8805	2955	4555	1295
9-10A	8320	3175	4080	1065

HOV	GP	Local	NB Tot
355	2130	1560	4045
430	3410	1940	5780
710	3780	3100	7590
475	3645	2785	6905

290
630
675
560

560
795
1130
935

6-7A	525
7-8A	460
8-9A	545
9-10A	590

	EB	WB
6-7A	1335	765
7-8A	2085	1240
8-9A	2080	1915
9-10A	1825	1955

EB	WB	
810	145	6-7A
1140	460	7-8A
1250	800	8-9A
1205	1090	9-10A

Exit 6	R 1	R 2	R 3	R 4	SBL	R 6	R 7	SBR
6-7A	595	80	30	85	420	950	150	105
7-8A	975	240	95	215	390	1215	210	70
8-9A	1325	315	105	360	425	1070	265	120
9-10A	1155	330	90	350	505	1075	315	85

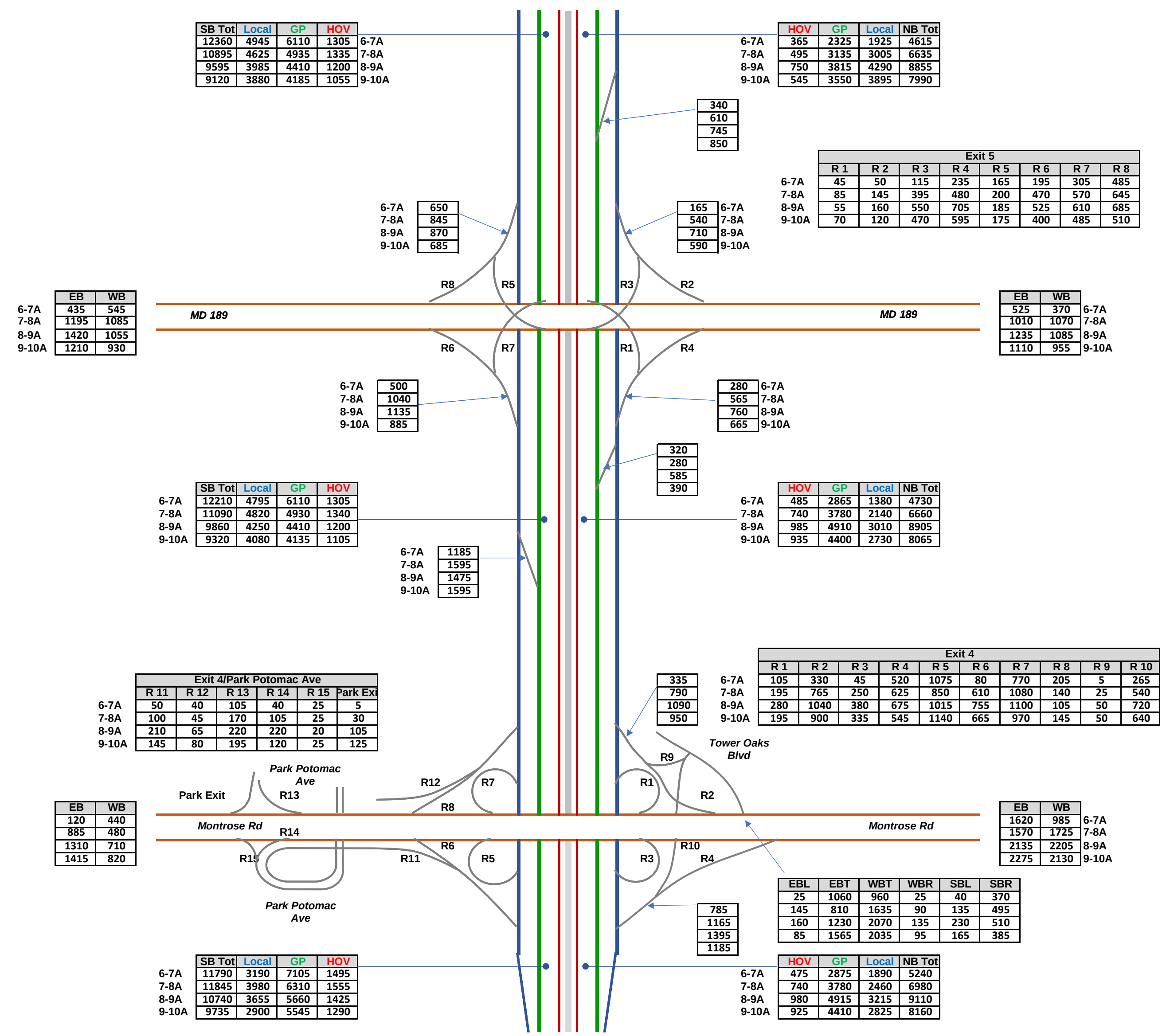
	NB Ramps/Nelson St							
	EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
6-7A	40	735	145	0	20	65	10	150
7-8A	155	1010	430	30	110	105	25	215
8-9A	320	1010	785	15	145	215	25	265
9-10A	225	940	1065	25	120	230	35	295

860
895
915
465

355
1005
1055
960

2027 No-Build Hourly AM Volume Diagram

2027 No-Build Hourly AM Volume Diagram



	SB Tot	Local	GP	HOV
6-7A	12360	4945	6110	1305
7-8A	10895	4625	4935	1335
8-9A	9595	3985	4410	1200
9-10A	9120	3880	4185	1055

	HOV	GP	Local	NB Tot
6-7A	365	2325	1925	4615
7-8A	495	3135	3005	6635
8-9A	750	3815	4290	8855
9-10A	545	3550	3895	7990

340
610
745
850

	Exit 5							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	45	50	115	235	165	195	305	485
7-8A	85	145	395	480	200	470	570	645
8-9A	55	160	550	705	185	525	610	685
9-10A	70	120	470	595	175	400	485	510

6-7A	650
7-8A	845
8-9A	870
9-10A	685

165	6-7A
540	7-8A
710	8-9A
590	9-10A

	EB	WB
6-7A	435	545
7-8A	1195	1085
8-9A	1420	1055
9-10A	1210	930

EB	WB	
525	370	6-7A
1010	1070	7-8A
1235	1085	8-9A
1110	955	9-10A

6-7A	500
7-8A	1040
8-9A	1135
9-10A	885

280	6-7A
565	7-8A
760	8-9A
665	9-10A

320
280
585
390

	SB Tot	Local	GP	HOV
6-7A	12210	4795	6110	1305
7-8A	11090	4820	4930	1340
8-9A	9860	4250	4410	1200
9-10A	9320	4080	4135	1105

	HOV	GP	Local	NB Tot
6-7A	485	2865	1380	4730
7-8A	740	3780	2140	6660
8-9A	985	4910	3010	8905
9-10A	935	4400	2730	8065

6-7A	1185
7-8A	1595
8-9A	1475
9-10A	1595

	Exit 4									
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
6-7A	105	330	45	520	1075	80	770	205	5	265
7-8A	195	765	250	625	850	610	1080	140	25	540
8-9A	280	1040	380	675	1015	755	1100	105	50	720
9-10A	195	900	335	545	1140	665	970	145	50	640

335
790
1090
950

	Exit 4/Park Potomac Ave					
	R 11	R 12	R 13	R 14	R 15	Park Exi
6-7A	50	40	105	40	25	5
7-8A	100	45	170	105	25	30
8-9A	210	65	220	220	20	105
9-10A	145	80	195	120	25	125

EB	WB
120	440
885	480
1310	710
1415	820

EB	WB	
1620	985	6-7A
1570	1725	7-8A
2135	2205	8-9A
2275	2130	9-10A

EBL	EBT	WBT	WBR	SBL	SBR
25	1060	960	25	40	370
145	810	1635	90	135	495
160	1230	2070	135	230	510
85	1565	2035	95	165	385

785
1165
1395
1185

	SB Tot	Local	GP	HOV
6-7A	11790	3190	7105	1495
7-8A	11845	3980	6310	1555
8-9A	10740	3655	5660	1425
9-10A	9735	2900	5545	1290

	HOV	GP	Local	NB Tot
6-7A	475	2875	1890	5240
7-8A	740	3780	2460	6980
8-9A	980	4915	3215	9110
9-10A	925	4410	2825	8160

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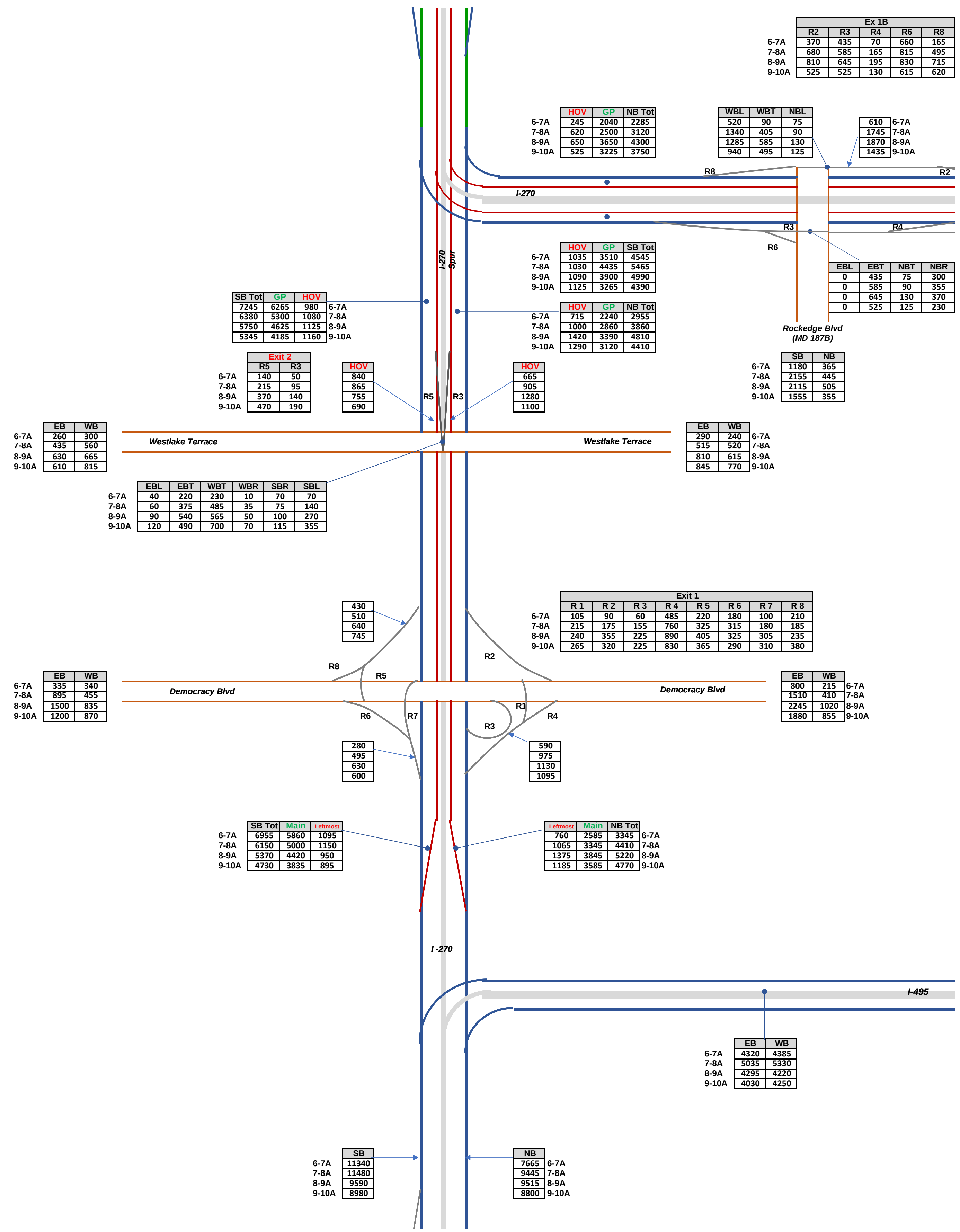
2027 No-Build Hourly AM Volume Diagram

2027 No-Build Hourly AM Volume Diagram



Ex 1B	R2	R3	R4	R6	R8
6-7A	370	435	70	660	165
7-8A	680	585	165	815	495
8-9A	810	645	195	830	715
9-10A	525	525	130	615	620

	HOV	GP	NB Tot
6-7A	245	2040	2285
7-8A	620	2500	3120
8-9A	650	3650	4300
9-10A	525	3225	3750

WBL	WBT	NBL
520	90	75
1340	405	90
1285	585	130
940	495	125

610	6-7A
1745	7-8A
1870	8-9A
1435	9-10A

	HOV	GP	SB Tot
6-7A	1035	3510	4545
7-8A	1030	4435	5465
8-9A	1090	3900	4990
9-10A	1125	3265	4390

EBL	EBT	NBT	NBR
0	435	75	300
0	585	90	355
0	645	130	370
0	525	125	230

SB Tot	GP	HOV	
7245	6265	980	6-7A
6380	5300	1080	7-8A
5750	4625	1125	8-9A
5345	4185	1160	9-10A

	HOV	GP	NB Tot
6-7A	715	2240	2955
7-8A	1000	2860	3860
8-9A	1420	3390	4810
9-10A	1290	3120	4410

	SB	NB
6-7A	1180	365
7-8A	2155	445
8-9A	2115	505
9-10A	1555	355

Exit 2	R5	R3
6-7A	140	50
7-8A	215	95
8-9A	370	140
9-10A	470	190

HOV
840
865
755
690

HOV
665
905
1280
1100

	EB	WB
6-7A	260	300
7-8A	435	560
8-9A	630	665
9-10A	610	815

EB	WB	
290	240	6-7A
515	520	7-8A
810	615	8-9A
845	770	9-10A

	EBL	EBT	WBT	WBR	SBR	SBL
6-7A	40	220	230	10	70	70
7-8A	60	375	485	35	75	140
8-9A	90	540	565	50	100	270
9-10A	120	490	700	70	115	355

430
510
640
745

Exit 1	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	105	90	60	485	220	180	100	210
7-8A	215	175	155	760	325	315	180	185
8-9A	240	355	225	890	405	325	305	235
9-10A	265	320	225	830	365	290	310	380

	EB	WB
6-7A	335	340
7-8A	895	455
8-9A	1500	835
9-10A	1200	870

EB	WB	
800	215	6-7A
1510	410	7-8A
2245	1020	8-9A
1880	855	9-10A

280
495
630
600

590
975
1130
1095

	SB Tot	Main	Leftmost
6-7A	6955	5860	1095
7-8A	6150	5000	1150
8-9A	5370	4420	950
9-10A	4730	3835	895

Leftmost	Main	NB Tot	
760	2585	3345	6-7A
1065	3345	4410	7-8A
1375	3845	5220	8-9A
1185	3585	4770	9-10A

	EB	WB
6-7A	4320	4385
7-8A	5035	5330
8-9A	4295	4220
9-10A	4030	4250

	SB
6-7A	11340
7-8A	11480
8-9A	9590
9-10A	8980

NB	
7665	6-7A
9445	7-8A
9515	8-9A
8800	9-10A

2027 No-Build Hourly AM Volume Diagram

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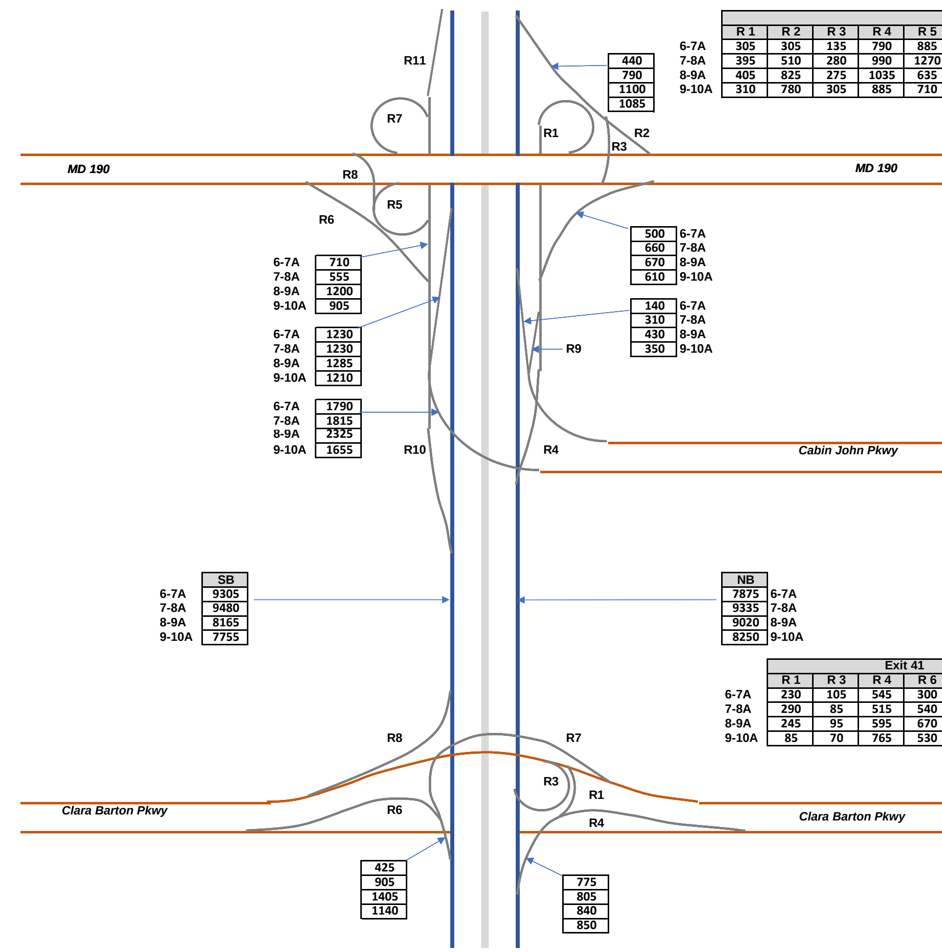
2027 No-Build Hourly AM Volume Diagram



Exit 39

	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
6-7A	305	305	135	790	885	505	270	135	15	655	1460
7-8A	395	510	280	990	1270	925	555	395	65	895	1665
8-9A	405	825	275	1035	635	1095	710	270	40	1255	1395
9-10A	310	780	305	885	710	770	580	210	35	1230	1245

Exit 41

	R 1	R 3	R 4	R 6	R 7	R 8
6-7A	230	105	545	300	125	205
7-8A	290	85	515	540	365	210
8-9A	245	95	595	670	735	115
9-10A	85	70	765	530	610	95

MD 190 (west)

	EB	WB
6-7A	935	620
7-8A	1900	1090
8-9A	2055	925
9-10A	1660	885

MD 190 (east)

	EB	WB
6-7A	1680	755
7-8A	2625	1365
8-9A	1990	1785
9-10A	1905	1725

	440
	790
	1100
	1085

500	6-7A
660	7-8A
670	8-9A
610	9-10A

140	6-7A
310	7-8A
430	8-9A
350	9-10A

6-7A	710
7-8A	555
8-9A	1200
9-10A	905

6-7A	1230
7-8A	1230
8-9A	1285
9-10A	1210

6-7A	1790
7-8A	1815
8-9A	2325
9-10A	1655

Cabin John Pkwy

	EB	WB
6-7A	1790	155
7-8A	1815	375
8-9A	2325	465
9-10A	1655	385

	SB
6-7A	9305
7-8A	9480
8-9A	8165
9-10A	7755

NB	
7875	6-7A
9335	7-8A
9020	8-9A
8250	9-10A

Clara Barton Pkwy (west)

	EB	WB
6-7A	560	575
7-8A	1455	660
8-9A	1460	365
9-10A	800	180

Clara Barton Pkwy (east)

	EB	WB
6-7A	700	265
7-8A	1345	525
8-9A	1290	740
9-10A	965	610

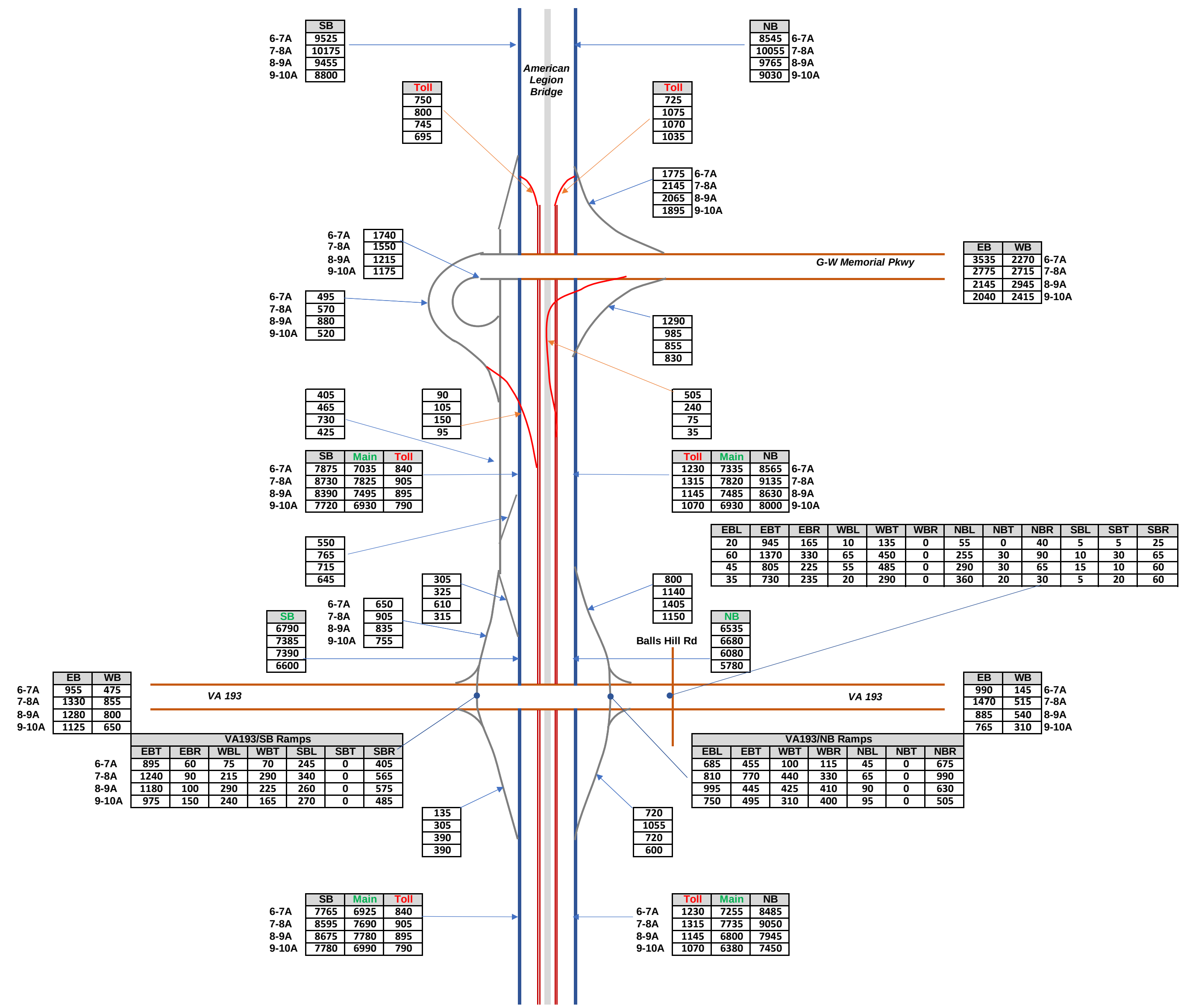
425
905
1405
1140

775
805
840
850

N

2027 No-Build Hourly AM Volume Diagram

2027 No-Build Hourly AM Volume Diagram



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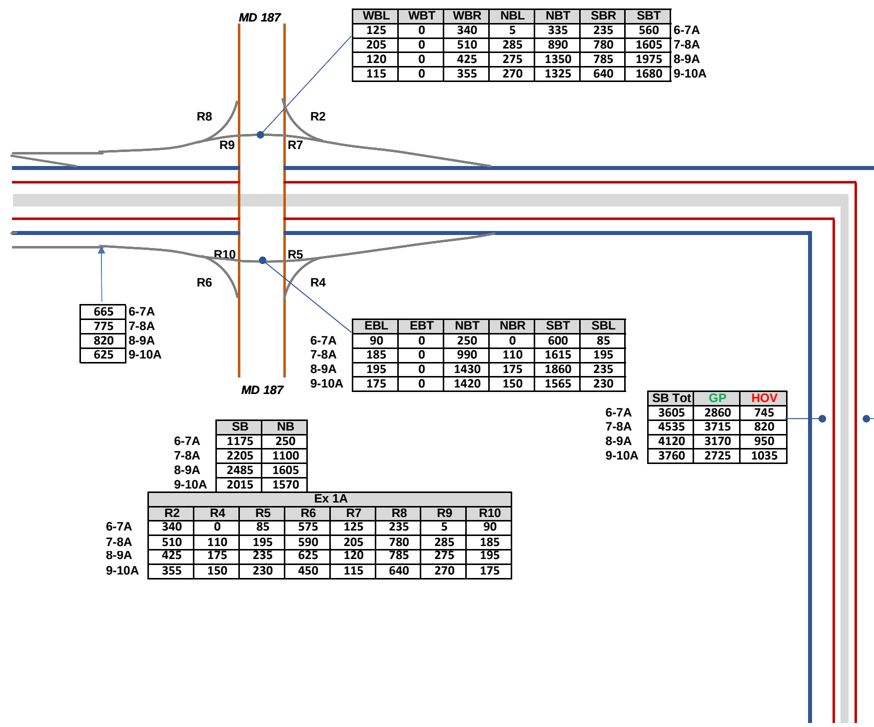
2027 No-Build Hourly AM Volume Diagram

2027 No-Build Hourly AM Volume Diagram



	SB	NB
6-7A	795	675
7-8A	2385	1400
8-9A	2760	1775
9-10A	2320	1680

WBL	WBT	WBR	NBL	NBT	SBR	SBT	
125	0	340	5	335	235	560	6-7A
205	0	510	285	890	780	1605	7-8A
120	0	425	275	1350	785	1975	8-9A
115	0	355	270	1325	640	1680	9-10A

665	6-7A
775	7-8A
820	8-9A
625	9-10A

	EBL	EBT	NBT	NBR	SBT	SBL
6-7A	90	0	250	0	600	85
7-8A	185	0	990	110	1615	195
8-9A	195	0	1430	175	1860	235
9-10A	175	0	1420	150	1565	230

	SB Tot	GP	HOV
6-7A	3605	2860	745
7-8A	4535	3715	820
8-9A	4120	3170	950
9-10A	3760	2725	1035

HOV	GP	NB Tot	
345	2610	2955	6-7A
655	3365	4020	7-8A
740	4200	4940	8-9A
570	3555	4125	9-10A

	SB	NB
6-7A	1175	250
7-8A	2205	1100
8-9A	2485	1605
9-10A	2015	1570

	Ex 1A							
	R2	R4	R5	R6	R7	R8	R9	R10
6-7A	340	0	85	575	125	235	5	90
7-8A	510	110	195	590	205	780	285	185
8-9A	425	175	235	625	120	785	275	195
9-10A	355	150	230	450	115	640	270	175

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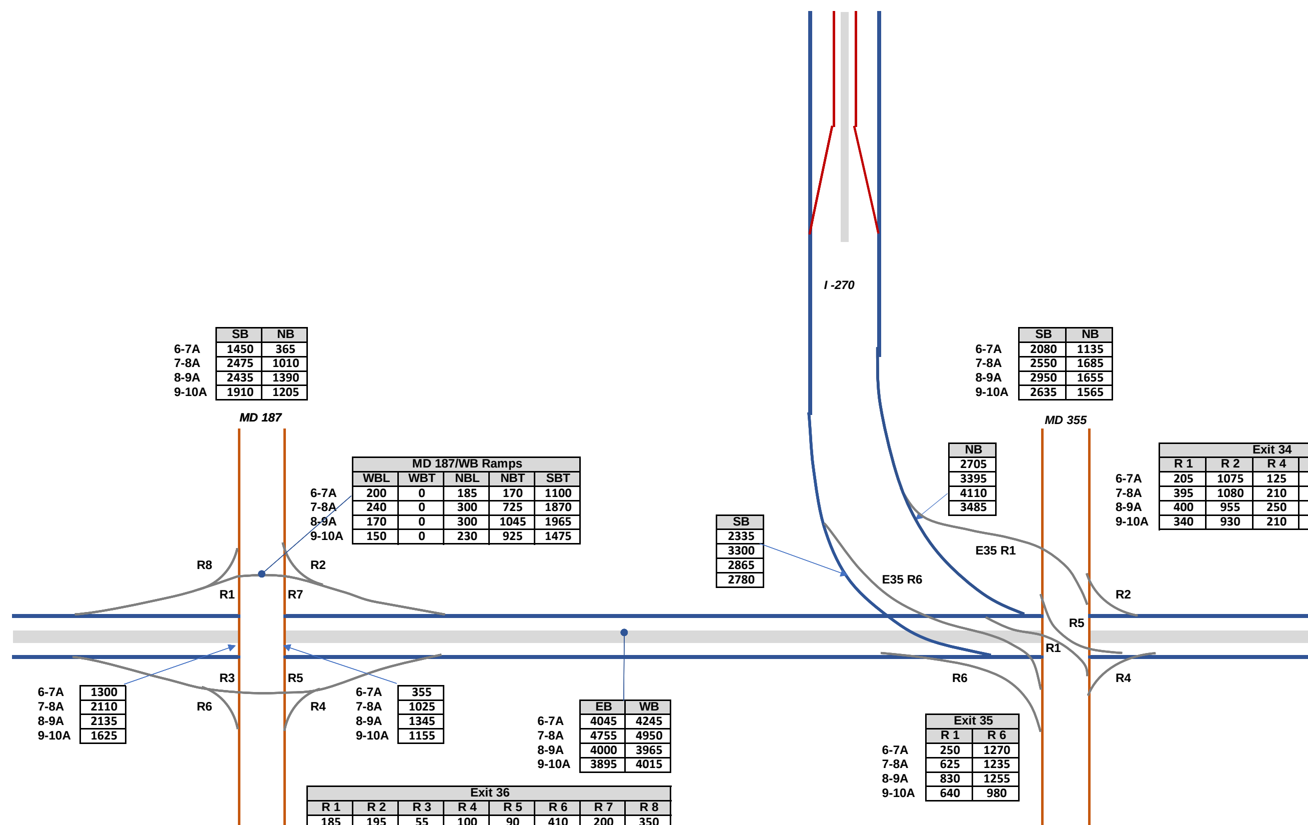
2027 No-Build Hourly AM Volume Diagram

2027 No-Build Hourly AM Volume Diagram



MD 187 (north)

	SB	NB
6-7A	1450	365
7-8A	2475	1010
8-9A	2435	1390
9-10A	1910	1205

MD 187/WB Ramps					
	WBL	WBT	NBL	NBT	SBT
6-7A	200	0	185	170	1100
7-8A	240	0	300	725	1870
8-9A	170	0	300	1045	1965
9-10A	150	0	230	925	1475

6-7A	1300
7-8A	2110
8-9A	2135
9-10A	1625

6-7A	355
7-8A	1025
8-9A	1345
9-10A	1155

	EB	WB
6-7A	4045	4245
7-8A	4755	4950
8-9A	4000	3965
9-10A	3895	4015

Exit 36							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
185	195	55	100	90	410	200	350
300	285	90	195	175	560	240	605
300	345	175	165	210	495	170	470
230	280	105	135	155	320	150	435

MD 187 (south)

	SB	NB
6-7A	1620	400
7-8A	2495	1130
8-9A	2420	1335
9-10A	1790	1185

SB
2335
3300
2865
2780

NB
2705
3395
4110
3485

MD 355 (north)

	SB	NB
6-7A	2080	1135
7-8A	2550	1685
8-9A	2950	1655
9-10A	2635	1565

Exit 34					
	R 1	R 2	R 4	R 5	R 6
6-7A	205	1075	125	570	490
7-8A	395	1080	210	985	580
8-9A	400	955	250	1055	465
9-10A	340	930	210	815	395

EB	WB	
6585	7820	6-7A
8670	9030	7-8A
7705	8630	8-9A
7305	8090	9-10A

Exit 35		
	R 1	R 6
6-7A	250	1270
7-8A	625	1235
8-9A	830	1255
9-10A	640	980

MD 355 (south)

	SB	NB
6-7A	3270	640
7-8A	3380	1835
8-9A	3615	2180
9-10A	3195	1825

2027 No-Build Hourly AM Volume Diagram

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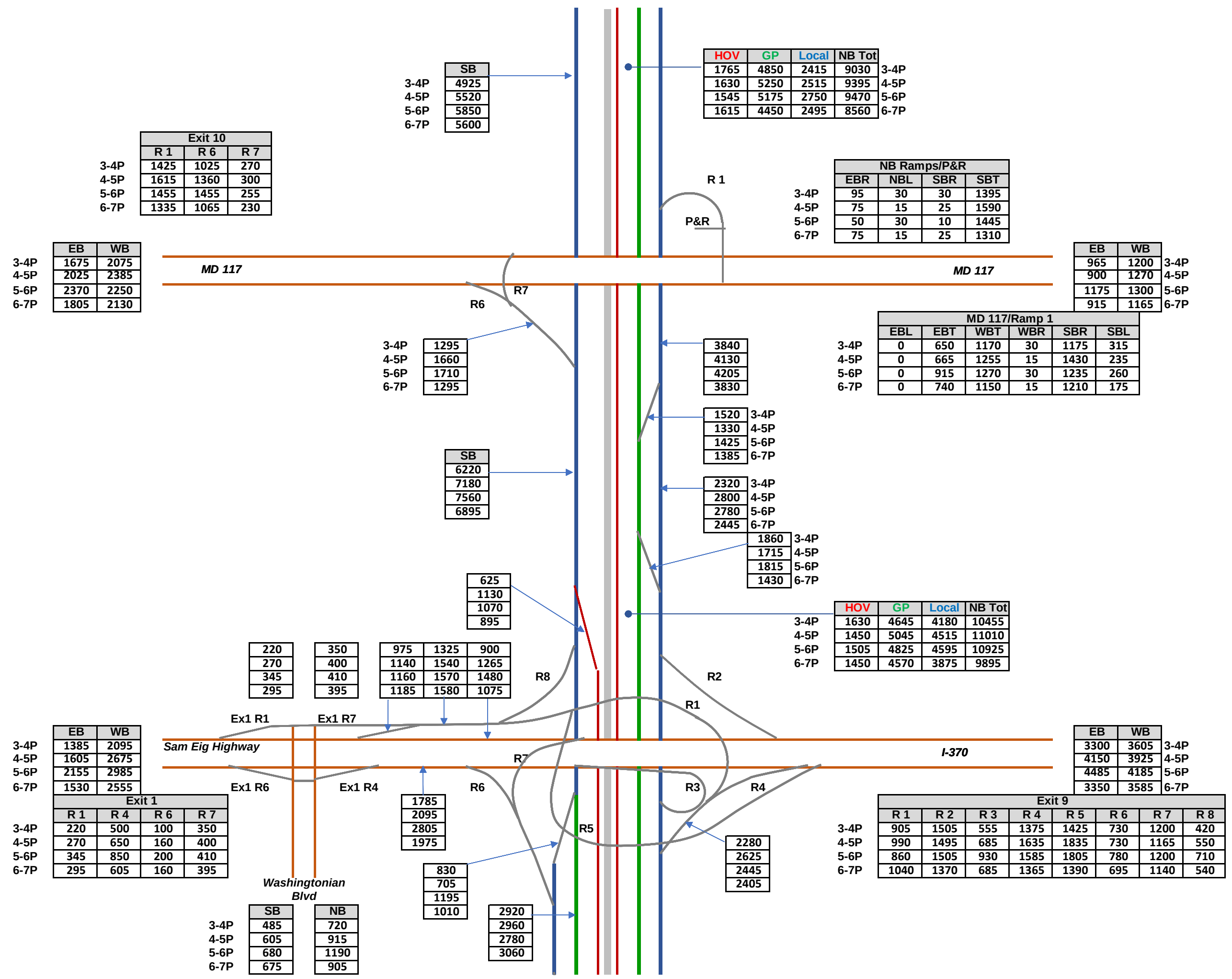


	SB
3-4P	4925
4-5P	5520
5-6P	5850
6-7P	5600

HOV	GP	Local	NB Tot	
1765	4850	2415	9030	3-4P
1630	5250	2515	9395	4-5P
1545	5175	2750	9470	5-6P
1615	4450	2495	8560	6-7P

	Exit 10		
	R 1	R 6	R 7
3-4P	1425	1025	270
4-5P	1615	1360	300
5-6P	1455	1455	255
6-7P	1335	1065	230

	NB Ramps/P&R			
	EBR	NBL	SBR	SBT
3-4P	95	30	30	1395
4-5P	75	15	25	1590
5-6P	50	30	10	1445
6-7P	75	15	25	1310

	EB	WB
3-4P	1675	2075
4-5P	2025	2385
5-6P	2370	2250
6-7P	1805	2130

EB	WB	
965	1200	3-4P
900	1270	4-5P
1175	1300	5-6P
915	1165	6-7P

	MD 117/Ramp 1					
	EBL	EBT	WBT	WBR	SBR	SBL
3-4P	0	650	1170	30	1175	315
4-5P	0	665	1255	15	1430	235
5-6P	0	915	1270	30	1235	260
6-7P	0	740	1150	15	1210	175

3-4P	1295
4-5P	1660
5-6P	1710
6-7P	1295

3840
4130
4205
3830

1520	3-4P
1330	4-5P
1425	5-6P
1385	6-7P

SB
6220
7180
7560
6895

2320	3-4P
2800	4-5P
2780	5-6P
2445	6-7P

1860	3-4P
1715	4-5P
1815	5-6P
1430	6-7P

625
1130
1070
895

	HOV	GP	Local	NB Tot
3-4P	1630	4645	4180	10455
4-5P	1450	5045	4515	11010
5-6P	1505	4825	4595	10925
6-7P	1450	4570	3875	9895

220
270
345
295

350
400
410
395

975	1325	900
1140	1540	1265
1160	1570	1480
1185	1580	1075

	EB	WB
3-4P	1385	2095
4-5P	1605	2675
5-6P	2155	2985
6-7P	1530	2555

EB	WB	
3300	3605	3-4P
4150	3925	4-5P
4485	4185	5-6P
3350	3585	6-7P

	Exit 1			
	R 1	R 4	R 6	R 7
3-4P	220	500	100	350
4-5P	270	650	160	400
5-6P	345	850	200	410
6-7P	295	605	160	395

1785
2095
2805
1975

830
705
1195
1010

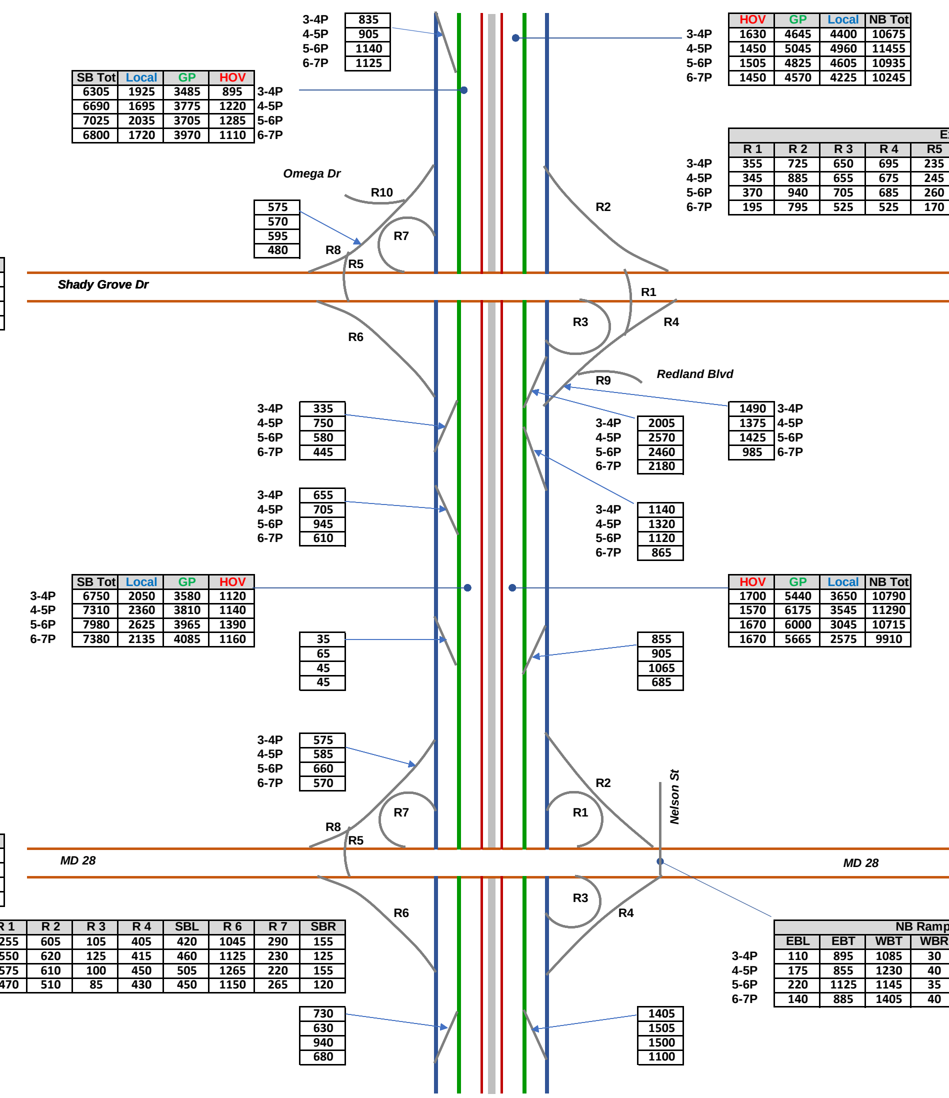
2920
2960
2780
3060

2280
2625
2445
2405

	SB	NB
3-4P	485	720
4-5P	605	915
5-6P	680	1190
6-7P	675	905

	Exit 9							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P	905	1505	555	1375	1425	730	1200	420
4-5P	990	1495	685	1635	1835	730	1165	550
5-6P	860	1505	930	1585	1805	780	1200	710
6-7P	1040	1370	685	1365	1390	695	1140	540

2027 No-Build Hourly PM Volume Diagram



Exit 8 – Northern mainline

	3-4P	4-5P	5-6P	6-7P
SB entering (top)	835	905	1140	1125

SB Tot	Local	GP	HOV	
6305	1925	3485	895	3-4P
6690	1695	3775	1220	4-5P
7025	2035	3705	1285	5-6P
6800	1720	3970	1110	6-7P

	HOV	GP	Local	NB Tot
3-4P	1630	4645	4400	10675
4-5P	1450	5045	4960	11455
5-6P	1505	4825	4605	10935
6-7P	1450	4570	4225	10245

Exit 8	R 1	R 2	R 3	R 4	R5	R 6	R 7	R8	R 9	R 10
3-4P	355	725	650	695	235	490	650	340	440	120
4-5P	345	885	655	675	245	685	665	325	355	160
5-6P	370	940	705	685	260	855	830	335	370	135
6-7P	195	795	525	525	170	495	705	310	265	140

575
570
595
480

Shady Grove Dr

	EB	WB
3-4P	1885	960
4-5P	2070	905
5-6P	2160	1020
6-7P	1475	715

EB	WB	
1675	1640	3-4P
1650	1785	4-5P
1545	2085	5-6P
1150	1710	6-7P

	3-4P	4-5P	5-6P	6-7P
SB	335	750	580	445
SB	655	705	945	610
NB	2005	2570	2460	2180
NB	1490	1375	1425	985
NB	1140	1320	1120	865

Between Exit 8 and Exit 6

	SB Tot	Local	GP	HOV
3-4P	6750	2050	3580	1120
4-5P	7310	2360	3810	1140
5-6P	7980	2625	3965	1390
6-7P	7380	2135	4085	1160

HOV	GP	Local	NB Tot
1700	5440	3650	10790
1570	6175	3545	11290
1670	6000	3045	10715
1670	5665	2575	9910

35	855	
65	905	
45	1065	
45	685	

	3-4P	4-5P	5-6P	6-7P
SB	575	585	660	570

Exit 6 – MD 28

	EB	WB
3-4P	1735	1935
4-5P	1820	2460
5-6P	2205	2460
6-7P	1810	2545

EB	WB	
1105	1115	3-4P
1065	1270	4-5P
1330	1180	5-6P
1075	1445	6-7P

Exit 6	R 1	R 2	R 3	R 4	SBL	R 6	R 7	SBR
3-4P	1255	605	105	405	420	1045	290	155
4-5P	1550	620	125	415	460	1125	230	125
5-6P	1575	610	100	450	505	1265	220	155
6-7P	1470	510	85	430	450	1150	265	120

NB Ramps/Nelson St	EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
3-4P	110	895	1085	30	225	180	30	335
4-5P	175	855	1230	40	230	185	25	405
5-6P	220	1125	1145	35	275	175	30	415
6-7P	140	885	1405	40	270	160	30	325

730	1405
630	1505
940	1500
680	1100

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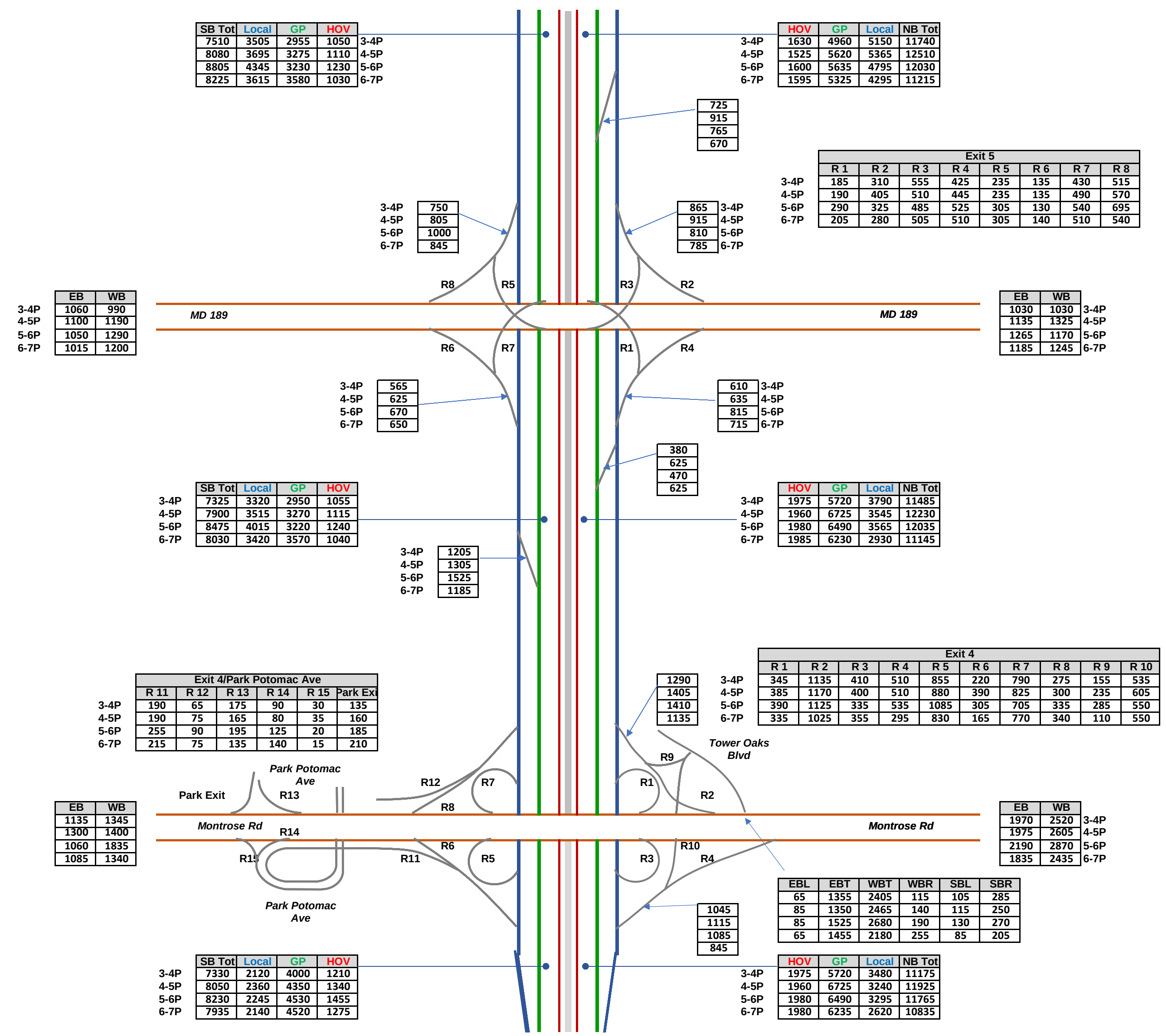

SB Tot	Local	GP	HOV	
7510	3505	2955	1050	3-4P
8080	3695	3275	1110	4-5P
8805	4345	3230	1230	5-6P
8225	3615	3580	1030	6-7P

	HOV	GP	Local	NB Tot
3-4P	1630	4960	5150	11740
4-5P	1525	5620	5365	12510
5-6P	1600	5635	4795	12030
6-7P	1595	5325	4295	11215

725
915
765
670

	Exit 5							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P	185	310	555	425	235	135	430	515
4-5P	190	405	510	445	235	135	490	570
5-6P	290	325	485	525	305	130	540	695
6-7P	205	280	505	510	305	140	510	540

3-4P	750
4-5P	805
5-6P	1000
6-7P	845

865	3-4P
915	4-5P
810	5-6P
785	6-7P

	EB	WB
3-4P	1060	990
4-5P	1100	1190
5-6P	1050	1290
6-7P	1015	1200

EB	WB	
1030	1030	3-4P
1135	1325	4-5P
1265	1170	5-6P
1185	1245	6-7P

3-4P	565
4-5P	625
5-6P	670
6-7P	650

610	3-4P
635	4-5P
815	5-6P
715	6-7P

380
625
470
625

	SB Tot	Local	GP	HOV
3-4P	7325	3320	2950	1055
4-5P	7900	3515	3270	1115
5-6P	8475	4015	3220	1240
6-7P	8030	3420	3570	1040

	HOV	GP	Local	NB Tot
3-4P	1975	5720	3790	11485
4-5P	1960	6725	3545	12230
5-6P	1980	6490	3565	12035
6-7P	1985	6230	2930	11145

3-4P	1205
4-5P	1305
5-6P	1525
6-7P	1185

	Exit 4/Park Potomac Ave					
	R 11	R 12	R 13	R 14	R 15	Park Exi
3-4P	190	65	175	90	30	135
4-5P	190	75	165	80	35	160
5-6P	255	90	195	125	20	185
6-7P	215	75	135	140	15	210

1290
1405
1410
1135

	Exit 4									
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
3-4P	345	1135	410	510	855	220	790	275	155	535
4-5P	385	1170	400	510	880	390	825	300	235	605
5-6P	390	1125	335	535	1085	305	705	335	285	550
6-7P	335	1025	355	295	830	165	770	340	110	550

EB	WB
1135	1345
1300	1400
1060	1835
1085	1340

EB	WB	
1970	2520	3-4P
1975	2605	4-5P
2190	2870	5-6P
1835	2435	6-7P

EBL	EBT	WBT	WBR	SBL	SBR
65	1355	2405	115	105	285
85	1350	2465	140	115	250
85	1525	2680	190	130	270
65	1455	2180	255	85	205

1045
1115
1085
845

	SB Tot	Local	GP	HOV
3-4P	7330	2120	4000	1210
4-5P	8050	2360	4350	1340
5-6P	8230	2245	4530	1455
6-7P	7935	2140	4520	1275

	HOV	GP	Local	NB Tot
3-4P	1975	5720	3480	11175
4-5P	1960	6725	3240	11925
5-6P	1980	6490	3295	11765
6-7P	1980	6235	2620	10835

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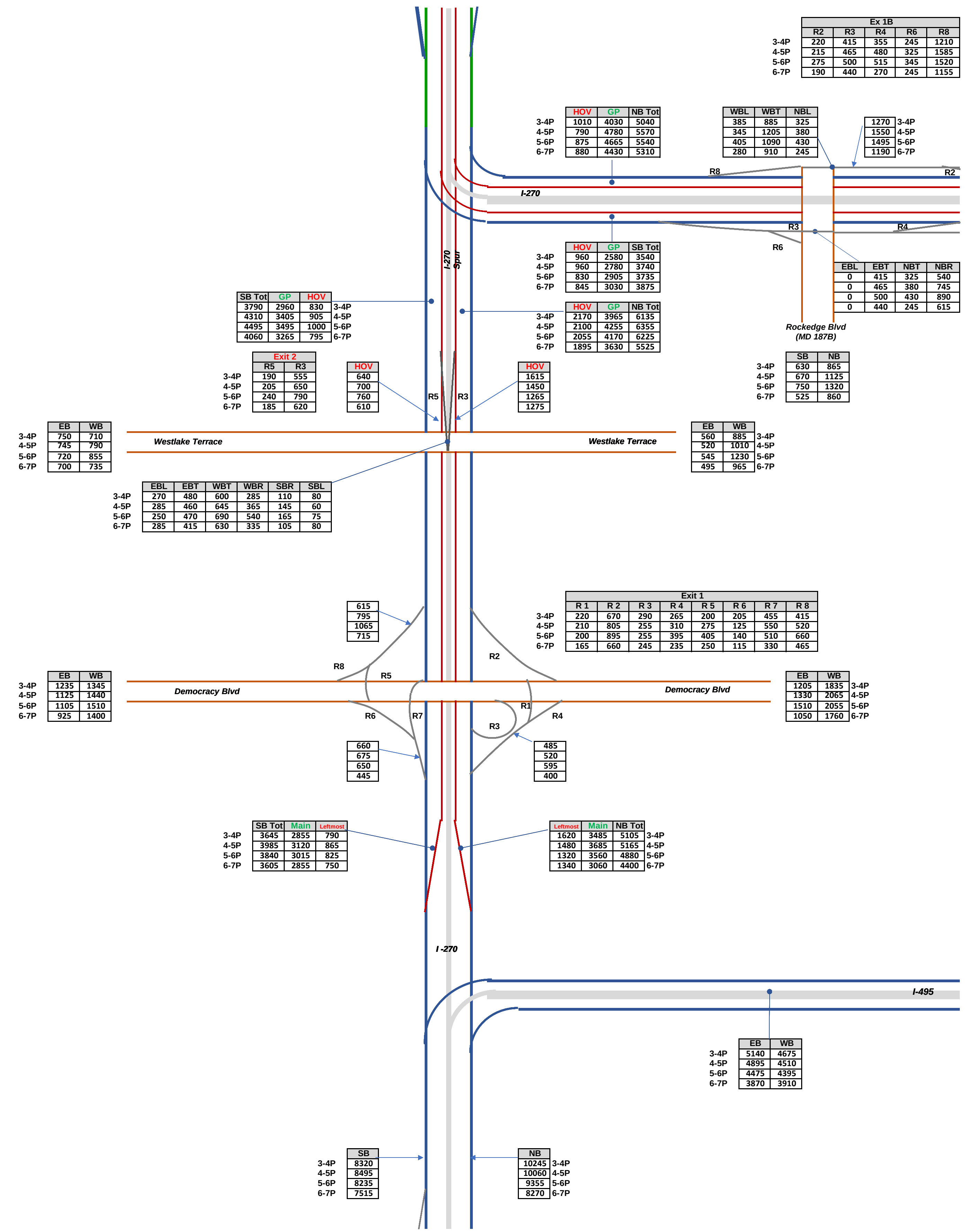

Ex 1B

	R2	R3	R4	R6	R8
3-4P	220	415	355	245	1210
4-5P	215	465	480	325	1585
5-6P	275	500	515	345	1520
6-7P	190	440	270	245	1155

	HOV	GP	NB Tot
3-4P	1010	4030	5040
4-5P	790	4780	5570
5-6P	875	4665	5540
6-7P	880	4430	5310

WBL	WBT	NBL
385	885	325
345	1205	380
405	1090	430
280	910	245

1270	3-4P
1550	4-5P
1495	5-6P
1190	6-7P

	HOV	GP	SB Tot
3-4P	960	2580	3540
4-5P	960	2780	3740
5-6P	830	2905	3735
6-7P	845	3030	3875

EBL	EBT	NBT	NBR
0	415	325	540
0	465	380	745
0	500	430	890
0	440	245	615

SB Tot	GP	HOV	
3790	2960	830	3-4P
4310	3405	905	4-5P
4495	3495	1000	5-6P
4060	3265	795	6-7P

	HOV	GP	NB Tot
3-4P	2170	3965	6135
4-5P	2100	4255	6355
5-6P	2055	4170	6225
6-7P	1895	3630	5525

Exit 2

	R5	R3
3-4P	190	555
4-5P	205	650
5-6P	240	790
6-7P	185	620

HOV
640
700
760
610

HOV
1615
1450
1265
1275

	SB	NB
3-4P	630	865
4-5P	670	1125
5-6P	750	1320
6-7P	525	860

	EB	WB
3-4P	750	710
4-5P	745	790
5-6P	720	855
6-7P	700	735

EB	WB	
560	885	3-4P
520	1010	4-5P
545	1230	5-6P
495	965	6-7P

	EBL	EBT	WBT	WBR	SBR	SBL
3-4P	270	480	600	285	110	80
4-5P	285	460	645	365	145	60
5-6P	250	470	690	540	165	75
6-7P	285	415	630	335	105	80

615
795
1065
715

Exit 1

	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P	220	670	290	265	200	205	455	415
4-5P	210	805	255	310	275	125	550	520
5-6P	200	895	255	395	405	140	510	660
6-7P	165	660	245	235	250	115	330	465

	EB	WB
3-4P	1235	1345
4-5P	1125	1440
5-6P	1105	1510
6-7P	925	1400

EB	WB	
1205	1835	3-4P
1330	2065	4-5P
1510	2055	5-6P
1050	1760	6-7P

660
675
650
445

485
520
595
400

	SB Tot	Main	Leftmost
3-4P	3645	2855	790
4-5P	3985	3120	865
5-6P	3840	3015	825
6-7P	3605	2855	750

Leftmost	Main	NB Tot	
1620	3485	5105	3-4P
1480	3685	5165	4-5P
1320	3560	4880	5-6P
1340	3060	4400	6-7P

	EB	WB
3-4P	5140	4675
4-5P	4895	4510
5-6P	4475	4395
6-7P	3870	3910

	SB
3-4P	8320
4-5P	8495
5-6P	8235
6-7P	7515

NB	
10245	3-4P
10060	4-5P
9355	5-6P
8270	6-7P

2027 No-Build Hourly PM Volume Diagram

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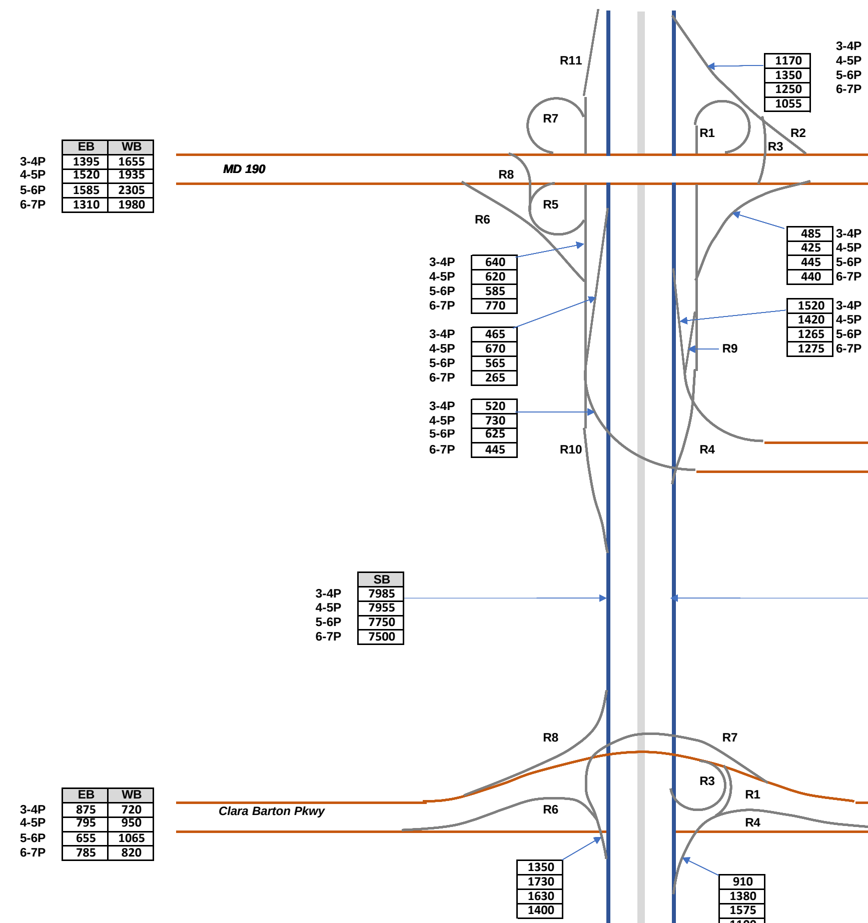
2027 No-Build Hourly PM Volume Diagram



	Exit 39										
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
3-4P	695	915	255	750	580	390	640	265	430	975	845
4-5P	1040	975	375	755	595	440	620	275	710	1000	870
5-6P	1185	915	335	865	645	480	585	280	765	1005	925
6-7P	1105	800	255	895	555	415	775	205	650	1005	755

	Exit 41					
	R 1	R 3	R 4	R 6	R 7	R 8
3-4P	425	185	485	475	875	50
4-5P	530	150	850	575	1155	35
5-6P	665	115	910	530	1100	25
6-7P	510	115	590	460	940	55

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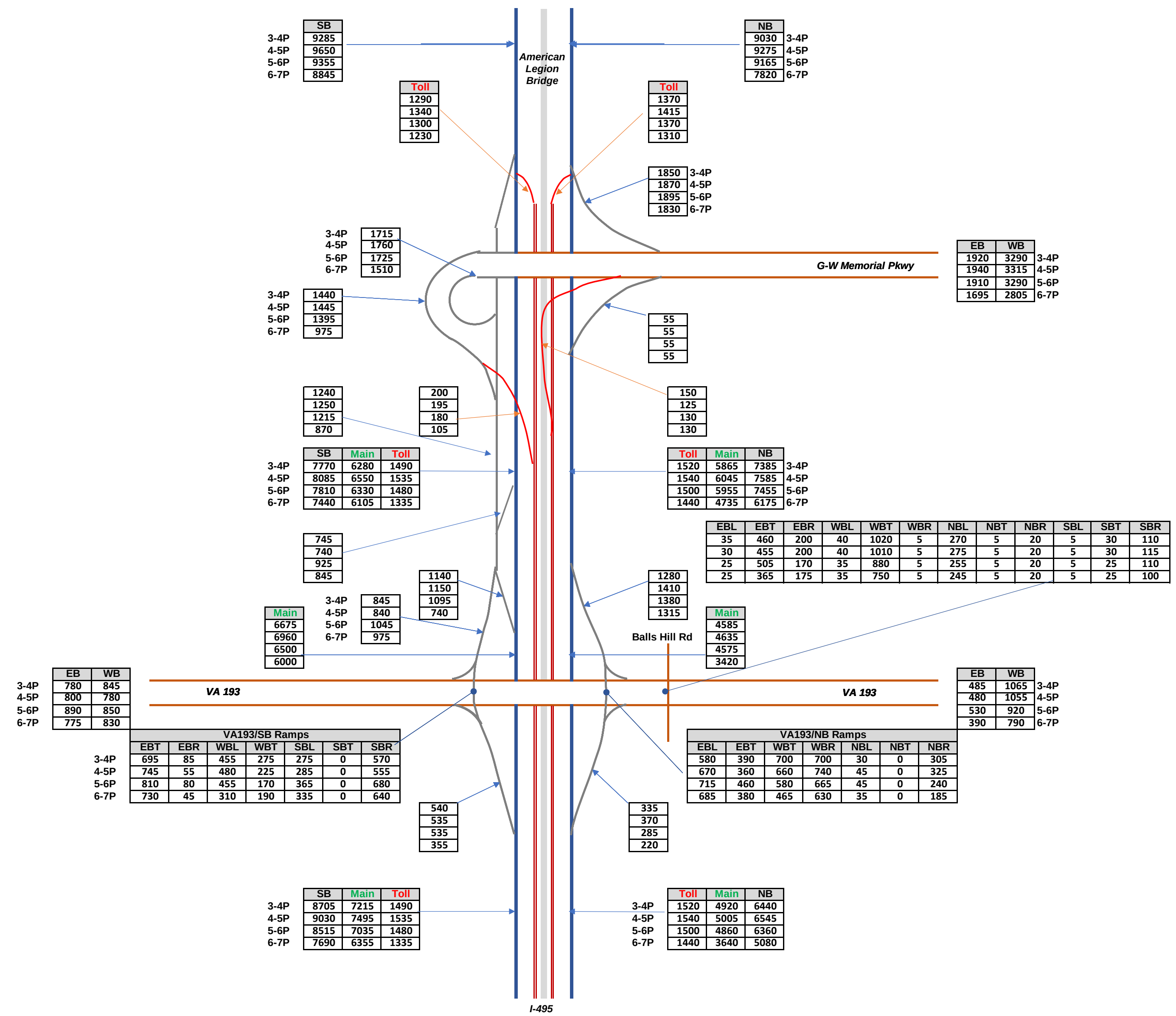

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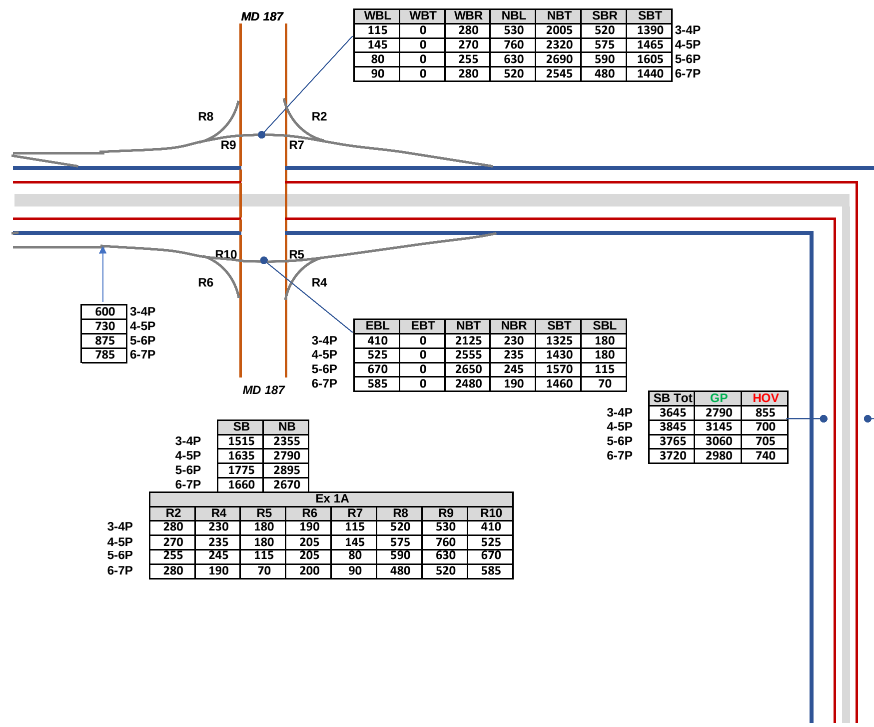


	SB	NB
3-4P	1910	2285
4-5P	2040	2590
5-6P	2195	2945
6-7P	1920	2825

WBL	WBT	WBR	NBL	NBT	SBR	SBT	
115	0	280	530	2005	520	1390	3-4P
145	0	270	760	2320	575	1465	4-5P
80	0	255	630	2690	590	1605	5-6P
90	0	280	520	2545	480	1440	6-7P

600	3-4P
730	4-5P
875	5-6P
785	6-7P

	EBL	EBT	NBT	NBR	SBT	SBL
3-4P	410	0	2125	230	1325	180
4-5P	525	0	2555	235	1430	180
5-6P	670	0	2650	245	1570	115
6-7P	585	0	2480	190	1460	70

	SB Tot	GP	HOV
3-4P	3645	2790	855
4-5P	3845	3145	700
5-6P	3765	3060	705
6-7P	3720	2980	740

HOV	GP	NB Tot	
885	3560	4445	3-4P
745	3870	4615	4-5P
790	3840	4630	5-6P
835	3880	4715	6-7P

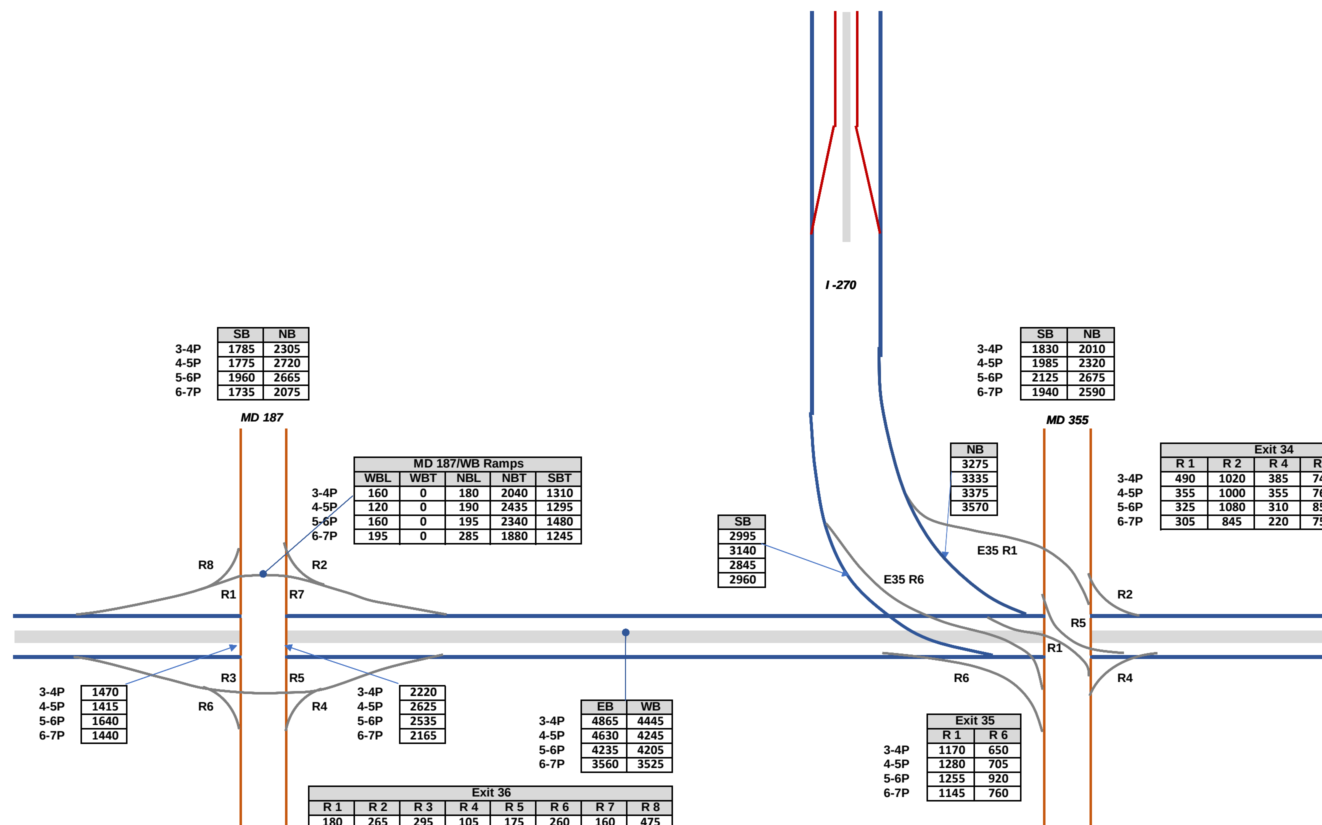
	SB	NB
3-4P	1515	2355
4-5P	1635	2790
5-6P	1775	2895
6-7P	1660	2670

	Ex 1A							
	R2	R4	R5	R6	R7	R8	R9	R10
3-4P	280	230	180	190	115	520	530	410
4-5P	270	235	180	205	145	575	760	525
5-6P	255	245	115	205	80	590	630	670
6-7P	280	190	70	200	90	480	520	585

2027 No-Build Hourly PM Volume Diagram

N

2027 No-Build Hourly PM Volume Diagram



MD 187 (north)

	SB	NB
3-4P	1785	2305
4-5P	1775	2720
5-6P	1960	2665
6-7P	1735	2075

	MD 187/WB Ramps				
	WBL	WBT	NBL	NBT	SBT
3-4P	160	0	180	2040	1310
4-5P	120	0	190	2435	1295
5-6P	160	0	195	2340	1480
6-7P	195	0	285	1880	1245

3-4P	1470
4-5P	1415
5-6P	1640
6-7P	1440

3-4P	2220
4-5P	2625
5-6P	2535
6-7P	2165

	EB	WB
3-4P	4865	4445
4-5P	4630	4245
5-6P	4235	4205
6-7P	3560	3525

Exit 36							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
180	265	295	105	175	260	160	475
190	285	335	105	170	205	120	480
195	325	370	135	185	190	160	480
285	195	425	150	150	185	195	490

MD 187 (south)

	SB	NB
3-4P	1555	2030
4-5P	1450	2395
5-6P	1645	2300
6-7P	1475	1890

SB
2995
3140
2845
2960

NB
3275
3335
3375
3570

MD 355 (north)

	SB	NB
3-4P	1830	2010
4-5P	1985	2320
5-6P	2125	2675
6-7P	1940	2590

	Exit 34				
	R 1	R 2	R 4	R 5	R 6
3-4P	490	1020	385	745	405
4-5P	355	1000	355	765	340
5-6P	325	1080	310	850	320
6-7P	305	845	220	750	370

EB	WB	
8585	8250	3-4P
8550	8225	4-5P
7920	8335	5-6P
7120	7635	6-7P

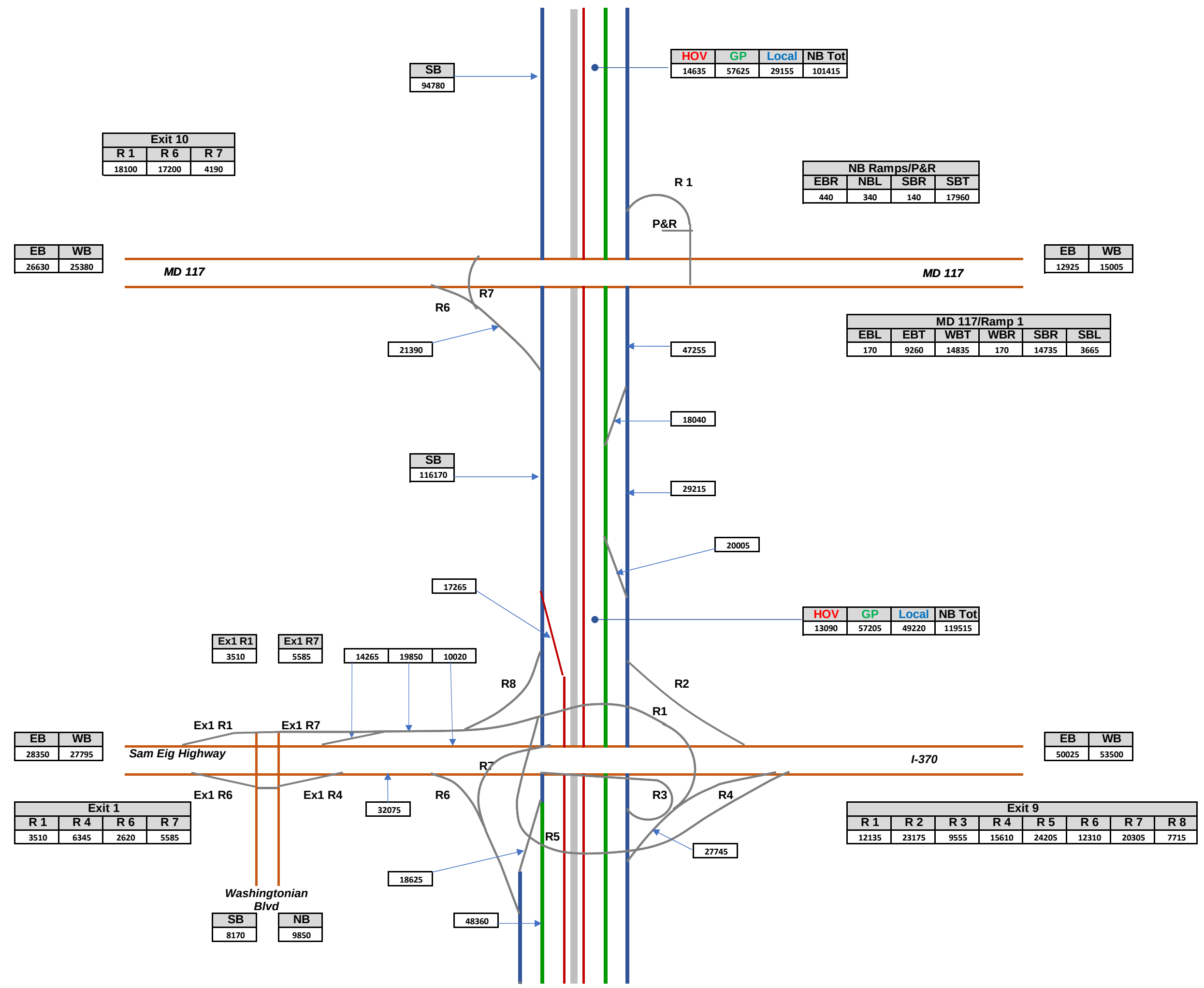
	Exit 35	
	R 1	R 6
3-4P	1170	650
4-5P	1280	705
5-6P	1255	920
6-7P	1145	760

MD 355 (south)

	SB	NB
3-4P	2140	3035
4-5P	2265	3310
5-6P	2515	3485
6-7P	2320	3415

2027 No-Build Hourly PM Volume Diagram

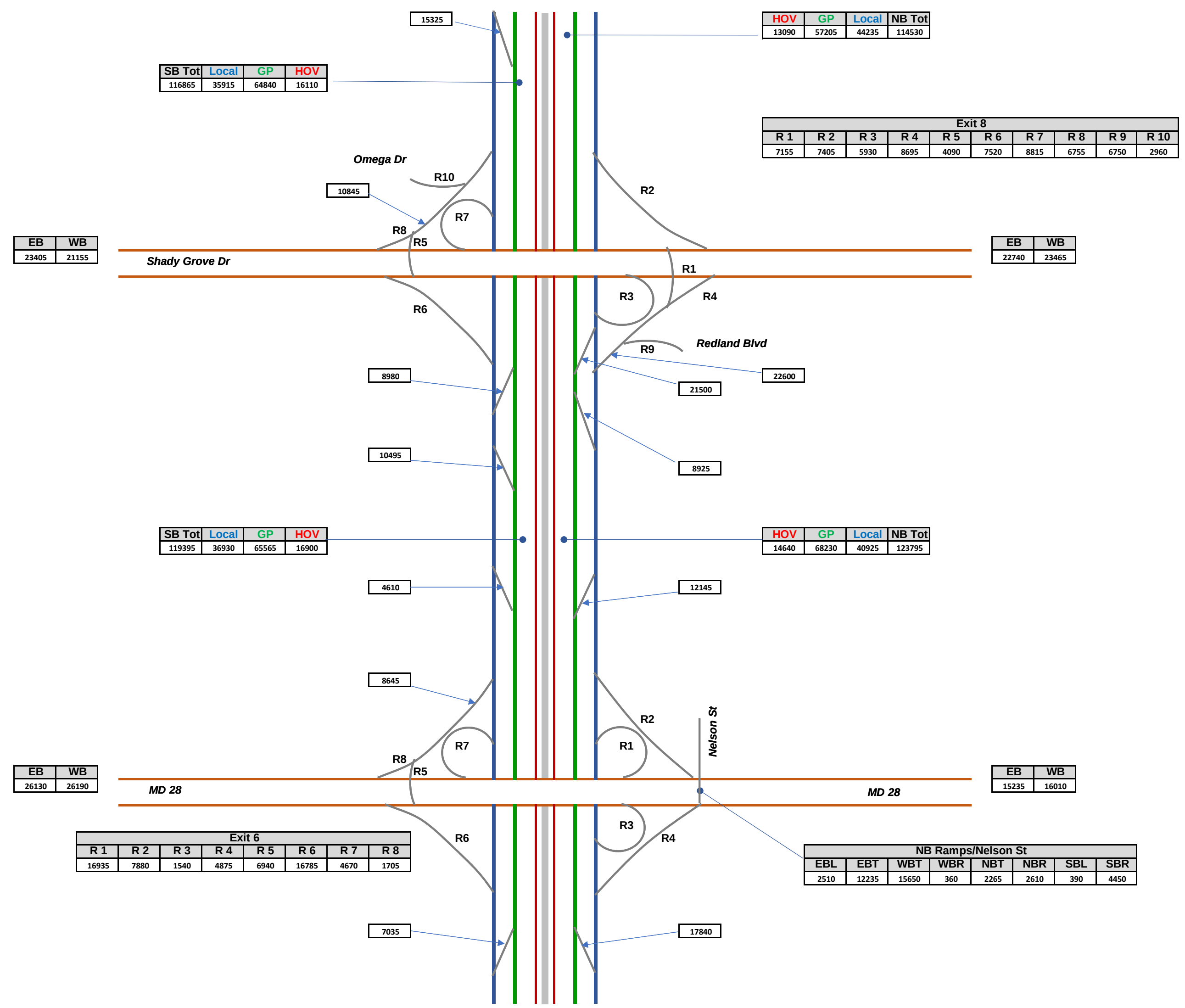
2027 No-Build ADT Volume Diagram



2027 No-Build ADT Volume Diagram

N

2027 No-Build ADT Volume Diagram



SB Tot	Local	GP	HOV
116865	35915	64840	16110

HOV	GP	Local	NB Tot
13090	57205	44235	114530

Exit 8									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
7155	7405	5930	8695	4090	7520	8815	6755	6750	2960

Shady Grove Dr (west):

EB	WB
23405	21155

Shady Grove Dr (east):

EB	WB
22740	23465

SB Tot	Local	GP	HOV
119395	36930	65565	16900

HOV	GP	Local	NB Tot
14640	68230	40925	123795

MD 28 (west):

EB	WB
26130	26190

MD 28 (east):

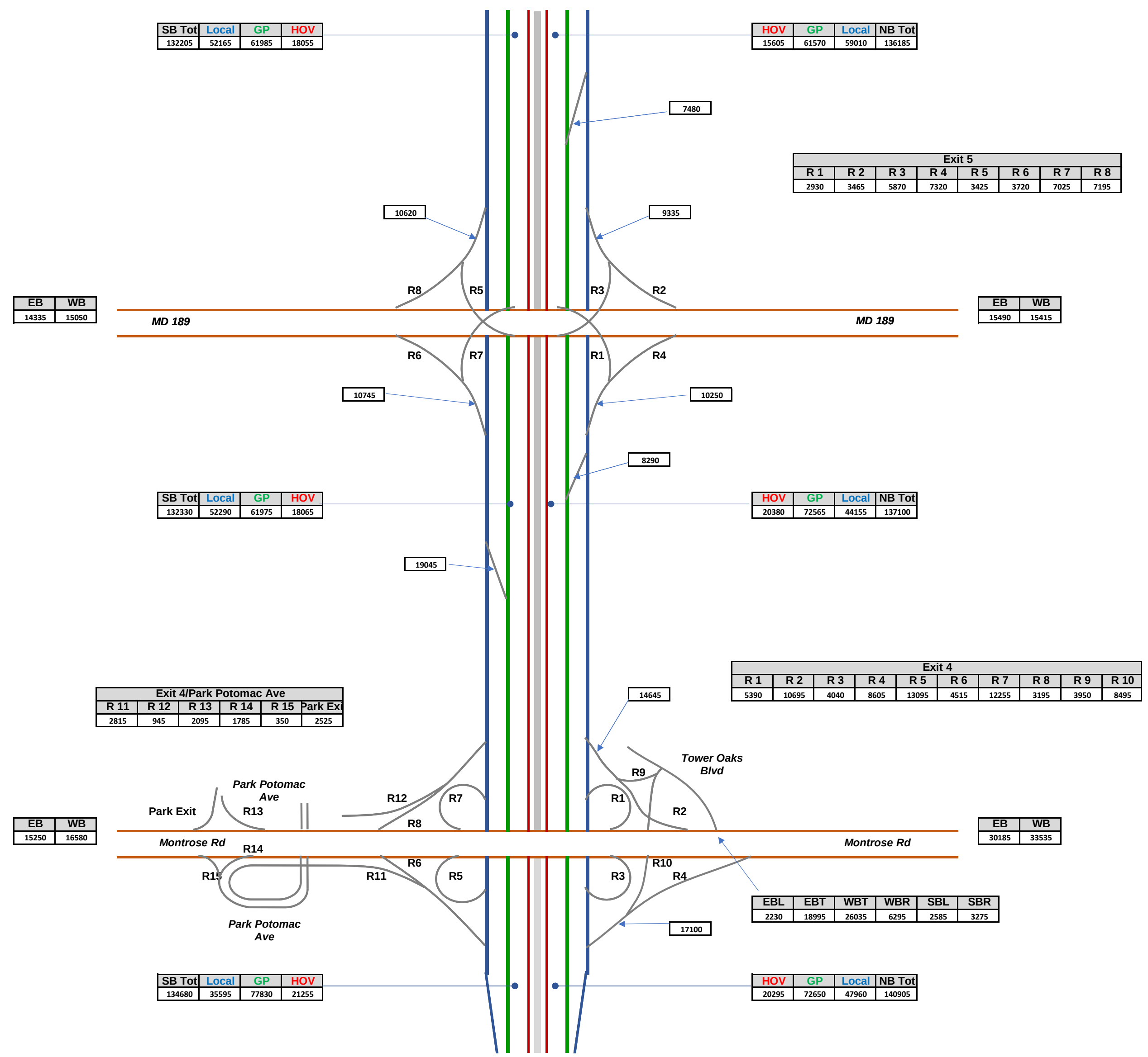
EB	WB
15235	16010

Exit 6							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
16935	7880	1540	4875	6940	16785	4670	1705

NB Ramps/Nelson St							
EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
2510	12235	15650	360	2265	2610	390	4450

2027 No-Build ADT Volume Diagram

2027 No-Build ADT Volume Diagram



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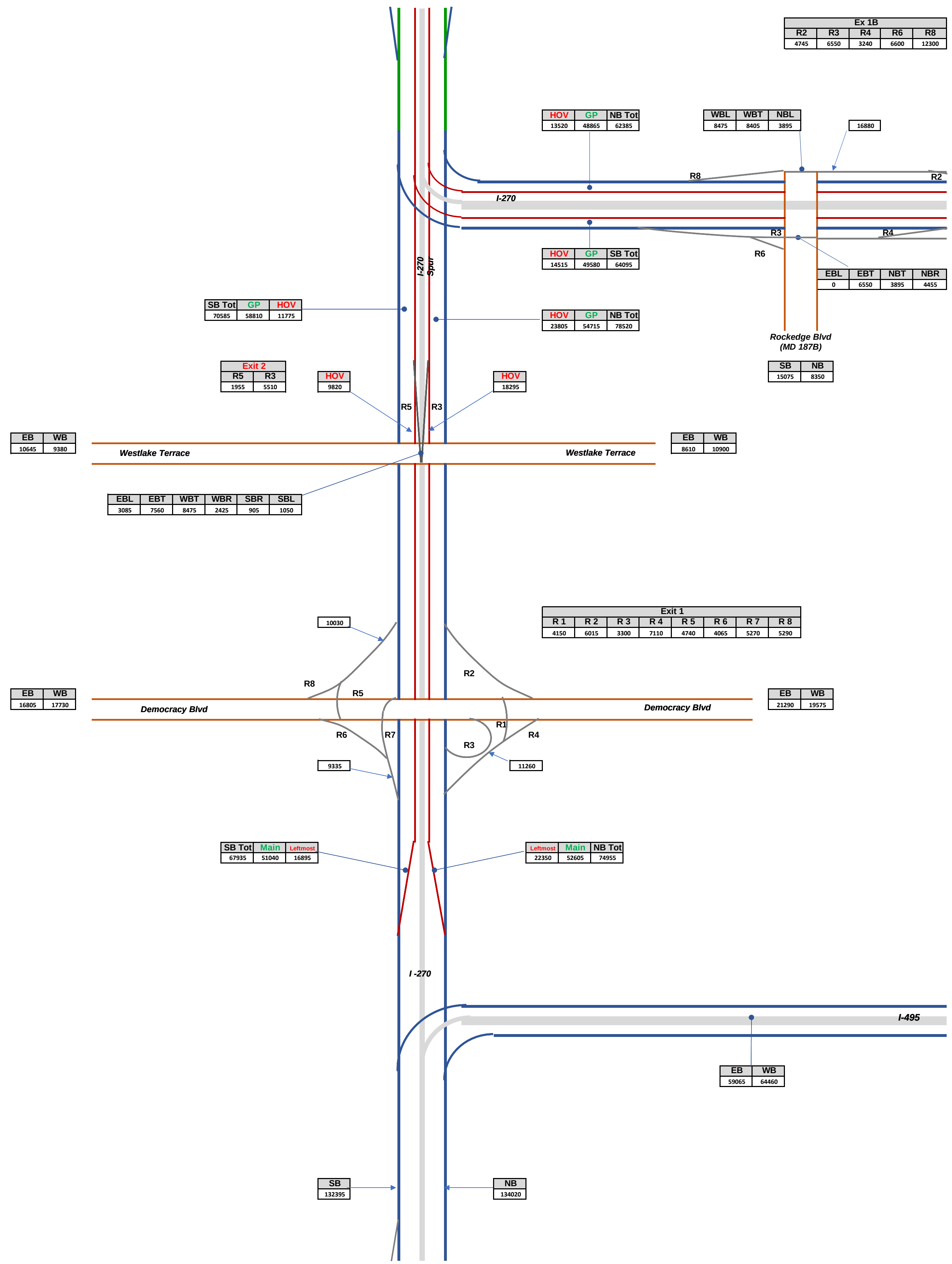
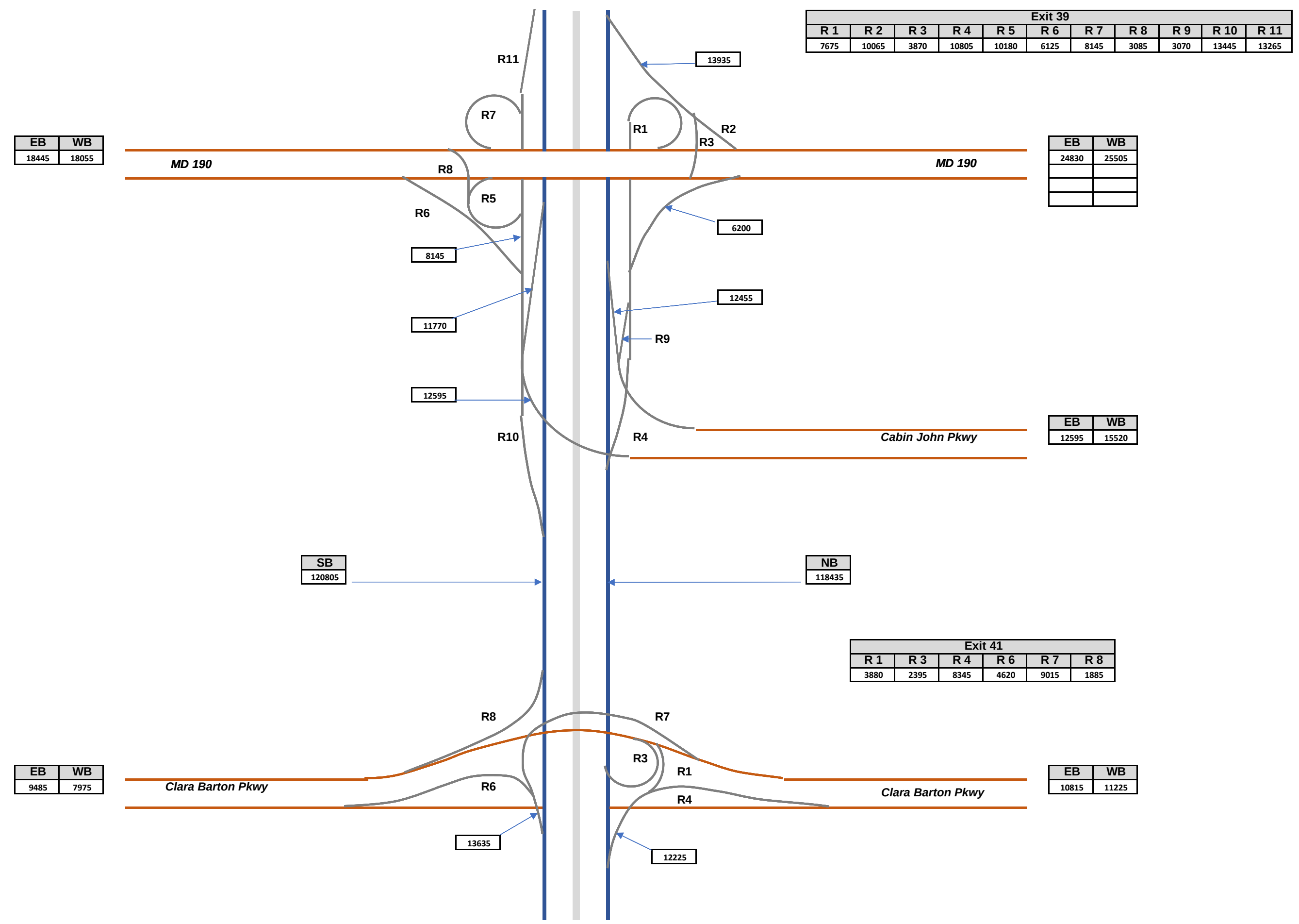
2027 No-Build ADT Volume Diagram

2027 No-Build ADT Volume Diagram



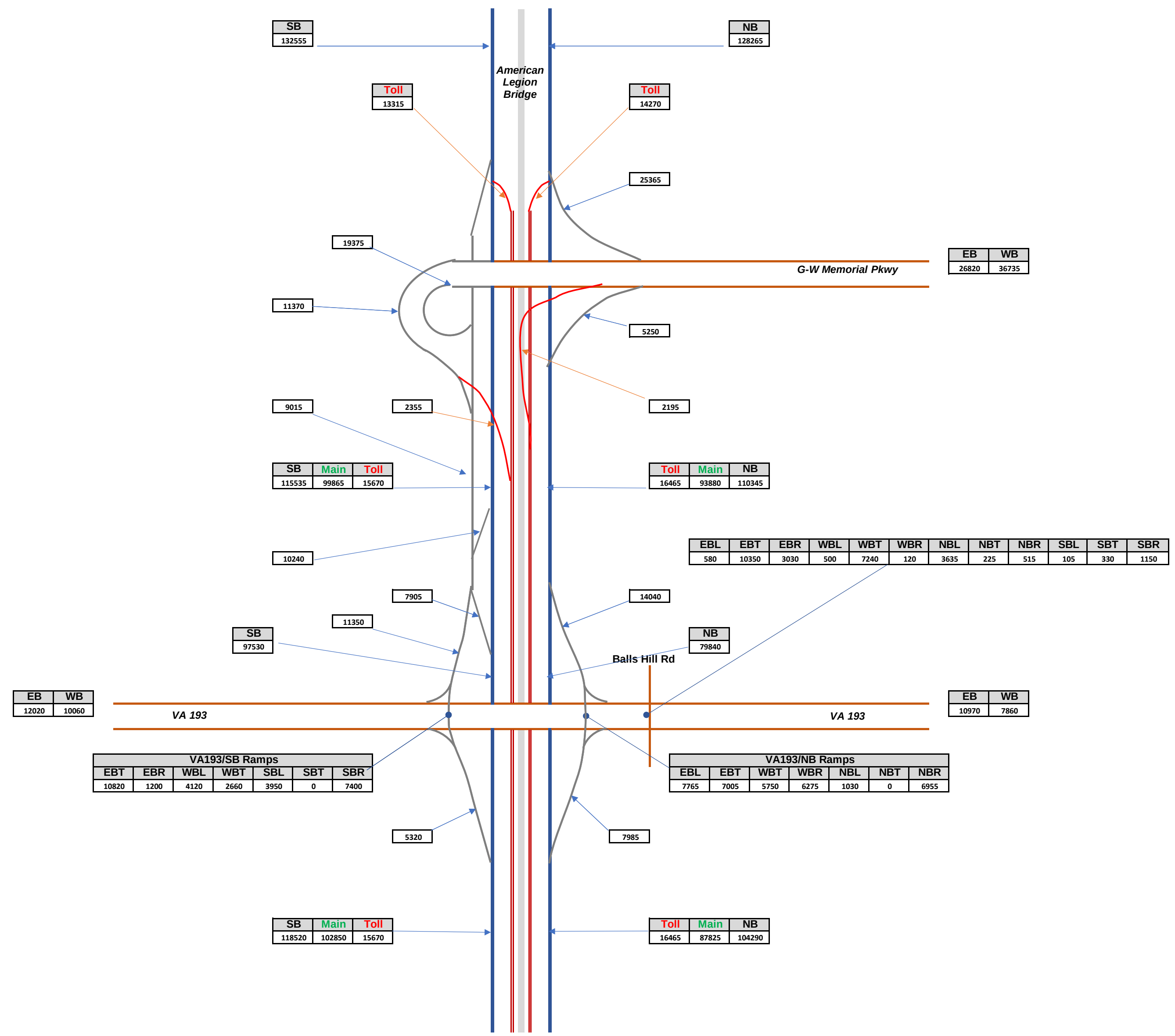
2027 No-Build ADT Volume Diagram

2027 No-Build ADT Volume Diagram



2027 No-Build ADT Volume Diagram

2027 No-Build ADT Volume Diagram

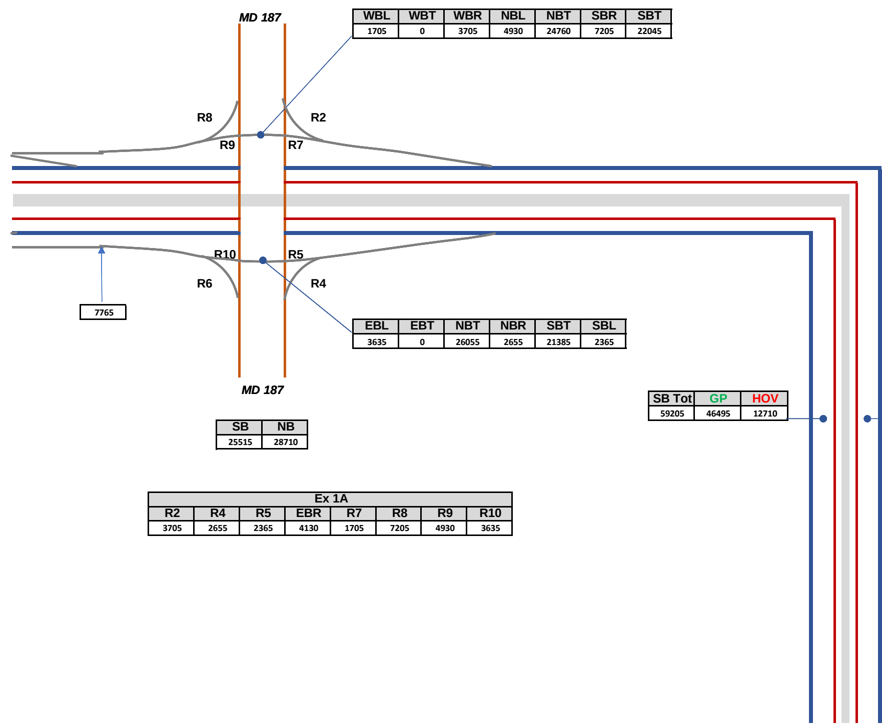


2027 No-Build ADT Volume Diagram

2027 No-Build ADT Volume Diagram

SB	NB
29250	28465

WBL	WBT	WBR	NBL	NBT	SBR	SBT
1705	0	3705	4930	24760	7205	22045



EBL	EBT	NBT	NBR	SBT	SBL
3635	0	26055	2655	21385	2365

SB Tot	GP	HOV
59205	46495	12710

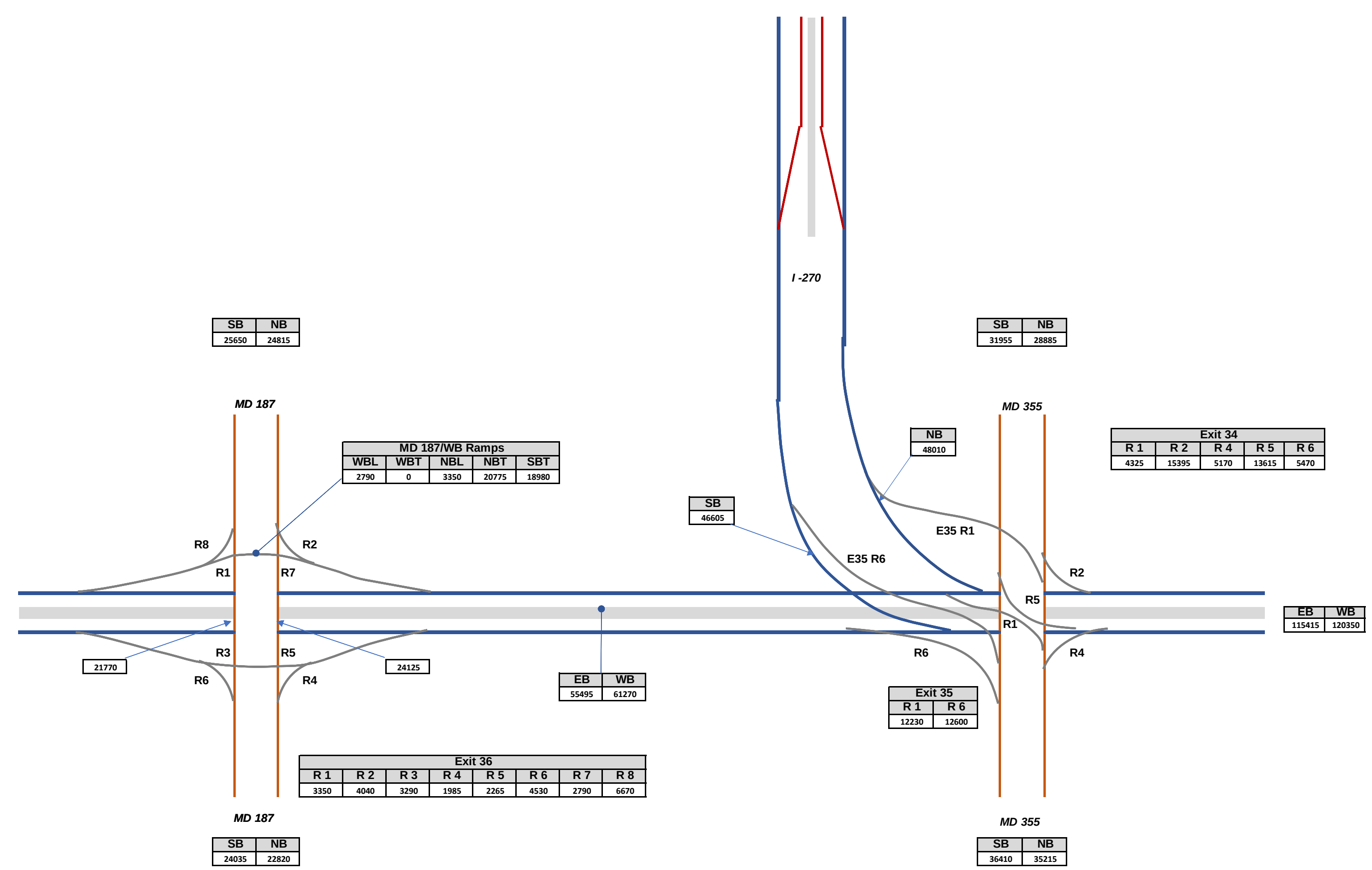
HOV	GP	NB Tot
10625	49615	60240

SB	NB
25515	28710

Ex 1A							
R2	R4	R5	EBR	R7	R8	R9	R10
3705	2655	2365	4130	1705	7205	4930	3635

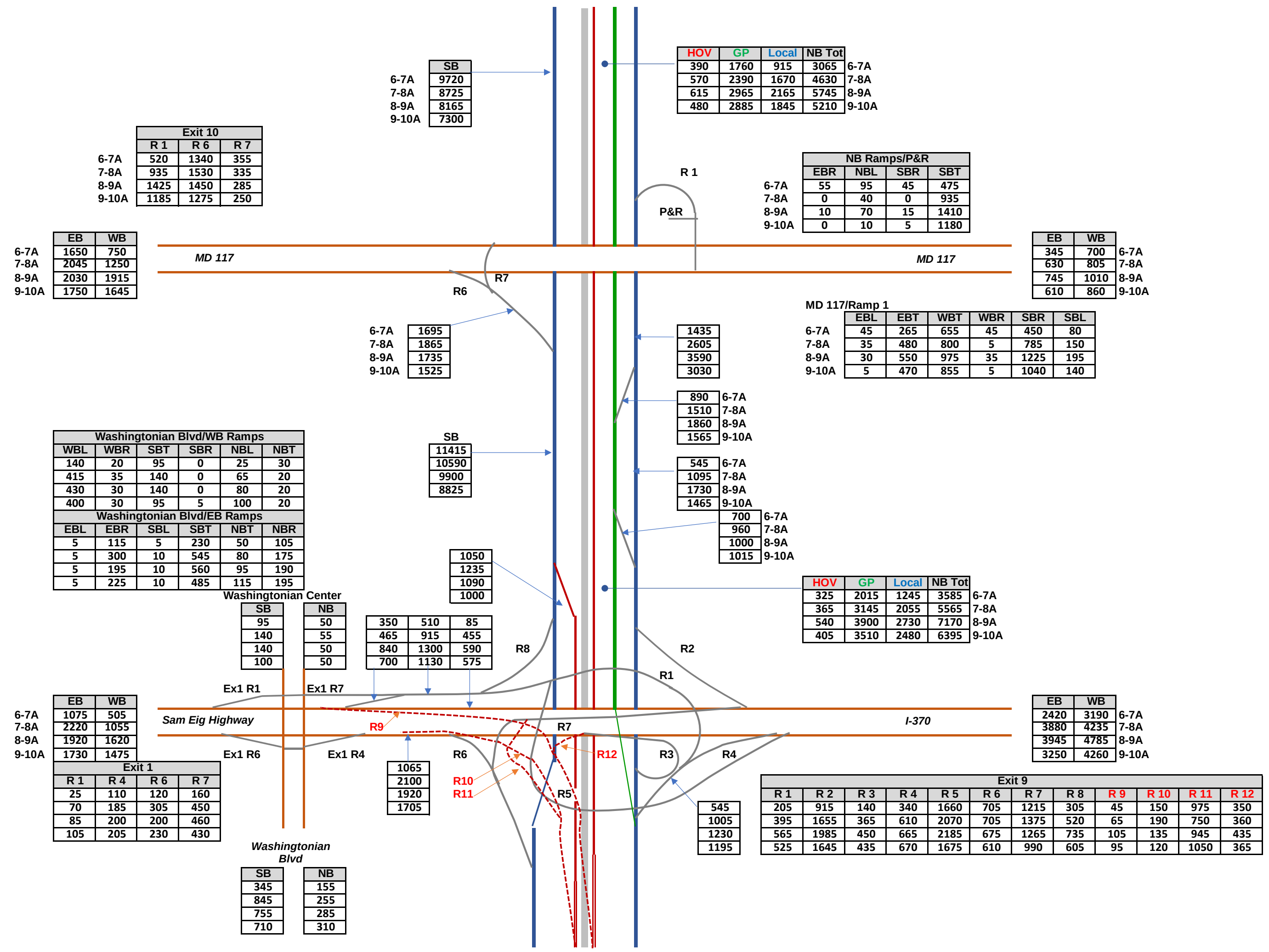
2027 No-Build ADT Volume Diagram

2027 No-Build ADT Volume Diagram



2027 No-Build ADT Volume Diagram

2027 Preferred Alternative Hourly AM Volume Diagram



Exit 10

	R 1	R 6	R 7
6-7A	520	1340	355
7-8A	935	1530	335
8-9A	1425	1450	285
9-10A	1185	1275	250

MD 117 (west)

	EB	WB
6-7A	1650	750
7-8A	2045	1250
8-9A	2030	1915
9-10A	1750	1645

SB

	SB
6-7A	9720
7-8A	8725
8-9A	8165
9-10A	7300

HOV	GP	Local	NB Tot	
390	1760	915	3065	6-7A
570	2390	1670	4630	7-8A
615	2965	2165	5745	8-9A
480	2885	1845	5210	9-10A

NB Ramps/P&R

	EBR	NBL	SBR	SBT
6-7A	55	95	45	475
7-8A	0	40	0	935
8-9A	10	70	15	1410
9-10A	0	10	5	1180

MD 117 (east)

EB	WB	
345	700	6-7A
630	805	7-8A
745	1010	8-9A
610	860	9-10A

MD 117/Ramp 1

	EBL	EBT	WBT	WBR	SBR	SBL
6-7A	45	265	655	45	450	80
7-8A	35	480	800	5	785	150
8-9A	30	550	975	35	1225	195
9-10A	5	470	855	5	1040	140

6-7A	1695
7-8A	1865
8-9A	1735
9-10A	1525

1435
2605
3590
3030

890	6-7A
1510	7-8A
1860	8-9A
1565	9-10A

SB
11415
10590
9900
8825

545	6-7A
1095	7-8A
1730	8-9A
1465	9-10A

700	6-7A
960	7-8A
1000	8-9A
1015	9-10A

Washingtonian Blvd/WB Ramps

WBL	WBR	SBT	SBR	NBL	NBT
140	20	95	0	25	30
415	35	140	0	65	20
430	30	140	0	80	20
400	30	95	5	100	20

Washingtonian Blvd/EB Ramps

EBL	EBR	SBL	SBT	NBT	NBR
5	115	5	230	50	105
5	300	10	545	80	175
5	195	10	560	95	190
5	225	10	485	115	195

1050
1235
1090
1000

HOV	GP	Local	NB Tot	
325	2015	1245	3585	6-7A
365	3145	2055	5565	7-8A
540	3900	2730	7170	8-9A
405	3510	2480	6395	9-10A

Washingtonian Center

SB	NB
95	50
140	55
140	50
100	50

350	510	85
465	915	455
840	1300	590
700	1130	575

Sam Eig Highway

	EB	WB
6-7A	1075	505
7-8A	2220	1055
8-9A	1920	1620
9-10A	1730	1475

Exit 1

R 1	R 4	R 6	R 7
25	110	120	160
70	185	305	450
85	200	200	460
105	205	230	430

1065
2100
1920
1705

I-370

EB	WB	
2420	3190	6-7A
3880	4235	7-8A
3945	4785	8-9A
3250	4260	9-10A

545
1005
1230
1195

Exit 9

R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12
205	915	140	340	1660	705	1215	305	45	150	975	350
395	1655	365	610	2070	705	1375	520	65	190	750	360
565	1985	450	665	2185	675	1265	735	105	135	945	435
525	1645	435	670	1675	610	990	605	95	120	1050	365

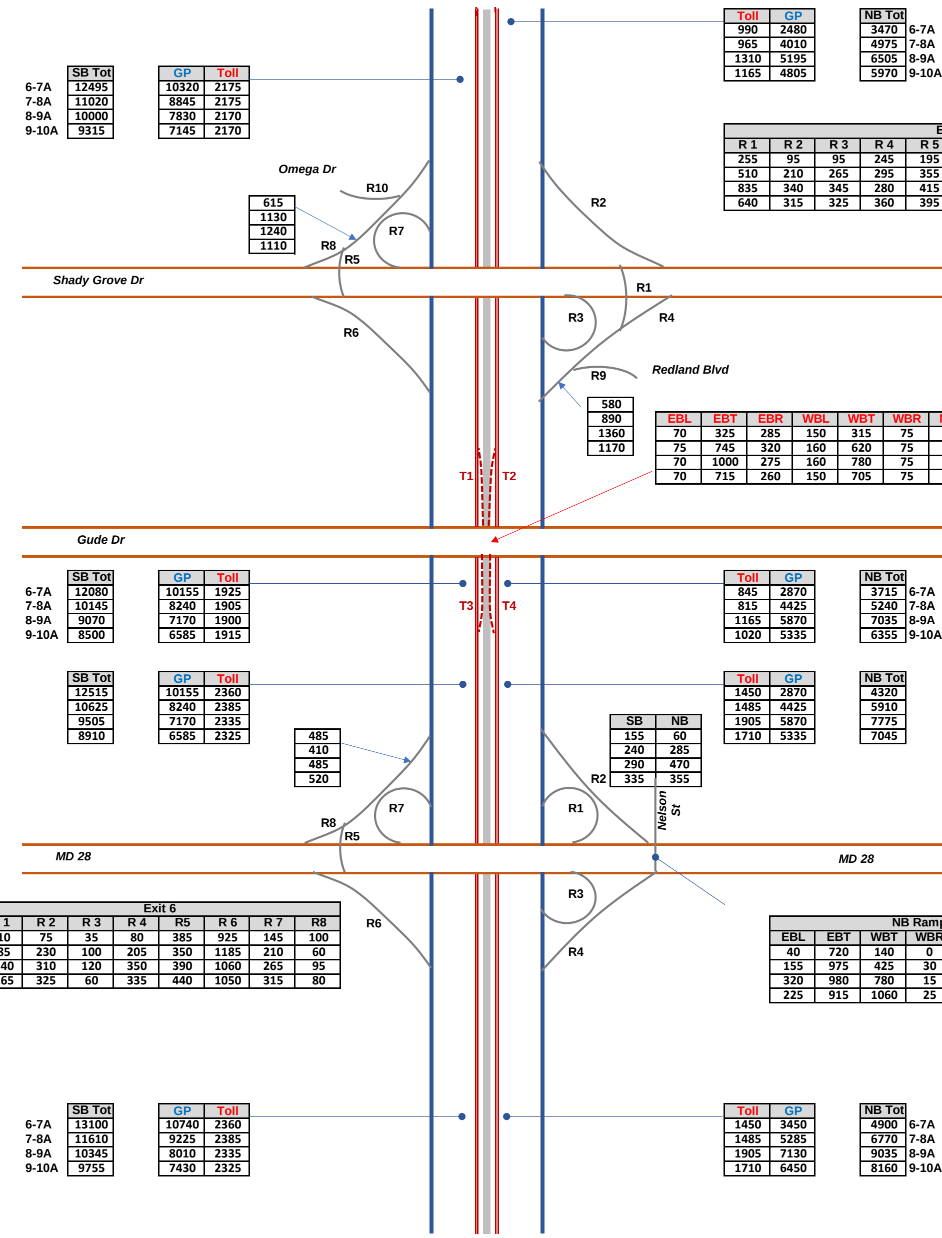
Washingtonian Blvd

SB	NB
345	155
845	255
755	285
710	310

2027 Preferred Alternative AM Hourly Volume Diagram

N

2027 Preferred Alternative Hourly AM Volume Diagram



	SB Tot
6-7A	12495
7-8A	11020
8-9A	10000
9-10A	9315

GP	Toll
10320	2175
8845	2175
7830	2170
7145	2170

Toll	GP
990	2480
965	4010
1310	5195
1165	4805

NB Tot	
3470	6-7A
4975	7-8A
6505	8-9A
5970	9-10A

Exit 8									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
255	95	95	245	195	160	500	420	80	210
510	210	265	295	355	325	445	775	85	245
835	340	345	280	415	405	515	825	245	340
640	315	325	360	395	410	530	715	170	390

615
1130
1240
1110

	EB	WB
6-7A	655	960
7-8A	1075	1980
8-9A	1365	2395
9-10A	1325	1905

EB	WB	
840	880	6-7A
1135	1350	7-8A
1310	1590	8-9A
1345	1395	9-10A

580
890
1360
1170

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
70	325	285	150	315	75	325	280	65	185
75	745	320	160	620	75	365	305	70	200
70	1000	275	160	780	75	375	365	70	200
70	715	260	150	705	75	350	340	70	185

	EB	WB
6-7A	680	660
7-8A	1140	995
8-9A	1345	1215
9-10A	1045	1115

EB	WB	
835	540	6-7A
1310	855	7-8A
1575	1015	8-9A
1250	930	9-10A

	SB Tot
6-7A	12080
7-8A	10145
8-9A	9070
9-10A	8500

GP	Toll
10155	1925
8240	1905
7170	1900
6585	1915

Toll	GP
845	2870
815	4425
1165	5870
1020	5335

NB Tot	
3715	6-7A
5240	7-8A
7035	8-9A
6355	9-10A

SB Tot
12515
10625
9505
8910

GP	Toll
10155	2360
8240	2385
7170	2335
6585	2325

Toll	GP
1450	2870
1485	4425
1905	5870
1710	5335

NB Tot
4320
5910
7775
7045

Gude Dr Exit			
T1	T2	T3	T4
250	145	435	605
270	150	480	670
270	145	435	740
255	145	410	690

485
410
485
520

SB	NB
155	60
240	285
290	470
335	355

EB	WB
1335	775
2065	1245
2090	1905
1810	1960

EB	WB
790	140
1105	455
1220	795
1185	1085

Exit 6							
R 1	R 2	R 3	R 4	R5	R 6	R 7	R8
610	75	35	80	385	925	145	100
985	230	100	205	350	1185	210	60
1340	310	120	350	390	1060	265	95
1165	325	60	335	440	1050	315	80

NB Ramps/Nelson St							
EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
40	720	140	0	20	60	10	145
155	975	425	30	100	105	25	215
320	980	780	15	135	215	25	265
225	915	1060	25	105	230	40	295

	SB Tot
6-7A	13100
7-8A	11610
8-9A	10345
9-10A	9755

GP	Toll
10740	2360
9225	2385
8010	2335
7430	2325

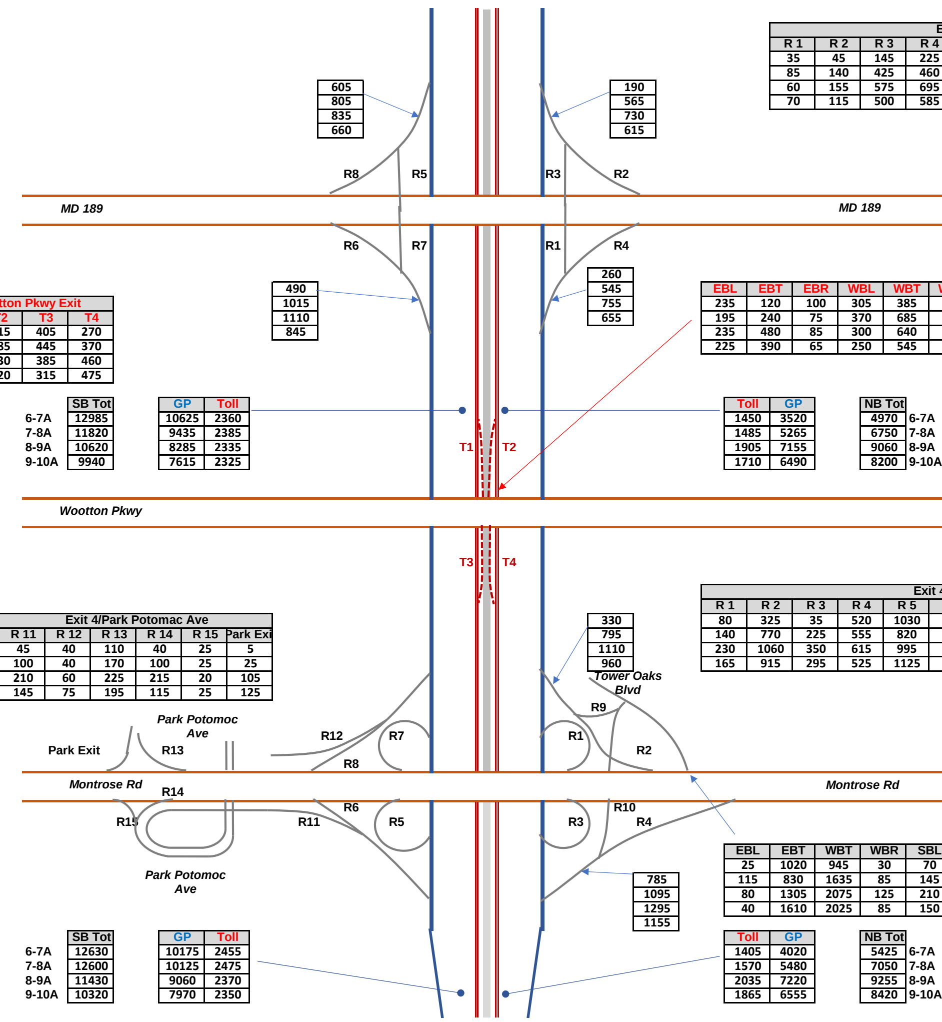
Toll	GP
1450	3450
1485	5285
1905	7130
1710	6450

NB Tot	
4900	6-7A
6770	7-8A
9035	8-9A
8160	9-10A

N

2027 Preferred Alternative AM Hourly Volume Diagram

2027 Preferred Alternative Hourly AM Volume Diagram



MD 189 (west)

	EB	WB
6-7A	465	495
7-8A	1200	1040
8-9A	1415	1020
9-10A	1215	925

MD 189 (east)

	EB	WB
6-7A	530	375
7-8A	995	1065
8-9A	1230	1085
9-10A	1105	960

Exit 5							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
35	45	145	225	170	185	305	435
85	140	425	460	205	445	570	600
60	155	575	695	190	495	615	645
70	115	500	585	180	375	470	480

605	190	490	260
805	565	1015	545
835	730	1110	755
660	615	845	655

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
235	120	100	305	385	80	225	45	105	205
195	240	75	370	685	90	320	50	170	185
235	480	85	300	640	95	405	55	205	145
225	390	65	250	545	95	415	60	130	160

Woootton Pkwy Exit			
T1	T2	T3	T4
310	315	405	270
355	285	445	370
350	330	385	460
290	320	315	475

	SB Tot	GP	Toll
6-7A	12985	10625	2360
7-8A	11820	9435	2385
8-9A	10620	8285	2335
9-10A	9940	7615	2325

Toll	GP	NB Tot	
1450	3520	4970	6-7A
1485	5265	6750	7-8A
1905	7155	9060	8-9A
1710	6490	8200	9-10A

Wootton Pkwy (west)

	EB	WB
6-7A	455	535
7-8A	510	905
8-9A	800	900
9-10A	680	735

Wootton Pkwy (east)

	EB	WB
6-7A	550	770
7-8A	745	1145
8-9A	1030	1035
9-10A	965	890

Exit 4/Park Potomac Ave					
R 11	R 12	R 13	R 14	R 15	Park Exi
45	40	110	40	25	5
100	40	170	100	25	25
210	60	225	215	20	105
145	75	195	115	25	125

Exit 4									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
80	325	35	520	1030	80	695	200	5	265
140	770	225	555	820	595	990	135	25	540
230	1060	350	615	995	720	1005	105	50	680
165	915	295	525	1125	645	910	145	45	630

330	785
795	1095
1110	1295
960	1155

Montrose Rd (west)

	EB	WB
6-7A	115	445
7-8A	865	470
8-9A	1265	710
9-10A	1375	825

Montrose Rd (east)

	EB	WB
6-7A	1610	975
7-8A	1525	1720
8-9A	2130	2200
9-10A	2285	2110

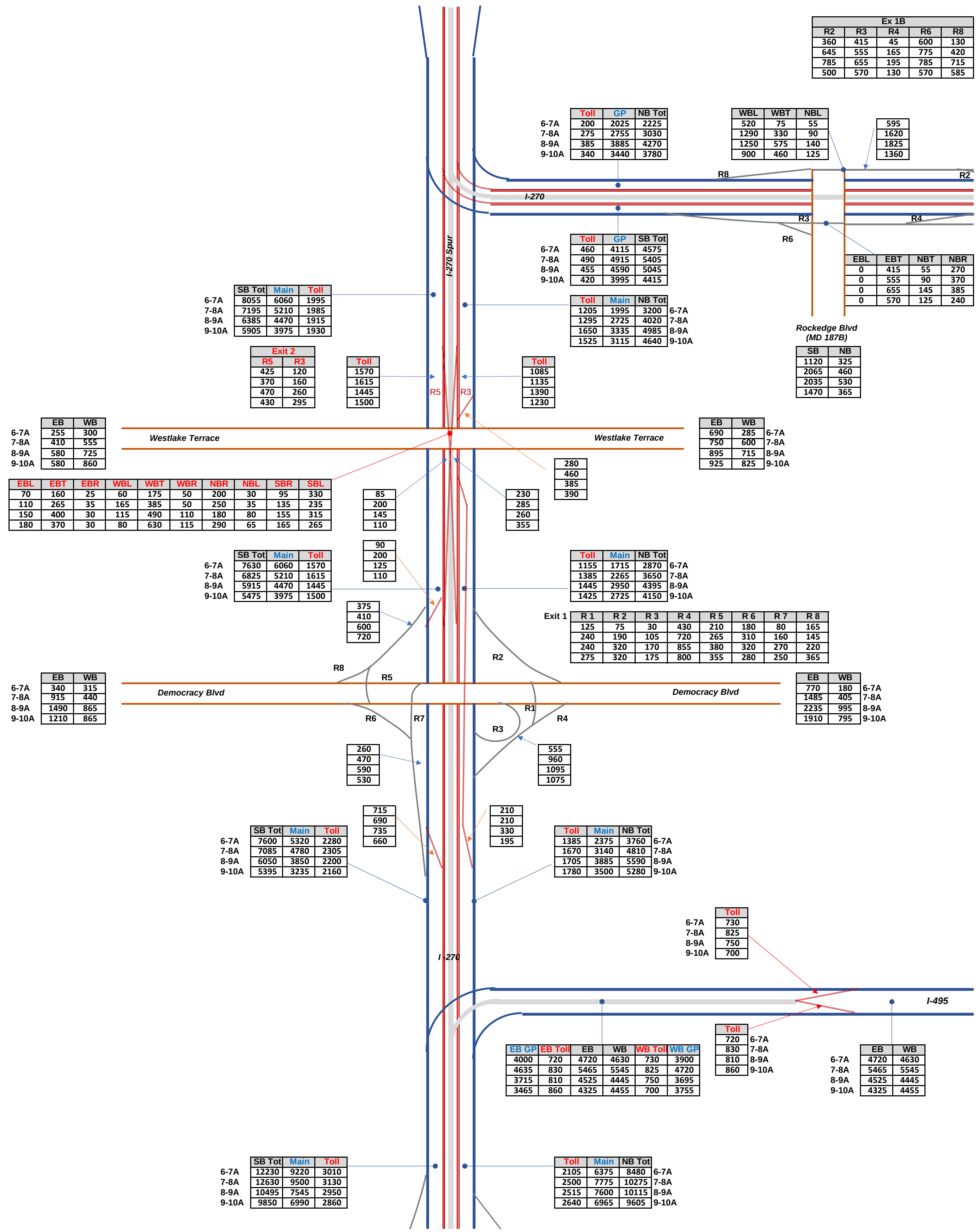
EBL	EBT	WBT	WBR	SBL	SBR
25	1020	945	30	70	345
115	830	1635	85	145	465
80	1305	2075	125	210	485
40	1610	2025	85	150	385

	SB Tot	GP	Toll
6-7A	12630	10175	2455
7-8A	12600	10125	2475
8-9A	11430	9060	2370
9-10A	10320	7970	2350

Toll	GP	NB Tot	
1405	4020	5425	6-7A
1570	5480	7050	7-8A
2035	7220	9255	8-9A
1865	6555	8420	9-10A

2027 Preferred Alternative AM Hourly Volume Diagram

2027 Preferred Alternative Hourly AM Volume Diagram



Ex 1B				
R2	R3	R4	R6	R8
360	415	45	600	130
645	555	165	775	420
785	655	195	785	715
500	570	130	570	585

	Toll	GP	NB Tot
6-7A	200	2025	2225
7-8A	275	2755	3030
8-9A	385	3885	4270
9-10A	340	3440	3780

WBL	WBT	NBL
520	75	55
1290	330	90
1250	575	140
900	460	125

595
1620
1825
1360

	Toll	GP	SB Tot
6-7A	460	4115	4575
7-8A	490	4915	5405
8-9A	455	4590	5045
9-10A	420	3995	4415

EBL	EBT	NBT	NBR
0	415	55	270
0	555	90	370
0	655	145	385
0	570	125	240

	SB Tot	Main	Toll
6-7A	8055	6060	1995
7-8A	7195	5210	1985
8-9A	6385	4470	1915
9-10A	5905	3975	1930

Toll	Main	NB Tot	
1205	1995	3200	6-7A
1295	2725	4020	7-8A
1650	3335	4985	8-9A
1525	3115	4640	9-10A

Rockedge Blvd (MD 187B)

SB	NB
1120	325
2065	460
2035	530
1470	365

Exit 2	
R5	R3
425	120
370	160
470	260
430	295

Toll
1570
1615
1445
1500

Toll
1085
1135
1390
1230

	EB	WB
6-7A	255	300
7-8A	410	555
8-9A	580	725
9-10A	580	860

EB	WB	
690	285	6-7A
750	600	7-8A
895	715	8-9A
925	825	9-10A

280
460
385
390

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
70	160	25	60	175	50	200	30	95	330
110	265	35	165	385	50	250	35	135	235
150	400	30	115	490	110	180	80	155	315
180	370	30	80	630	115	290	65	165	265

85
200
145
110

230
285
260
355

90
200
125
110

	SB Tot	Main	Toll
6-7A	7630	6060	1570
7-8A	6825	5210	1615
8-9A	5915	4470	1445
9-10A	5475	3975	1500

Toll	Main	NB Tot	
1155	1715	2870	6-7A
1385	2265	3650	7-8A
1445	2950	4395	8-9A
1425	2725	4150	9-10A

375
410
600
720

Exit 1

R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
125	75	30	430	210	180	80	165
240	190	105	720	265	310	160	145
240	320	170	855	380	320	270	220
275	320	175	800	355	280	250	365

	EB	WB
6-7A	340	315
7-8A	915	440
8-9A	1490	865
9-10A	1210	865

EB	WB	
770	180	6-7A
1485	405	7-8A
2235	995	8-9A
1910	795	9-10A

260
470
590
530

555
960
1095
1075

715
690
735
660

210
210
330
195

	SB Tot	Main	Toll
6-7A	7600	5320	2280
7-8A	7085	4780	2305
8-9A	6050	3850	2200
9-10A	5395	3235	2160

Toll	Main	NB Tot	
1385	2375	3760	6-7A
1670	3140	4810	7-8A
1705	3885	5590	8-9A
1780	3500	5280	9-10A

	Toll
6-7A	730
7-8A	825
8-9A	750
9-10A	700

Toll	
720	6-7A
830	7-8A
810	8-9A
860	9-10A

EB GP	EB Toll	EB	WB	WB Toll	WB GP
4000	720	4720	4630	730	3900
4635	830	5465	5545	825	4720
3715	810	4525	4445	750	3695
3465	860	4325	4455	700	3755

	EB	WB
6-7A	4720	4630
7-8A	5465	5545
8-9A	4525	4445
9-10A	4325	4455

	SB Tot	Main	Toll
6-7A	12230	9220	3010
7-8A	12630	9500	3130
8-9A	10495	7545	2950
9-10A	9850	6990	2860

Toll	Main	NB Tot	
2105	6375	8480	6-7A
2500	7775	10275	7-8A
2515	7600	10115	8-9A
2640	6965	9605	9-10A

2027 Preferred Alternative AM Hourly Volume Diagram

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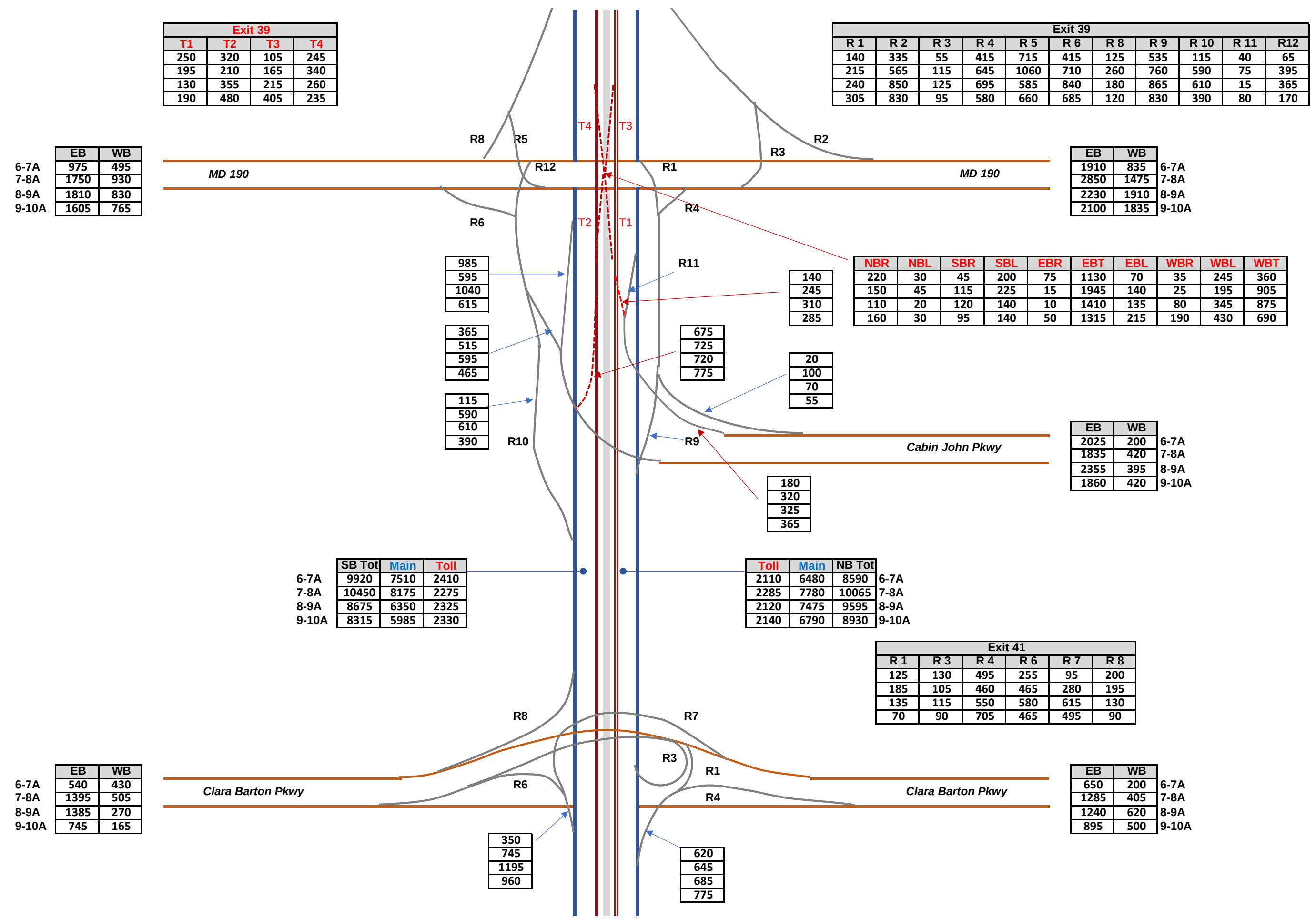

Exit 39

T1	T2	T3	T4
250	320	105	245
195	210	165	340
130	355	215	260
190	480	405	235

Exit 39

R 1	R 2	R 3	R 4	R 5	R 6	R 8	R 9	R 10	R 11	R12
140	335	55	415	715	415	125	535	115	40	65
215	565	115	645	1060	710	260	760	590	75	395
240	850	125	695	585	840	180	865	610	15	365
305	830	95	580	660	685	120	830	390	80	170

MD 190 (west)

	EB	WB
6-7A	975	495
7-8A	1750	930
8-9A	1810	830
9-10A	1605	765

MD 190 (east)

EB	WB	
1910	835	6-7A
2850	1475	7-8A
2230	1910	8-9A
2100	1835	9-10A

NBR	NBL	SBR	SBL	EBR	EBT	EBL	WBR	WBL	WBT
220	30	45	200	75	1130	70	35	245	360
150	45	115	225	15	1945	140	25	195	905
110	20	120	140	10	1410	135	80	345	875
160	30	95	140	50	1315	215	190	430	690

Cabin John Pkwy

EB	WB	
2025	200	6-7A
1835	420	7-8A
2355	395	8-9A
1860	420	9-10A

	SB Tot	Main	Toll
6-7A	9920	7510	2410
7-8A	10450	8175	2275
8-9A	8675	6350	2325
9-10A	8315	5985	2330

Toll	Main	NB Tot	
2110	6480	8590	6-7A
2285	7780	10065	7-8A
2120	7475	9595	8-9A
2140	6790	8930	9-10A

Exit 41

R 1	R 3	R 4	R 6	R 7	R 8
125	130	495	255	95	200
185	105	460	465	280	195
135	115	550	580	615	130
70	90	705	465	495	90

Clara Barton Pkwy (west)

	EB	WB
6-7A	540	430
7-8A	1395	505
8-9A	1385	270
9-10A	745	165

Clara Barton Pkwy (east)

EB	WB	
650	200	6-7A
1285	405	7-8A
1240	620	8-9A
895	500	9-10A

2027 Preferred Alternative AM Hourly Volume Diagram

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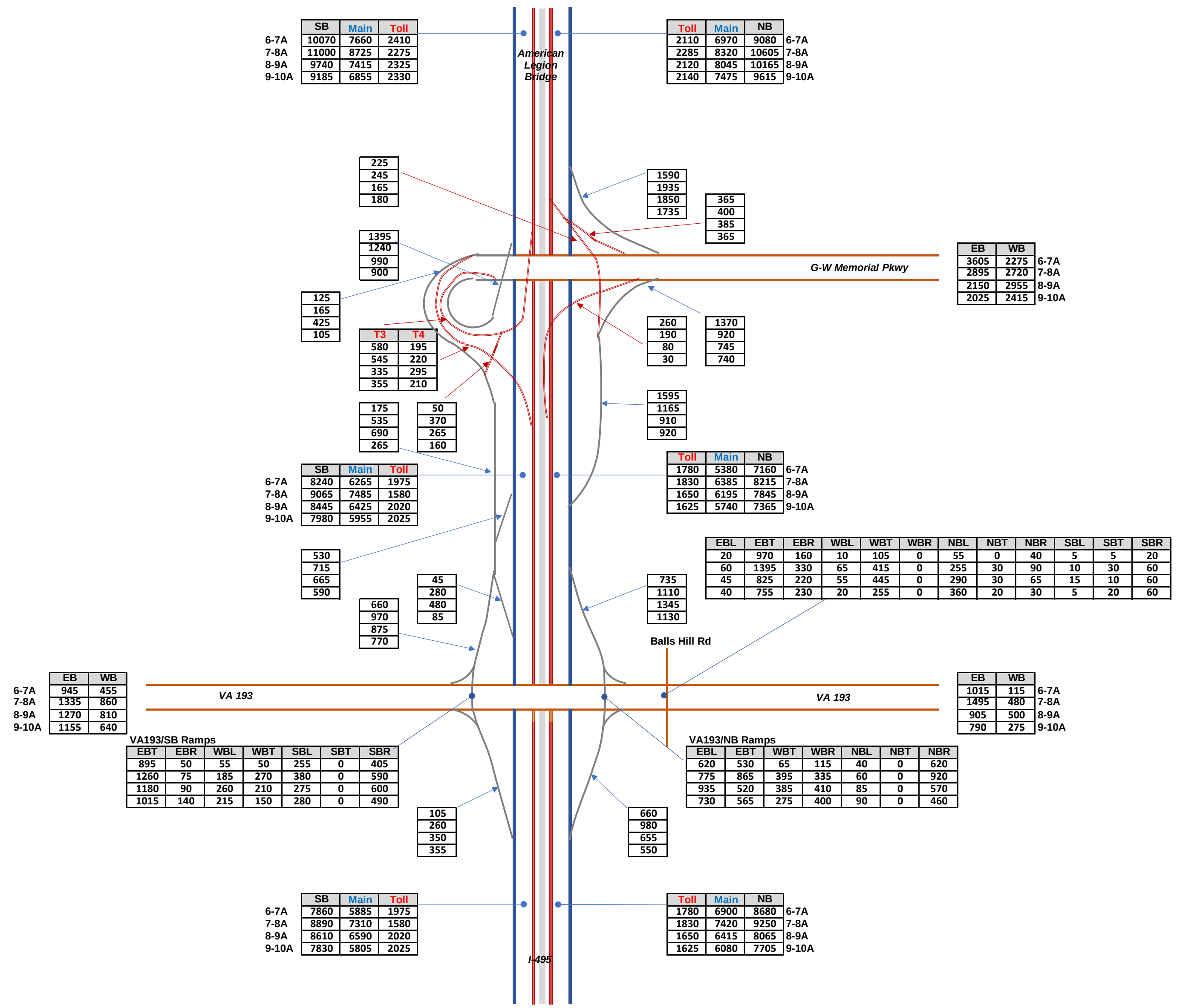
2027 Preferred Alternative Hourly AM Volume Diagram



	SB	Main	Toll
6-7A	10070	7660	2410
7-8A	11000	8725	2275
8-9A	9740	7415	2325
9-10A	9185	6855	2330

Toll	Main	NB	
2110	6970	9080	6-7A
2285	8320	10605	7-8A
2120	8045	10165	8-9A
2140	7475	9615	9-10A

EB	WB	
3605	2275	6-7A
2895	2720	7-8A
2150	2955	8-9A
2025	2415	9-10A

T3	T4
580	195
545	220
335	295
355	210

	SB	Main	Toll
6-7A	8240	6265	1975
7-8A	9065	7485	1580
8-9A	8445	6425	2020
9-10A	7980	5955	2025

Toll	Main	NB	
1780	5380	7160	6-7A
1830	6385	8215	7-8A
1650	6195	7845	8-9A
1625	5740	7365	9-10A

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
20	970	160	10	105	0	55	0	40	5	5	20
60	1395	330	65	415	0	255	30	90	10	30	60
45	825	220	55	445	0	290	30	65	15	10	60
40	755	230	20	255	0	360	20	30	5	20	60

	EB	WB
6-7A	945	455
7-8A	1335	860
8-9A	1270	810
9-10A	1155	640

EB	WB	
1015	115	6-7A
1495	480	7-8A
905	500	8-9A
790	275	9-10A

VA193/SB Ramps

EBT	EBR	WBL	WBT	SBL	SBT	SBR
895	50	55	50	255	0	405
1260	75	185	270	380	0	590
1180	90	260	210	275	0	600
1015	140	215	150	280	0	490

VA193/NB Ramps

EBL	EBT	WBT	WBR	NBL	NBT	NBR
620	530	65	115	40	0	620
775	865	395	335	60	0	920
935	520	385	410	85	0	570
730	565	275	400	90	0	460

	SB	Main	Toll
6-7A	7860	5885	1975
7-8A	8890	7310	1580
8-9A	8610	6590	2020
9-10A	7830	5805	2025

Toll	Main	NB	
1780	6900	8680	6-7A
1830	7420	9250	7-8A
1650	6415	8065	8-9A
1625	6080	7705	9-10A

2027 Preferred Alternative AM Hourly Volume Diagram

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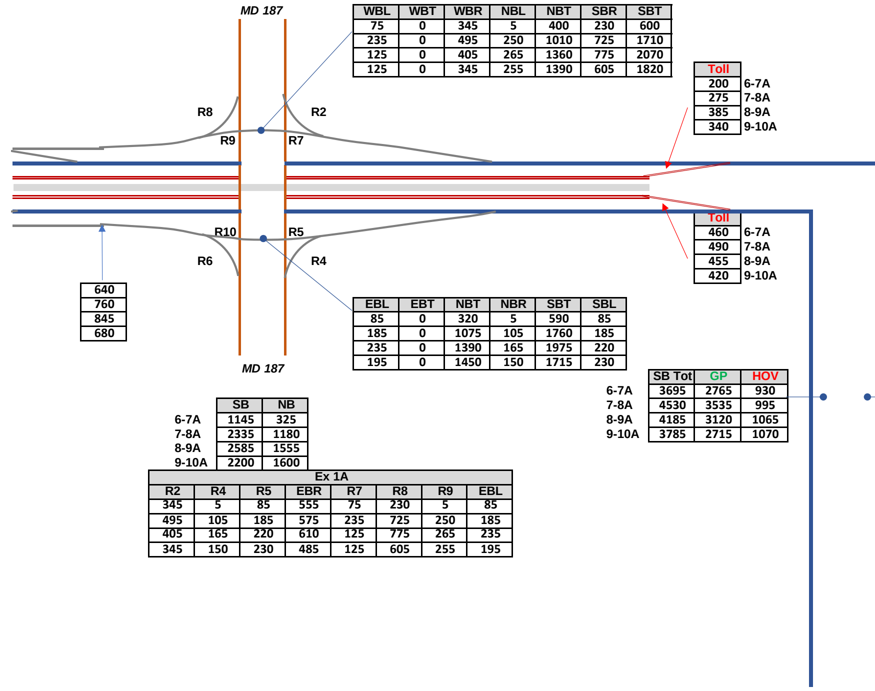

	SB	NB
6-7A	830	745
7-8A	2435	1505
8-9A	2845	1765
9-10A	2425	1735

WBL	WBT	WBR	NBL	NBT	SBR	SBT
75	0	345	5	400	230	600
235	0	495	250	1010	725	1710
125	0	405	265	1360	775	2070
125	0	345	255	1390	605	1820

Toll	
200	6-7A
275	7-8A
385	8-9A
340	9-10A

Toll	
460	6-7A
490	7-8A
455	8-9A
420	9-10A

640
760
845
680

EBL	EBT	NBT	NBR	SBT	SBL
85	0	320	5	590	85
185	0	1075	105	1760	185
235	0	1390	165	1975	220
195	0	1450	150	1715	230

	SB Tot	GP	HOV
6-7A	3695	2765	930
7-8A	4530	3535	995
8-9A	4185	3120	1065
9-10A	3785	2715	1070

HOV	GP	NB Tot	
355	2520	2875	6-7A
715	3270	3985	7-8A
740	4130	4870	8-9A
575	3590	4165	9-10A

	SB	NB
6-7A	1145	325
7-8A	2335	1180
8-9A	2585	1555
9-10A	2200	1600

Ex 1A							
R2	R4	R5	EBR	R7	R8	R9	EBL
345	5	85	555	75	230	5	85
495	105	185	575	235	725	250	185
405	165	220	610	125	775	265	235
345	150	230	485	125	605	255	195

2027 Preferred Alternative AM Hourly Volume Diagram

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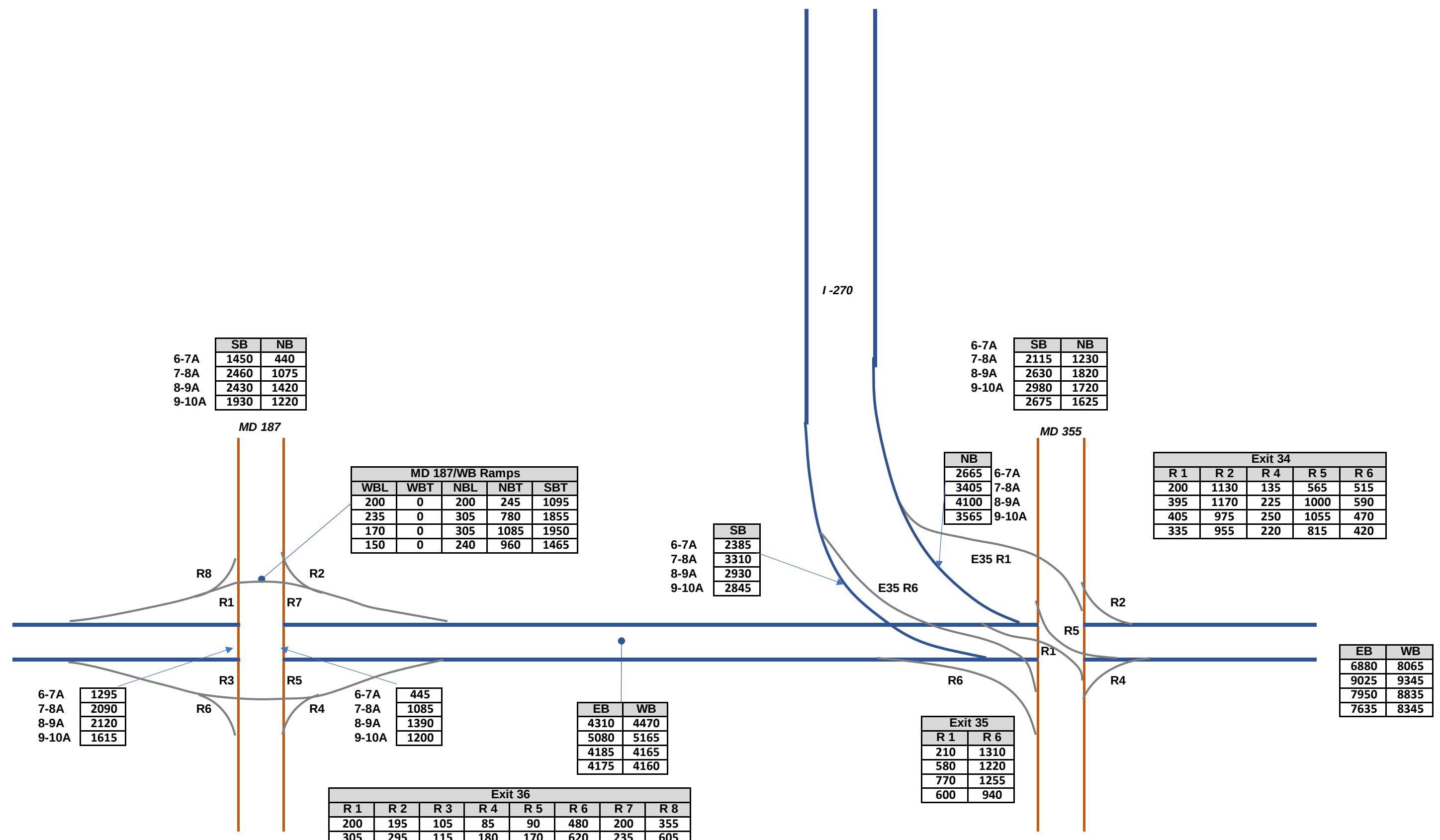

MD 187 (north)

	SB	NB
6-7A	1450	440
7-8A	2460	1075
8-9A	2430	1420
9-10A	1930	1220

MD 187/WB Ramps				
WBL	WBT	NBL	NBT	SBT
200	0	200	245	1095
235	0	305	780	1855
170	0	305	1085	1950
150	0	240	960	1465

6-7A	1295
7-8A	2090
8-9A	2120
9-10A	1615

6-7A	445
7-8A	1085
8-9A	1390
9-10A	1200

EB	WB
4310	4470
5080	5165
4185	4165
4175	4160

Exit 36							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
200	195	105	85	90	480	200	355
305	295	115	180	170	620	235	605
305	335	190	150	215	515	170	480
240	260	95	120	155	330	150	465

MD 187 (south)

	SB	NB
6-7A	1685	425
7-8A	2540	1150
8-9A	2420	1350
9-10A	1790	1225

	SB
6-7A	2385
7-8A	3310
8-9A	2930
9-10A	2845

NB	
2665	6-7A
3405	7-8A
4100	8-9A
3565	9-10A

MD 355 (north)

6-7A	SB	NB
7-8A	2115	1230
8-9A	2630	1820
9-10A	2980	1720
	2675	1625

Exit 34				
R 1	R 2	R 4	R 5	R 6
200	1130	135	565	515
395	1170	225	1000	590
405	975	250	1055	470
335	955	220	815	420

EB	WB
6880	8065
9025	9345
7950	8835
7635	8345

Exit 35	
R 1	R 6
210	1310
580	1220
770	1255
600	940

MD 355 (south)

	SB	NB
6-7A	3375	645
7-8A	3440	1850
8-9A	3650	2170
9-10A	3220	1825

N

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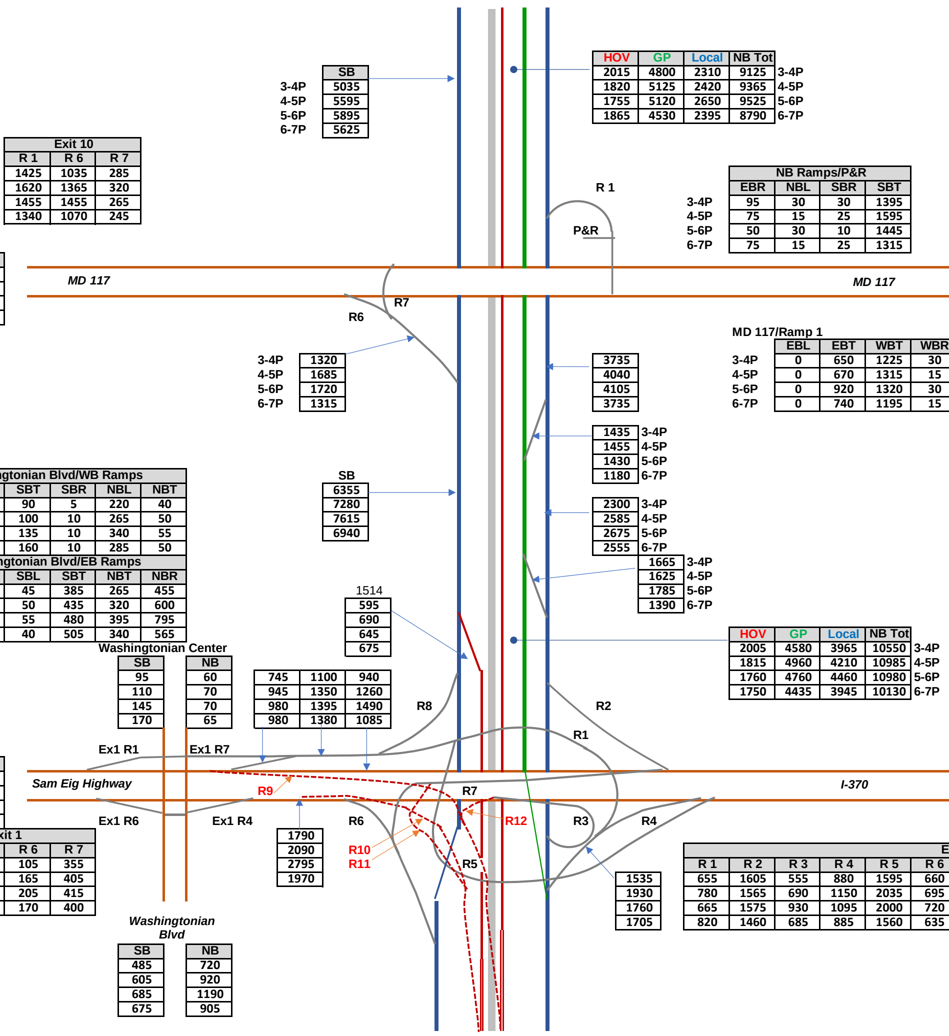

SB

Period	SB
3-4P	5035
4-5P	5595
5-6P	5895
6-7P	5625

HOV	GP	Local	NB Tot	Period
2015	4800	2310	9125	3-4P
1820	5125	2420	9365	4-5P
1755	5120	2650	9525	5-6P
1865	4530	2395	8790	6-7P

Exit 10

Period	R 1	R 6	R 7
3-4P	1425	1035	285
4-5P	1620	1365	320
5-6P	1455	1455	265
6-7P	1340	1070	245

NB Ramps/P&R

Period	EBR	NBL	SBR	SBT
3-4P	95	30	30	1395
4-5P	75	15	25	1595
5-6P	50	30	10	1445
6-7P	75	15	25	1315

Period	EB	WB
3-4P	1685	2090
4-5P	2035	2430
5-6P	2375	2290
6-7P	1810	2160

EB	WB	Period
990	1255	3-4P
905	1330	4-5P
1180	1350	5-6P
920	1210	6-7P

MD 117/Ramp 1

Period	EBL	EBT	WBT	WBR	SBR	SBL
3-4P	0	650	1225	30	1150	340
4-5P	0	670	1315	15	1435	235
5-6P	0	920	1320	30	1235	260
6-7P	0	740	1195	15	1210	180

Period	
3-4P	1320
4-5P	1685
5-6P	1720
6-7P	1315

3735
4040
4105
3735

	Period
1435	3-4P
1455	4-5P
1430	5-6P
1180	6-7P

Washingtonian Blvd/WB Ramps

WBL	WBR	SBT	SBR	NBL	NBT
340	15	90	5	220	40
385	20	100	10	265	50
400	15	135	10	340	55
385	15	160	10	285	50

Washingtonian Blvd/EB Ramps

EBL	EBR	SBL	SBT	NBT	NBR
5	100	45	385	265	455
5	160	50	435	320	600
5	200	55	480	395	795
5	165	40	505	340	565

SB

6355
7280
7615
6940

	Period
2300	3-4P
2585	4-5P
2675	5-6P
2555	6-7P

	Period
1665	3-4P
1625	4-5P
1785	5-6P
1390	6-7P

1514

595
690
645
675

HOV	GP	Local	NB Tot	Period
2005	4580	3965	10550	3-4P
1815	4960	4210	10985	4-5P
1760	4760	4460	10980	5-6P
1750	4435	3945	10130	6-7P

Washingtonian Center

SB	NB
95	60
110	70
145	70
170	65

745	1100	940
945	1350	1260
980	1395	1490
980	1380	1085

Period	EB	WB
3-4P	1395	2130
4-5P	1605	2660
5-6P	2150	2970
6-7P	1535	2550

EB	WB	Period
3715	4140	3-4P
4610	4520	4-5P
4905	4745	5-6P
3810	4155	6-7P

Exit 1

R 1	R 4	R 6	R 7
225	500	105	355
275	650	165	405
350	850	205	415
295	605	170	400

1790
2090
2795
1970

1535
1930
1760
1705

Exit 9

R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12
655	1605	555	880	1595	660	790	430	235	85	805	750
780	1565	690	1150	2035	695	855	555	195	60	840	780
665	1575	930	1095	2000	720	740	715	165	60	940	725
820	1460	685	885	1560	635	755	545	205	65	855	780

Washingtonian Blvd

SB	NB
485	720
605	920
685	1190
675	905

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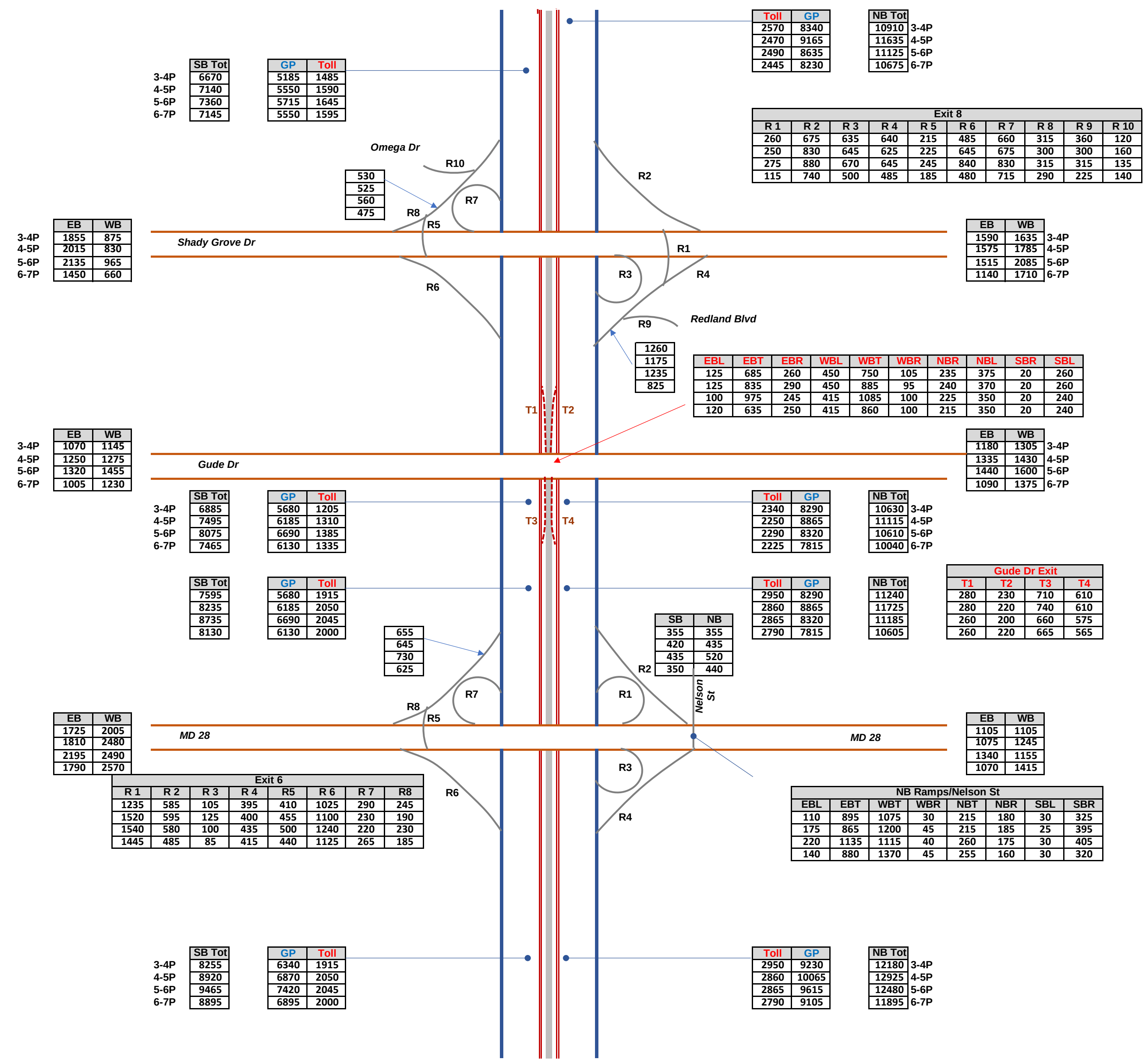

SB (north of Shady Grove Dr)

	SB Tot	GP	Toll
3-4P	6670	5185	1485
4-5P	7140	5550	1590
5-6P	7360	5715	1645
6-7P	7145	5550	1595

NB (north of Shady Grove Dr)

Toll	GP	NB Tot	
2570	8340	10910	3-4P
2470	9165	11635	4-5P
2490	8635	11125	5-6P
2445	8230	10675	6-7P

Exit 8									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
260	675	635	640	215	485	660	315	360	120
250	830	645	625	225	645	675	300	300	160
275	880	670	645	245	840	830	315	315	135
115	740	500	485	185	480	715	290	225	140

530
525
560
475

Shady Grove Dr (west)

	EB	WB
3-4P	1855	875
4-5P	2015	830
5-6P	2135	965
6-7P	1450	660

Shady Grove Dr (east)

EB	WB	
1590	1635	3-4P
1575	1785	4-5P
1515	2085	5-6P
1140	1710	6-7P

1260
1175
1235
825

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
125	685	260	450	750	105	235	375	20	260
125	835	290	450	885	95	240	370	20	260
100	975	245	415	1085	100	225	350	20	240
120	635	250	415	860	100	215	350	20	240

Gude Dr (west)

	EB	WB
3-4P	1070	1145
4-5P	1250	1275
5-6P	1320	1455
6-7P	1005	1230

Gude Dr (east)

EB	WB	
1180	1305	3-4P
1335	1430	4-5P
1440	1600	5-6P
1090	1375	6-7P

SB (south of Gude Dr)

	SB Tot	GP	Toll
3-4P	6885	5680	1205
4-5P	7495	6185	1310
5-6P	8075	6690	1385
6-7P	7465	6130	1335

NB (south of Gude Dr)

Toll	GP	NB Tot	
2340	8290	10630	3-4P
2250	8865	11115	4-5P
2290	8320	10610	5-6P
2225	7815	10040	6-7P

SB (north of MD 28)

SB Tot	GP	Toll
7595	5680	1915
8235	6185	2050
8735	6690	2045
8130	6130	2000

NB (north of MD 28)

Toll	GP	NB Tot
2950	8290	11240
2860	8865	11725
2865	8320	11185
2790	7815	10605

Gude Dr Exit			
T1	T2	T3	T4
280	230	710	610
280	220	740	610
260	200	660	575
260	220	665	565

655
645
730
625

Nelson St

SB	NB
355	355
420	435
435	520
350	440

MD 28 (west)

EB	WB
1725	2005
1810	2480
2195	2490
1790	2570

MD 28 (east)

EB	WB
1105	1105
1075	1245
1340	1155
1070	1415

Exit 6							
R 1	R 2	R 3	R 4	R5	R 6	R 7	R8
1235	585	105	395	410	1025	290	245
1520	595	125	400	455	1100	230	190
1540	580	100	435	500	1240	220	230
1445	485	85	415	440	1125	265	185

NB Ramps/Nelson St							
EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
110	895	1075	30	215	180	30	325
175	865	1200	45	215	185	25	395
220	1135	1115	40	260	175	30	405
140	880	1370	45	255	160	30	320

SB (south of MD 28)

	SB Tot	GP	Toll
3-4P	8255	6340	1915
4-5P	8920	6870	2050
5-6P	9465	7420	2045
6-7P	8895	6895	2000

NB (south of MD 28)

Toll	GP	NB Tot	
2950	9230	12180	3-4P
2860	10065	12925	4-5P
2865	9615	12480	5-6P
2790	9105	11895	6-7P

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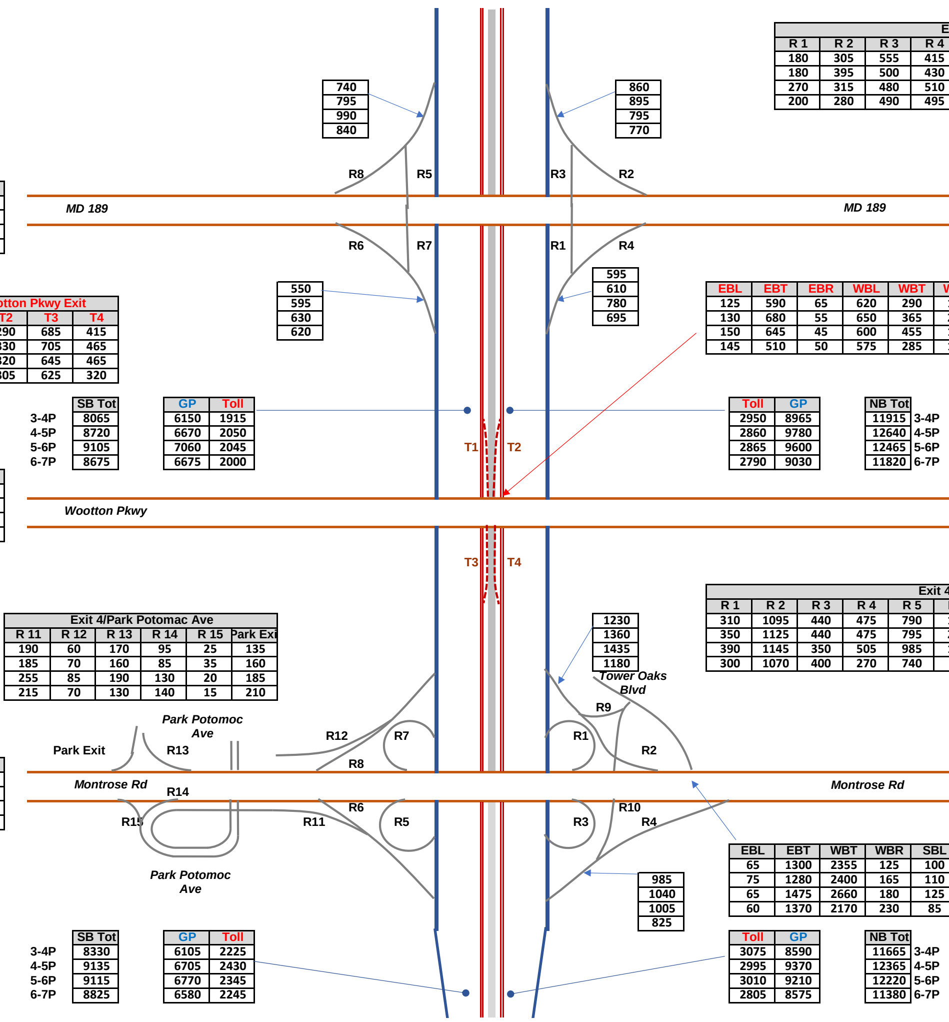

Exit 5							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
180	305	555	415	235	125	425	505
180	395	500	430	235	120	475	560
270	315	480	510	305	110	520	685
200	280	490	495	305	125	495	535

740
795
990
840

860
895
795
770

	EB	WB
3-4P	1045	1000
4-5P	1070	1195
5-6P	1020	1295
6-7P	990	1215

EB	WB	
1015	1045	3-4P
1115	1325	4-5P
1245	1175	5-6P
1175	1255	6-7P

550
595
630
620

595
610
780
695

Wooотton Pkwy Exit			
T1	T2	T3	T4
375	290	685	415
325	330	705	465
345	320	645	465
380	305	625	320

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
125	590	65	620	290	165	290	125	215	160
130	680	55	650	365	200	355	110	140	185
150	645	45	600	455	170	340	125	145	200
145	510	50	575	285	160	195	125	175	205

	SB Tot
3-4P	8065
4-5P	8720
5-6P	9105
6-7P	8675

GP	Toll
6150	1915
6670	2050
7060	2045
6675	2000

Toll	GP
2950	8965
2860	9780
2865	9600
2790	9030

NB Tot	
11915	3-4P
12640	4-5P
12465	5-6P
11820	6-7P

	EB	WB
3-4P	780	630
4-5P	865	615
5-6P	840	725
6-7P	705	585

EB	WB	
1040	1075	3-4P
1220	1215	4-5P
1185	1225	5-6P
910	1020	6-7P

Exit 4									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
310	1095	440	475	790	120	765	270	135	510
350	1125	440	475	795	210	805	300	235	565
390	1145	350	505	985	170	695	340	290	500
300	1070	400	270	740	90	755	345	110	555

Exit 4/Park Potomac Ave					
R 11	R 12	R 13	R 14	R 15	Park Exi
190	60	170	95	25	135
185	70	160	85	35	160
255	85	190	130	20	185
215	70	130	140	15	210

1230
1360
1435
1180

	EB	WB
3-4P	1065	1355
4-5P	1160	1405
5-6P	965	1845
6-7P	1055	1320

EB	WB	
1875	2480	3-4P
1865	2565	4-5P
2105	2840	5-6P
1725	2400	6-7P

EBL	EBT	WBT	WBR	SBL	SBR
65	1300	2355	125	100	315
75	1280	2400	165	110	285
65	1475	2660	180	125	300
60	1370	2170	230	85	250

985
1040
1005
825

	SB Tot
3-4P	8330
4-5P	9135
5-6P	9115
6-7P	8825

GP	Toll
6105	2225
6705	2430
6770	2345
6580	2245

Toll	GP
3075	8590
2995	9370
3010	9210
2805	8575

NB Tot	
11665	3-4P
12365	4-5P
12220	5-6P
11380	6-7P

2027 Preferred Alternative PM Hourly Volume Diagram

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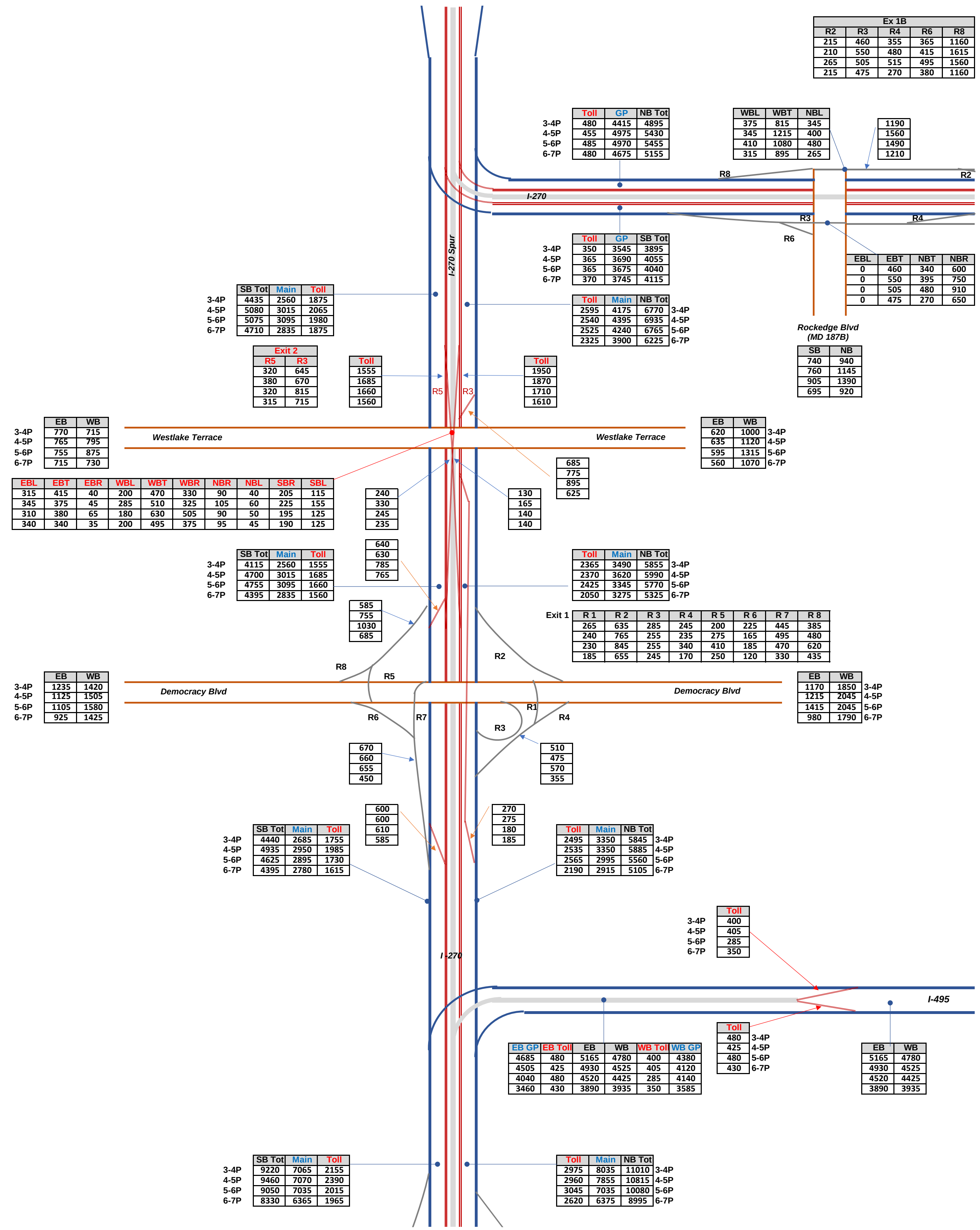
2027 Preferred Alternative Hourly PM Volume Diagram



Ex 1B				
R2	R3	R4	R6	R8
215	460	355	365	1160
210	550	480	415	1615
265	505	515	495	1560
215	475	270	380	1160

	Toll	GP	NB Tot
3-4P	480	4415	4895
4-5P	455	4975	5430
5-6P	485	4970	5455
6-7P	480	4675	5155

WBL	WBT	NBL
375	815	345
345	1215	400
410	1080	480
315	895	265

1190
1560
1490
1210

	Toll	GP	SB Tot
3-4P	350	3545	3895
4-5P	365	3690	4055
5-6P	365	3675	4040
6-7P	370	3745	4115

EBL	EBT	NBT	NBR
0	460	340	600
0	550	395	750
0	505	480	910
0	475	270	650

	SB Tot	Main	Toll
3-4P	4435	2560	1875
4-5P	5080	3015	2065
5-6P	5075	3095	1980
6-7P	4710	2835	1875

Toll	Main	NB Tot	
2595	4175	6770	3-4P
2540	4395	6935	4-5P
2525	4240	6765	5-6P
2325	3900	6225	6-7P

Rockedge Blvd (MD 187B)

SB	NB
740	940
760	1145
905	1390
695	920

Exit 2	
R5	R3
320	645
380	670
320	815
315	715

Toll
1555
1685
1660
1560

Toll
1950
1870
1710
1610

	EB	WB
3-4P	770	715
4-5P	765	795
5-6P	755	875
6-7P	715	730

EB	WB	
620	1000	3-4P
635	1120	4-5P
595	1315	5-6P
560	1070	6-7P

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
315	415	40	200	470	330	90	40	205	115
345	375	45	285	510	325	105	60	225	155
310	380	65	180	630	505	90	50	195	125
340	340	35	200	495	375	95	45	190	125

240
330
245
235

130
165
140
140

685
775
895
625

640
630
785
765

	SB Tot	Main	Toll
3-4P	4115	2560	1555
4-5P	4700	3015	1685
5-6P	4755	3095	1660
6-7P	4395	2835	1560

Toll	Main	NB Tot	
2365	3490	5855	3-4P
2370	3620	5990	4-5P
2425	3345	5770	5-6P
2050	3275	5325	6-7P

585
755
1030
685

Exit 1

R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
265	635	285	245	200	225	445	385
240	765	255	235	275	165	495	480
230	845	255	340	410	185	470	620
185	655	245	170	250	120	330	435

	EB	WB
3-4P	1235	1420
4-5P	1125	1505
5-6P	1105	1580
6-7P	925	1425

EB	WB	
1170	1850	3-4P
1215	2045	4-5P
1415	2045	5-6P
980	1790	6-7P

670
660
655
450

510
475
570
355

600
600
610
585

270
275
180
185

	SB Tot	Main	Toll
3-4P	4440	2685	1755
4-5P	4935	2950	1985
5-6P	4625	2895	1730
6-7P	4395	2780	1615

Toll	Main	NB Tot	
2495	3350	5845	3-4P
2535	3350	5885	4-5P
2565	2995	5560	5-6P
2190	2915	5105	6-7P

	Toll
3-4P	400
4-5P	405
5-6P	285
6-7P	350

Toll	
480	3-4P
425	4-5P
480	5-6P
430	6-7P

EB GP	EB Toll	EB	WB	WB Toll	WB GP
4685	480	5165	4780	400	4380
4505	425	4930	4525	405	4120
4040	480	4520	4425	285	4140
3460	430	3890	3935	350	3585

EB	WB
5165	4780
4930	4525
4520	4425
3890	3935

	SB Tot	Main	Toll
3-4P	9220	7065	2155
4-5P	9460	7070	2390
5-6P	9050	7035	2015
6-7P	8330	6365	1965

Toll	Main	NB Tot	
2975	8035	11010	3-4P
2960	7855	10815	4-5P
3045	7035	10080	5-6P
2620	6375	8995	6-7P

2027 Preferred Alternative PM Hourly Volume Diagram

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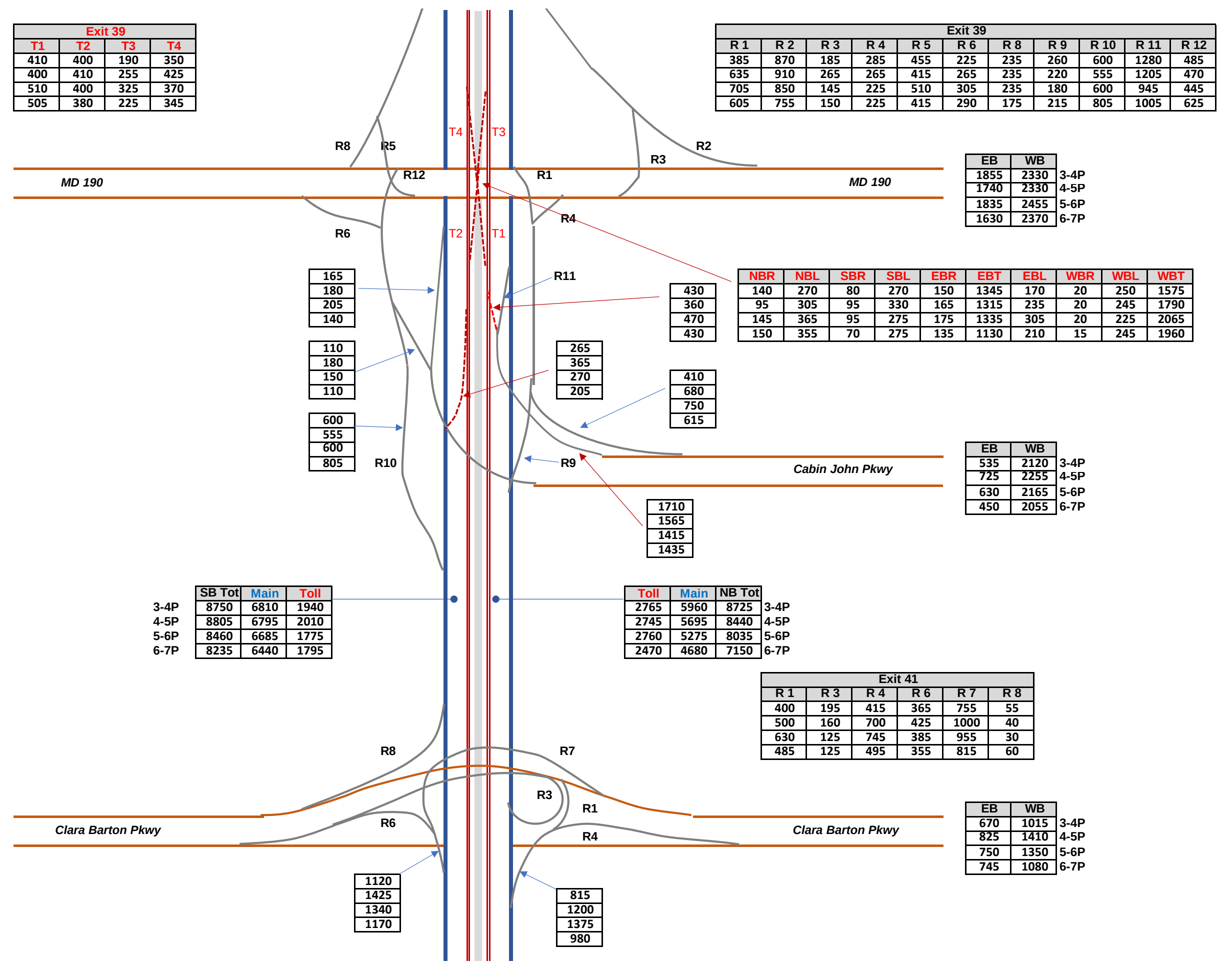

Exit 39			
T1	T2	T3	T4
410	400	190	350
400	410	255	425
510	400	325	370
505	380	225	345

Exit 39										
R 1	R 2	R 3	R 4	R 5	R 6	R 8	R 9	R 10	R 11	R 12
385	870	185	285	455	225	235	260	600	1280	485
635	910	265	265	415	265	235	220	555	1205	470
705	850	145	225	510	305	235	180	600	945	445
605	755	150	225	415	290	175	215	805	1005	625

MD 190 (west)

	EB	WB
3-4P	1435	1675
4-5P	1565	1955
5-6P	1610	2315
6-7P	1350	1935

MD 190 (east)

EB	WB	
1855	2330	3-4P
1740	2330	4-5P
1835	2455	5-6P
1630	2370	6-7P

NBR	NBL	SBR	SBL	EBR	EBT	EBL	WBR	WBL	WBT
140	270	80	270	150	1345	170	20	250	1575
95	305	95	330	165	1315	235	20	245	1790
145	365	95	275	175	1335	305	20	225	2065
150	355	70	275	135	1130	210	15	245	1960

165	110	600	265	430	410	1710	1120	815
180	180	555	365	360	680	1565	1425	1200
205	150	600	270	470	750	1415	1340	1375
140	110	805	205	430	615	1435	1170	980

Cabin John Pkwy

EB	WB	
535	2120	3-4P
725	2255	4-5P
630	2165	5-6P
450	2055	6-7P

	SB Tot	Main	Toll
3-4P	8750	6810	1940
4-5P	8805	6795	2010
5-6P	8460	6685	1775
6-7P	8235	6440	1795

Toll	Main	NB Tot	
2765	5960	8725	3-4P
2745	5695	8440	4-5P
2760	5275	8035	5-6P
2470	4680	7150	6-7P

Exit 41					
R 1	R 3	R 4	R 6	R 7	R 8
400	195	415	365	755	55
500	160	700	425	1000	40
630	125	745	385	955	30
485	125	495	355	815	60

Clara Barton Pkwy (west)

	EB	WB
3-4P	815	715
4-5P	710	950
5-6P	515	1055
6-7P	730	810

Clara Barton Pkwy (east)

EB	WB	
670	1015	3-4P
825	1410	4-5P
750	1350	5-6P
745	1080	6-7P

2027 Preferred Alternative PM Hourly Volume Diagram

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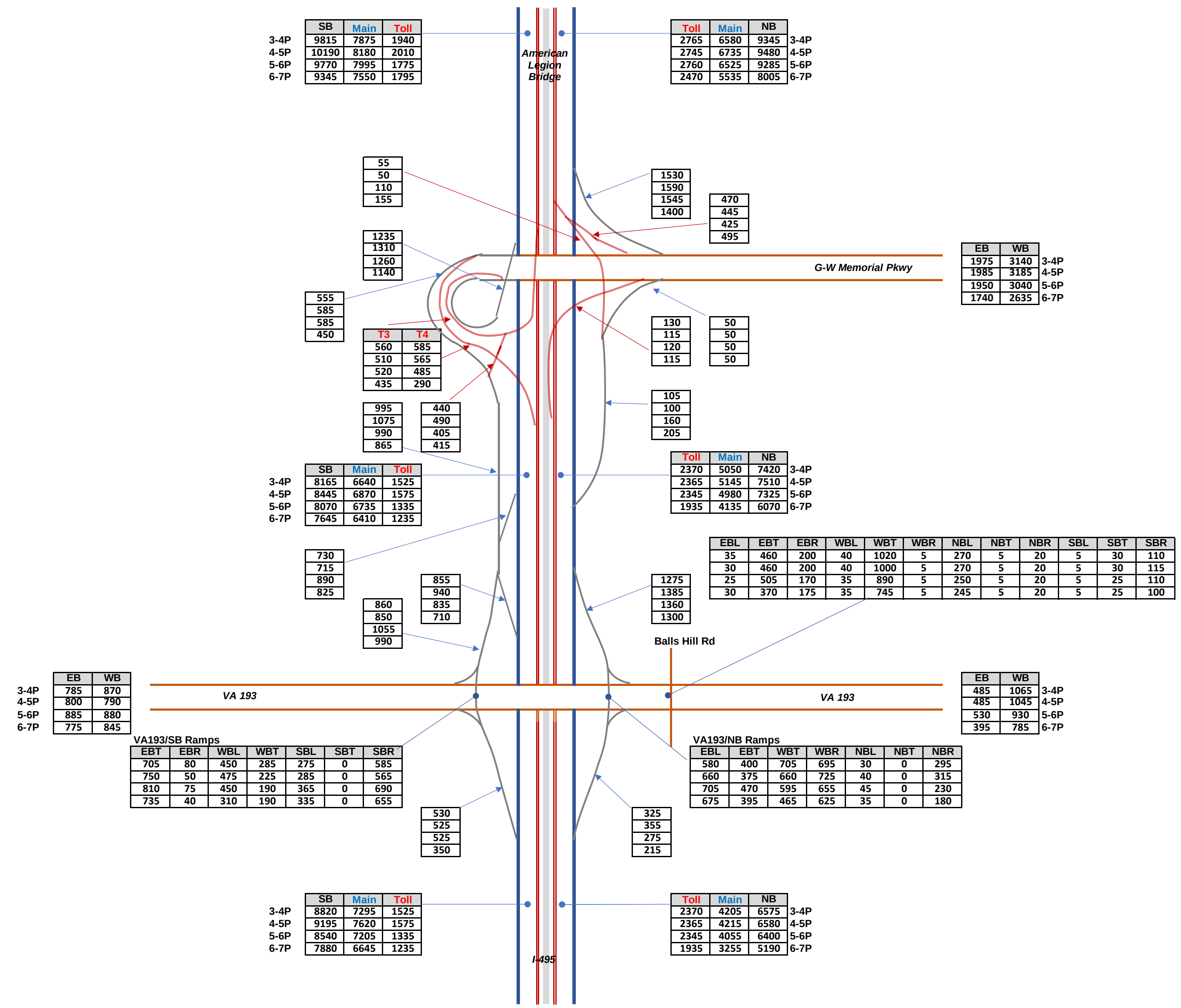
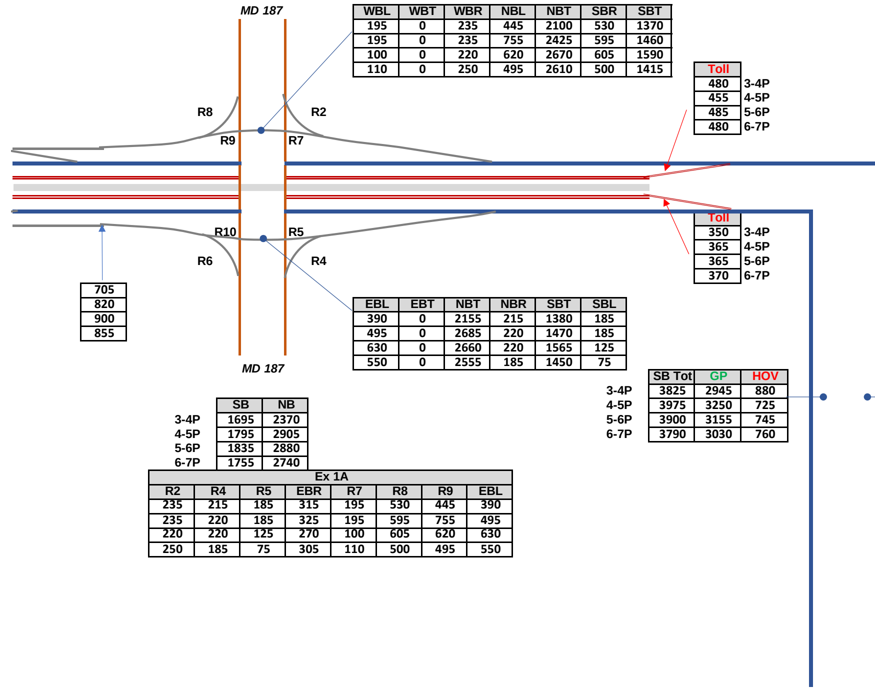
2027 Preferred Alternative Hourly PM Volume Diagram



2027 Preferred Alternative PM Hourly Volume Diagram

2027 Preferred Alternative Hourly PM Volume Diagram



	SB	NB
3-4P	1900	2335
4-5P	2055	2660
5-6P	2195	2890
6-7P	1915	2860

WBL	WBT	WBR	NBL	NBT	SBR	SBT
195	0	235	445	2100	530	1370
195	0	235	755	2425	595	1460
100	0	220	620	2670	605	1590
110	0	250	495	2610	500	1415

Toll	
480	3-4P
455	4-5P
485	5-6P
480	6-7P

Toll	
350	3-4P
365	4-5P
365	5-6P
370	6-7P

705
820
900
855

EBL	EBT	NBT	NBR	SBT	SBL
390	0	2155	215	1380	185
495	0	2685	220	1470	185
630	0	2660	220	1565	125
550	0	2555	185	1450	75

	SB Tot	GP	HOV
3-4P	3825	2945	880
4-5P	3975	3250	725
5-6P	3900	3155	745
6-7P	3790	3030	760

HOV	GP	NB Tot	
965	3415	4380	3-4P
780	3675	4455	4-5P
800	3680	4480	5-6P
845	3725	4570	6-7P

	SB	NB
3-4P	1695	2370
4-5P	1795	2905
5-6P	1835	2880
6-7P	1755	2740

Ex 1A							
R2	R4	R5	EBR	R7	R8	R9	EBL
235	215	185	315	195	530	445	390
235	220	185	325	195	595	755	495
220	220	125	270	100	605	620	630
250	185	75	305	110	500	495	550

2027 Preferred Alternative PM Hourly Volume Diagram

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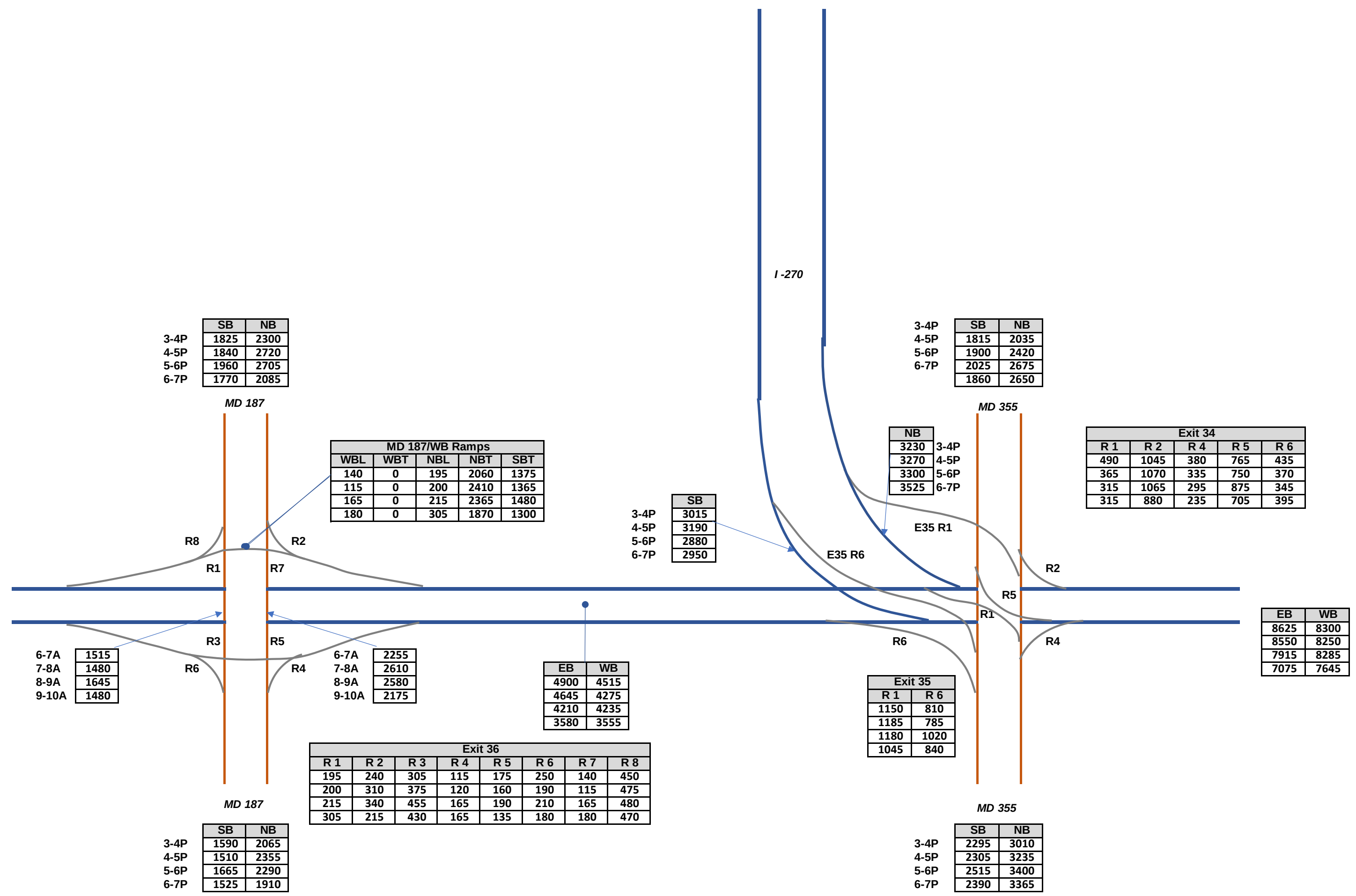
2027 Preferred Alternative Hourly PM Volume Diagram



MD 187 (north)

	SB	NB
3-4P	1825	2300
4-5P	1840	2720
5-6P	1960	2705
6-7P	1770	2085

MD 187/WB Ramps				
WBL	WBT	NBL	NBT	SBT
140	0	195	2060	1375
115	0	200	2410	1365
165	0	215	2365	1480
180	0	305	1870	1300

6-7A	1515
7-8A	1480
8-9A	1645
9-10A	1480

6-7A	2255
7-8A	2610
8-9A	2580
9-10A	2175

EB	WB
4900	4515
4645	4275
4210	4235
3580	3555

Exit 36							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
195	240	305	115	175	250	140	450
200	310	375	120	160	190	115	475
215	340	455	165	190	210	165	480
305	215	430	165	135	180	180	470

MD 187 (south)

	SB	NB
3-4P	1590	2065
4-5P	1510	2355
5-6P	1665	2290
6-7P	1525	1910

	SB
3-4P	3015
4-5P	3190
5-6P	2880
6-7P	2950

NB	
3230	3-4P
3270	4-5P
3300	5-6P
3525	6-7P

MD 355 (north)

	SB	NB
3-4P	1815	2035
4-5P	1900	2420
5-6P	2025	2675
6-7P	1860	2650

Exit 34				
R 1	R 2	R 4	R 5	R 6
490	1045	380	765	435
365	1070	335	750	370
315	1065	295	875	345
315	880	235	705	395

EB	WB
8625	8300
8550	8250
7915	8285
7075	7645

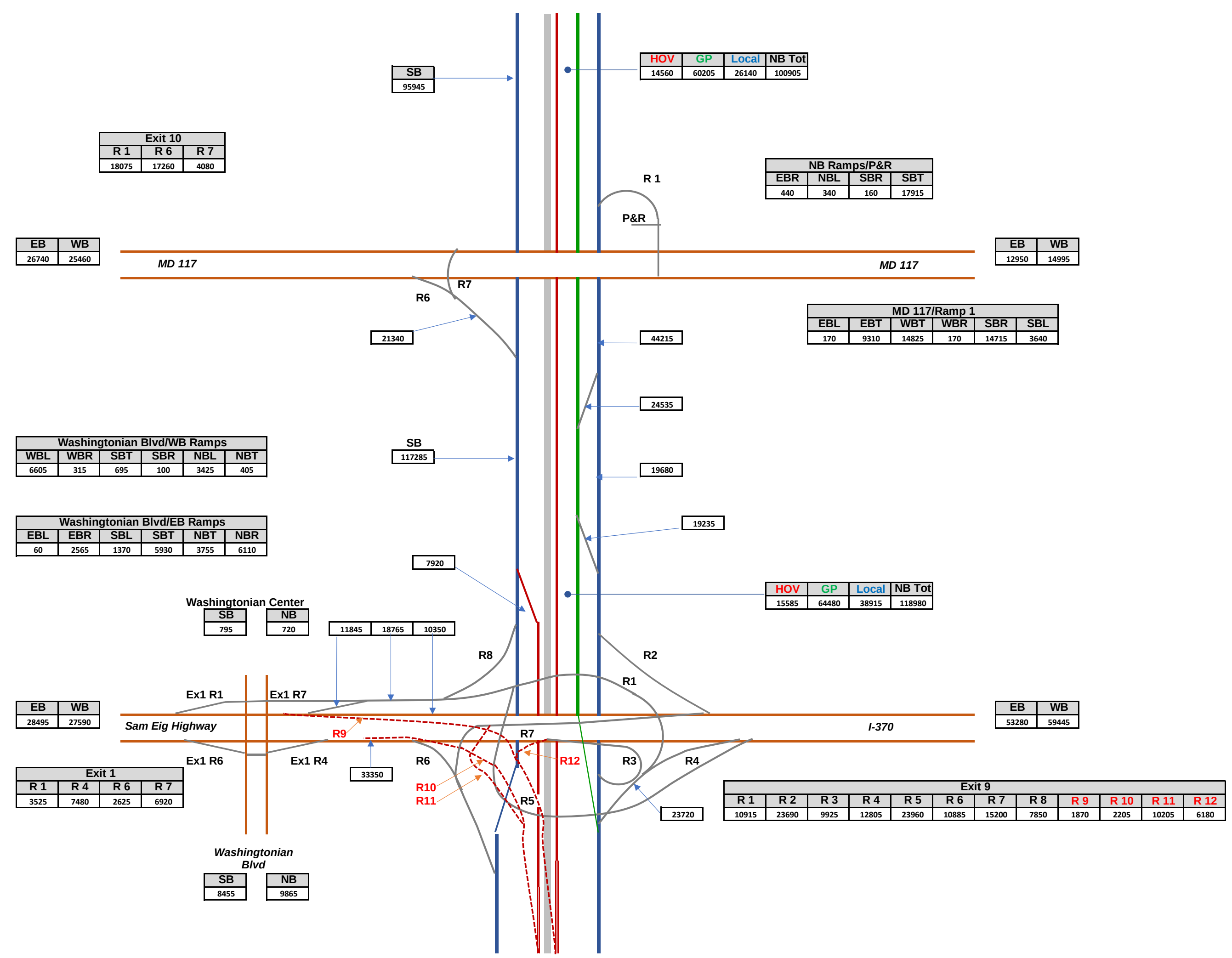
Exit 35	
R 1	R 6
1150	810
1185	785
1180	1020
1045	840

MD 355 (south)

	SB	NB
3-4P	2295	3010
4-5P	2305	3235
5-6P	2515	3400
6-7P	2390	3365

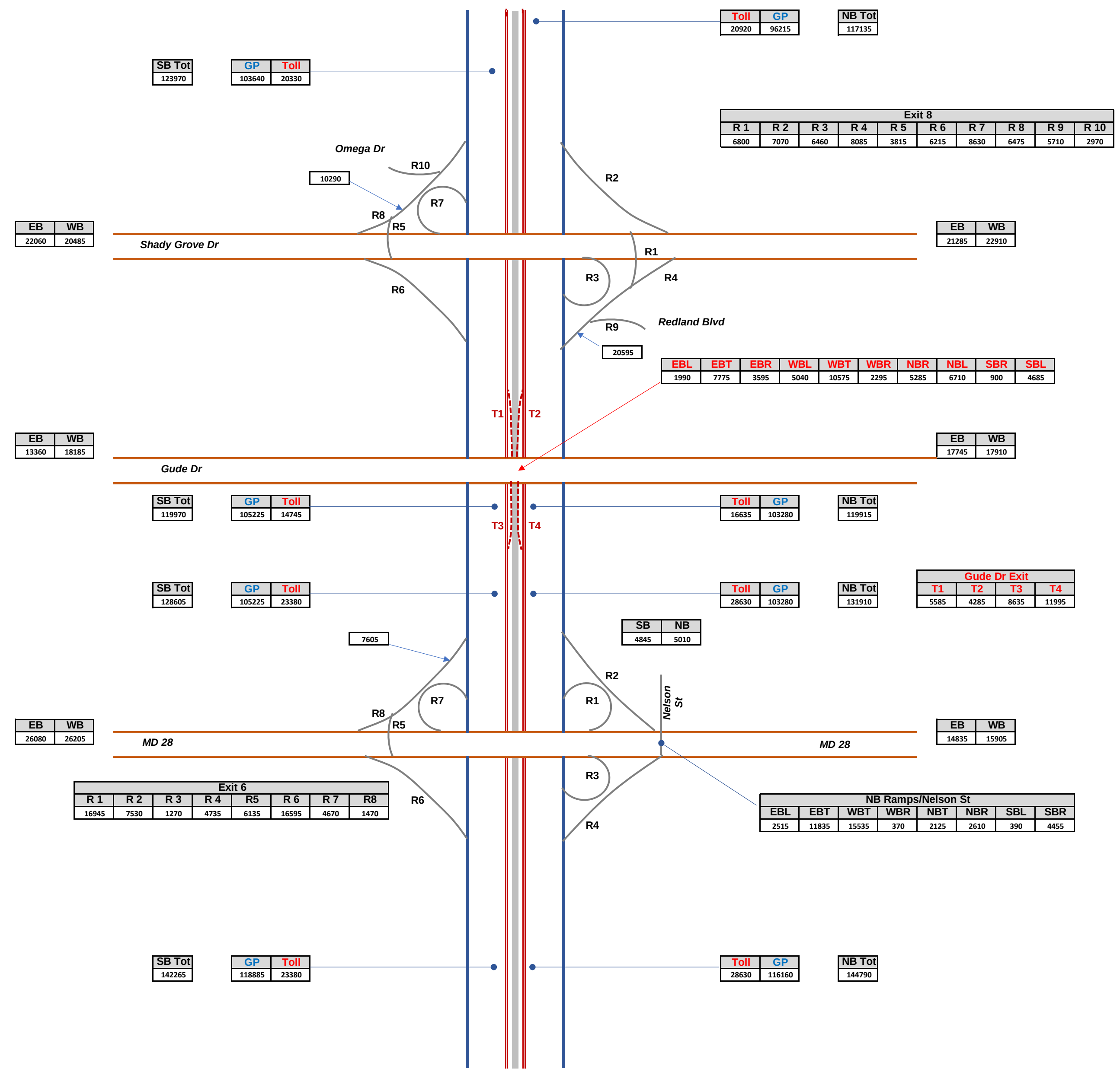
2027 Preferred Alternative PM Hourly Volume Diagram

2027 Preferred Alternative ADT Volume Diagram



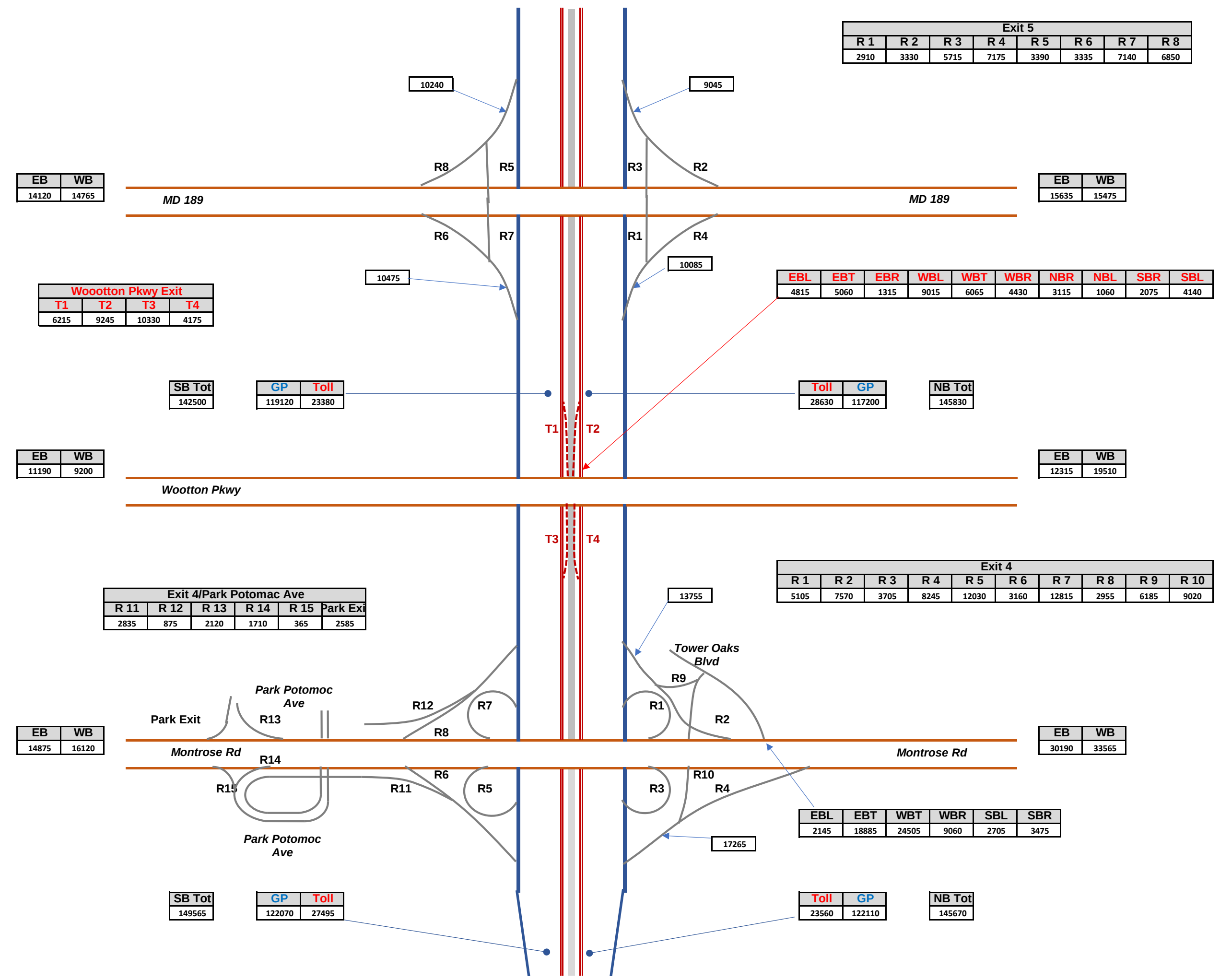
2027 Preferred Alternative ADT Volume Diagram

2027 Preferred Alternative ADT Volume Diagram



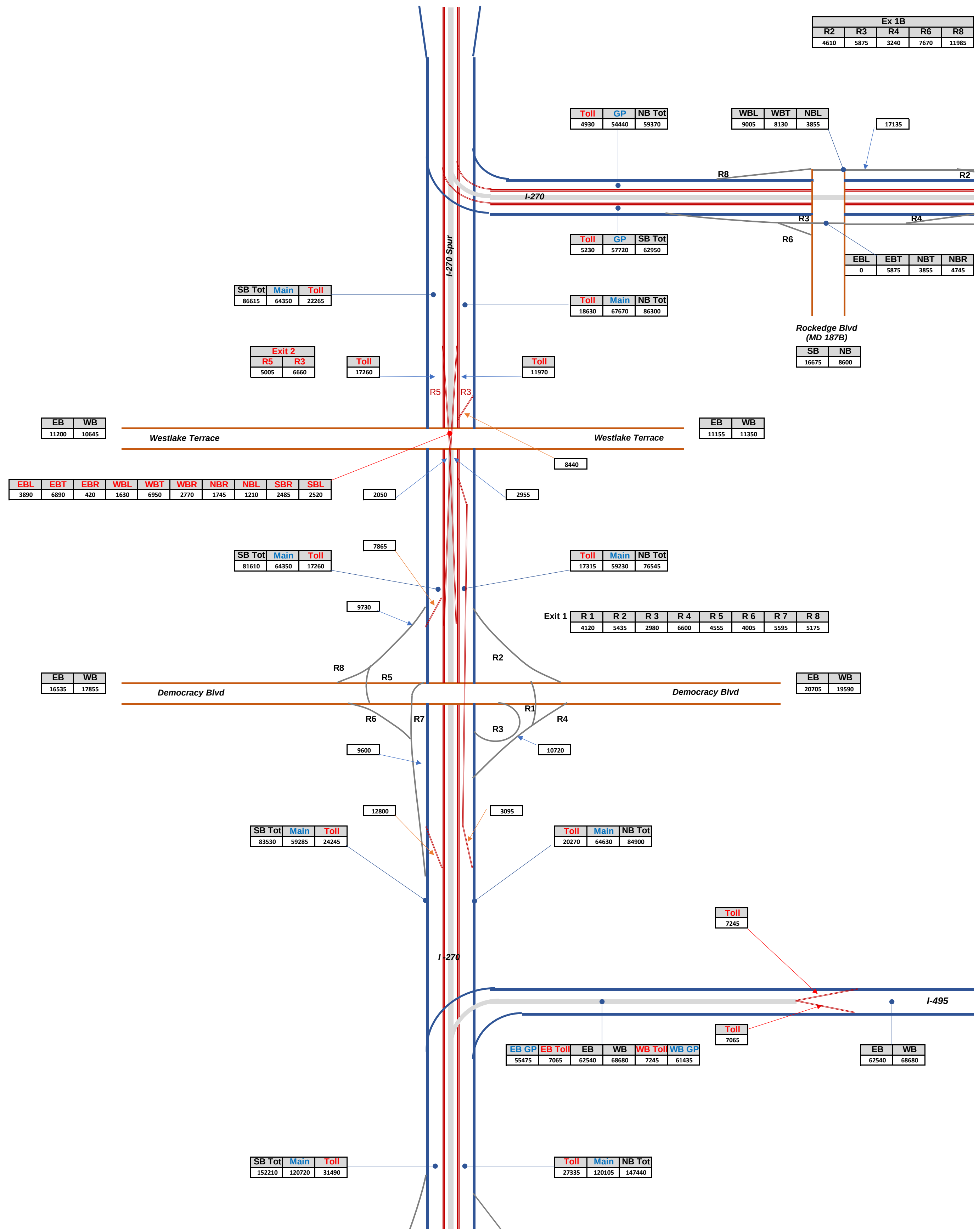
2027 Preferred Alternative ADT Volume Diagram

2027 Preferred Alternative ADT Volume Diagram



2027 Preferred Alternative ADT Volume Diagram

2027 Preferred Alternative ADT Volume Diagram



2027 Preferred Alternative ADT Volume Diagram

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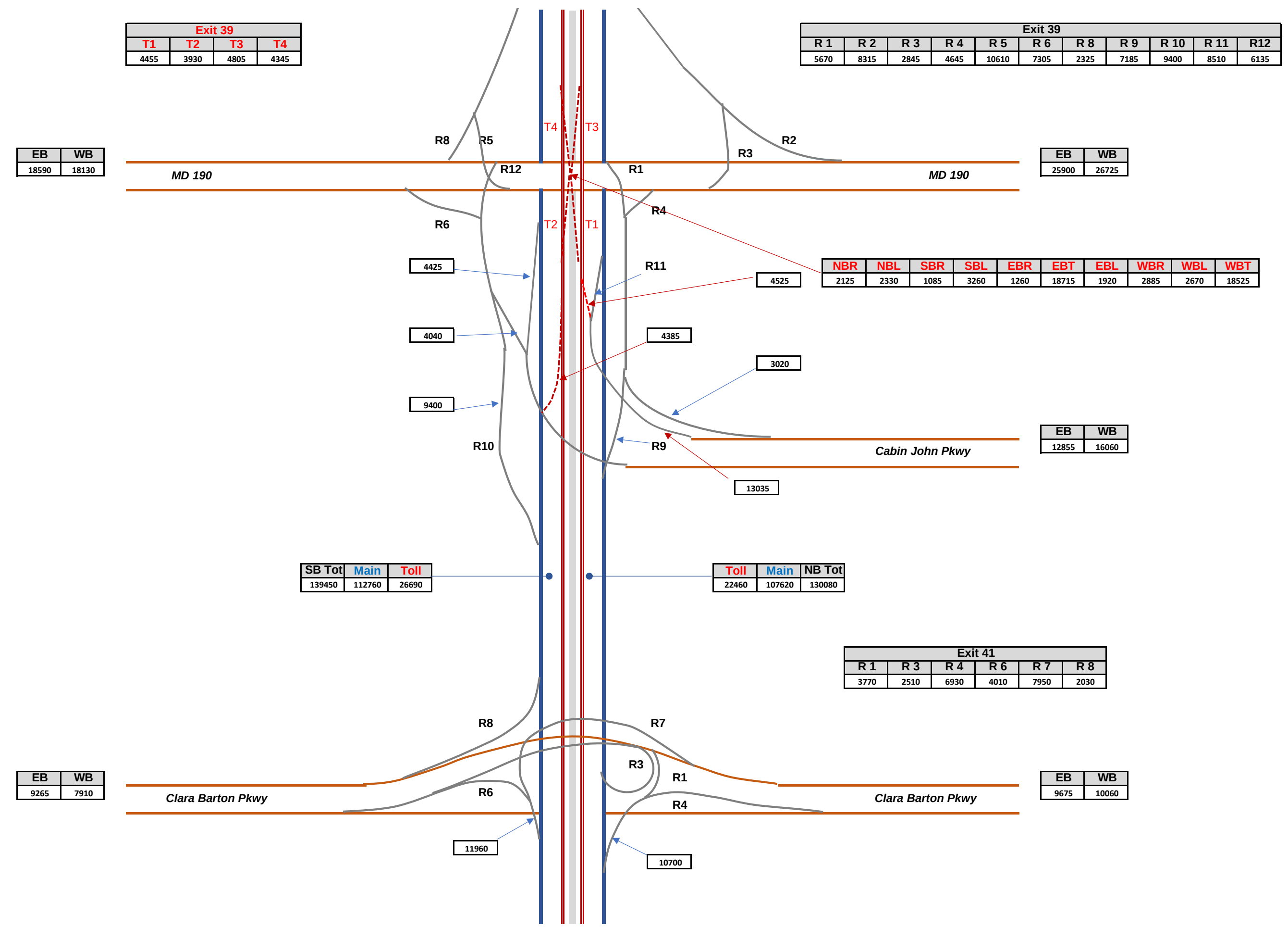
2027 Preferred Alternative ADT Volume Diagram



2027 Preferred Alternative ADT Volume Diagram

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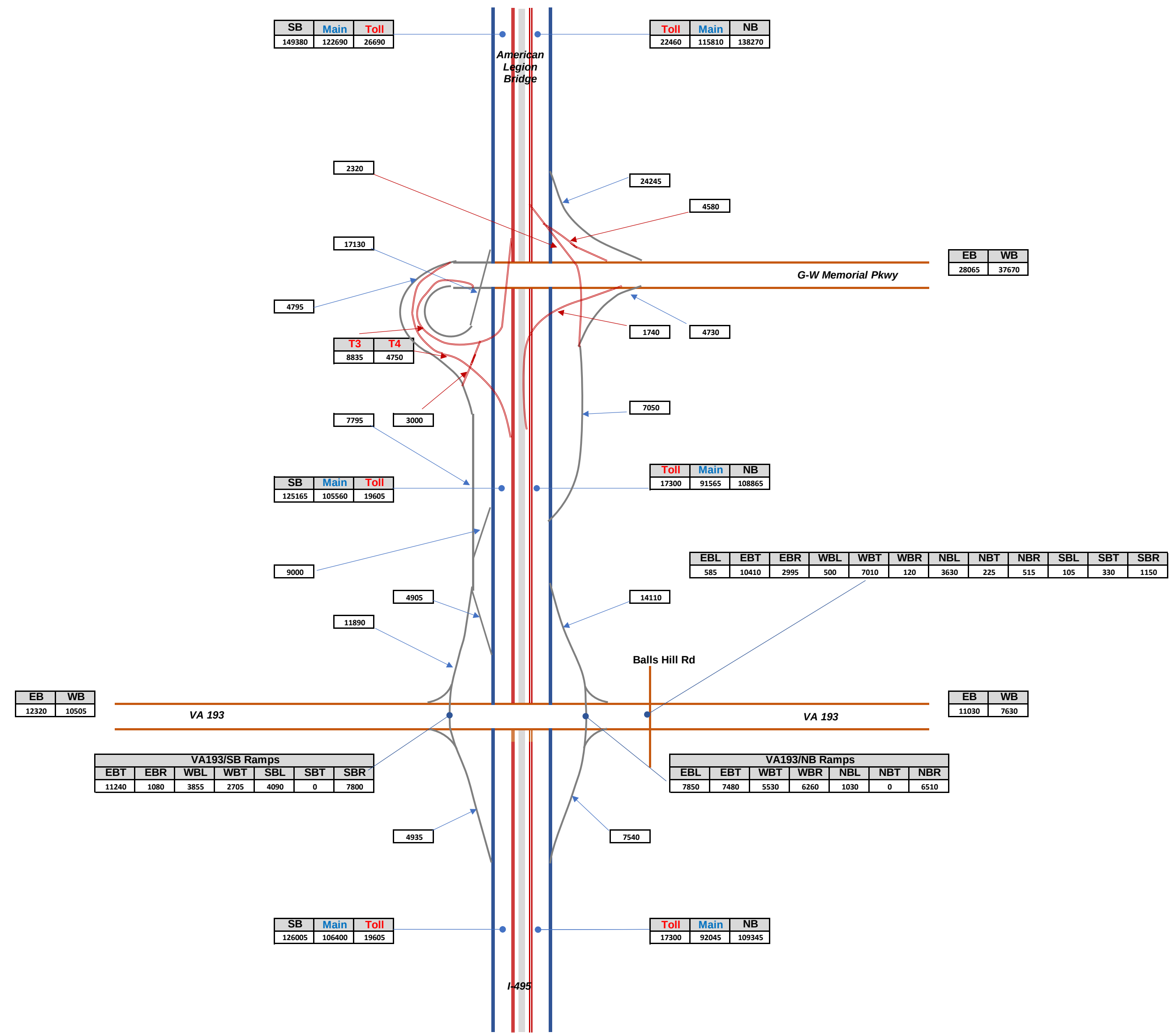
2027 Preferred Alternative ADT Volume Diagram



2027 Preferred Alternative ADT Volume Diagram

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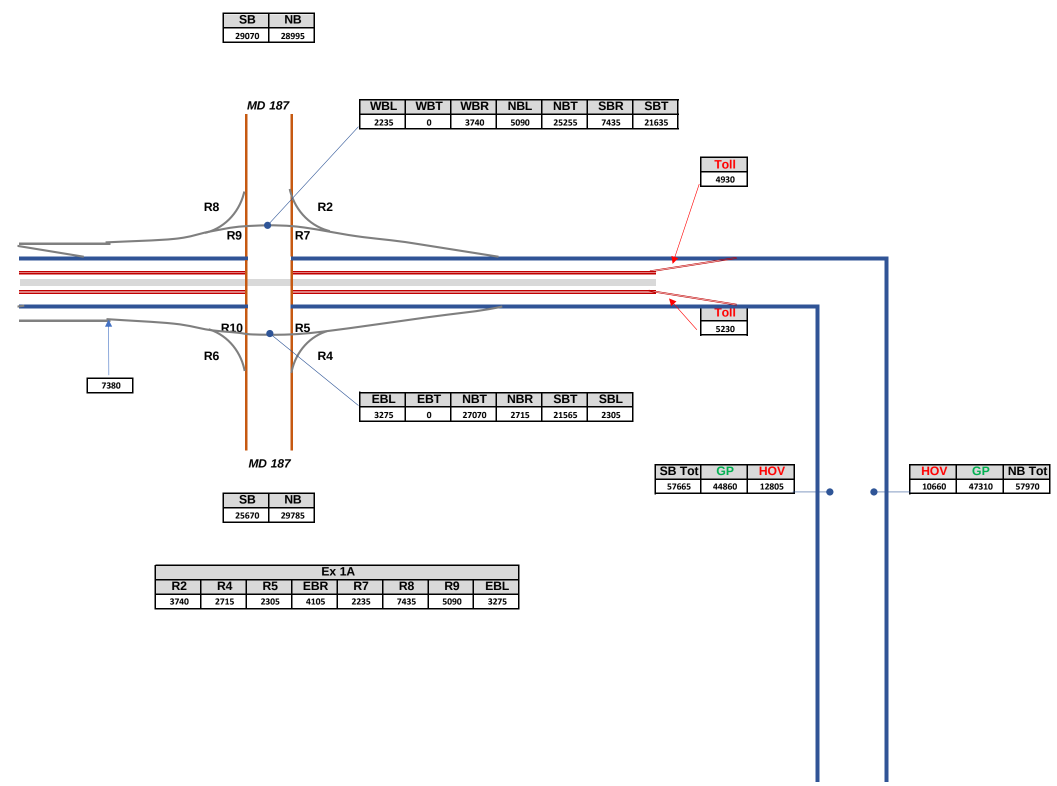
2027 Preferred Alternative ADT Volume Diagram



2027 Preferred Alternative ADT Volume Diagram

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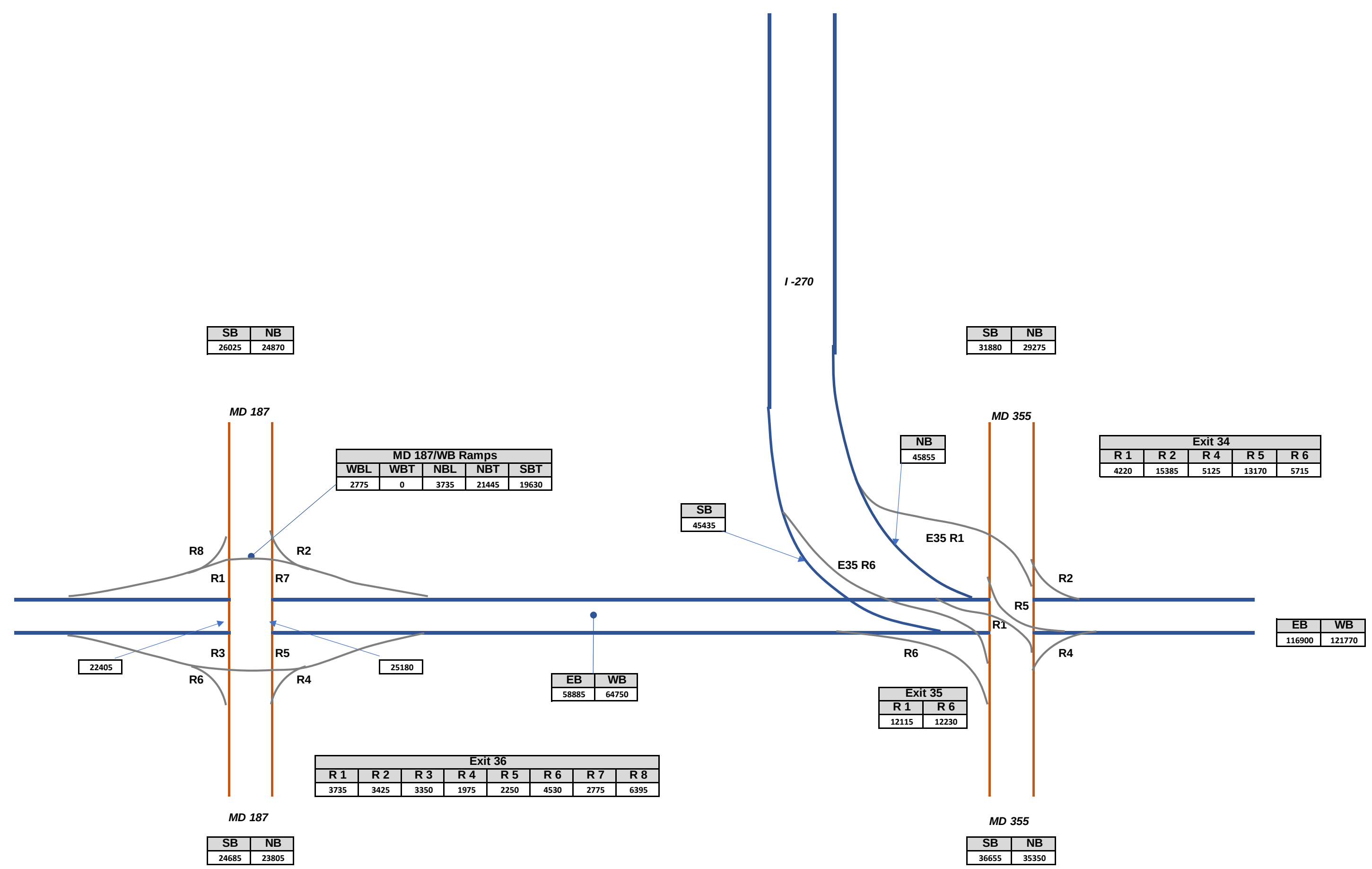
2027 Preferred Alternative ADT Volume Diagram



2027 Preferred Alternative ADT Volume Diagram

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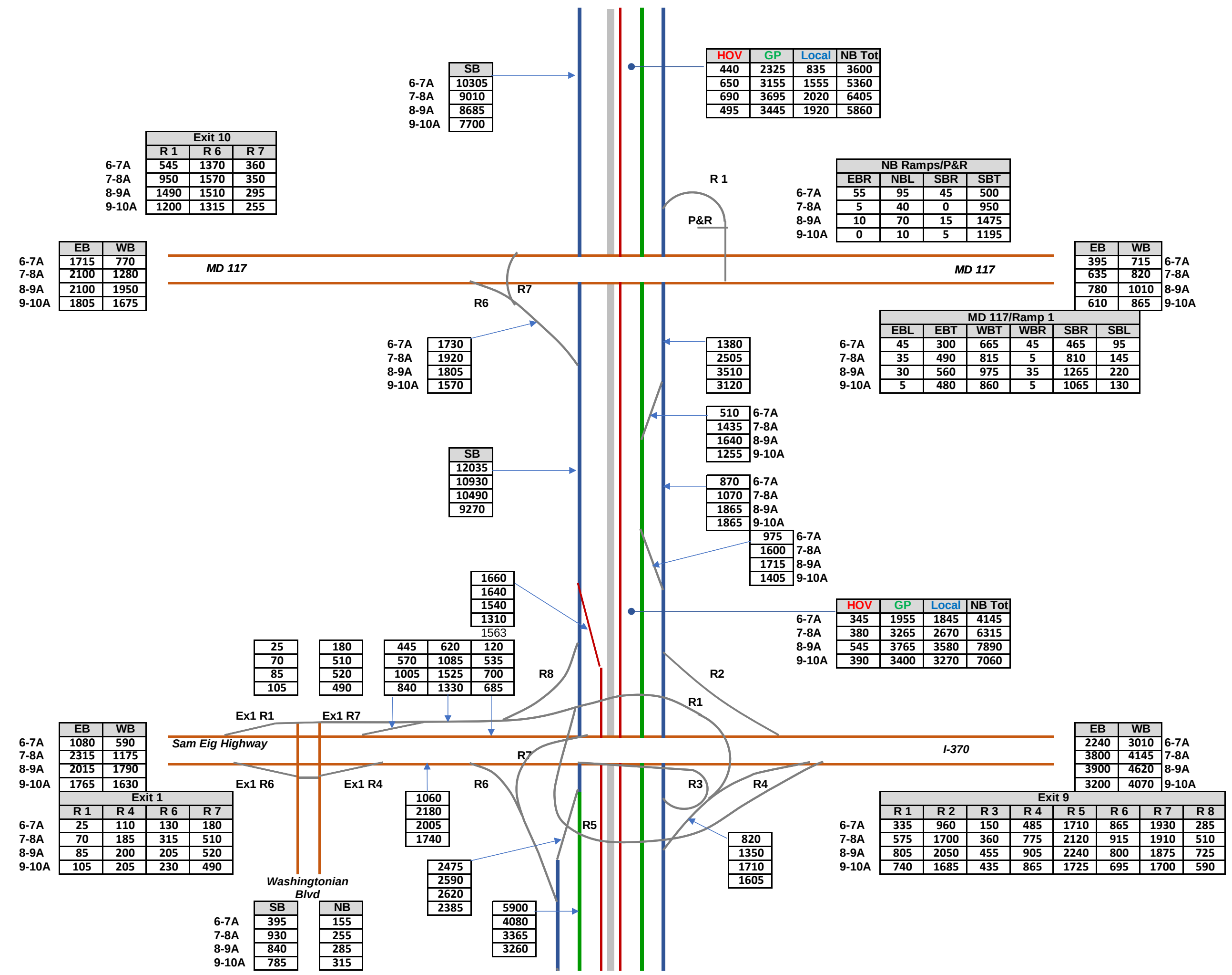
2045 No-Build Hourly AM Volume Diagram



2045 No-Build Hourly AM Volume Diagram

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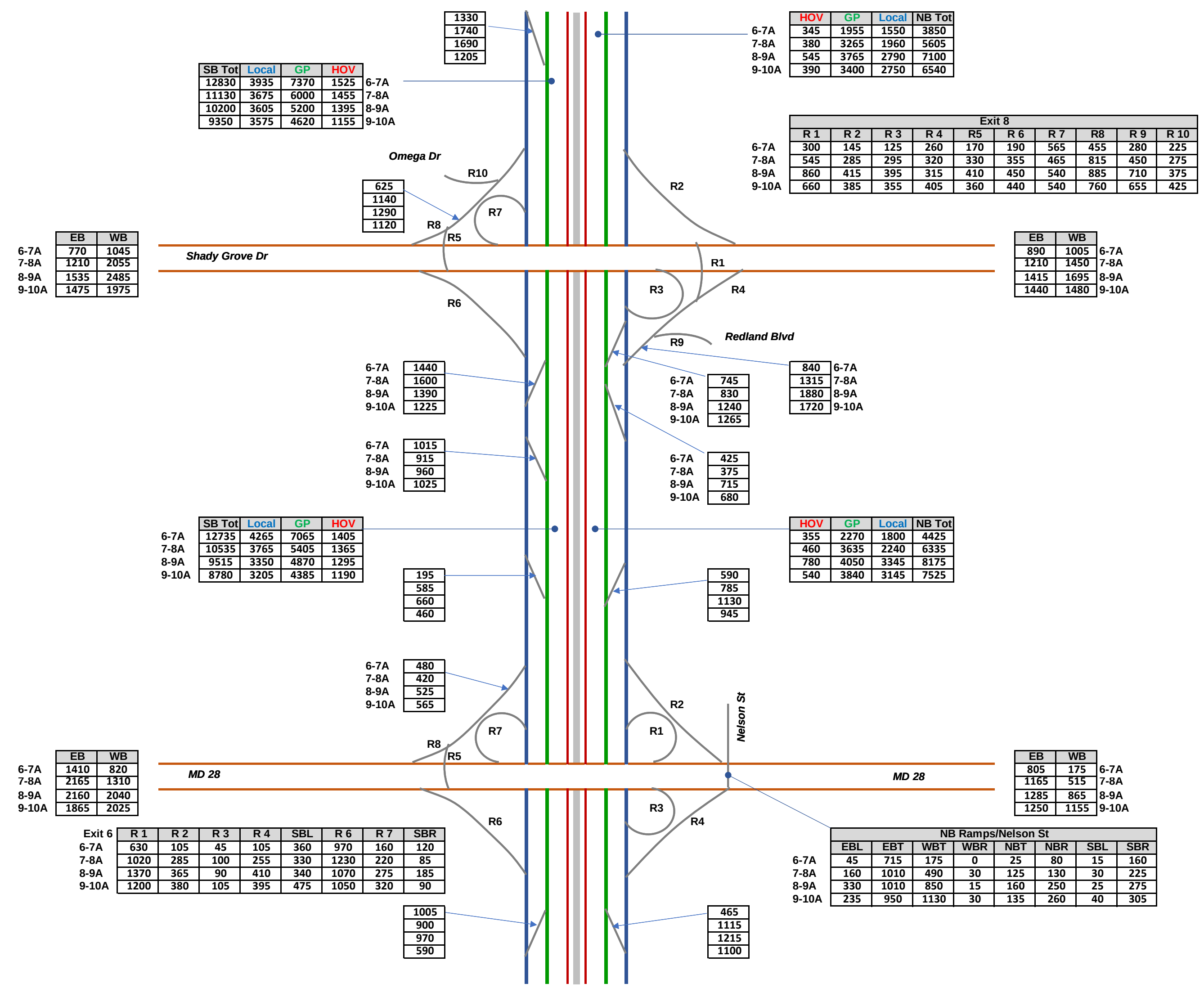
2045 No-Build Hourly AM Volume Diagram



	1330
	1740
	1690
	1205

	SB Tot	Local	GP	HOV
6-7A	12830	3935	7370	1525
7-8A	11130	3675	6000	1455
8-9A	10200	3605	5200	1395
9-10A	9350	3575	4620	1155

	HOV	GP	Local	NB Tot
6-7A	345	1955	1550	3850
7-8A	380	3265	1960	5605
8-9A	545	3765	2790	7100
9-10A	390	3400	2750	6540

Exit 8										
	R 1	R 2	R 3	R 4	R5	R 6	R 7	R8	R 9	R 10
6-7A	300	145	125	260	170	190	565	455	280	225
7-8A	545	285	295	320	330	355	465	815	450	275
8-9A	860	415	395	315	410	450	540	885	710	375
9-10A	660	385	355	405	360	440	540	760	655	425

	625
	1140
	1290
	1120

	EB	WB
6-7A	770	1045
7-8A	1210	2055
8-9A	1535	2485
9-10A	1475	1975

	EB	WB
6-7A	890	1005
7-8A	1210	1450
8-9A	1415	1695
9-10A	1440	1480

6-7A	1440
7-8A	1600
8-9A	1390
9-10A	1225

6-7A	745
7-8A	830
8-9A	1240
9-10A	1265

6-7A	840
7-8A	1315
8-9A	1880
9-10A	1720

6-7A	1015
7-8A	915
8-9A	960
9-10A	1025

6-7A	425
7-8A	375
8-9A	715
9-10A	680

	SB Tot	Local	GP	HOV
6-7A	12735	4265	7065	1405
7-8A	10535	3765	5405	1365
8-9A	9515	3350	4870	1295
9-10A	8780	3205	4385	1190

	HOV	GP	Local	NB Tot
6-7A	355	2270	1800	4425
7-8A	460	3635	2240	6335
8-9A	780	4050	3345	8175
9-10A	540	3840	3145	7525

	195
	585
	660
	460

	590
	785
	1130
	945

6-7A	480
7-8A	420
8-9A	525
9-10A	565

	EB	WB
6-7A	1410	820
7-8A	2165	1310
8-9A	2160	2040
9-10A	1865	2025

	EB	WB
6-7A	805	175
7-8A	1165	515
8-9A	1285	865
9-10A	1250	1155

Exit 6	R 1	R 2	R 3	R 4	SBL	R 6	R 7	SBR
6-7A	630	105	45	105	360	970	160	120
7-8A	1020	285	100	255	330	1230	220	85
8-9A	1370	365	90	410	340	1070	275	185
9-10A	1200	380	105	395	475	1050	320	90

NB Ramps/Nelson St								
	EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
6-7A	45	715	175	0	25	80	15	160
7-8A	160	1010	490	30	125	130	30	225
8-9A	330	1010	850	15	160	250	25	275
9-10A	235	950	1130	30	135	260	40	305

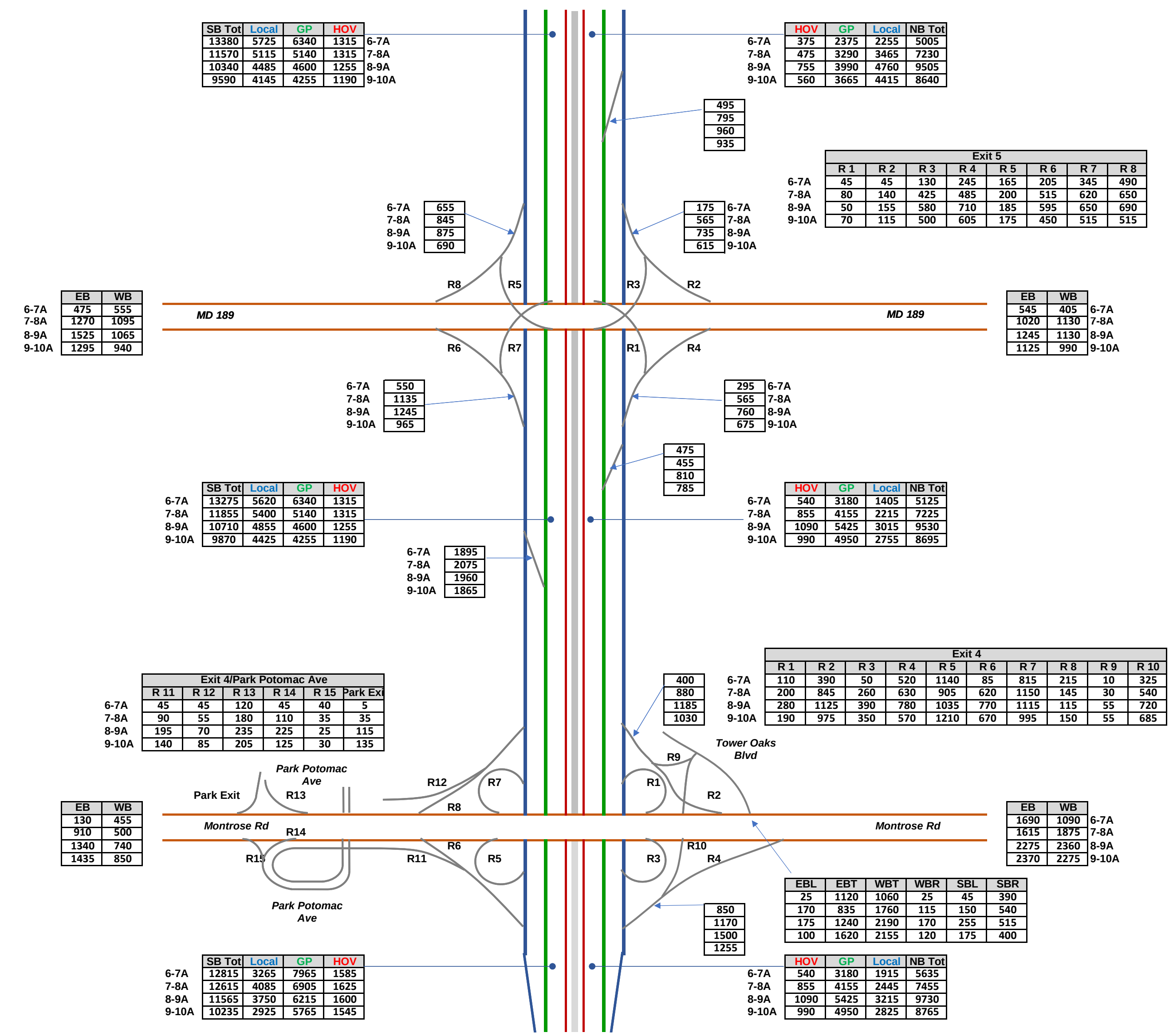
	1005
	900
	970
	590

	465
	1115
	1215
	1100

2045 No-Build Hourly AM Volume Diagram

N

2045 No-Build Hourly AM Volume Diagram



SB Tot	Local	GP	HOV	
13380	5725	6340	1315	6-7A
11570	5115	5140	1315	7-8A
10340	4485	4600	1255	8-9A
9590	4145	4255	1190	9-10A

	HOV	GP	Local	NB Tot
6-7A	375	2375	2255	5005
7-8A	475	3290	3465	7230
8-9A	755	3990	4760	9505
9-10A	560	3665	4415	8640

495
795
960
935

	Exit 5							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	45	45	130	245	165	205	345	490
7-8A	80	140	425	485	200	515	620	650
8-9A	50	155	580	710	185	595	650	690
9-10A	70	115	500	605	175	450	515	515

6-7A	655
7-8A	845
8-9A	875
9-10A	690

175	6-7A
565	7-8A
735	8-9A
615	9-10A

	EB	WB
6-7A	475	555
7-8A	1270	1095
8-9A	1525	1065
9-10A	1295	940

EB	WB	
545	405	6-7A
1020	1130	7-8A
1245	1130	8-9A
1125	990	9-10A

6-7A	550
7-8A	1135
8-9A	1245
9-10A	965

295	6-7A
565	7-8A
760	8-9A
675	9-10A

475
455
810
785

	SB Tot	Local	GP	HOV
6-7A	13275	5620	6340	1315
7-8A	11855	5400	5140	1315
8-9A	10710	4855	4600	1255
9-10A	9870	4425	4255	1190

	HOV	GP	Local	NB Tot
6-7A	540	3180	1405	5125
7-8A	855	4155	2215	7225
8-9A	1090	5425	3015	9530
9-10A	990	4950	2755	8695

6-7A	1895
7-8A	2075
8-9A	1960
9-10A	1865

	Exit 4									
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
6-7A	110	390	50	520	1140	85	815	215	10	325
7-8A	200	845	260	630	905	620	1150	145	30	540
8-9A	280	1125	390	780	1035	770	1115	115	55	720
9-10A	190	975	350	570	1210	670	995	150	55	685

400
880
1185
1030

	Exit 4/Park Potomac Ave					
	R 11	R 12	R 13	R 14	R 15	Park Exi
6-7A	45	45	120	45	40	5
7-8A	90	55	180	110	35	35
8-9A	195	70	235	225	25	115
9-10A	140	85	205	125	30	135

EB	WB
130	455
910	500
1340	740
1435	850

EB	WB	
1690	1090	6-7A
1615	1875	7-8A
2275	2360	8-9A
2370	2275	9-10A

EBL	EBT	WBT	WBR	SBL	SBR
25	1120	1060	25	45	390
170	835	1760	115	150	540
175	1240	2190	170	255	515
100	1620	2155	120	175	400

850
1170
1500
1255

	SB Tot	Local	GP	HOV
6-7A	12815	3265	7965	1585
7-8A	12615	4085	6905	1625
8-9A	11565	3750	6215	1600
9-10A	10235	2925	5765	1545

	HOV	GP	Local	NB Tot
6-7A	540	3180	1915	5635
7-8A	855	4155	2445	7455
8-9A	1090	5425	3215	9730
9-10A	990	4950	2825	8765

2045 No-Build Hourly AM Volume Diagram

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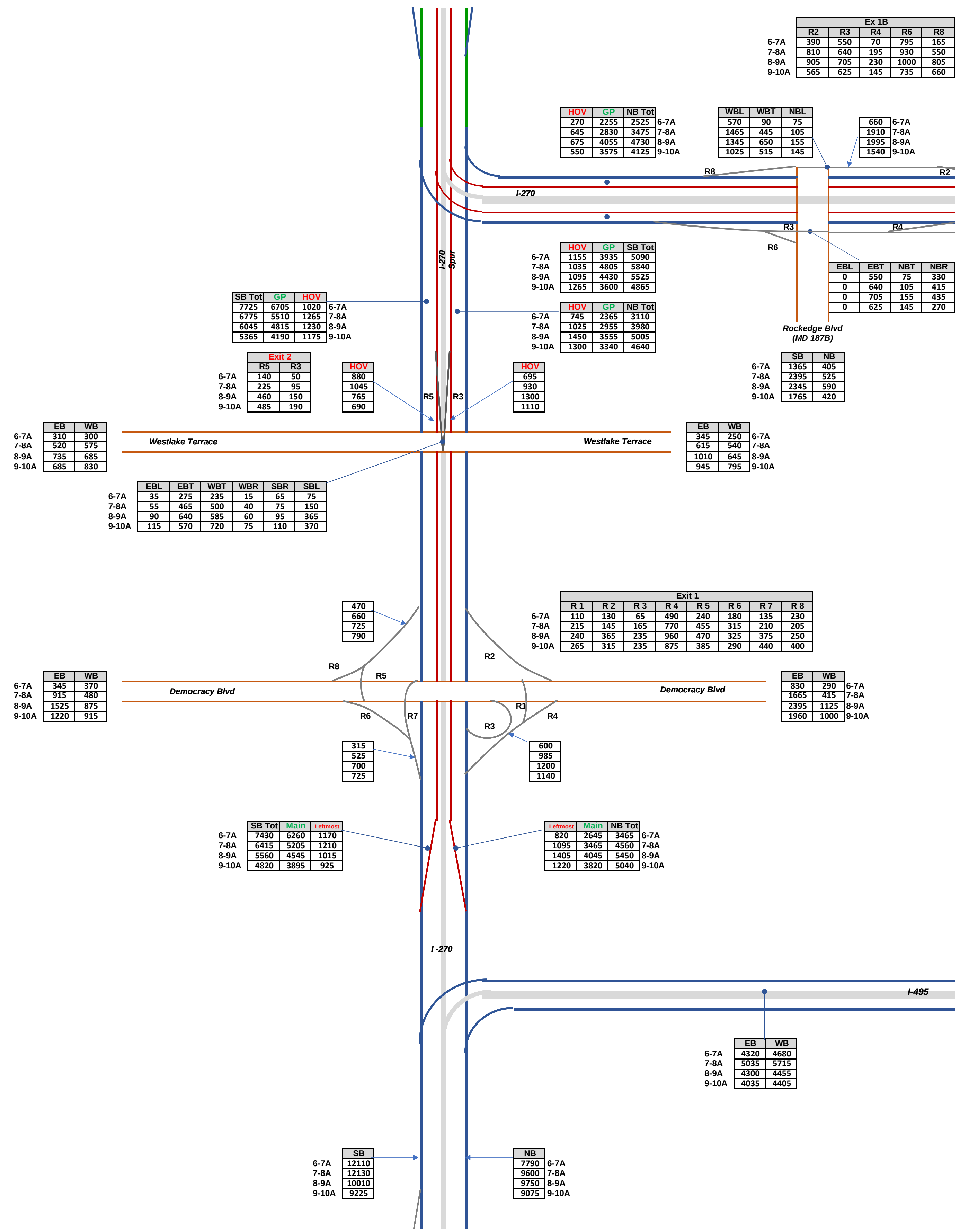
2045 No-Build Hourly AM Volume Diagram



	Ex 1B				
	R2	R3	R4	R6	R8
6-7A	390	550	70	795	165
7-8A	810	640	195	930	550
8-9A	905	705	230	1000	805
9-10A	565	625	145	735	660

HOV	GP	NB Tot	
270	2255	2525	6-7A
645	2830	3475	7-8A
675	4055	4730	8-9A
550	3575	4125	9-10A

WBL	WBT	NBL
570	90	75
1465	445	105
1345	650	155
1025	515	145

660	6-7A
1910	7-8A
1995	8-9A
1540	9-10A

	HOV	GP	SB Tot
6-7A	1155	3935	5090
7-8A	1035	4805	5840
8-9A	1095	4430	5525
9-10A	1265	3600	4865

EBL	EBT	NBT	NBR
0	550	75	330
0	640	105	415
0	705	155	435
0	625	145	270

SB Tot	GP	HOV	
7725	6705	1020	6-7A
6775	5510	1265	7-8A
6045	4815	1230	8-9A
5365	4190	1175	9-10A

	HOV	GP	NB Tot
6-7A	745	2365	3110
7-8A	1025	2955	3980
8-9A	1450	3555	5005
9-10A	1300	3340	4640

	Exit 2	
	R5	R3
6-7A	140	50
7-8A	225	95
8-9A	460	150
9-10A	485	190

HOV
880
1045
765
690

HOV
695
930
1300
1110

	SB	NB
6-7A	1365	405
7-8A	2395	525
8-9A	2345	590
9-10A	1765	420

	EB	WB
6-7A	310	300
7-8A	520	575
8-9A	735	685
9-10A	685	830

EB	WB	
345	250	6-7A
615	540	7-8A
1010	645	8-9A
945	795	9-10A

	EBL	EBT	WBT	WBR	SBR	SBL
6-7A	35	275	235	15	65	75
7-8A	55	465	500	40	75	150
8-9A	90	640	585	60	95	365
9-10A	115	570	720	75	110	370

470	
660	
725	
790	

	Exit 1							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	110	130	65	490	240	180	135	230
7-8A	215	145	165	770	455	315	210	205
8-9A	240	365	235	960	470	325	375	250
9-10A	265	315	235	875	385	290	440	400

	EB	WB
6-7A	345	370
7-8A	915	480
8-9A	1525	875
9-10A	1220	915

EB	WB	
830	290	6-7A
1665	415	7-8A
2395	1125	8-9A
1960	1000	9-10A

315
525
700
725

600
985
1200
1140

	SB Tot	Main	Leftmost
6-7A	7430	6260	1170
7-8A	6415	5205	1210
8-9A	5560	4545	1015
9-10A	4820	3895	925

Leftmost	Main	NB Tot	
820	2645	3465	6-7A
1095	3465	4560	7-8A
1405	4045	5450	8-9A
1220	3820	5040	9-10A

	EB	WB
6-7A	4320	4680
7-8A	5035	5715
8-9A	4300	4455
9-10A	4035	4405

	SB
6-7A	12110
7-8A	12130
8-9A	10010
9-10A	9225

NB	
7790	6-7A
9600	7-8A
9750	8-9A
9075	9-10A

2045 No-Build Hourly AM Volume Diagram

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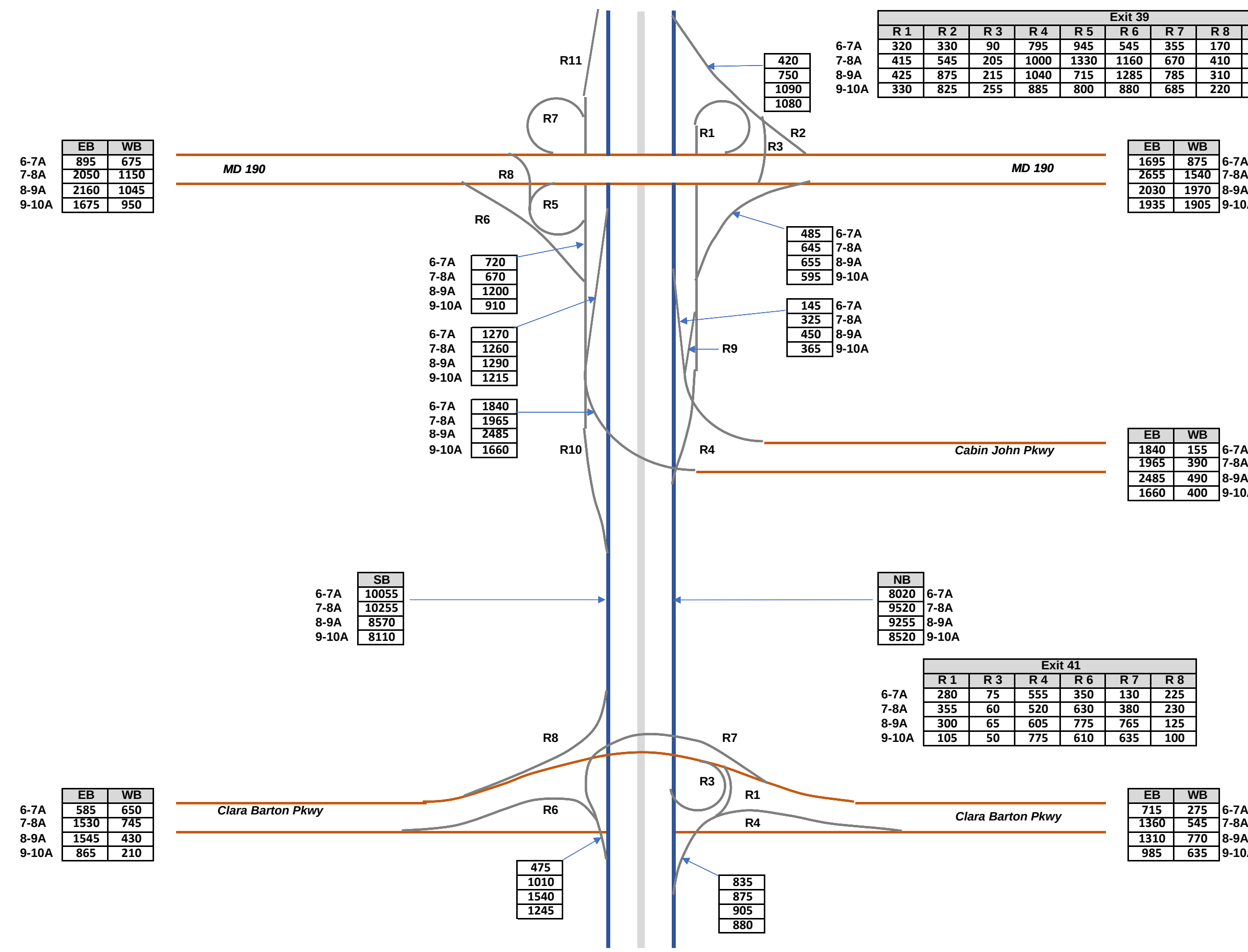
2045 No-Build Hourly AM Volume Diagram



	Exit 39										
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
6-7A	320	330	90	795	945	545	355	170	15	690	1475
7-8A	415	545	205	1000	1330	1160	670	410	65	1125	1735
8-9A	425	875	215	1040	715	1285	785	310	40	1290	1440
9-10A	330	825	255	885	800	880	685	220	35	1345	1250

	Exit 41					
	R 1	R 3	R 4	R 6	R 7	R 8
6-7A	280	75	555	350	130	225
7-8A	355	60	520	630	380	230
8-9A	300	65	605	775	765	125
9-10A	105	50	775	610	635	100

2045 No-Build Hourly AM Volume Diagram

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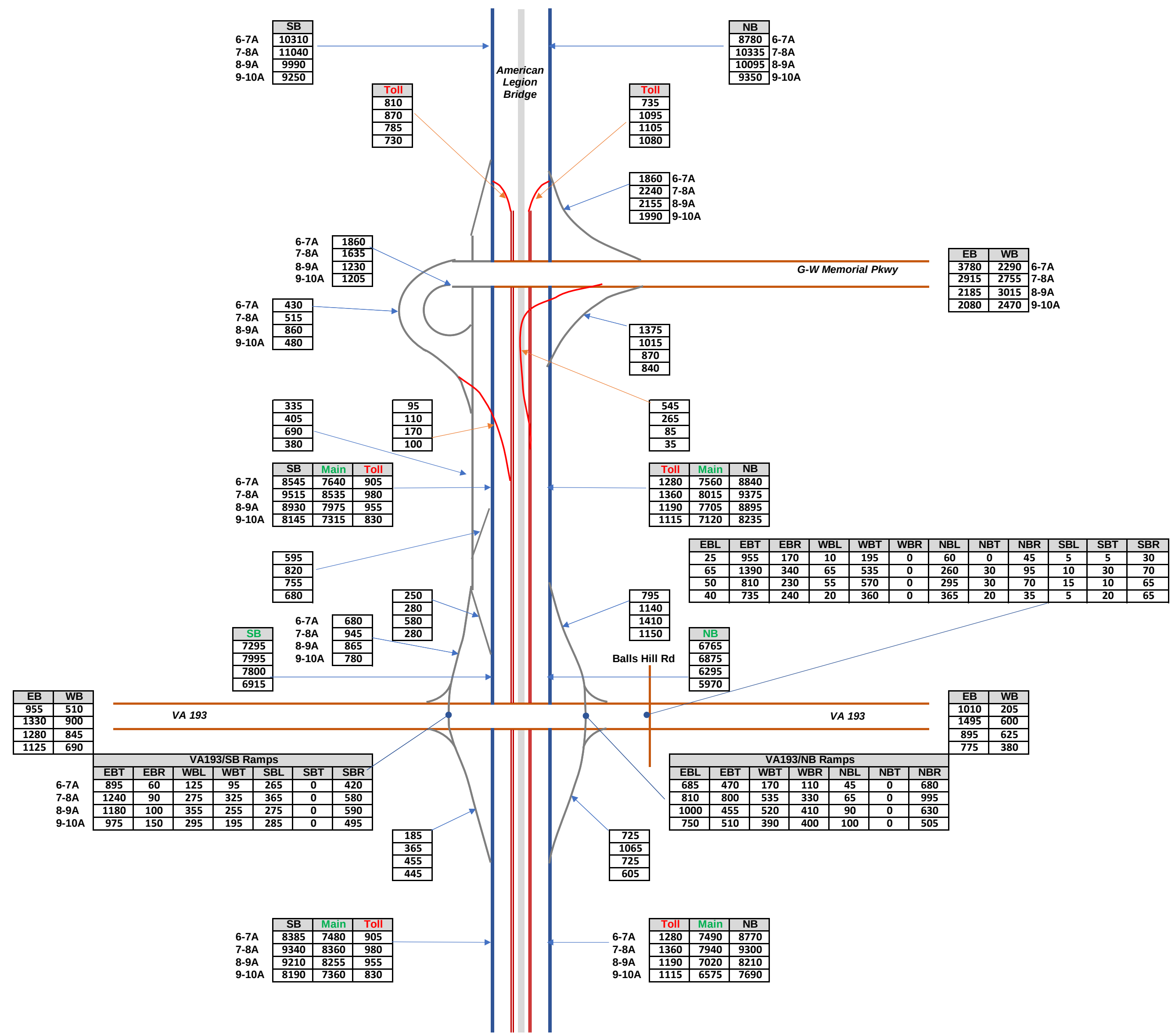
2045 No-Build Hourly AM Volume Diagram

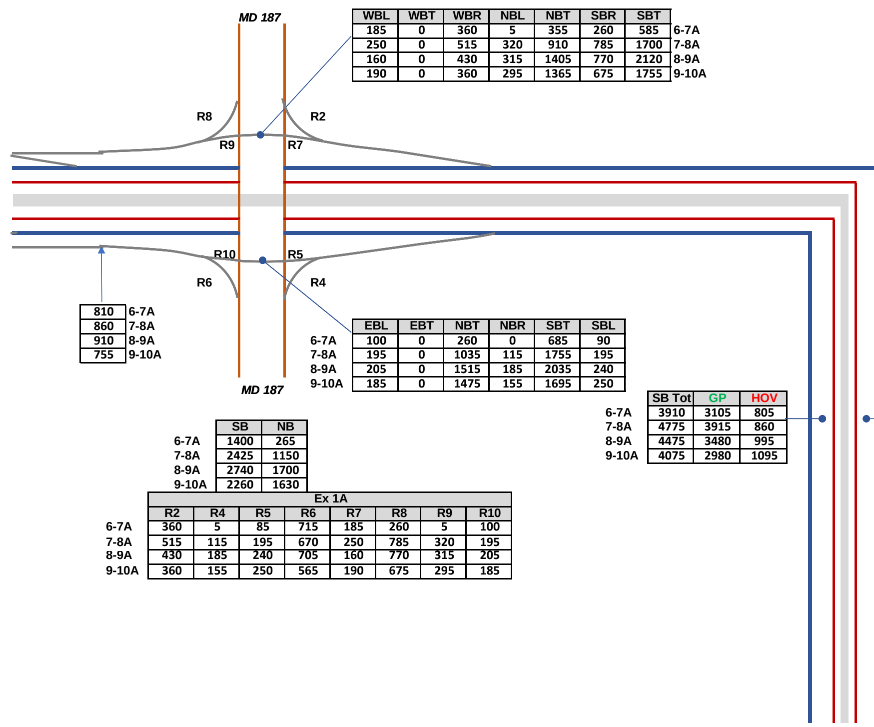


2045 No-Build Hourly AM Volume Diagram

2045 No-Build Hourly AM Volume Diagram

	SB	NB
6-7A	850	715
7-8A	2485	1425
8-9A	2890	1835
9-10A	2430	1720

WBL	WBT	WBR	NBL	NBT	SBR	SBT	
185	0	360	5	355	260	585	6-7A
250	0	515	320	910	785	1700	7-8A
160	0	430	315	1405	770	2120	8-9A
190	0	360	295	1365	675	1755	9-10A



810	6-7A
860	7-8A
910	8-9A
755	9-10A

	EBL	EBT	NBT	NBR	SBT	SBL
6-7A	100	0	260	0	685	90
7-8A	195	0	1035	115	1755	195
8-9A	205	0	1515	185	2035	240
9-10A	185	0	1475	155	1695	250

	SB Tot	GP	HOV
6-7A	3910	3105	805
7-8A	4775	3915	860
8-9A	4475	3480	995
9-10A	4075	2980	1095

HOV	GP	NB Tot	
380	2920	3300	6-7A
755	3740	4495	7-8A
775	4645	5420	8-9A
605	3970	4575	9-10A

	SB	NB
6-7A	1400	265
7-8A	2425	1150
8-9A	2740	1700
9-10A	2260	1630

	Ex 1A							
	R2	R4	R5	R6	R7	R8	R9	R10
6-7A	360	5	85	715	185	260	5	100
7-8A	515	115	195	670	250	785	320	195
8-9A	430	185	240	705	160	770	315	205
9-10A	360	155	250	565	190	675	295	185

2045 No-Build Hourly AM Volume Diagram

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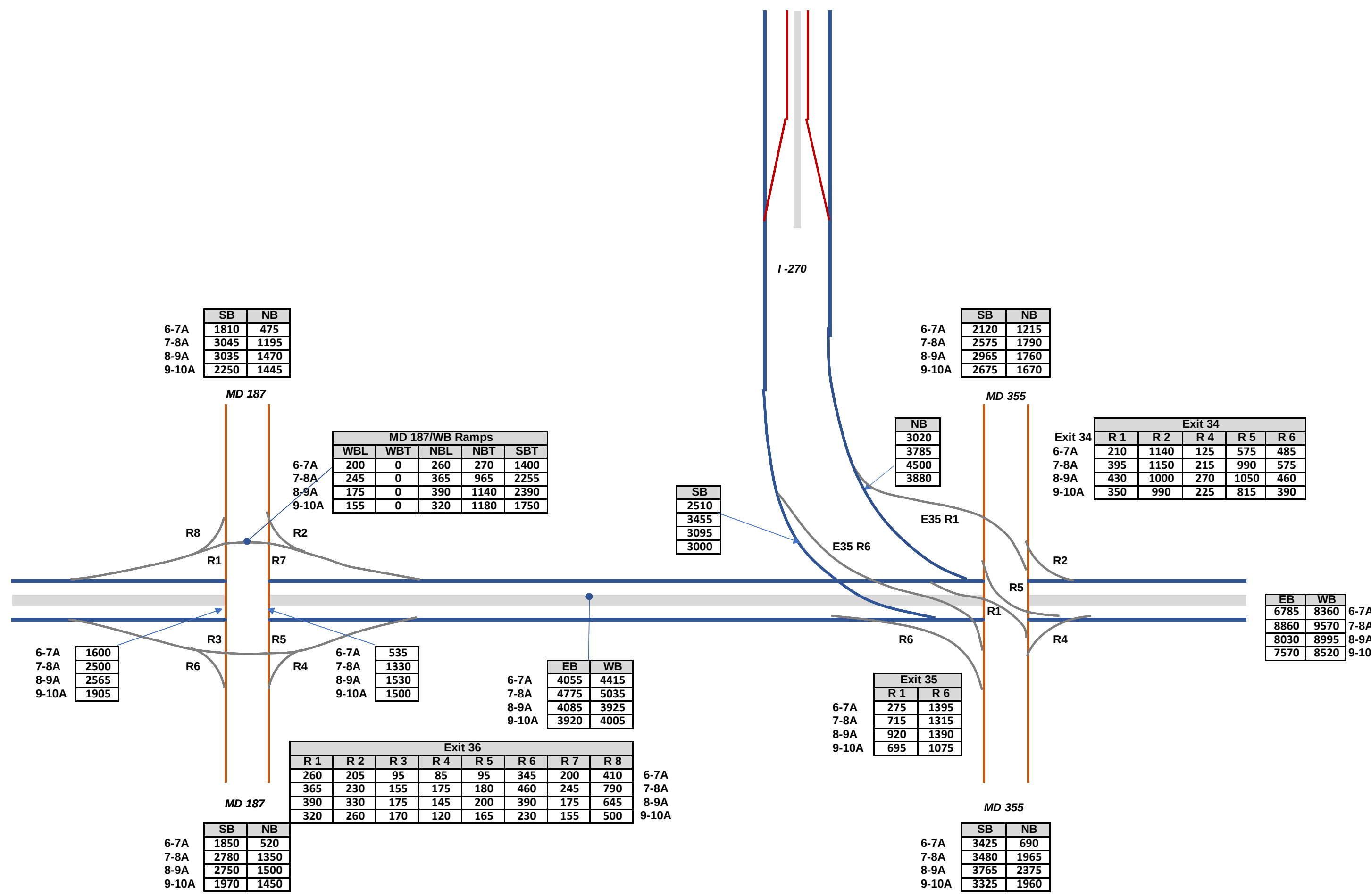
2045 No-Build Hourly AM Volume Diagram



MD 187 (north)

	SB	NB
6-7A	1810	475
7-8A	3045	1195
8-9A	3035	1470
9-10A	2250	1445

MD 187/WB Ramps

	WBL	WBT	NBL	NBT	SBT
6-7A	200	0	260	270	1400
7-8A	245	0	365	965	2255
8-9A	175	0	390	1140	2390
9-10A	155	0	320	1180	1750

6-7A	1600
7-8A	2500
8-9A	2565
9-10A	1905

6-7A	535
7-8A	1330
8-9A	1530
9-10A	1500

	EB	WB
6-7A	4055	4415
7-8A	4775	5035
8-9A	4085	3925
9-10A	3920	4005

Exit 36

	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
6-7A	260	205	95	85	95	345	200	410
7-8A	365	230	155	175	180	460	245	790
8-9A	390	330	175	145	200	390	175	645
9-10A	320	260	170	120	165	230	155	500

MD 187 (south)

	SB	NB
6-7A	1850	520
7-8A	2780	1350
8-9A	2750	1500
9-10A	1970	1450

SB
2510
3455
3095
3000

NB
3020
3785
4500
3880

MD 355 (north)

	SB	NB
6-7A	2120	1215
7-8A	2575	1790
8-9A	2965	1760
9-10A	2675	1670

Exit 34

Exit 34	R 1	R 2	R 4	R 5	R 6
6-7A	210	1140	125	575	485
7-8A	395	1150	215	990	575
8-9A	430	1000	270	1050	460
9-10A	350	990	225	815	390

	EB	WB
6-7A	6785	8360
7-8A	8860	9570
8-9A	8030	8995
9-10A	7570	8520

Exit 35

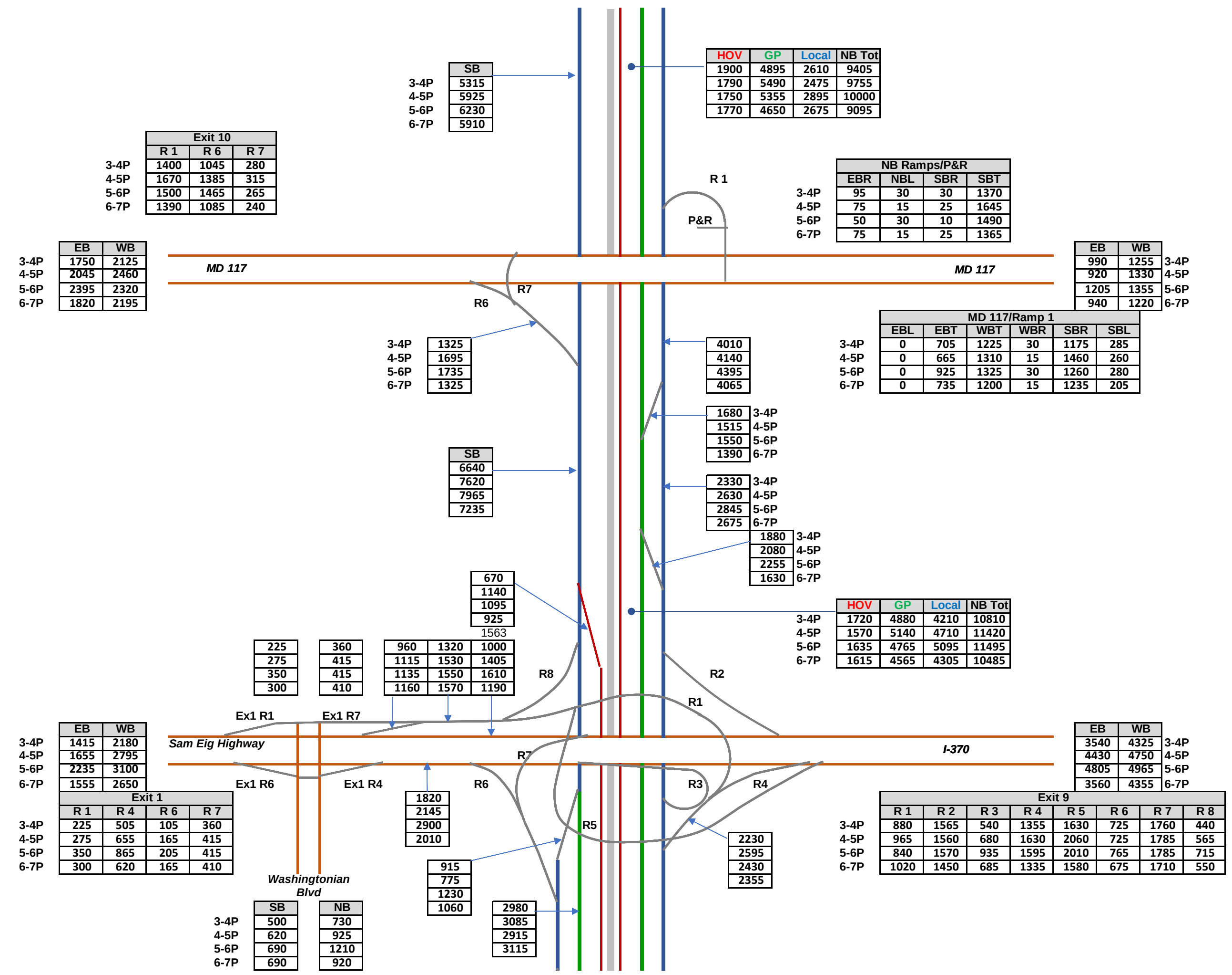
	R 1	R 6
6-7A	275	1395
7-8A	715	1315
8-9A	920	1390
9-10A	695	1075

MD 355 (south)

	SB	NB
6-7A	3425	690
7-8A	3480	1965
8-9A	3765	2375
9-10A	3325	1960

2045 No-Build Hourly AM Volume Diagram

2045 No-Build Hourly PM Volume Diagram



2045 No-Build Hourly PM Volume Diagram

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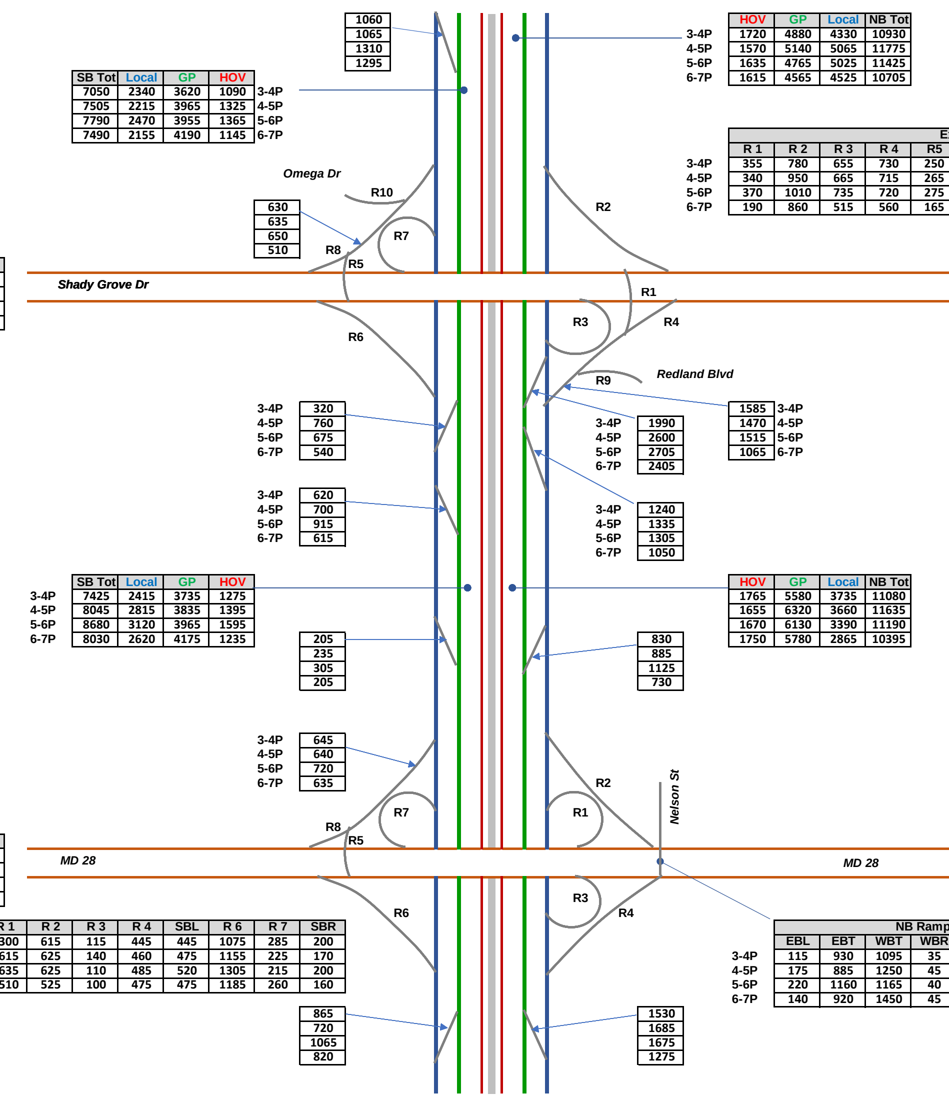
2045 No-Build Hourly PM Volume Diagram



1060
1065
1310
1295

	HOV	GP	Local	NB Tot
3-4P	1720	4880	4330	10930
4-5P	1570	5140	5065	11775
5-6P	1635	4765	5025	11425
6-7P	1615	4565	4525	10705

SB Tot	Local	GP	HOV	
7050	2340	3620	1090	3-4P
7505	2215	3965	1325	4-5P
7790	2470	3955	1365	5-6P
7490	2155	4190	1145	6-7P

	Exit 8									
	R 1	R 2	R 3	R 4	R5	R 6	R 7	R8	R 9	R 10
3-4P	355	780	655	730	250	520	635	385	505	150
4-5P	340	950	665	715	265	705	655	370	415	185
5-6P	370	1010	735	720	275	865	830	375	425	155
6-7P	190	860	515	560	165	520	695	350	315	165

630
635
650
510

	EB	WB
3-4P	1945	1005
4-5P	2130	945
5-6P	2230	1055
6-7P	1545	750

EB	WB	
1750	1680	3-4P
1740	1840	4-5P
1620	2155	5-6P
1235	1765	6-7P

3-4P	320
4-5P	760
5-6P	675
6-7P	540

1585	3-4P
1470	4-5P
1515	5-6P
1065	6-7P

3-4P	1990
4-5P	2600
5-6P	2705
6-7P	2405

3-4P	620
4-5P	700
5-6P	915
6-7P	615

3-4P	1240
4-5P	1335
5-6P	1305
6-7P	1050

	SB Tot	Local	GP	HOV
3-4P	7425	2415	3735	1275
4-5P	8045	2815	3835	1395
5-6P	8680	3120	3965	1595
6-7P	8030	2620	4175	1235

HOV	GP	Local	NB Tot
1765	5580	3735	11080
1655	6320	3660	11635
1670	6130	3390	11190
1750	5780	2865	10395

205
235
305
205

830
885
1125
730

3-4P	645
4-5P	640
5-6P	720
6-7P	635

	EB	WB
3-4P	1785	2065
4-5P	1880	2620
5-6P	2280	2600
6-7P	1870	2695

EB	WB	
1135	1130	3-4P
1100	1295	4-5P
1365	1205	5-6P
1110	1495	6-7P

Exit 6	R 1	R 2	R 3	R 4	SBL	R 6	R 7	SBR
3-4P	1300	615	115	445	445	1075	285	200
4-5P	1615	625	140	460	475	1155	225	170
5-6P	1635	625	110	485	520	1305	215	200
6-7P	1510	525	100	475	475	1185	260	160

	NB Ramps/Nelson St							
	EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
3-4P	115	930	1095	35	270	170	35	370
4-5P	175	885	1250	45	280	180	30	440
5-6P	220	1160	1165	40	315	170	35	445
6-7P	140	920	1450	45	320	155	35	355

865
720
1065
820

1530
1685
1675
1275

2045 No-Build Hourly PM Volume Diagram

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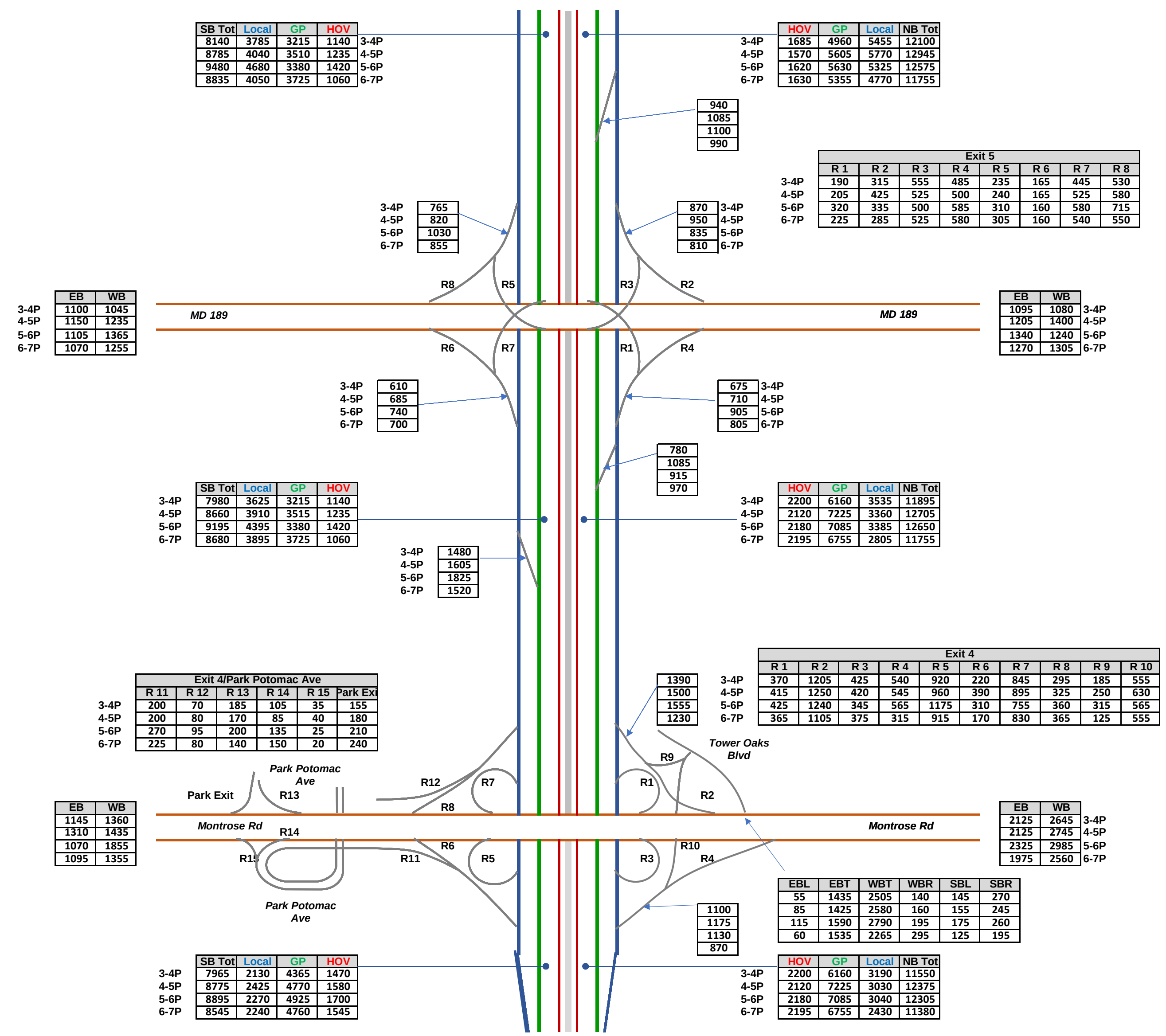
2045 No-Build Hourly PM Volume Diagram



SB Tot	Local	GP	HOV	
8140	3785	3215	1140	3-4P
8785	4040	3510	1235	4-5P
9480	4680	3380	1420	5-6P
8835	4050	3725	1060	6-7P

	HOV	GP	Local	NB Tot
3-4P	1685	4960	5455	12100
4-5P	1570	5605	5770	12945
5-6P	1620	5630	5325	12575
6-7P	1630	5355	4770	11755

940
1085
1100
990

	Exit 5							
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P	190	315	555	485	235	165	445	530
4-5P	205	425	525	500	240	165	525	580
5-6P	320	335	500	585	310	160	580	715
6-7P	225	285	525	580	305	160	540	550

3-4P	765
4-5P	820
5-6P	1030
6-7P	855

870	3-4P
950	4-5P
835	5-6P
810	6-7P

	EB	WB
3-4P	1100	1045
4-5P	1150	1235
5-6P	1105	1365
6-7P	1070	1255

EB	WB	
1095	1080	3-4P
1205	1400	4-5P
1340	1240	5-6P
1270	1305	6-7P

3-4P	610
4-5P	685
5-6P	740
6-7P	700

675	3-4P
710	4-5P
905	5-6P
805	6-7P

780
1085
915
970

	SB Tot	Local	GP	HOV
3-4P	7980	3625	3215	1140
4-5P	8660	3910	3515	1235
5-6P	9195	4395	3380	1420
6-7P	8680	3895	3725	1060

	HOV	GP	Local	NB Tot
3-4P	2200	6160	3535	11895
4-5P	2120	7225	3360	12705
5-6P	2180	7085	3385	12650
6-7P	2195	6755	2805	11755

3-4P	1480
4-5P	1605
5-6P	1825
6-7P	1520

1390	3-4P
1500	4-5P
1555	5-6P
1230	6-7P

	Exit 4									
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
3-4P	370	1205	425	540	920	220	845	295	185	555
4-5P	415	1250	420	545	960	390	895	325	250	630
5-6P	425	1240	345	565	1175	310	755	360	315	565
6-7P	365	1105	375	315	915	170	830	365	125	555

	Exit 4/Park Potomac Ave					
	R 11	R 12	R 13	R 14	R 15	Park Exi
3-4P	200	70	185	105	35	155
4-5P	200	80	170	85	40	180
5-6P	270	95	200	135	25	210
6-7P	225	80	140	150	20	240

EB	WB
1145	1360
1310	1435
1070	1855
1095	1355

EB	WB	
2125	2645	3-4P
2125	2745	4-5P
2325	2985	5-6P
1975	2560	6-7P

EBL	EBT	WBT	WBR	SBL	SBR
55	1435	2505	140	145	270
85	1425	2580	160	155	245
115	1590	2790	195	175	260
60	1535	2265	295	125	195

1100
1175
1130
870

	SB Tot	Local	GP	HOV
3-4P	7965	2130	4365	1470
4-5P	8775	2425	4770	1580
5-6P	8895	2270	4925	1700
6-7P	8545	2240	4760	1545

	HOV	GP	Local	NB Tot
3-4P	2200	6160	3190	11550
4-5P	2120	7225	3030	12375
5-6P	2180	7085	3040	12305
6-7P	2195	6755	2430	11380

2045 No-Build Hourly PM Volume Diagram

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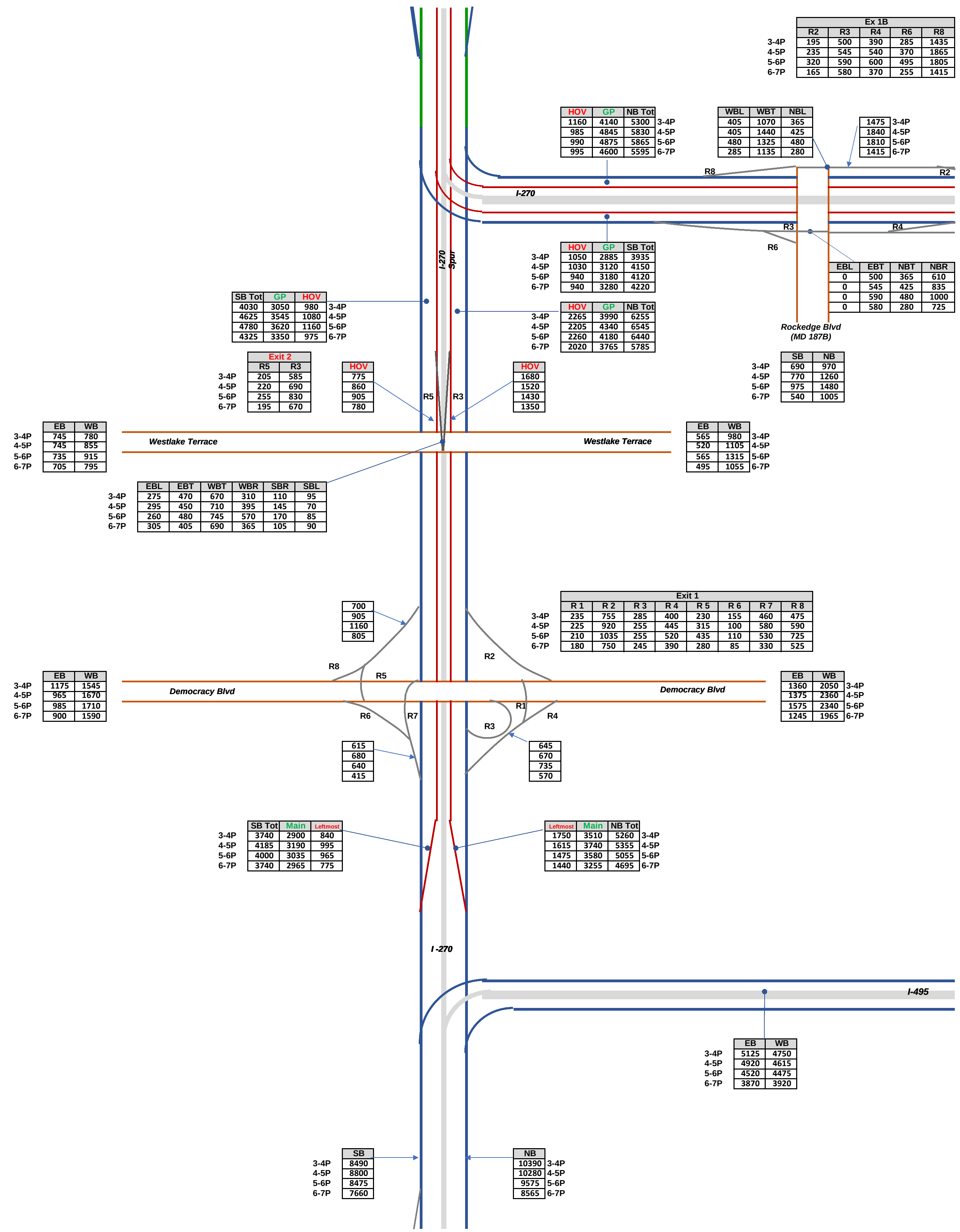
2045 No-Build Hourly PM Volume Diagram



Ex 1B	R2	R3	R4	R6	R8
3-4P	195	500	390	285	1435
4-5P	235	545	540	370	1865
5-6P	320	590	600	495	1805
6-7P	165	580	370	255	1415

	HOV	GP	NB Tot
3-4P	1160	4140	5300
4-5P	985	4845	5830
5-6P	990	4875	5865
6-7P	995	4600	5595

WBL	WBT	NBL
405	1070	365
405	1440	425
480	1325	480
285	1135	280

3-4P	1475
4-5P	1840
5-6P	1810
6-7P	1415

	HOV	GP	SB Tot
3-4P	1050	2885	3935
4-5P	1030	3120	4150
5-6P	940	3180	4120
6-7P	940	3280	4220

EBL	EBT	NBT	NBR
0	500	365	610
0	545	425	835
0	590	480	1000
0	580	280	725

	SB Tot	GP	HOV
3-4P	4030	3050	980
4-5P	4625	3545	1080
5-6P	4780	3620	1160
6-7P	4325	3350	975

	HOV	GP	NB Tot
3-4P	2265	3990	6255
4-5P	2205	4340	6545
5-6P	2260	4180	6440
6-7P	2020	3765	5785

	SB	NB
3-4P	690	970
4-5P	770	1260
5-6P	975	1480
6-7P	540	1005

Exit 2	R5	R3
3-4P	205	585
4-5P	220	690
5-6P	255	830
6-7P	195	670

HOV
775
860
905
780

HOV
1680
1520
1430
1350

	EB	WB
3-4P	745	780
4-5P	745	855
5-6P	735	915
6-7P	705	795

	EB	WB
3-4P	565	980
4-5P	520	1105
5-6P	565	1315
6-7P	495	1055

	EBL	EBT	WBT	WBR	SBR	SBL
3-4P	275	470	670	310	110	95
4-5P	295	450	710	395	145	70
5-6P	260	480	745	570	170	85
6-7P	305	405	690	365	105	90

700
905
1160
805

Exit 1	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
3-4P	235	755	285	400	230	155	460	475
4-5P	225	920	255	445	315	100	580	590
5-6P	210	1035	255	520	435	110	530	725
6-7P	180	750	245	390	280	85	330	525

	EB	WB
3-4P	1175	1545
4-5P	965	1670
5-6P	985	1710
6-7P	900	1590

	EB	WB
3-4P	1360	2050
4-5P	1375	2360
5-6P	1575	2340
6-7P	1245	1965

615
680
640
415

645
670
735
570

	SB Tot	Main	Leftmost
3-4P	3740	2900	840
4-5P	4185	3190	995
5-6P	4000	3035	965
6-7P	3740	2965	775

	Leftmost	Main	NB Tot
3-4P	1750	3510	5260
4-5P	1615	3740	5355
5-6P	1475	3580	5055
6-7P	1440	3255	4695

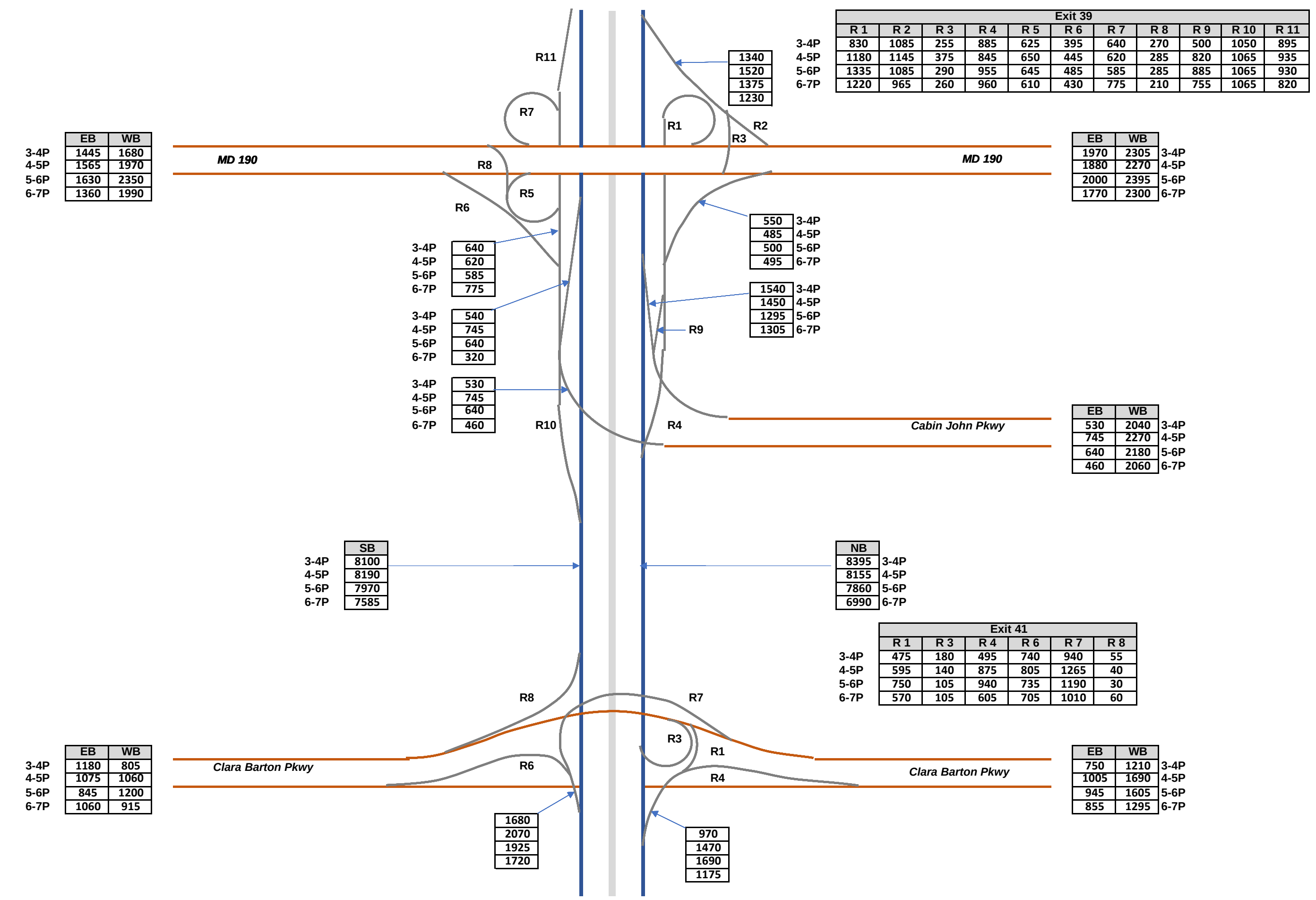
	EB	WB
3-4P	5125	4750
4-5P	4920	4615
5-6P	4520	4475
6-7P	3870	3920

	SB
3-4P	8490
4-5P	8800
5-6P	8475
6-7P	7660

	NB
3-4P	10390
4-5P	10280
5-6P	9575
6-7P	8565

2045 No-Build Hourly PM Volume Diagram

2045 No-Build Hourly PM Volume Diagram



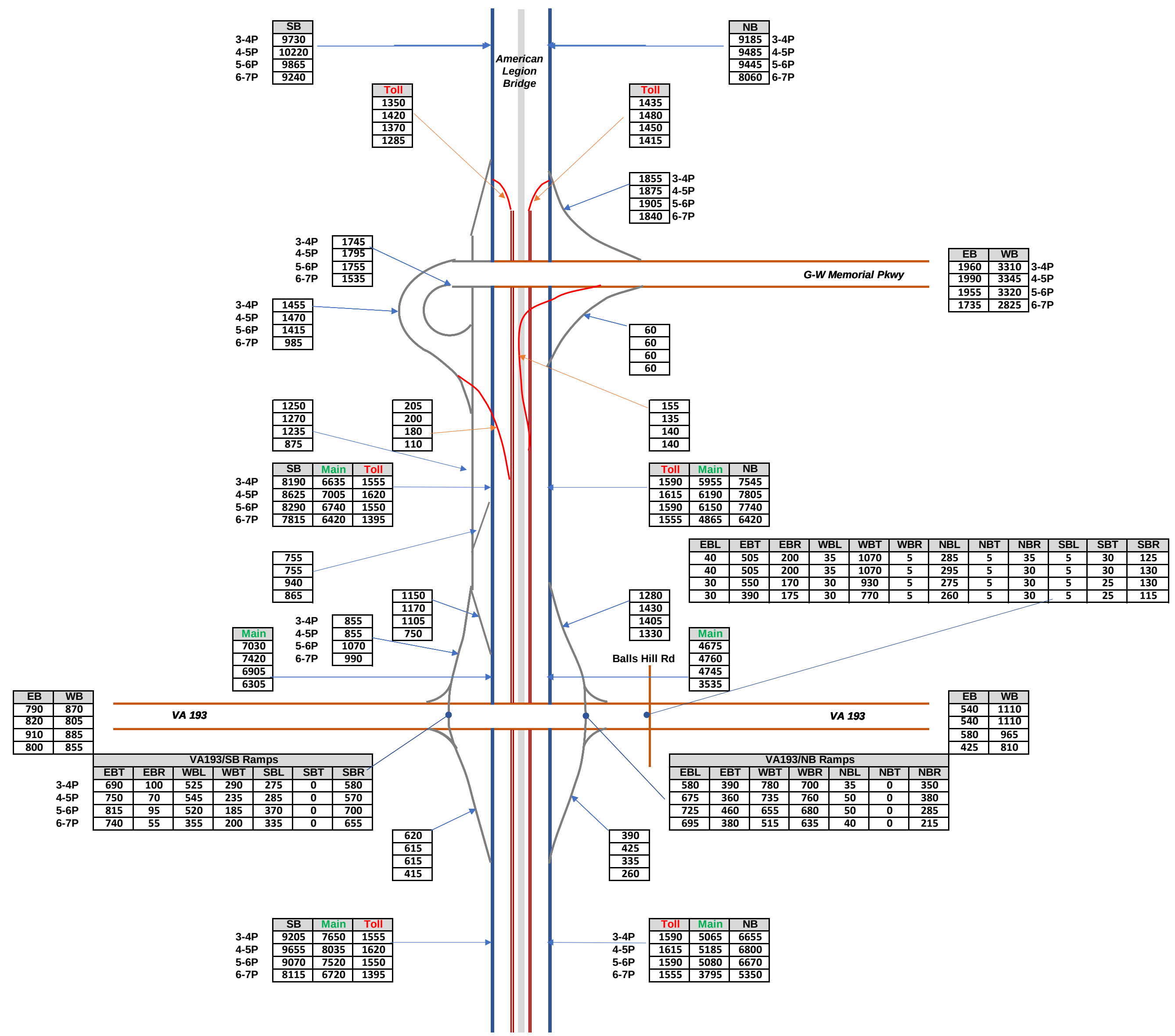
	Exit 39										
	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
3-4P	830	1085	255	885	625	395	640	270	500	1050	895
4-5P	1180	1145	375	845	650	445	620	285	820	1065	935
5-6P	1335	1085	290	955	645	485	585	285	885	1065	930
6-7P	1220	965	260	960	610	430	775	210	755	1065	820

	Exit 41					
	R 1	R 3	R 4	R 6	R 7	R 8
3-4P	475	180	495	740	940	55
4-5P	595	140	875	805	1265	40
5-6P	750	105	940	735	1190	30
6-7P	570	105	605	705	1010	60

2045 No-Build Hourly PM Volume Diagram

N

2045 No-Build Hourly PM Volume Diagram

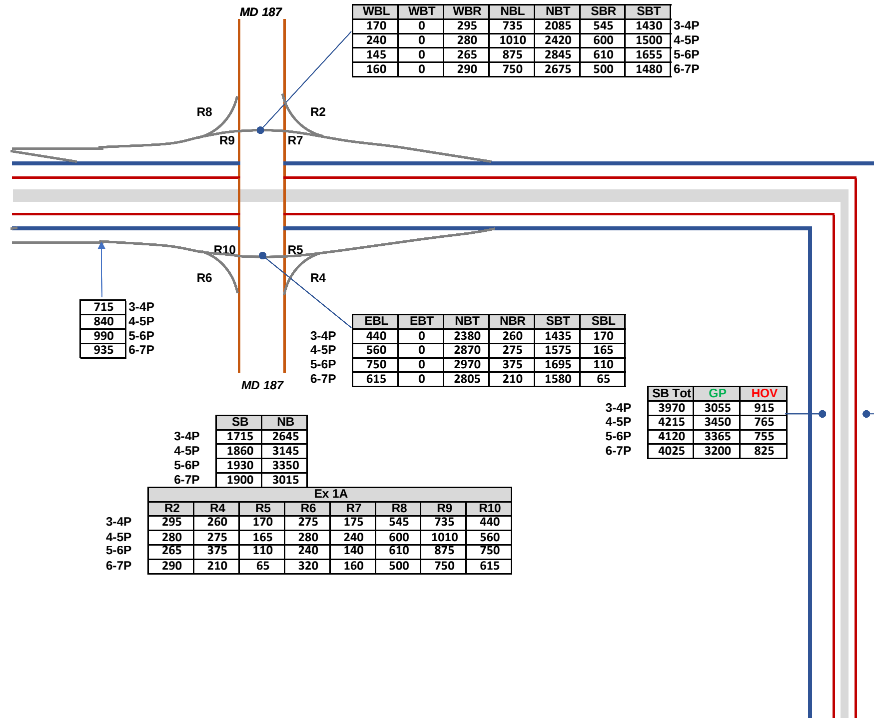


2045 No-Build Hourly PM Volume Diagram

2045 No-Build Hourly PM Volume Diagram

	SB	NB
3-4P	1975	2385
4-5P	2100	2700
5-6P	2270	3115
6-7P	1985	2965

WBL	WBT	WBR	NBL	NBT	SBR	SBT	
170	0	295	735	2085	545	1430	3-4P
240	0	280	1010	2420	600	1500	4-5P
145	0	265	875	2845	610	1655	5-6P
160	0	290	750	2675	500	1480	6-7P



715	3-4P
840	4-5P
990	5-6P
935	6-7P

	EBL	EBT	NBT	NBR	SBT	SBL
3-4P	440	0	2380	260	1435	170
4-5P	560	0	2870	275	1575	165
5-6P	750	0	2970	375	1695	110
6-7P	615	0	2805	210	1580	65

	SB Tot	GP	HOV
3-4P	3970	3055	915
4-5P	4215	3450	765
5-6P	4120	3365	755
6-7P	4025	3200	825

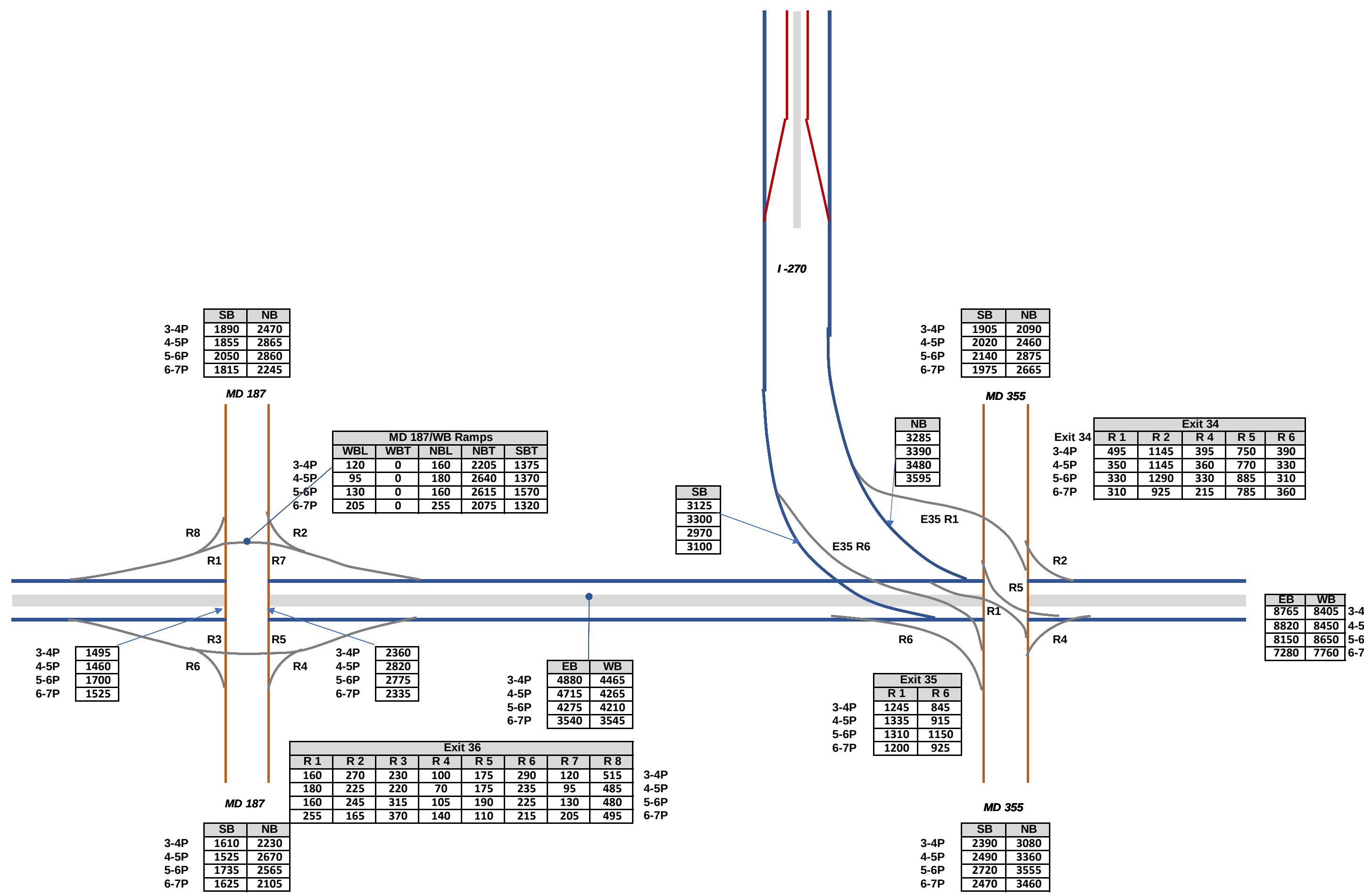
HOV	GP	NB Tot	
975	3560	4535	3-4P
845	3880	4725	4-5P
875	3915	4790	5-6P
865	3930	4795	6-7P

	SB	NB
3-4P	1715	2645
4-5P	1860	3145
5-6P	1930	3350
6-7P	1900	3015

	Ex 1A							
	R2	R4	R5	R6	R7	R8	R9	R10
3-4P	295	260	170	275	175	545	735	440
4-5P	280	275	165	280	240	600	1010	560
5-6P	265	375	110	240	140	610	875	750
6-7P	290	210	65	320	160	500	750	615

2045 No-Build Hourly PM Volume Diagram

2045 No-Build Hourly PM Volume Diagram



MD 187 (north)

	SB	NB
3-4P	1890	2470
4-5P	1855	2865
5-6P	2050	2860
6-7P	1815	2245

MD 187/WB Ramps

	WBL	WBT	NBL	NBT	SBT
3-4P	120	0	160	2205	1375
4-5P	95	0	180	2640	1370
5-6P	130	0	160	2615	1570
6-7P	205	0	255	2075	1320

3-4P	1495
4-5P	1460
5-6P	1700
6-7P	1525

3-4P	2360
4-5P	2820
5-6P	2775
6-7P	2335

	EB	WB
3-4P	4880	4465
4-5P	4715	4265
5-6P	4275	4210
6-7P	3540	3545

Exit 36

R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	
160	270	230	100	175	290	120	515	3-4P
180	225	220	70	175	235	95	485	4-5P
160	245	315	105	190	225	130	480	5-6P
255	165	370	140	110	215	205	495	6-7P

MD 187 (south)

	SB	NB
3-4P	1610	2230
4-5P	1525	2670
5-6P	1735	2565
6-7P	1625	2105

SB
3125
3300
2970
3100

NB
3285
3390
3480
3595

MD 355 (north)

	SB	NB
3-4P	1905	2090
4-5P	2020	2460
5-6P	2140	2875
6-7P	1975	2665

Exit 34

Exit 34	R 1	R 2	R 4	R 5	R 6
3-4P	495	1145	395	750	390
4-5P	350	1145	360	770	330
5-6P	330	1290	330	885	310
6-7P	310	925	215	785	360

EB	WB	
8765	8405	3-4P
8820	8450	4-5P
8150	8650	5-6P
7280	7760	6-7P

Exit 35

	R 1	R 6
3-4P	1245	845
4-5P	1335	915
5-6P	1310	1150
6-7P	1200	925

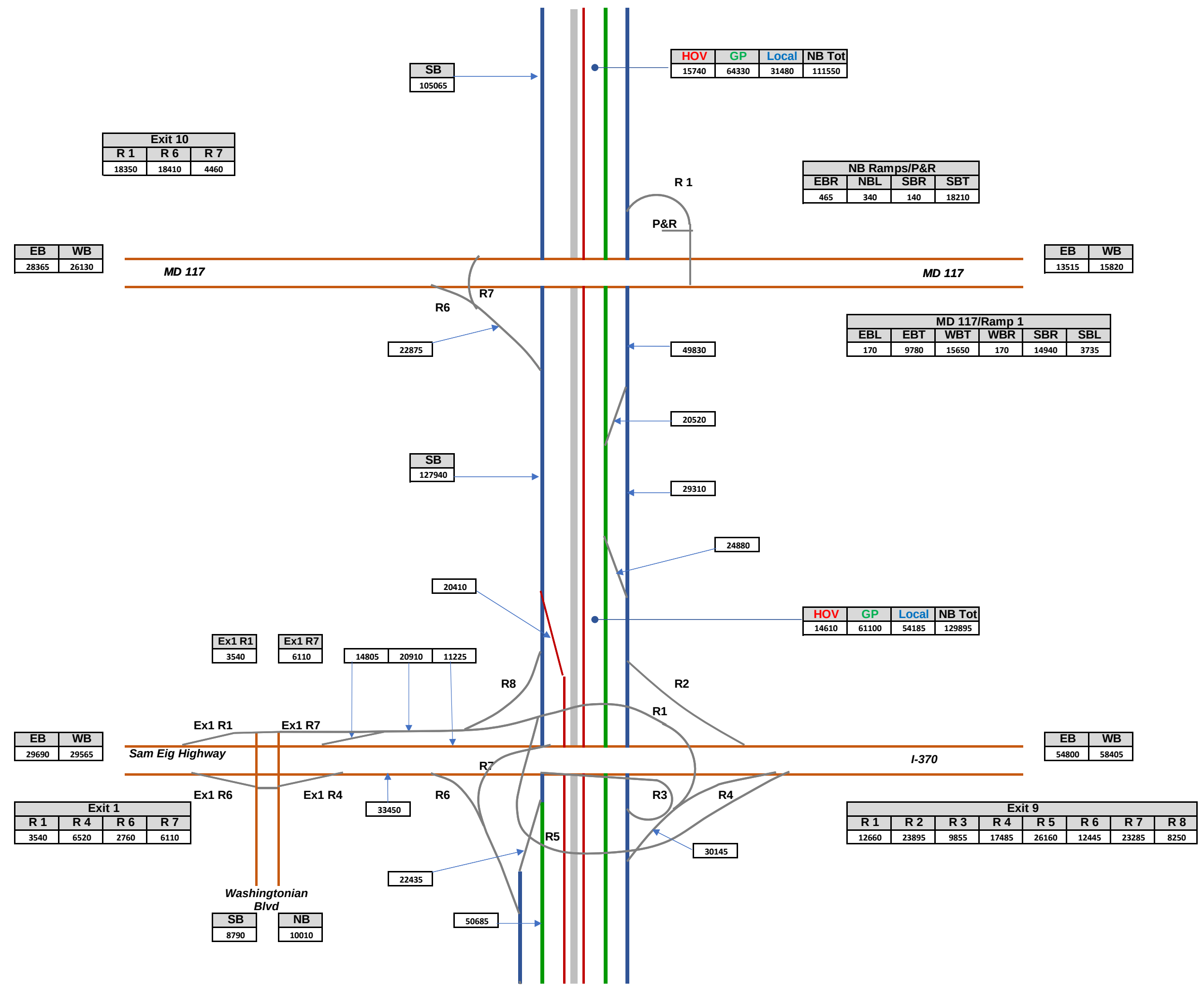
MD 355 (south)

	SB	NB
3-4P	2390	3080
4-5P	2490	3360
5-6P	2720	3555
6-7P	2470	3460

2045 No-Build Hourly PM Volume Diagram

N

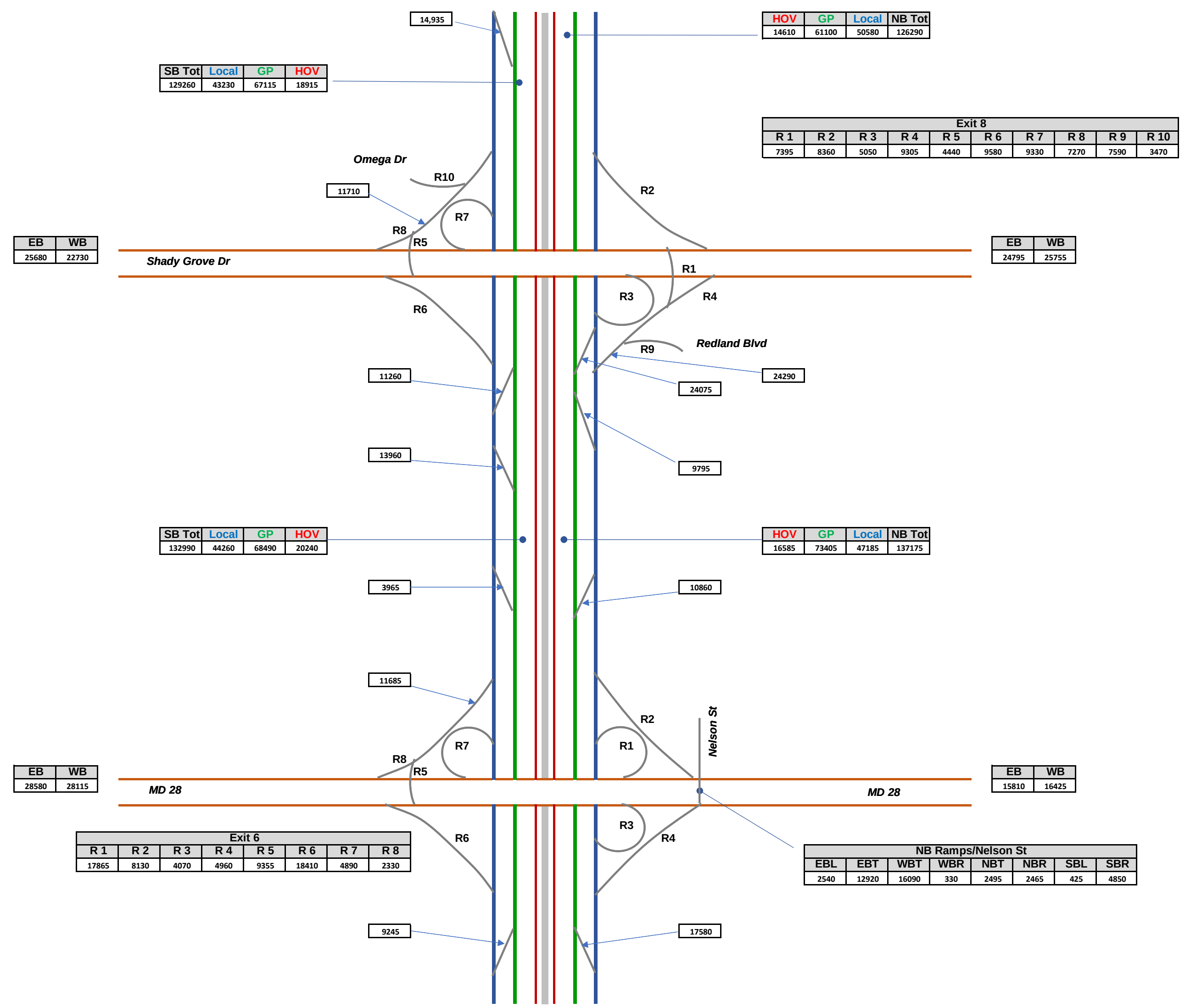
2045 No-Build ADT Volume Diagram



2045 No-Build ADT Volume Diagram

N

2045 No-Build ADT Volume Diagram



SB Tot	Local	GP	HOV
129260	43230	67115	18915

HOV	GP	Local	NB Tot
14610	61100	50580	126290

Exit 8									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
7395	8360	5050	9305	4440	9580	9330	7270	7590	3470

EB	WB
25680	22730

EB	WB
24795	25755

SB Tot	Local	GP	HOV
132990	44260	68490	20240

HOV	GP	Local	NB Tot
16585	73405	47185	137175

EB	WB
28580	28115

EB	WB
15810	16425

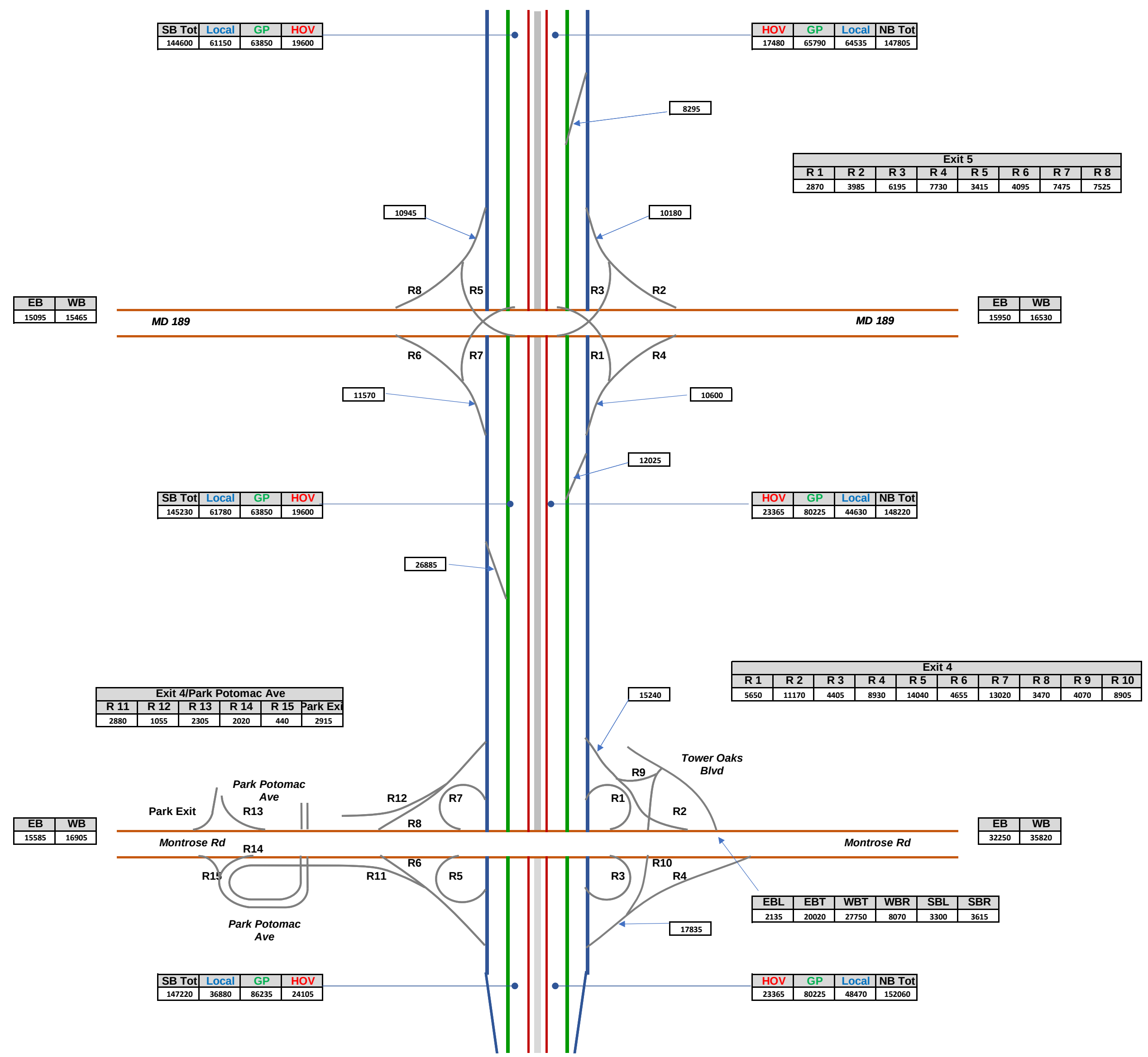
Exit 6							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
17865	8130	4070	4960	9355	18410	4890	2330

NB Ramps/Nelson St							
EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
2540	12920	16090	330	2495	2465	425	4850

2045 No-Build ADT Volume Diagram

N

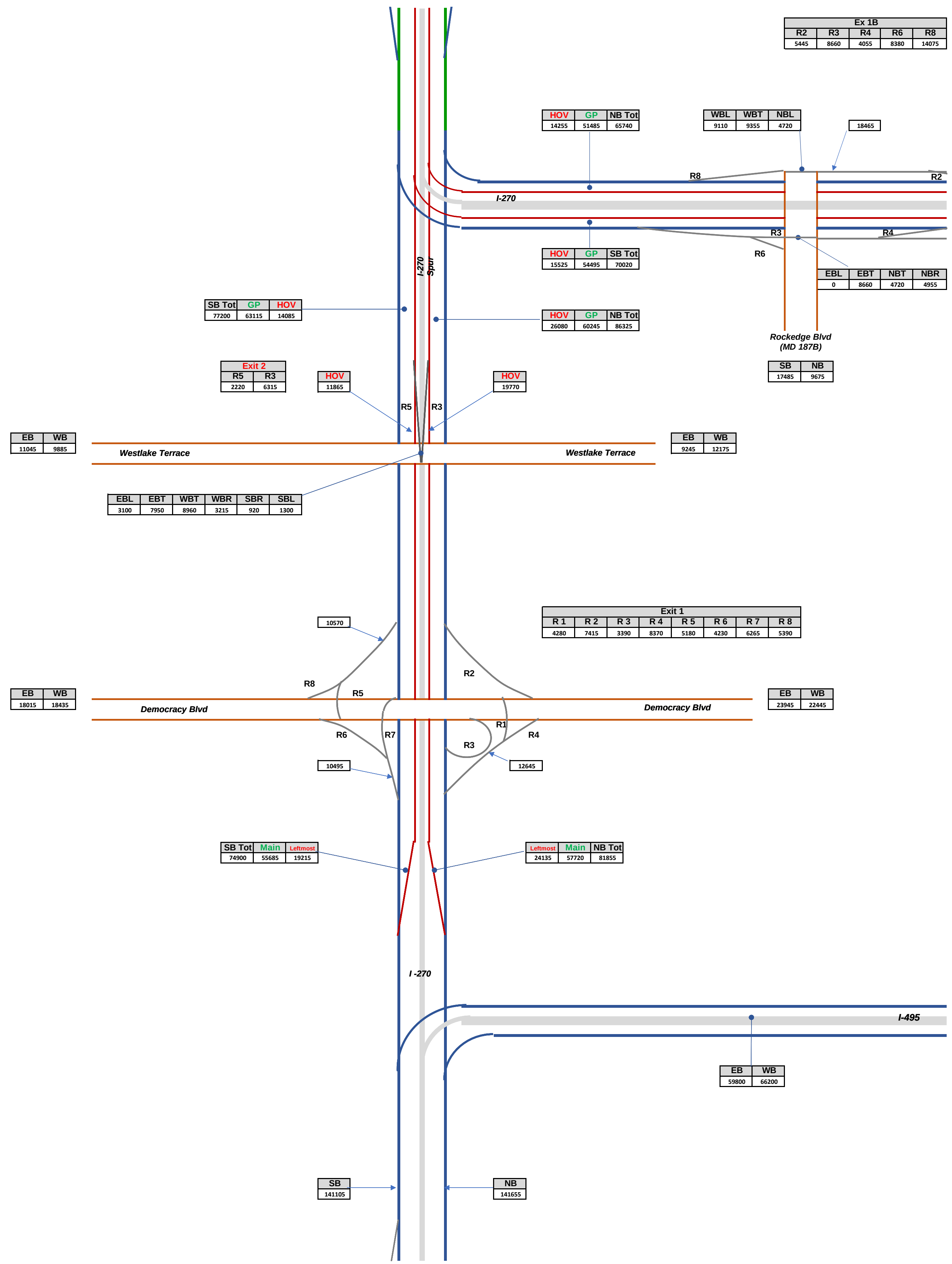
2045 No-Build ADT Volume Diagram



2045 No-Build ADT Volume Diagram

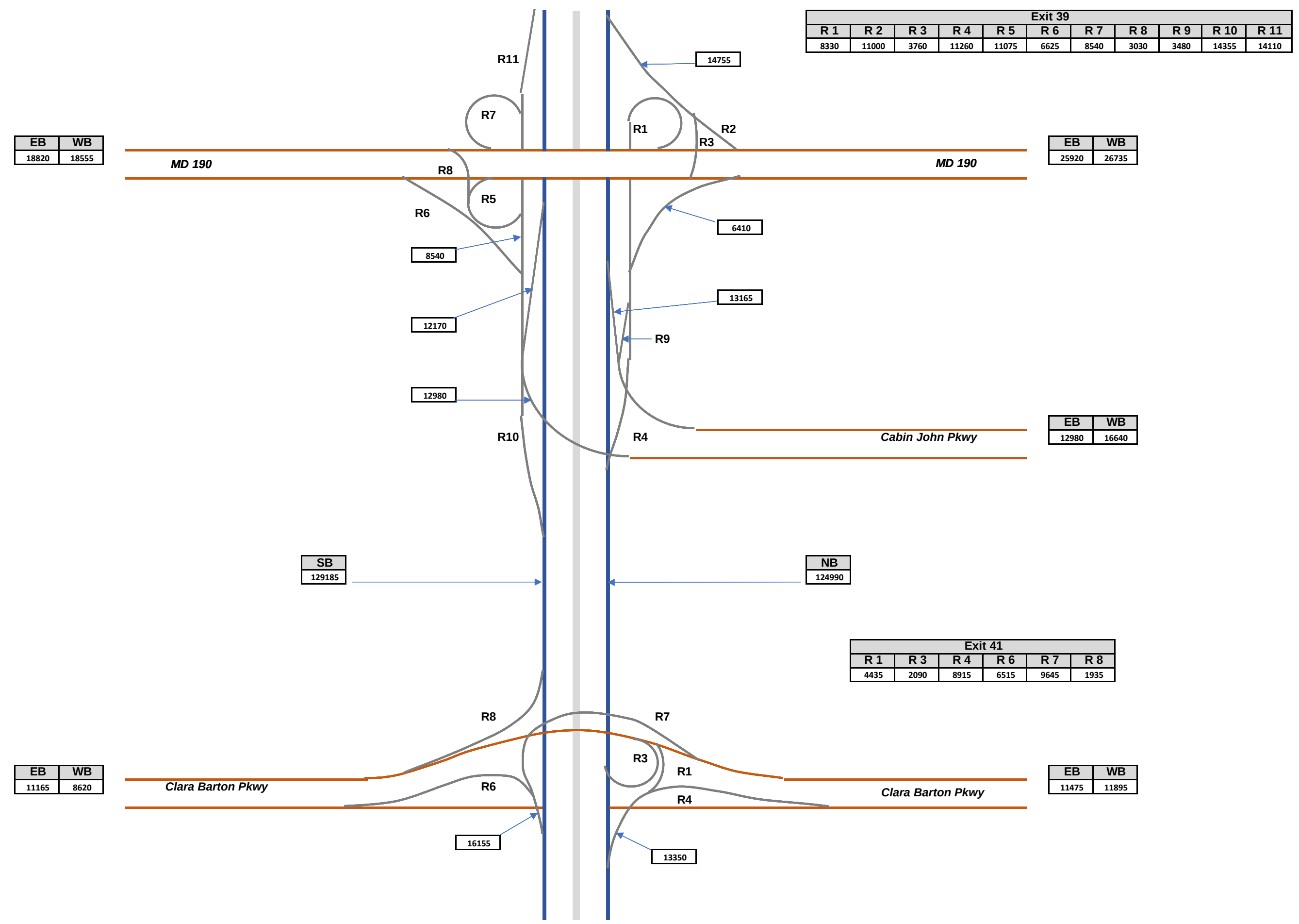
N

2045 No-Build ADT Volume Diagram



2045 No-Build ADT Volume Diagram

2045 No-Build ADT Volume Diagram



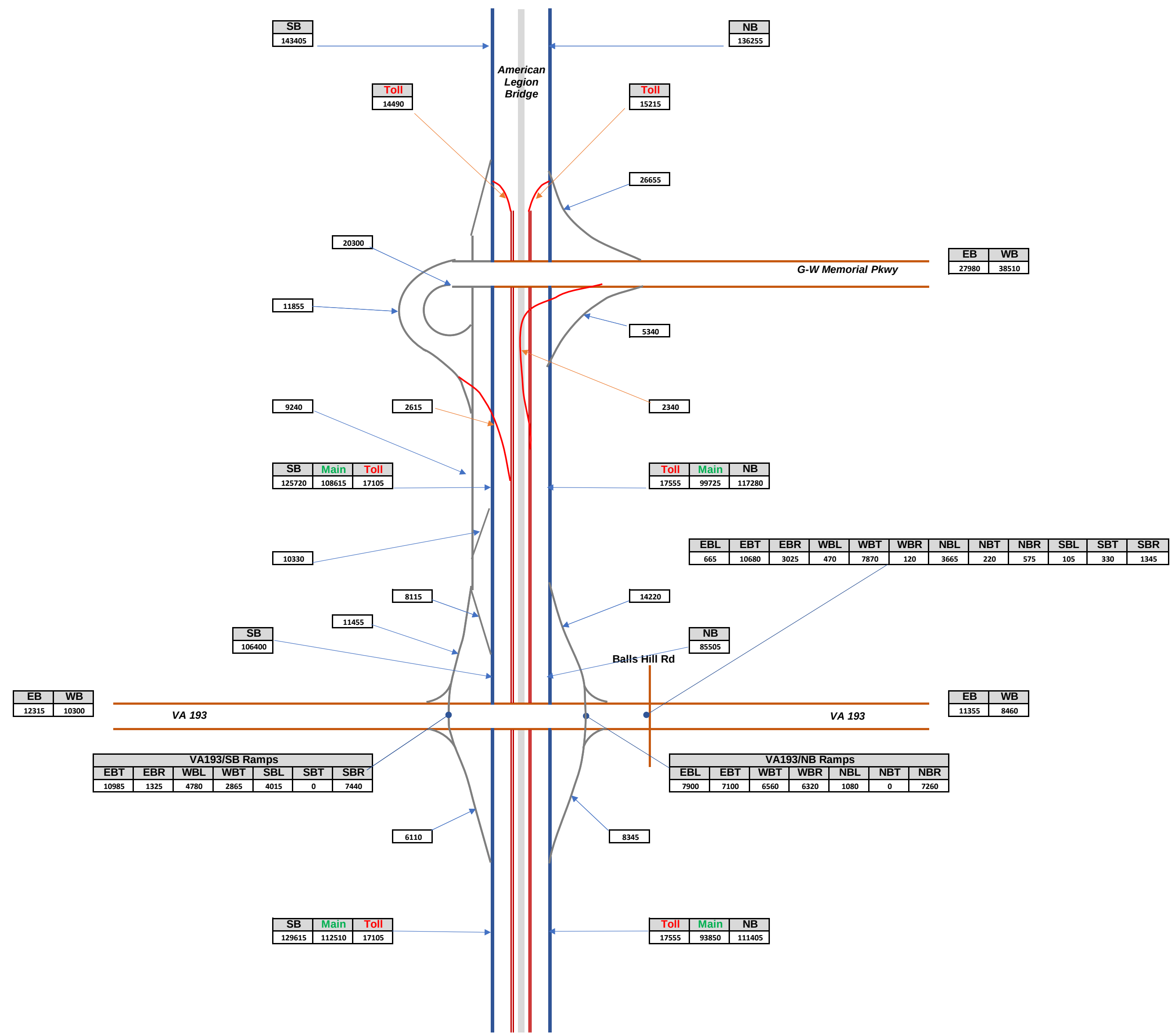
Exit 39										
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
8330	11000	3760	11260	11075	6625	8540	3030	3480	14355	14110

Exit 41					
R 1	R 3	R 4	R 6	R 7	R 8
4435	2090	8915	6515	9645	1935

2045 No-Build ADT Volume Diagram

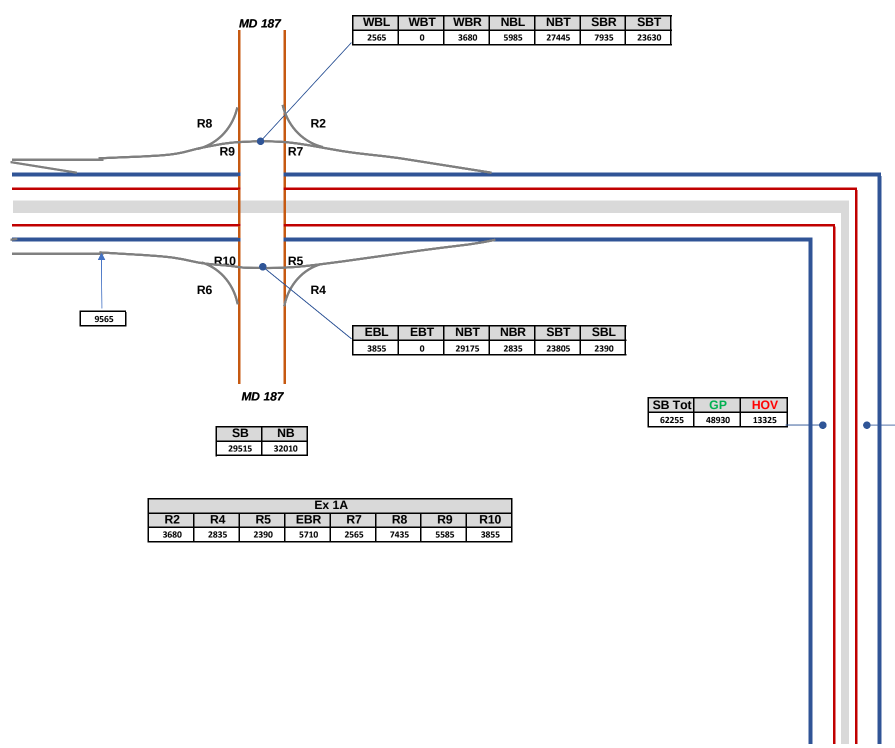
N

2045 No-Build ADT Volume Diagram



2045 No-Build ADT Volume Diagram

2045 No-Build ADT Volume Diagram



SB	NB
31065	31130

WBL	WBT	WBR	NBL	NBT	SBR	SBT
2565	0	3680	5985	27445	7935	23630

EBL	EBT	NBT	NBR	SBT	SBL
3855	0	29175	2835	23805	2390

SB	NB
29515	32010

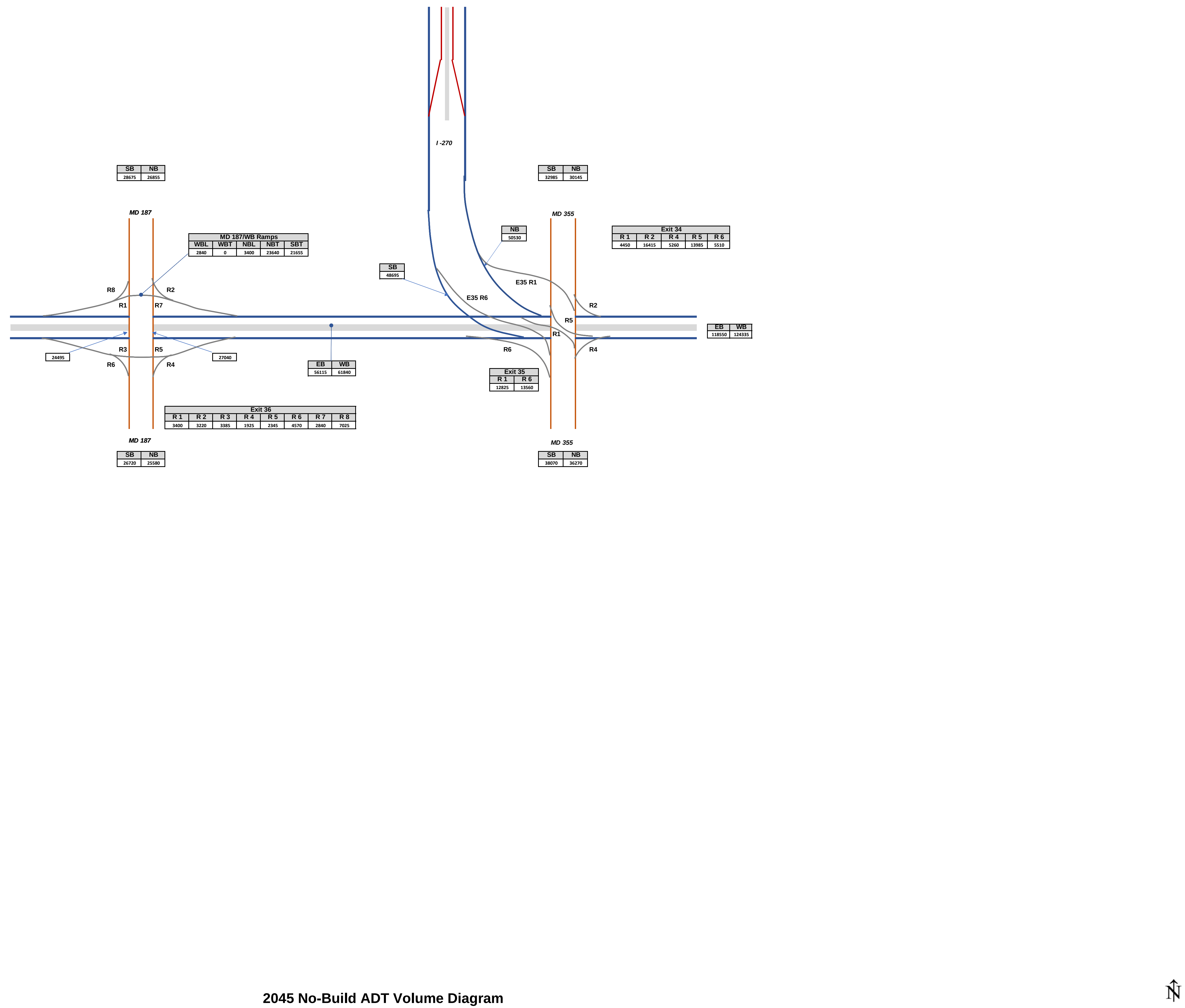
Ex 1A							
R2	R4	R5	EBR	R7	R8	R9	R10
3680	2835	2390	5710	2565	7435	5585	3855

SB Tot	GP	HOV
62255	48930	13325

HOV	GP	NB Tot
11195	52160	63355

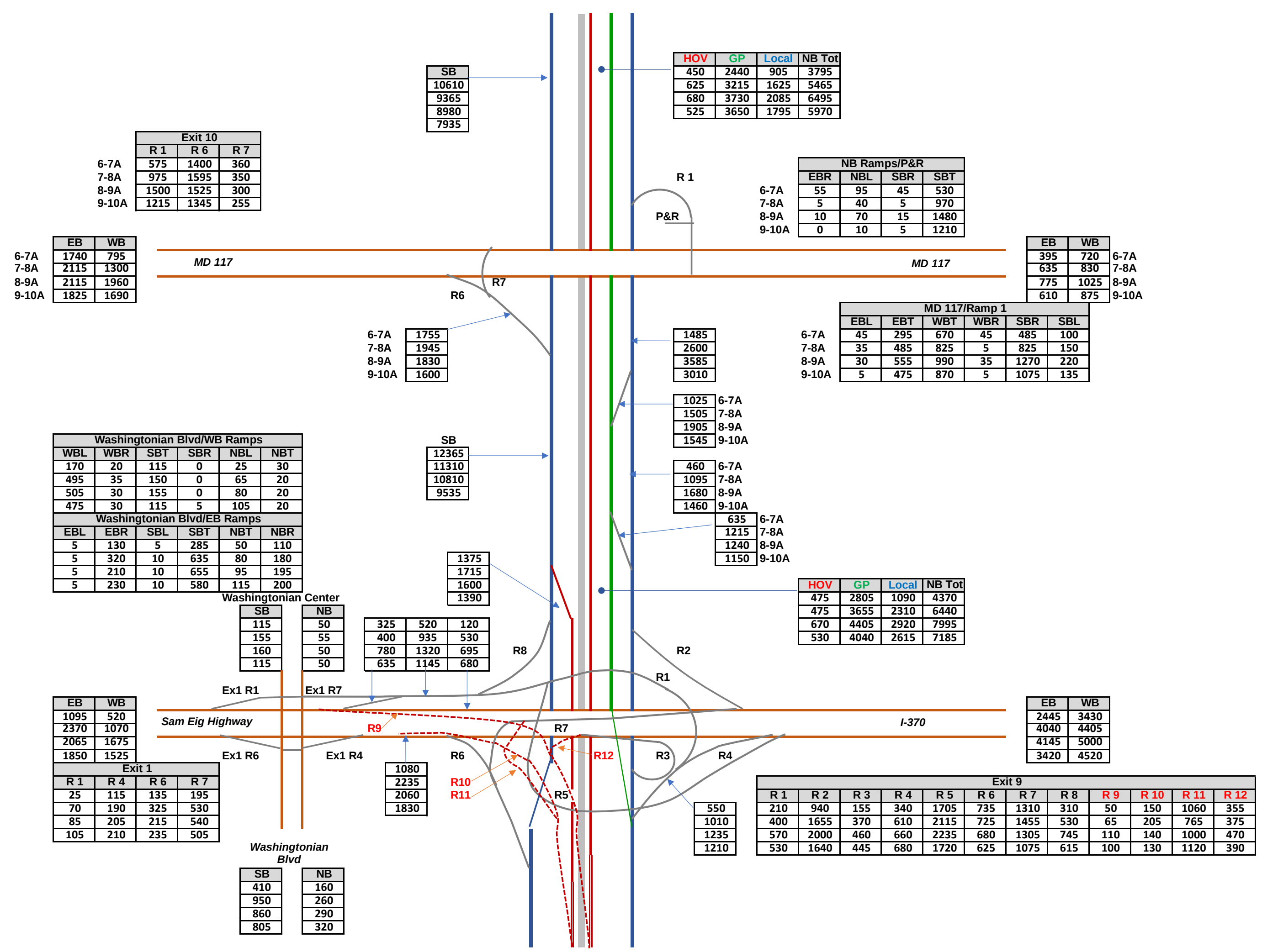
2045 No-Build ADT Volume Diagram

2045 No-Build ADT Volume Diagram



2045 No-Build ADT Volume Diagram

2045 Preferred Alternative Hourly AM Volume Diagram



SB
10610
9365
8980
7935

HOV	GP	Local	NB Tot
450	2440	905	3795
625	3215	1625	5465
680	3730	2085	6495
525	3650	1795	5970

	Exit 10		
	R 1	R 6	R 7
6-7A	575	1400	360
7-8A	975	1595	350
8-9A	1500	1525	300
9-10A	1215	1345	255

	NB Ramps/P&R			
	EBR	NBL	SBR	SBT
6-7A	55	95	45	530
7-8A	5	40	5	970
8-9A	10	70	15	1480
9-10A	0	10	5	1210

	EB	WB
6-7A	1740	795
7-8A	2115	1300
8-9A	2115	1960
9-10A	1825	1690

EB	WB	
395	720	6-7A
635	830	7-8A
775	1025	8-9A
610	875	9-10A

	MD 117/Ramp 1					
	EBL	EBT	WBT	WBR	SBR	SBL
6-7A	45	295	670	45	485	100
7-8A	35	485	825	5	825	150
8-9A	30	555	990	35	1270	220
9-10A	5	475	870	5	1075	135

6-7A	1755
7-8A	1945
8-9A	1830
9-10A	1600

1485
2600
3585
3010

1025	6-7A
1505	7-8A
1905	8-9A
1545	9-10A

460	6-7A
1095	7-8A
1680	8-9A
1460	9-10A

635	6-7A
1215	7-8A
1240	8-9A
1150	9-10A

Washingtonian Blvd/WB Ramps					
WBL	WBR	SBT	SBR	NBL	NBT
170	20	115	0	25	30
495	35	150	0	65	20
505	30	155	0	80	20
475	30	115	5	105	20
Washingtonian Blvd/EB Ramps					
EBL	EBR	SBL	SBT	NBT	NBR
5	130	5	285	50	110
5	320	10	635	80	180
5	210	10	655	95	195
5	230	10	580	115	200

SB
12365
11310
10810
9535

1375
1715
1600
1390

HOV	GP	Local	NB Tot
475	2805	1090	4370
475	3655	2310	6440
670	4405	2920	7995
530	4040	2615	7185

Washingtonian Center

SB	NB
115	50
155	55
160	50
115	50

325	520	120
400	935	530
780	1320	695
635	1145	680

EB	WB
1095	520
2370	1070
2065	1675
1850	1525

Exit 1			
R 1	R 4	R 6	R 7
25	115	135	195
70	190	325	530
85	205	215	540
105	210	235	505

1080
2235
2060
1830

Washingtonian Blvd

SB	NB
410	160
950	260
860	290
805	320

EB	WB
2445	3430
4040	4405
4145	5000
3420	4520

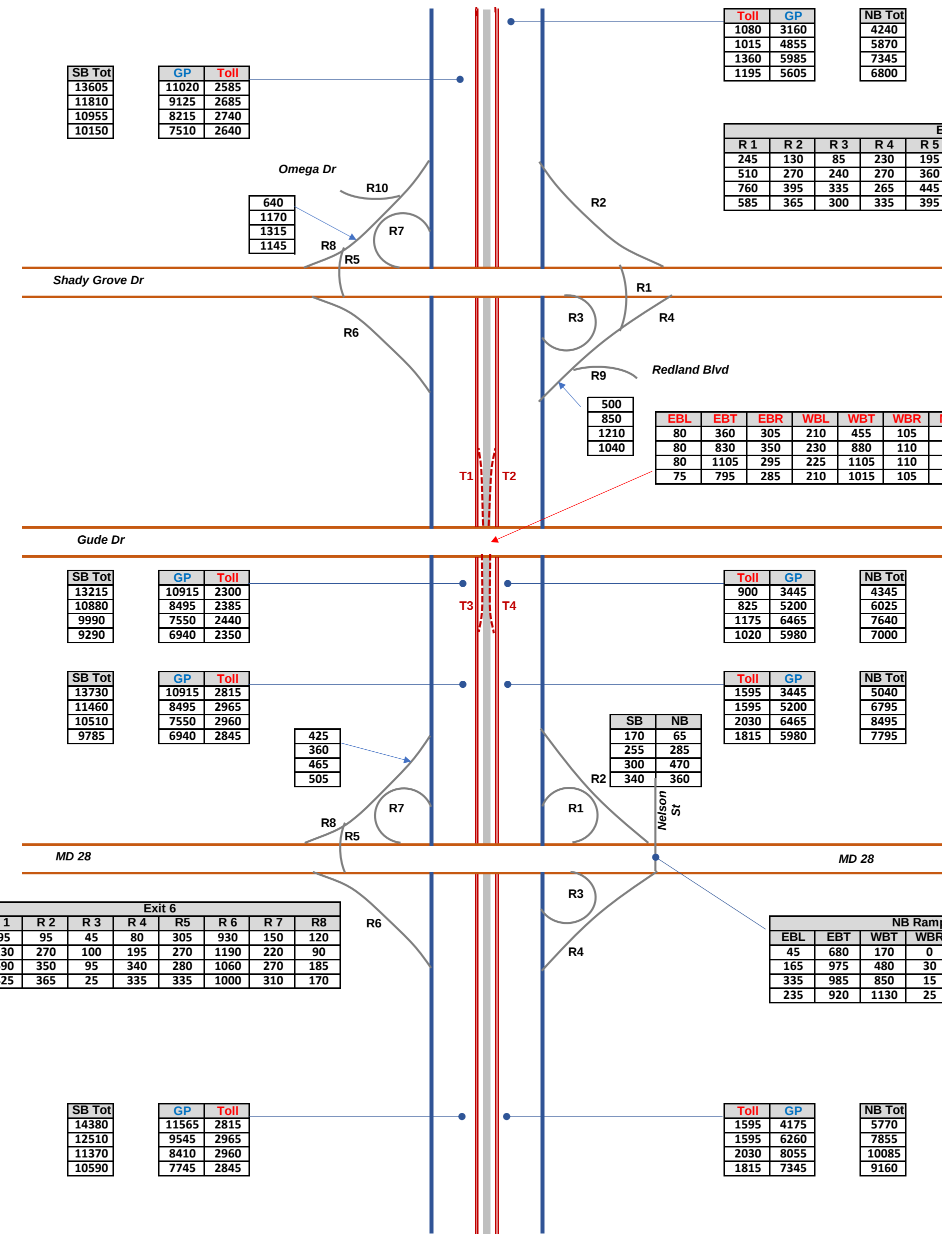
550
1010
1235
1210

Exit 9											
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12
210	940	155	340	1705	735	1310	310	50	150	1060	355
400	1655	370	610	2115	725	1455	530	65	205	765	375
570	2000	460	660	2235	680	1305	745	110	140	1000	470
530	1640	445	680	1720	625	1075	615	100	130	1120	390

2045 Preferred Alternative Hourly AM Volume Diagram

N

2045 Preferred Alternative Hourly AM Volume Diagram



SB Tot
13605
11810
10955
10150

GP	Toll
11020	2585
9125	2685
8215	2740
7510	2640

Toll	GP
1080	3160
1015	4855
1360	5985
1195	5605

NB Tot
4240
5870
7345
6800

Exit 8									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
245	130	85	230	195	150	590	450	25	205
510	270	240	270	360	300	490	810	65	255
760	395	335	265	445	405	605	870	190	355
585	365	300	335	395	400	585	755	120	405

640
1170
1315
1145

EB	WB
695	955
1100	1980
1430	2335
1370	1860

EB	WB
885	985
1190	1420
1395	1700
1400	1475

500
850
1210
1040

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
80	360	305	210	455	105	360	335	80	205
80	830	350	230	880	110	405	365	85	220
80	1105	295	225	1105	110	415	435	85	220
75	795	285	210	1015	105	390	405	85	205

EB	WB
740	865
1260	1330
1480	1625
1150	1505

EB	WB
930	765
1450	1220
1740	1440
1395	1330

SB Tot
13215
10880
9990
9290

GP	Toll
10915	2300
8495	2385
7550	2440
6940	2350

Toll	GP
900	3445
825	5200
1175	6465
1020	5980

NB Tot
4345
6025
7640
7000

Gude Dr Exit			
T1	T2	T3	T4
285	180	515	700
300	190	580	770
305	185	525	850
290	175	495	800

SB Tot
13730
11460
10510
9785

GP	Toll
10915	2815
8495	2965
7550	2960
6940	2845

Toll	GP
1595	3445
1595	5200
2030	6465
1815	5980

NB Tot
5040
6795
8495
7795

425
360
465
505

SB	NB
170	65
255	285
300	470
340	360

EB	WB
1395	995
2160	1535
2190	2385
1845	2350

EB	WB
755	170
1115	510
1235	865
1200	1155

Exit 6							
R 1	R 2	R 3	R 4	R5	R 6	R 7	R8
795	95	45	80	305	930	150	120
1230	270	100	195	270	1190	220	90
1690	350	95	340	280	1060	270	185
1425	365	25	335	335	1000	310	170

NB Ramps/Nelson St							
EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
45	680	170	0	20	60	15	150
165	975	480	30	90	105	30	220
335	985	850	15	120	220	30	270
235	920	1130	25	100	235	45	300

SB Tot
14380
12510
11370
10590

GP	Toll
11565	2815
9545	2965
8410	2960
7745	2845

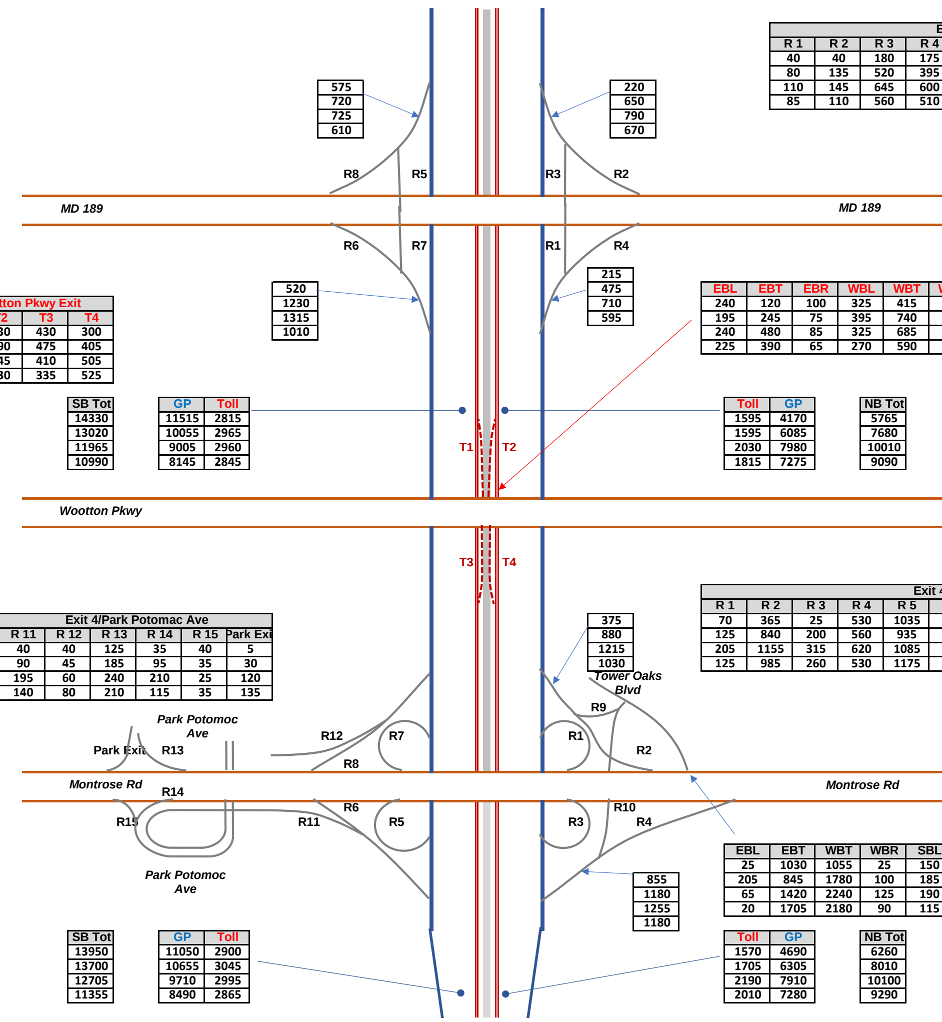
Toll	GP
1595	4175
1595	6260
2030	8055
1815	7345

NB Tot
5770
7855
10085
9160

2045 Preferred Alternative Hourly AM Volume Diagram

N

2045 Preferred Alternative Hourly AM Volume Diagram



Exit 5							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
40	40	180	175	165	185	335	410
80	135	520	395	200	615	615	520
110	145	645	600	190	670	650	535
85	110	560	510	180	495	515	430

575
720
725
610

220
650
790
670

EB	WB
585	470
1550	990
1760	995
1485	900

EB	WB
555	395
1015	1140
1235	1145
1120	1005

520
1230
1315
1010

215
475
710
595

Wooötton Pkwy Exit			
T1	T2	T3	T4
345	330	430	300
390	290	475	405
375	345	410	505
315	330	335	525

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
240	120	100	325	415	85	255	45	115	225
195	245	75	395	740	95	355	50	185	205
240	480	85	325	685	105	455	55	210	165
225	390	65	270	590	105	465	60	135	180

SB Tot
14330
13020
11965
10990

GP	Toll
11515	2815
10055	2965
9005	2960
8145	2845

Toll	GP
1595	4170
1595	6085
2030	7980
1815	7275

NB Tot
5765
7680
10010
9090

EB	WB
460	575
520	975
810	950
685	785

EB	WB
600	830
805	1235
1100	1115
1035	960

Exit 4									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
70	365	25	530	1035	80	685	195	10	320
125	840	200	560	935	610	1010	130	40	620
205	1155	315	620	1085	725	1040	110	65	640
125	985	260	530	1175	650	955	145	45	645

Exit 4/Park Potomac Ave					
R 11	R 12	R 13	R 14	R 15	Park Exi
40	40	125	35	40	5
90	45	185	95	35	30
195	60	240	210	25	120
140	80	210	115	35	135

375
880
1215
1030

EB	WB
130	450
865	460
1260	720
1375	825

EB	WB
1710	1080
1585	1880
2230	2365
2350	2270

EBL	EBT	WBT	WBR	SBL	SBR
25	1030	1055	25	150	305
205	845	1780	100	185	430
65	1420	2240	125	190	475
20	1705	2180	90	115	395

855
1180
1255
1180

SB Tot
13950
13700
12705
11355

GP	Toll
11050	2900
10655	3045
9710	2995
8490	2865

Toll	GP
1570	4690
1705	6305
2190	7910
2010	7280

NB Tot
6260
8010
10100
9290

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2045 Preferred Alternative Hourly AM Volume Diagram

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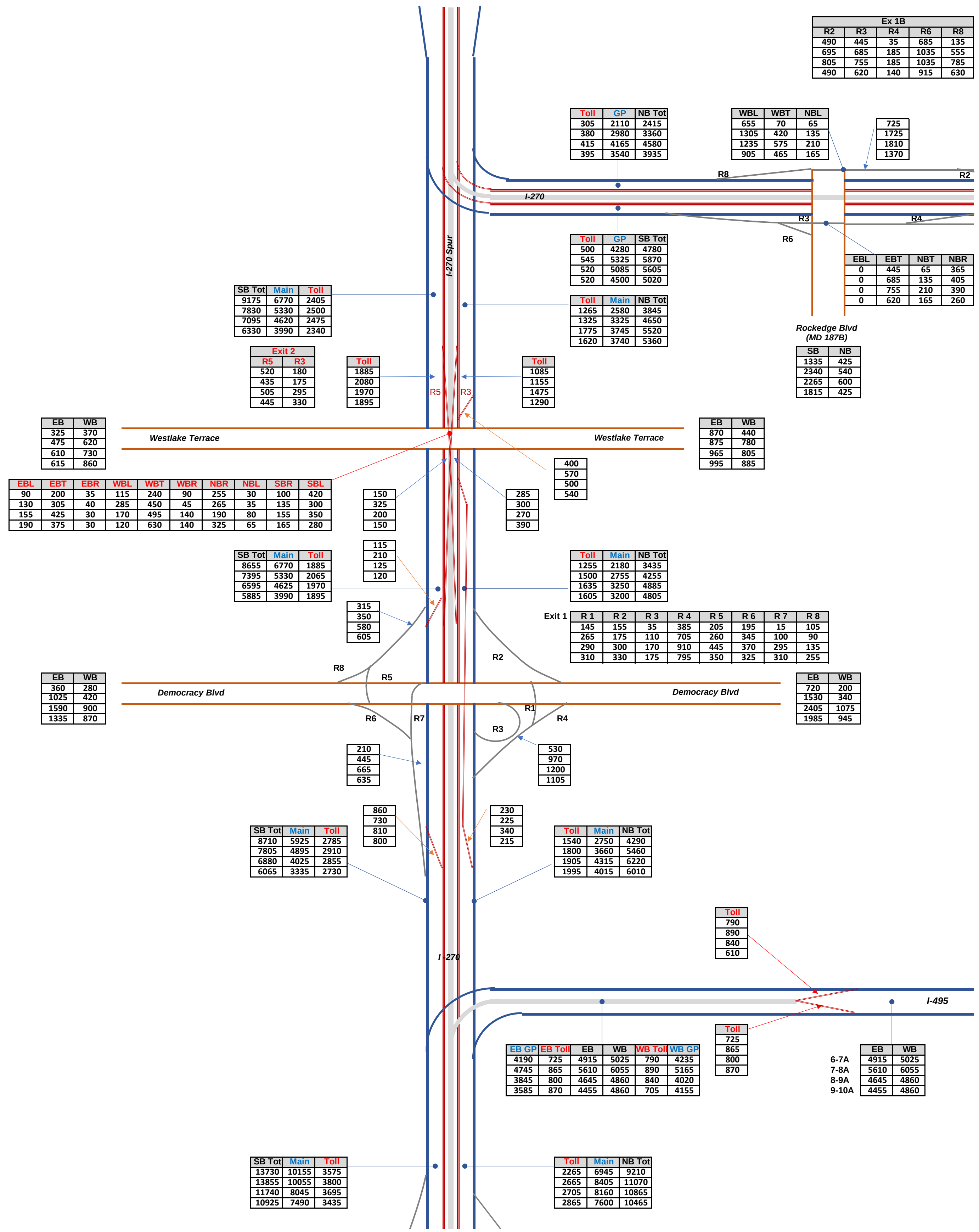

Ex 1B				
R2	R3	R4	R6	R8
490	445	35	685	135
695	685	185	1035	555
805	755	185	1035	785
490	620	140	915	630

Toll	GP	NB Tot
305	2110	2415
380	2980	3360
415	4165	4580
395	3540	3935

WBL	WBT	NBL
655	70	65
1305	420	135
1235	575	210
905	465	165

725
1725
1810
1370

Toll	GP	SB Tot
500	4280	4780
545	5325	5870
520	5085	5605
520	4500	5020

EBL	EBT	NBT	NBR
0	445	65	365
0	685	135	405
0	755	210	390
0	620	165	260

SB Tot	Main	Toll
9175	6770	2405
7830	5330	2500
7095	4620	2475
6330	3990	2340

Toll	Main	NB Tot
1265	2580	3845
1325	3325	4650
1775	3745	5520
1620	3740	5360

SB	NB
1335	425
2340	540
2265	600
1815	425

Exit 2	
R5	R3
520	180
435	175
505	295
445	330

Toll
1885
2080
1970
1895

Toll
1085
1155
1475
1290

EB	WB
325	370
475	620
610	730
615	860

EB	WB
870	440
875	780
965	805
995	885

400
570
500
540

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
90	200	35	115	240	90	255	30	100	420
130	305	40	285	450	45	265	35	135	300
155	425	30	170	495	140	190	80	155	350
190	375	30	120	630	140	325	65	165	280

150
325
200
150

285
300
270
390

115
210
125
120

SB Tot	Main	Toll
8655	6770	1885
7395	5330	2065
6595	4625	1970
5885	3990	1895

Toll	Main	NB Tot
1255	2180	3435
1500	2755	4255
1635	3250	4885
1605	3200	4805

315
350
580
605

Exit 1

R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
145	155	35	385	205	195	15	105
265	175	110	705	260	345	100	90
290	300	170	910	445	370	295	135
310	330	175	795	350	325	310	255

EB	WB
360	280
1025	420
1590	900
1335	870

EB	WB
720	200
1530	340
2405	1075
1985	945

210
445
665
635

530
970
1200
1105

860
730
810
800

230
225
340
215

SB Tot	Main	Toll
8710	5925	2785
7805	4895	2910
6880	4025	2855
6065	3335	2730

Toll	Main	NB Tot
1540	2750	4290
1800	3660	5460
1905	4315	6220
1995	4015	6010

Toll
790
890
840
610

Toll
725
865
800
870

EB GP	EB Toll	EB	WB	WB Toll	WB GP
4190	725	4915	5025	790	4235
4745	865	5610	6055	890	5165
3845	800	4645	4860	840	4020
3585	870	4455	4860	705	4155

	EB	WB
6-7A	4915	5025
7-8A	5610	6055
8-9A	4645	4860
9-10A	4455	4860

SB Tot	Main	Toll
13730	10155	3575
13855	10055	3800
11740	8045	3695
10925	7490	3435

Toll	Main	NB Tot
2265	6945	9210
2665	8405	11070
2705	8160	10865
2865	7600	10465

2045 Preferred Alternative Hourly AM Volume Diagram

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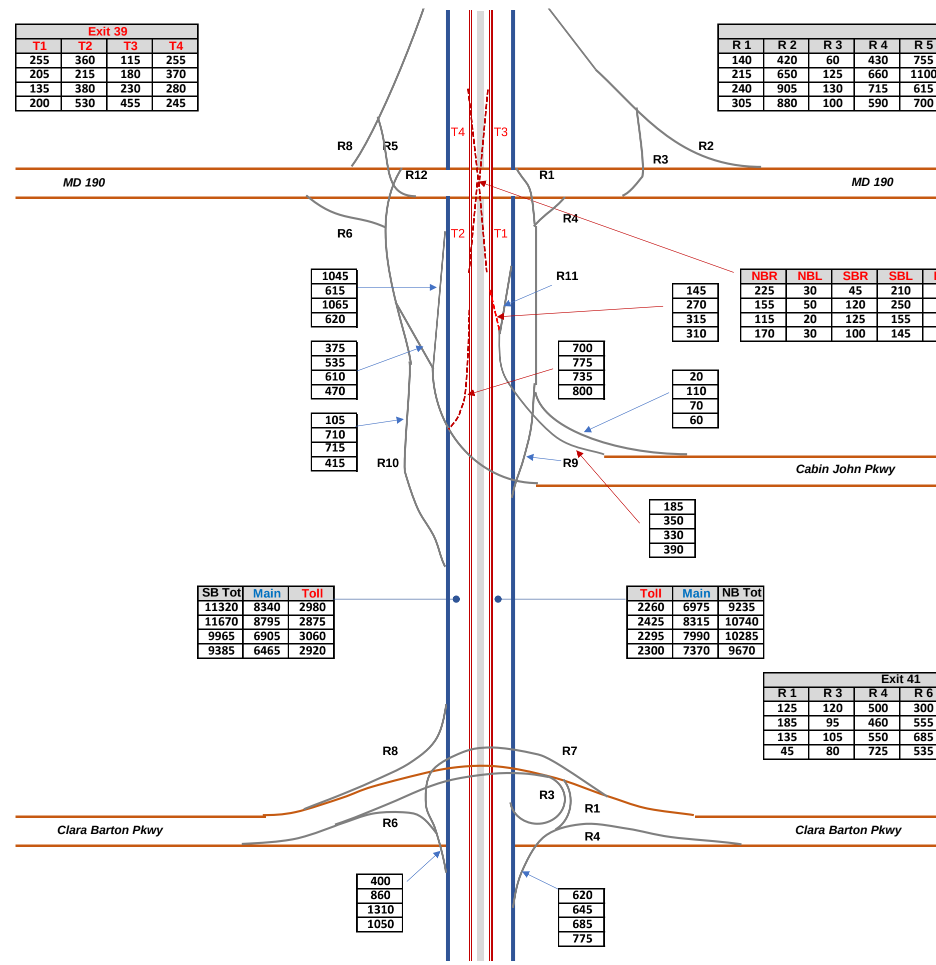
2045 Preferred Alternative Hourly AM Volume Diagram



Exit 39			
T1	T2	T3	T4
255	360	115	255
205	215	180	370
135	380	230	280
200	530	455	245

Exit 39										
R 1	R 2	R 3	R 4	R 5	R 6	R 8	R 9	R 10	R 11	R12
140	420	60	430	755	415	125	550	105	40	65
215	650	125	660	1100	810	260	765	710	80	440
240	905	130	715	615	930	180	885	715	15	395
305	880	100	590	700	690	120	835	415	80	190

MD 190 (west):

EB	WB
930	495
1890	935
1955	830
1690	765

MD 190 (east):

EB	WB
1925	965
2960	1615
2340	2030
2225	1995

NBR	NBL	SBR	SBL	EBR	EBT	EBL	WBR	WBL	WBT
225	30	45	210	75	1120	75	40	285	360
155	50	120	250	15	2020	150	30	200	950
115	20	125	155	10	1490	145	85	370	905
170	30	100	145	55	1420	220	235	475	710

1045	375	105	145	700	20	185	400	620
615	535	710	270	775	110	350	860	645
1065	610	715	315	735	70	330	1310	685
620	470	415	310	800	60	390	1050	775

Cabin John Pkwy:

EB	WB
2120	205
1925	460
2410	400
1890	450

SB Tot	Main	Toll
11320	8340	2980
11670	8795	2875
9965	6905	3060
9385	6465	2920

Toll	Main	NB Tot
2260	6975	9235
2425	8315	10740
2295	7990	10285
2300	7370	9670

Exit 41					
R 1	R 3	R 4	R 6	R 7	R 8
125	120	500	300	100	220
185	95	460	555	310	195
135	105	550	685	625	130
45	80	725	535	515	115

Clara Barton Pkwy (west):

EB	WB
585	425
1495	475
1500	270
825	165

Clara Barton Pkwy (east):

EB	WB
660	185
1305	405
1260	630
940	515

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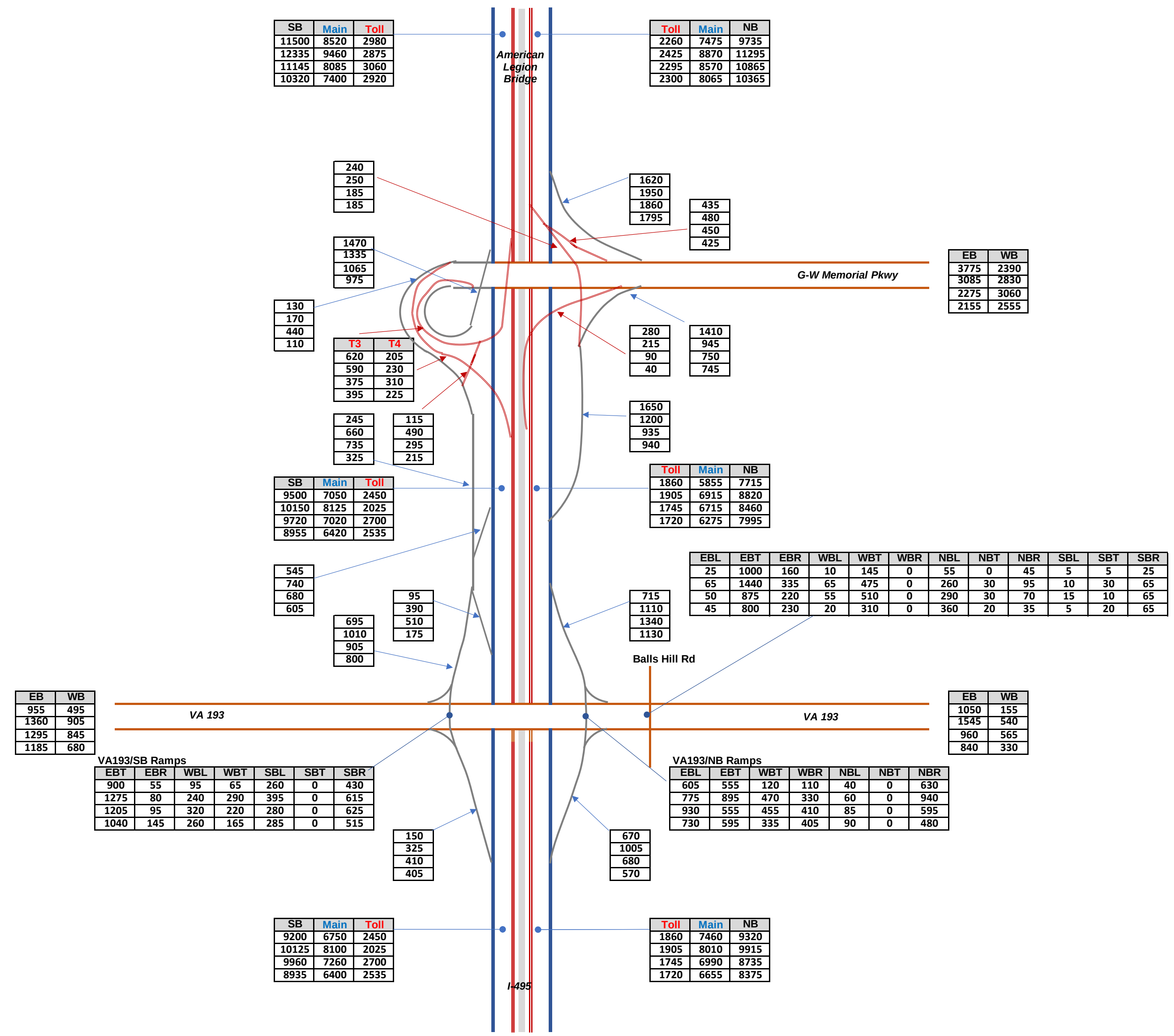

SB	Main	Toll
11500	8520	2980
12335	9460	2875
11145	8085	3060
10320	7400	2920

Toll	Main	NB
2260	7475	9735
2425	8870	11295
2295	8570	10865
2300	8065	10365

G-W Memorial Pkwy

EB	WB
3775	2390
3085	2830
2275	3060
2155	2555

T3	T4
620	205
590	230
375	310
395	225

SB	Main	Toll
9500	7050	2450
10150	8125	2025
9720	7020	2700
8955	6420	2535

Toll	Main	NB
1860	5855	7715
1905	6915	8820
1745	6715	8460
1720	6275	7995

Balls Hill Rd

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
25	1000	160	10	145	0	55	0	45	5	5	25
65	1440	335	65	475	0	260	30	95	10	30	65
50	875	220	55	510	0	290	30	70	15	10	65
45	800	230	20	310	0	360	20	35	5	20	65

VA 193 (west)

EB	WB
955	495
1360	905
1295	845
1185	680

VA 193 (east)

EB	WB
1050	155
1545	540
960	565
840	330

VA193/SB Ramps

EBT	EBR	WBL	WBT	SBL	SBT	SBR
900	55	95	65	260	0	430
1275	80	240	290	395	0	615
1205	95	320	220	280	0	625
1040	145	260	165	285	0	515

VA193/NB Ramps

EBL	EBT	WBT	WBR	NBL	NBT	NBR
605	555	120	110	40	0	630
775	895	470	330	60	0	940
930	555	455	410	85	0	595
730	595	335	405	90	0	480

SB	Main	Toll
9200	6750	2450
10125	8100	2025
9960	7260	2700
8935	6400	2535

Toll	Main	NB
1860	7460	9320
1905	8010	9915
1745	6990	8735
1720	6655	8375

2045 Preferred Alternative Hourly AM Volume Diagram

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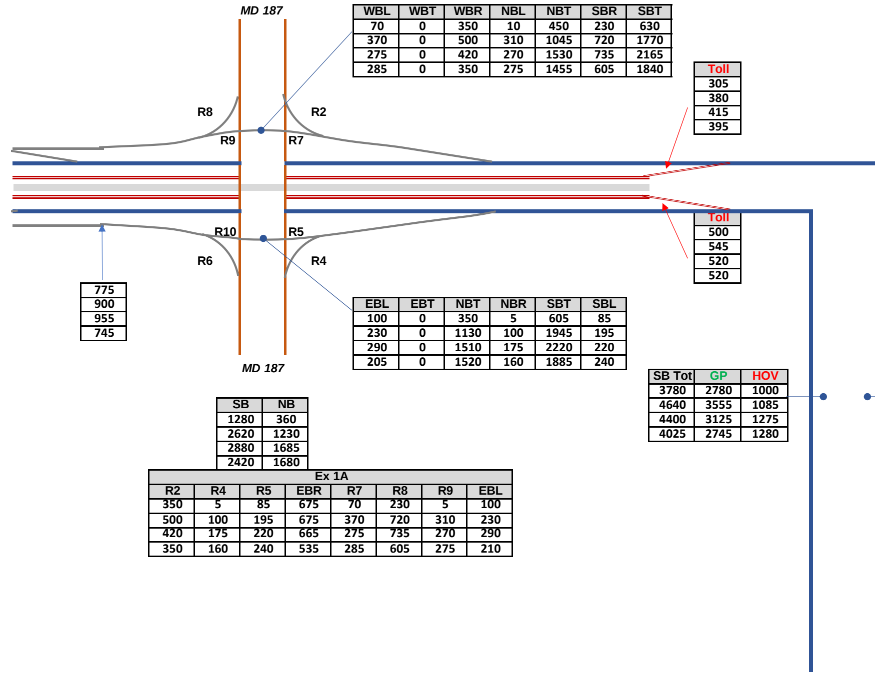
SB	NB
860	800
2490	1550
2900	1950
2445	1800

WBL	WBT	WBR	NBL	NBT	SBR	SBT
70	0	350	10	450	230	630
370	0	500	310	1045	720	1770
275	0	420	270	1530	735	2165
285	0	350	275	1455	605	1840



Toll
305
380
415
395

Toll
500
545
520
520

775
900
955
745

EBL	EBT	NBT	NBR	SBT	SBL
100	0	350	5	605	85
230	0	1130	100	1945	195
290	0	1510	175	2220	220
205	0	1520	160	1885	240

SB Tot	GP	HOV
3780	2780	1000
4640	3555	1085
4400	3125	1275
4025	2745	1280

HOV	GP	NB Tot
405	2785	3190
915	3465	4380
810	4485	5295
630	3800	4430

SB	NB
1280	360
2620	1230
2880	1685
2420	1680

Ex 1A							
R2	R4	R5	EBR	R7	R8	R9	EBL
350	5	85	675	70	230	5	100
500	100	195	675	370	720	310	230
420	175	220	665	275	735	270	290
350	160	240	535	285	605	275	210

2045 Preferred Alternative Hourly AM Volume Diagram

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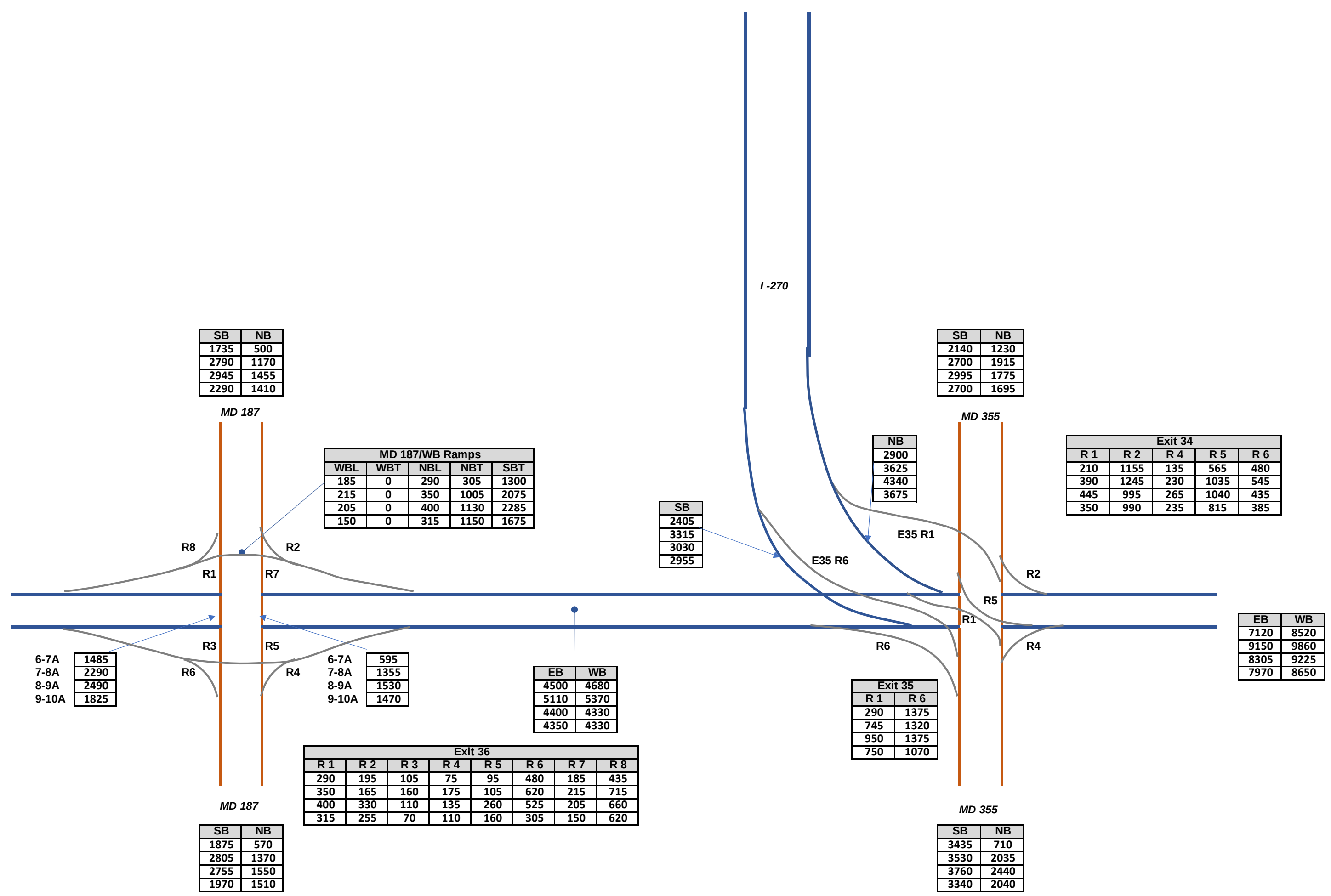

MD 187 (north)

SB	NB
1735	500
2790	1170
2945	1455
2290	1410

MD 187/WB Ramps				
WBL	WBT	NBL	NBT	SBT
185	0	290	305	1300
215	0	350	1005	2075
205	0	400	1130	2285
150	0	315	1150	1675

6-7A	1485
7-8A	2290
8-9A	2490
9-10A	1825

6-7A	595
7-8A	1355
8-9A	1530
9-10A	1470

Exit 36							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
290	195	105	75	95	480	185	435
350	165	160	175	105	620	215	715
400	330	110	135	260	525	205	660
315	255	70	110	160	305	150	620

MD 187 (south)

SB	NB
1875	570
2805	1370
2755	1550
1970	1510

EB	WB
4500	4680
5110	5370
4400	4330
4350	4330

SB
2405
3315
3030
2955

NB
2900
3625
4340
3675

MD 355 (north)

SB	NB
2140	1230
2700	1915
2995	1775
2700	1695

Exit 34				
R 1	R 2	R 4	R 5	R 6
210	1155	135	565	480
390	1245	230	1035	545
445	995	265	1040	435
350	990	235	815	385

Exit 35	
R 1	R 6
290	1375
745	1320
950	1375
750	1070

EB	WB
7120	8520
9150	9860
8305	9225
7970	8650

MD 355 (south)

SB	NB
3435	710
3530	2035
3760	2440
3340	2040

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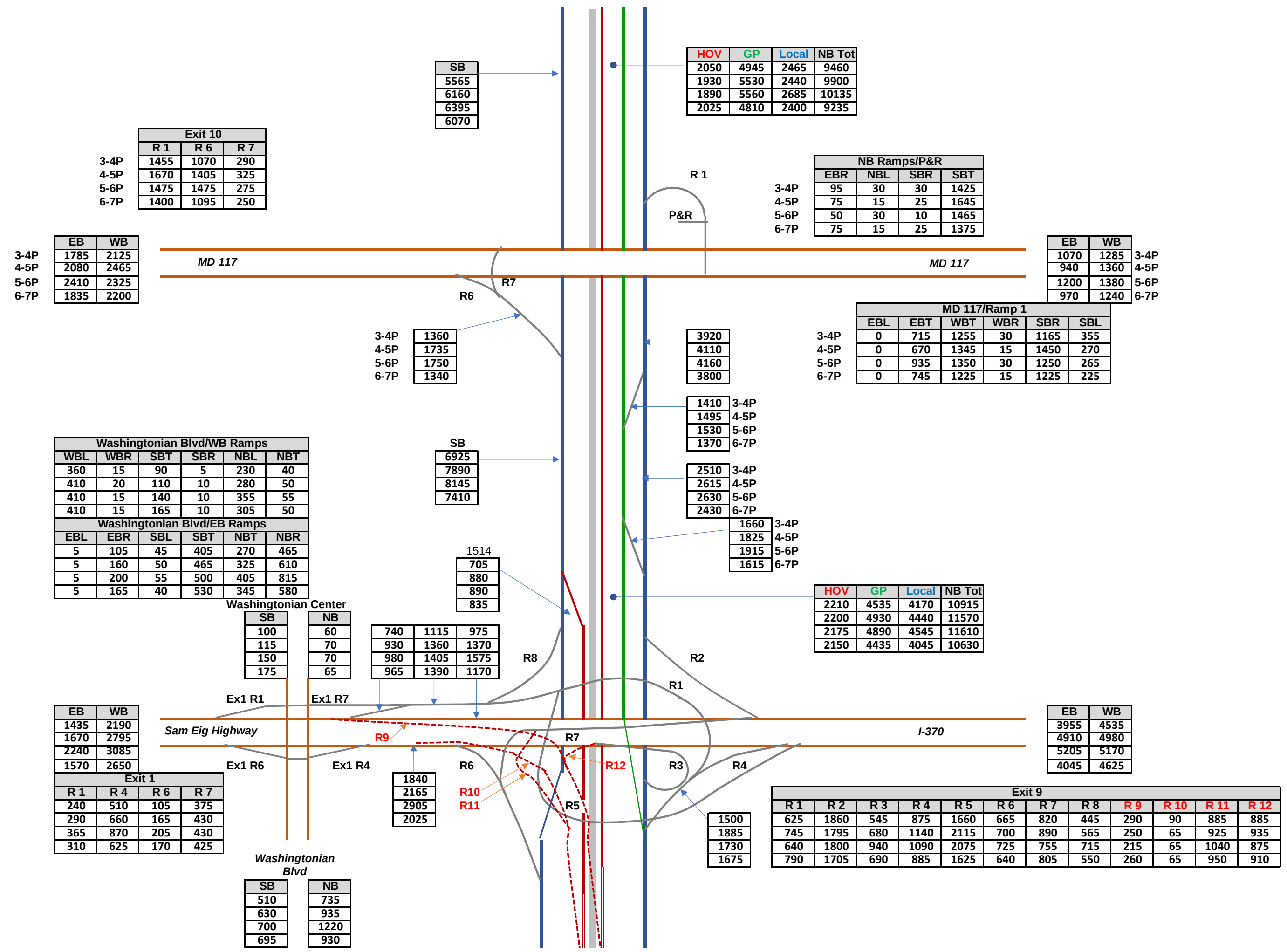

SB
5565
6160
6395
6070

HOV	GP	Local	NB Tot
2050	4945	2465	9460
1930	5530	2440	9900
1890	5560	2685	10135
2025	4810	2400	9235

	Exit 10		
	R 1	R 6	R 7
3-4P	1455	1070	290
4-5P	1670	1405	325
5-6P	1475	1475	275
6-7P	1400	1095	250

	NB Ramps/P&R			
	EBR	NBL	SBR	SBT
3-4P	95	30	30	1425
4-5P	75	15	25	1645
5-6P	50	30	10	1465
6-7P	75	15	25	1375

	EB	WB
3-4P	1785	2125
4-5P	2080	2465
5-6P	2410	2325
6-7P	1835	2200

EB	WB	
1070	1285	3-4P
940	1360	4-5P
1200	1380	5-6P
970	1240	6-7P

	MD 117/Ramp 1					
	EBL	EBT	WBT	WBR	SBR	SBL
3-4P	0	715	1255	30	1165	355
4-5P	0	670	1345	15	1450	270
5-6P	0	935	1350	30	1250	265
6-7P	0	745	1225	15	1225	225

3-4P	1360
4-5P	1735
5-6P	1750
6-7P	1340

3920
4110
4160
3800

1410	3-4P
1495	4-5P
1530	5-6P
1370	6-7P

Washingtonian Blvd/WB Ramps					
WBL	WBR	SBT	SBR	NBL	NBT
360	15	90	5	230	40
410	20	110	10	280	50
410	15	140	10	355	55
410	15	165	10	305	50
Washingtonian Blvd/EB Ramps					
EBL	EBR	SBL	SBT	NBT	NBR
5	105	45	405	270	465
5	160	50	465	325	610
5	200	55	500	405	815
5	165	40	530	345	580

SB
6925
7890
8145
7410

2510	3-4P
2615	4-5P
2630	5-6P
2430	6-7P

1660	3-4P
1825	4-5P
1915	5-6P
1615	6-7P

705
880
890
835

HOV	GP	Local	NB Tot
2210	4535	4170	10915
2200	4930	4440	11570
2175	4890	4545	11610
2150	4435	4045	10630

Washingtonian Center

SB	NB
100	60
115	70
150	70
175	65

740	1115	975
930	1360	1370
980	1405	1575
965	1390	1170

EB	WB
1435	2190
1670	2795
2240	3085
1570	2650

Exit 1			
R 1	R 4	R 6	R 7
240	510	105	375
290	660	165	430
365	870	205	430
310	625	170	425

1840
2165
2905
2025

EB	WB
3955	4535
4910	4980
5205	5170
4045	4625

1500
1885
1730
1675

Exit 9											
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12
625	1860	545	875	1660	665	820	445	290	90	885	885
745	1795	680	1140	2115	700	890	565	250	65	925	935
640	1800	940	1090	2075	725	755	715	215	65	1040	875
790	1705	690	885	1625	640	805	550	260	65	950	910

Washingtonian Blvd

SB	NB
510	735
630	935
700	1220
695	930

2045 Preferred Alternative Hourly PM Volume Diagram

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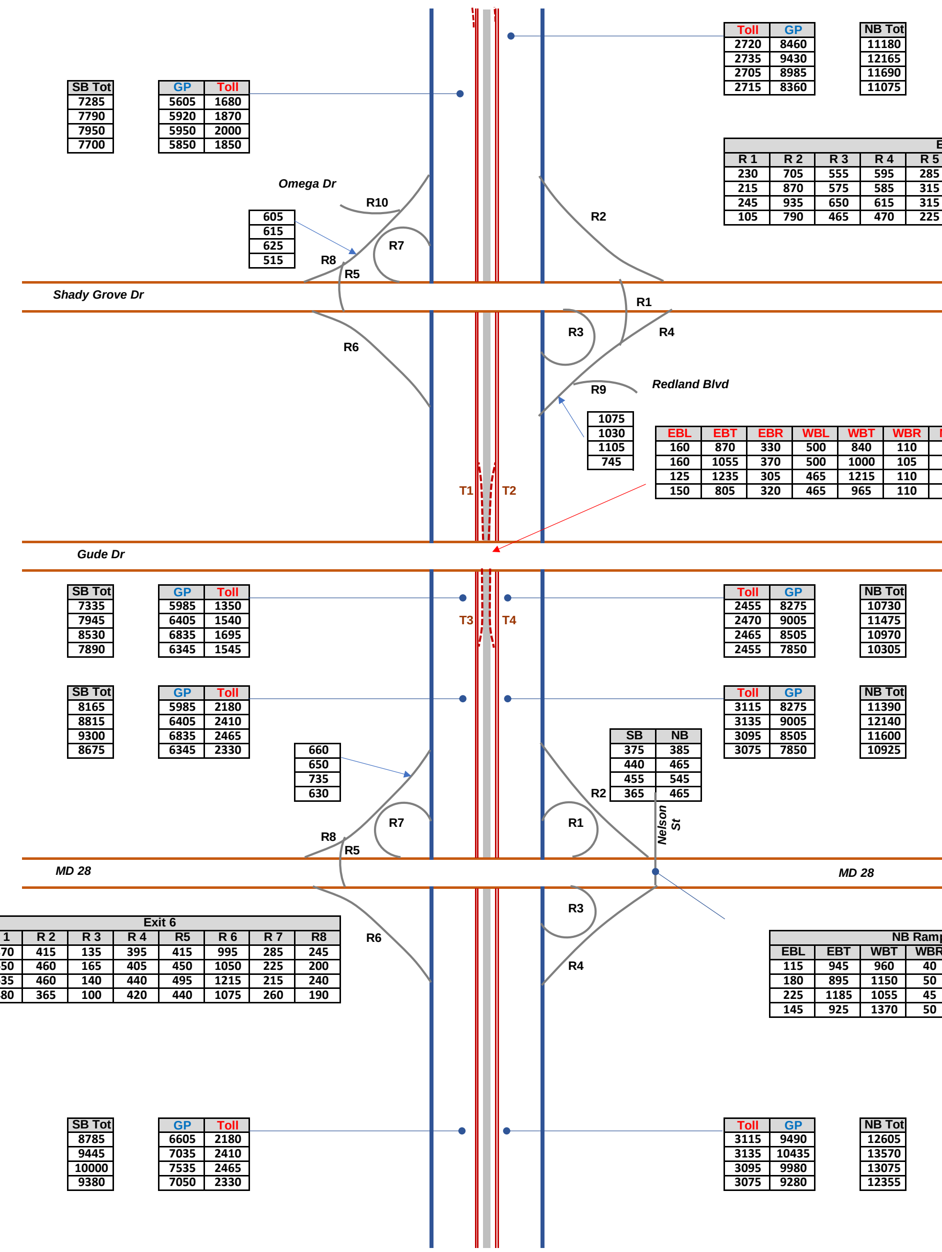
2045 Preferred Alternative Hourly PM Volume Diagram



Toll	GP
2720	8460
2735	9430
2705	8985
2715	8360

NB Tot
11180
12165
11690
11075

SB Tot
7285
7790
7950
7700

GP	Toll
5605	1680
5920	1870
5950	2000
5850	1850

Exit 8									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
230	705	555	595	285	485	640	320	250	145
215	870	575	585	315	610	670	300	230	180
245	935	650	615	315	825	845	310	245	150
105	790	465	470	225	470	700	285	175	160

605
615
625
515

EB	WB
1860	865
1990	795
2140	930
1460	640

EB	WB
1695	1660
1700	1815
1595	2150
1215	1740

1075
1030
1105
745

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
160	870	330	500	840	110	280	385	20	310
160	1055	370	500	1000	105	285	380	20	310
125	1235	305	465	1215	110	270	360	20	290
150	805	320	465	965	110	260	360	20	290

EB	WB
1355	1245
1585	1400
1665	1595
1275	1340

EB	WB
1460	1450
1650	1605
1795	1795
1350	1540

SB Tot
7335
7945
8530
7890

GP	Toll
5985	1350
6405	1540
6835	1695
6345	1545

Toll	GP
2455	8275
2470	9005
2465	8505
2455	7850

NB Tot
10730
11475
10970
10305

Gude Dr Exit			
T1	T2	T3	T4
330	270	830	665
330	265	870	665
305	240	770	630
305	260	785	615

SB Tot
8165
8815
9300
8675

GP	Toll
5985	2180
6405	2410
6835	2465
6345	2330

Toll	GP
3115	8275
3135	9005
3095	8505
3075	7850

NB Tot
11390
12140
11600
10925

660
650
735
630

SB	NB
375	385
440	465
455	545
365	465

EB	WB
1780	2215
1840	2725
2265	2670
1805	2745

EB	WB
1140	995
1095	1200
1385	1100
1110	1420

Exit 6							
R 1	R 2	R 3	R 4	R5	R 6	R 7	R8
1370	415	135	395	415	995	285	245
1650	460	165	405	450	1050	225	200
1635	460	140	440	495	1215	215	240
1480	365	100	420	440	1075	260	190

NB Ramps/Nelson St							
EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBR
115	945	960	40	230	165	35	340
180	895	1150	50	235	170	30	410
225	1185	1055	45	275	165	35	415
145	925	1370	50	270	145	35	330

SB Tot
8785
9445
10000
9380

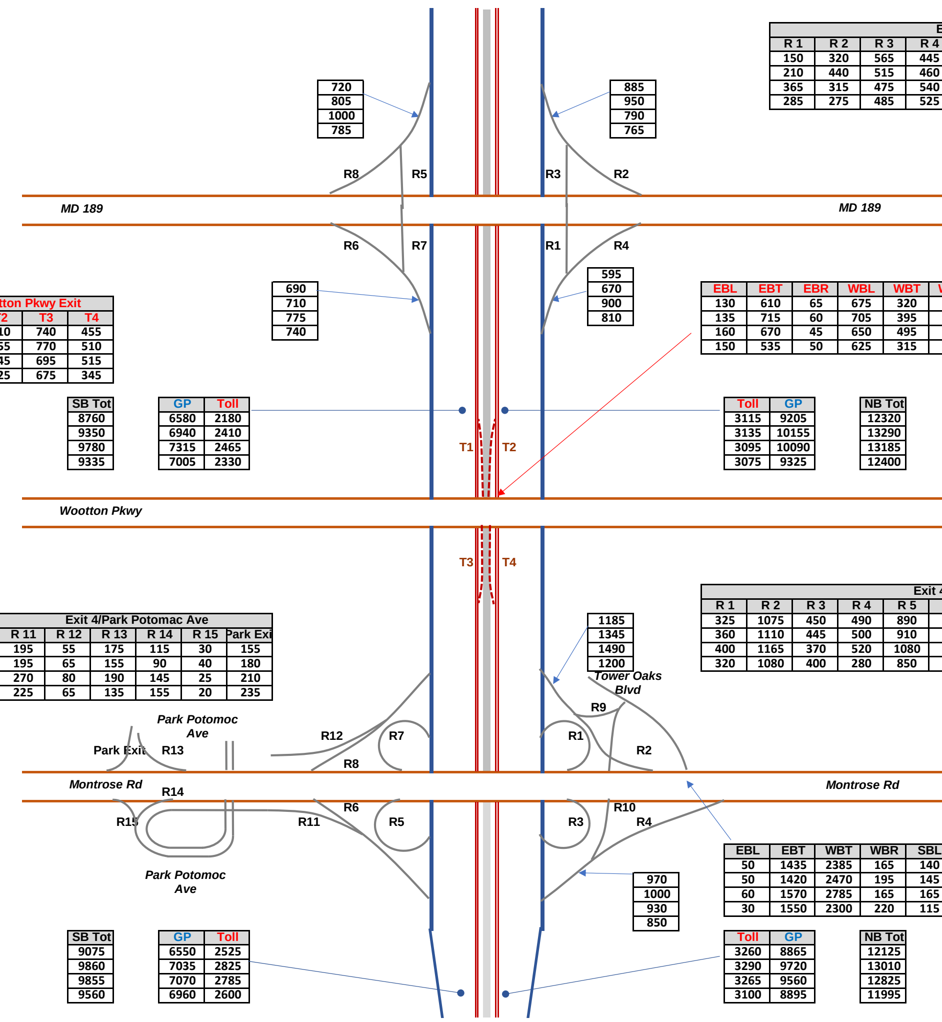
GP	Toll
6605	2180
7035	2410
7535	2465
7050	2330

Toll	GP
3115	9490
3135	10435
3095	9980
3075	9280

NB Tot
12605
13570
13075
12355

N

2045 Preferred Alternative Hourly PM Volume Diagram



720
805
1000
785

885
950
790
765

Exit 5							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
150	320	565	445	230	150	540	490
210	440	515	460	235	125	585	570
365	315	475	540	305	125	650	695
285	275	485	525	285	135	605	500

EB	WB
1140	1005
1140	1265
1080	1420
1035	1300

EB	WB
1100	1220
1195	1510
1320	1330
1220	1395

690
710
775
740

595
670
900
810

Woootton Pkwy Exit			
T1	T2	T3	T4
400	310	740	455
355	355	770	510
375	345	695	515
405	325	675	345

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
130	610	65	675	320	185	325	130	220	180
135	715	60	705	395	220	395	115	150	205
160	670	45	650	495	185	385	130	155	220
150	535	50	625	315	175	215	130	185	225

SB Tot
8760
9350
9780
9335

GP	Toll
6580	2180
6940	2410
7315	2465
7005	2330

Toll	GP
3115	9205
3135	10155
3095	10090
3075	9325

NB Tot
12320
13290
13185
12400

EB	WB
805	670
910	660
880	780
740	625

EB	WB
1110	1175
1315	1325
1275	1325
980	1110

Exit 4									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
325	1075	450	490	890	90	900	270	115	475
360	1110	445	500	910	200	975	300	235	500
400	1165	370	520	1080	155	835	340	325	410
320	1080	400	280	850	65	935	345	120	570

Exit 4/Park Potomac Ave					
R 11	R 12	R 13	R 14	R 15	Park Exi
195	55	175	115	30	155
195	65	155	90	40	180
270	80	190	145	25	210
225	65	135	155	20	235

1185
1345
1490
1200

EB	WB
1050	1370
1150	1430
955	1915
1060	1385

EB	WB
2065	2550
2065	2665
2255	2950
1950	2520

EBL	EBT	WBT	WBR	SBL	SBR
50	1435	2385	165	140	380
50	1420	2470	195	145	360
60	1570	2785	165	165	375
30	1550	2300	220	115	330

970
1000
930
850

SB Tot
9075
9860
9855
9560

GP	Toll
6550	2525
7035	2825
7070	2785
6960	2600

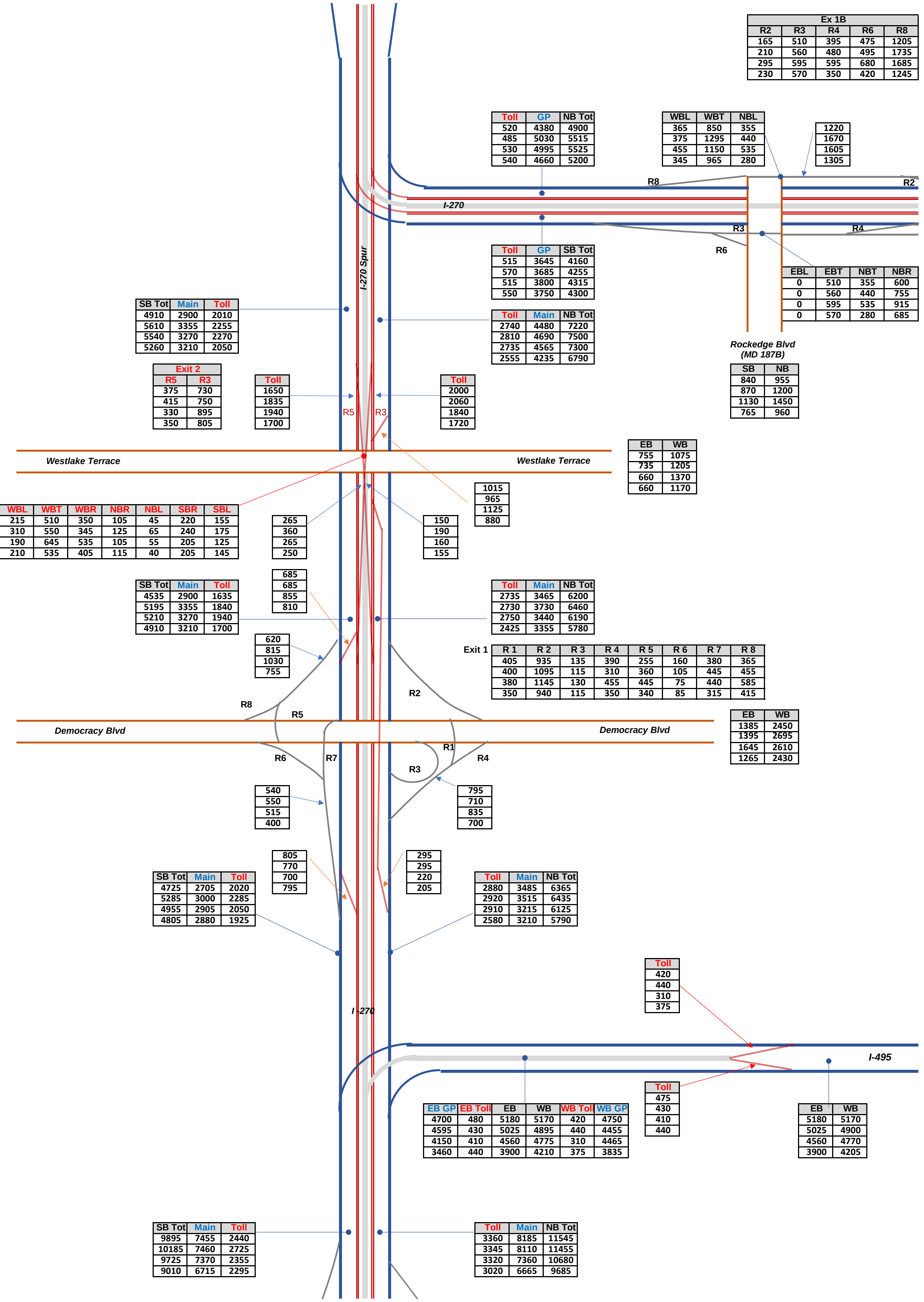
Toll	GP
3260	8865
3290	9720
3265	9560
3100	8895

NB Tot
12125
13010
12825
11995

2045 Preferred Alternative Hourly PM Volume Diagram

N

2045 Preferred Alternative Hourly PM Volume Diagram



Ex 1B				
R2	R3	R4	R6	R8
165	510	395	475	1205
210	560	480	495	1735
295	595	595	680	1685
230	570	350	420	1245

Toll	GP	NB Tot
520	4380	4900
485	5030	5515
530	4995	5525
540	4660	5200

WBL	WBT	NBL
365	850	355
375	1295	440
455	1150	535
345	965	280

1220
1670
1605
1305

Toll	GP	SB Tot
515	3645	4160
570	3685	4255
515	3800	4315
550	3750	4300

EBL	EBT	NBT	NBR
0	510	355	600
0	560	440	755
0	595	535	915
0	570	280	685

SB Tot	Main	Toll
4910	2900	2010
5610	3355	2255
5540	3270	2270
5260	3210	2050

Toll	Main	NB Tot
2740	4480	7220
2810	4690	7500
2735	4565	7300
2555	4235	6790

Rockedge Blvd (MD 187B)

SB	NB
840	955
870	1200
1130	1450
765	960

Exit 2	
R5	R3
375	730
415	750
330	895
350	805

Toll
1650
1835
1940
1700

Toll
2000
2060
1840
1720

EB	WB
925	770
890	855
865	905
840	795

EB	WB
755	1075
735	1205
660	1370
660	1170

1015
965
1125
880

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
380	495	50	215	510	350	105	45	220	155
405	440	50	310	550	345	125	65	240	175
360	430	75	190	645	535	105	55	205	125
400	400	40	210	535	405	115	40	205	145

265
360
265
250

150
190
160
155

685
685
855
810

SB Tot	Main	Toll
4535	2900	1635
5195	3355	1840
5210	3270	1940
4910	3210	1700

Toll	Main	NB Tot
2735	3465	6200
2730	3730	6460
2750	3440	6190
2425	3355	5780

620
815
1030
755

Exit 1

R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
405	935	135	390	255	160	380	365
400	1095	115	310	360	105	445	455
380	1145	130	455	445	75	440	585
350	940	115	350	340	85	315	415

EB	WB
1035	1905
945	2005
955	1990
775	1945

EB	WB
1385	2450
1395	2695
1645	2610
1265	2430

540
550
515
400

795
710
835
700

805
770
700
795

295
295
220
205

SB Tot	Main	Toll
4725	2705	2020
5285	3000	2285
4955	2905	2050
4805	2880	1925

Toll	Main	NB Tot
2880	3485	6365
2920	3515	6435
2910	3215	6125
2580	3210	5790

Toll
420
440
310
375

Toll
475
430
410
440

EB GP	EB Toll	EB	WB	WB Toll	WB GP
4700	480	5180	5170	420	4750
4595	430	5025	4895	440	4455
4150	410	4560	4775	310	4465
3460	440	3900	4210	375	3835

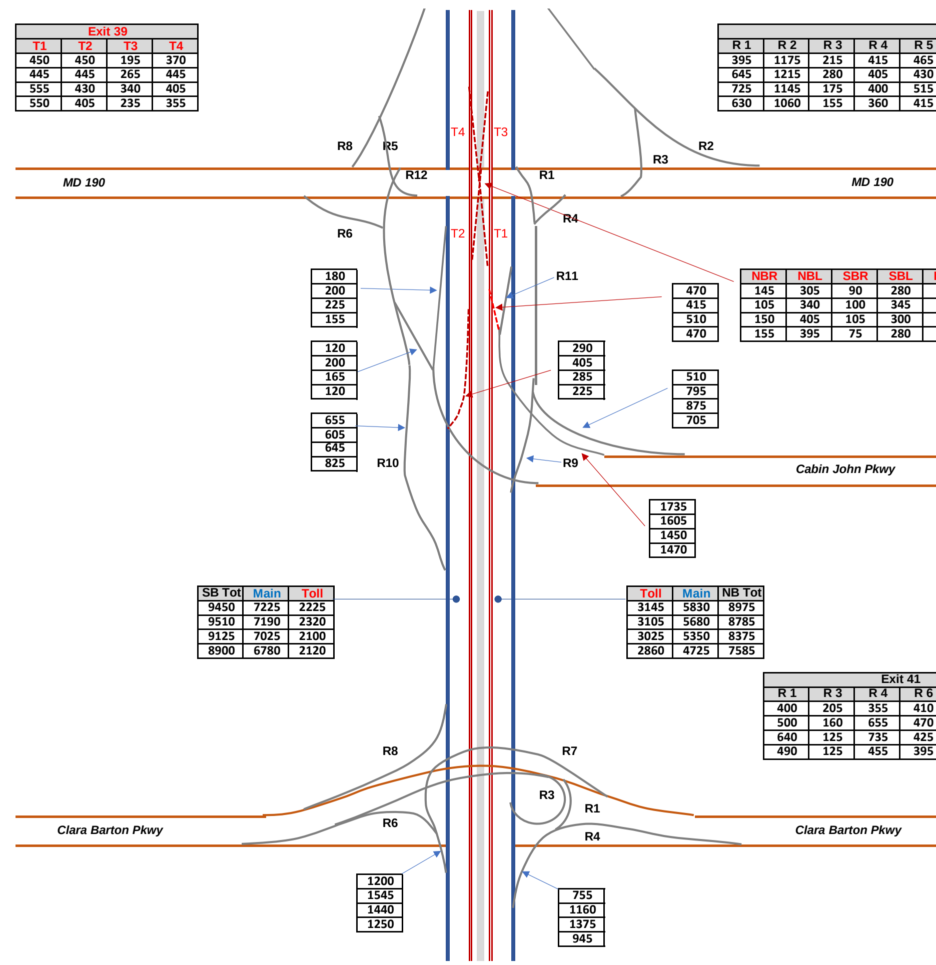
EB	WB
5180	5170
5025	4900
4560	4770
3900	4205

SB Tot	Main	Toll
9895	7455	2440
10185	7460	2725
9725	7370	2355
9010	6715	2295

Toll	Main	NB Tot
3360	8185	11545
3345	8110	11455
3320	7360	10680
3020	6665	9685

2045 Preferred Alternative Hourly PM Volume Diagram

2045 Preferred Alternative Hourly PM Volume Diagram



Exit 39			
T1	T2	T3	T4
450	450	195	370
445	445	265	445
555	430	340	405
550	405	235	355

Exit 39										
R 1	R 2	R 3	R 4	R 5	R 6	R 8	R 9	R 10	R 11	R 12
395	1175	215	415	465	265	240	300	655	1265	510
645	1215	280	405	430	310	245	260	605	1190	495
725	1145	175	400	515	330	240	250	645	940	475
630	1060	155	360	415	305	185	270	825	1000	635

EB	WB
1480	1710
1605	1980
1645	2360
1385	1995

EB	WB
1980	2670
1895	2665
2010	2775
1780	2690

NBR	NBL	SBR	SBL	EBR	EBT	EBL	WBR	WBL	WBT
145	305	90	280	165	1350	170	25	285	1575
105	340	100	345	170	1320	240	25	275	1790
150	405	105	300	180	1340	315	25	250	2085
155	395	75	280	135	1135	220	15	270	1975

180
200
225
155

470
415
510
470

120
200
165
120

290
405
285
225

510
795
875
705

655
605
645
825

EB	WB
590	2245
805	2400
685	2325
500	2175

1735
1605
1450
1470

SB Tot	Main	Toll
9450	7225	2225
9510	7190	2320
9125	7025	2100
8900	6780	2120

Toll	Main	NB Tot
3145	5830	8975
3105	5680	8785
3025	5350	8375
2860	4725	7585

Exit 41					
R 1	R 3	R 4	R 6	R 7	R 8
400	205	355	410	790	85
500	160	655	470	1075	70
640	125	735	425	1010	60
490	125	455	395	855	90

EB	WB
870	750
765	985
555	1110
775	855

EB	WB
610	1060
785	1490
740	1420
710	1130

1200
1545
1440
1250

755
1160
1375
945

2045 Preferred Alternative Hourly PM Volume Diagram

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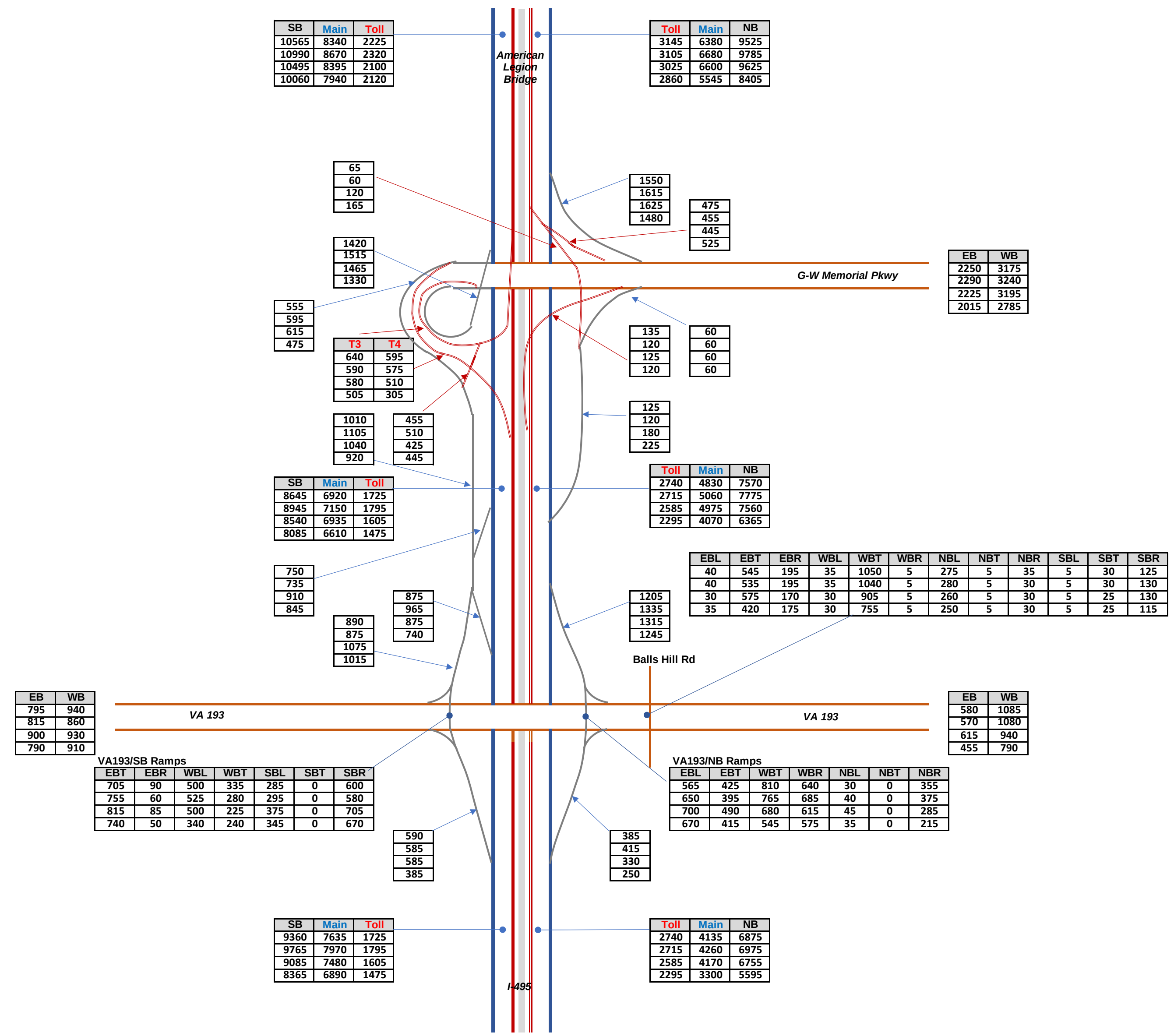
2045 Preferred Alternative Hourly PM Volume Diagram



SB	Main	Toll
10565	8340	2225
10990	8670	2320
10495	8395	2100
10060	7940	2120

Toll	Main	NB
3145	6380	9525
3105	6680	9785
3025	6600	9625
2860	5545	8405

65
60
120
165

1550
1615
1625
1480

475
455
445
525

1420
1515
1465
1330

EB	WB
2250	3175
2290	3240
2225	3195
2015	2785

555
595
615
475

T3	T4
640	595
590	575
580	510
505	305

135
120
125
120

60
60
60
60

125
120
180
225

1010
1105
1040
920

455
510
425
445

SB	Main	Toll
8645	6920	1725
8945	7150	1795
8540	6935	1605
8085	6610	1475

Toll	Main	NB
2740	4830	7570
2715	5060	7775
2585	4975	7560
2295	4070	6365

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
40	545	195	35	1050	5	275	5	35	5	30	125
40	535	195	35	1040	5	280	5	30	5	30	130
30	575	170	30	905	5	260	5	30	5	25	130
35	420	175	30	755	5	250	5	30	5	25	115

750
735
910
845

875
965
875
740

890
875
1075
1015

1205
1335
1315
1245

EB	WB
795	940
815	860
900	930
790	910

EB	WB
580	1085
570	1080
615	940
455	790

VA193/SB Ramps

EBT	EBR	WBL	WBT	SBL	SBT	SBR
705	90	500	335	285	0	600
755	60	525	280	295	0	580
815	85	500	225	375	0	705
740	50	340	240	345	0	670

VA193/NB Ramps

EBL	EBT	WBT	WBR	NBL	NBT	NBR
565	425	810	640	30	0	355
650	395	765	685	40	0	375
700	490	680	615	45	0	285
670	415	545	575	35	0	215

590
585
585
385

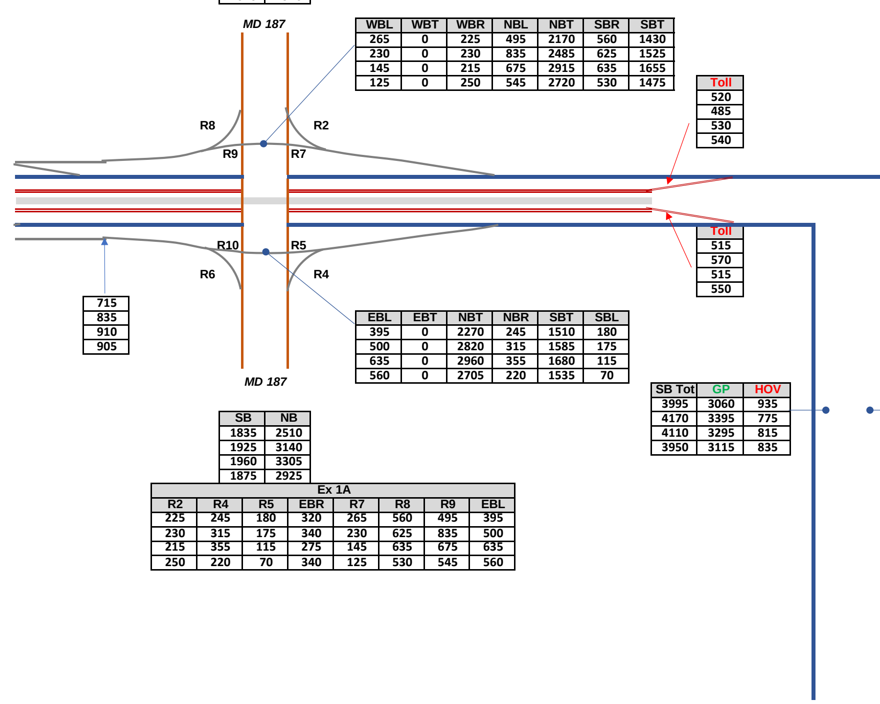
385
415
330
250

SB	Main	Toll
9360	7635	1725
9765	7970	1795
9085	7480	1605
8365	6890	1475

Toll	Main	NB
2740	4135	6875
2715	4260	6975
2585	4170	6755
2295	3300	5595

2045 Preferred Alternative Hourly PM Volume Diagram

2045 Preferred Alternative Hourly PM Volume Diagram



SB	NB
1990	2395
2150	2710
2290	3130
2010	2970

WBL	WBT	WBR	NBL	NBT	SBR	SBT
265	0	225	495	2170	560	1430
230	0	230	835	2485	625	1525
145	0	215	675	2915	635	1655
125	0	250	545	2720	530	1475

Toll
520
485
530
540

Toll
515
570
515
550

715
835
910
905

EBL	EBT	NBT	NBR	SBT	SBL
395	0	2270	245	1510	180
500	0	2820	315	1585	175
635	0	2960	355	1680	115
560	0	2705	220	1535	70

SB Tot	GP	HOV
3995	3060	935
4170	3395	775
4110	3295	815
3950	3115	835

HOV	GP	NB Tot
1230	3120	4350
1055	3390	4445
1030	3460	4490
1075	3500	4575

SB	NB
1835	2510
1925	3140
1960	3305
1875	2925

Ex 1A							
R2	R4	R5	EBR	R7	R8	R9	EBL
225	245	180	320	265	560	495	395
230	315	175	340	230	625	835	500
215	355	115	275	145	635	675	635
250	220	70	340	125	530	545	560

2045 Preferred Alternative Hourly PM Volume Diagram

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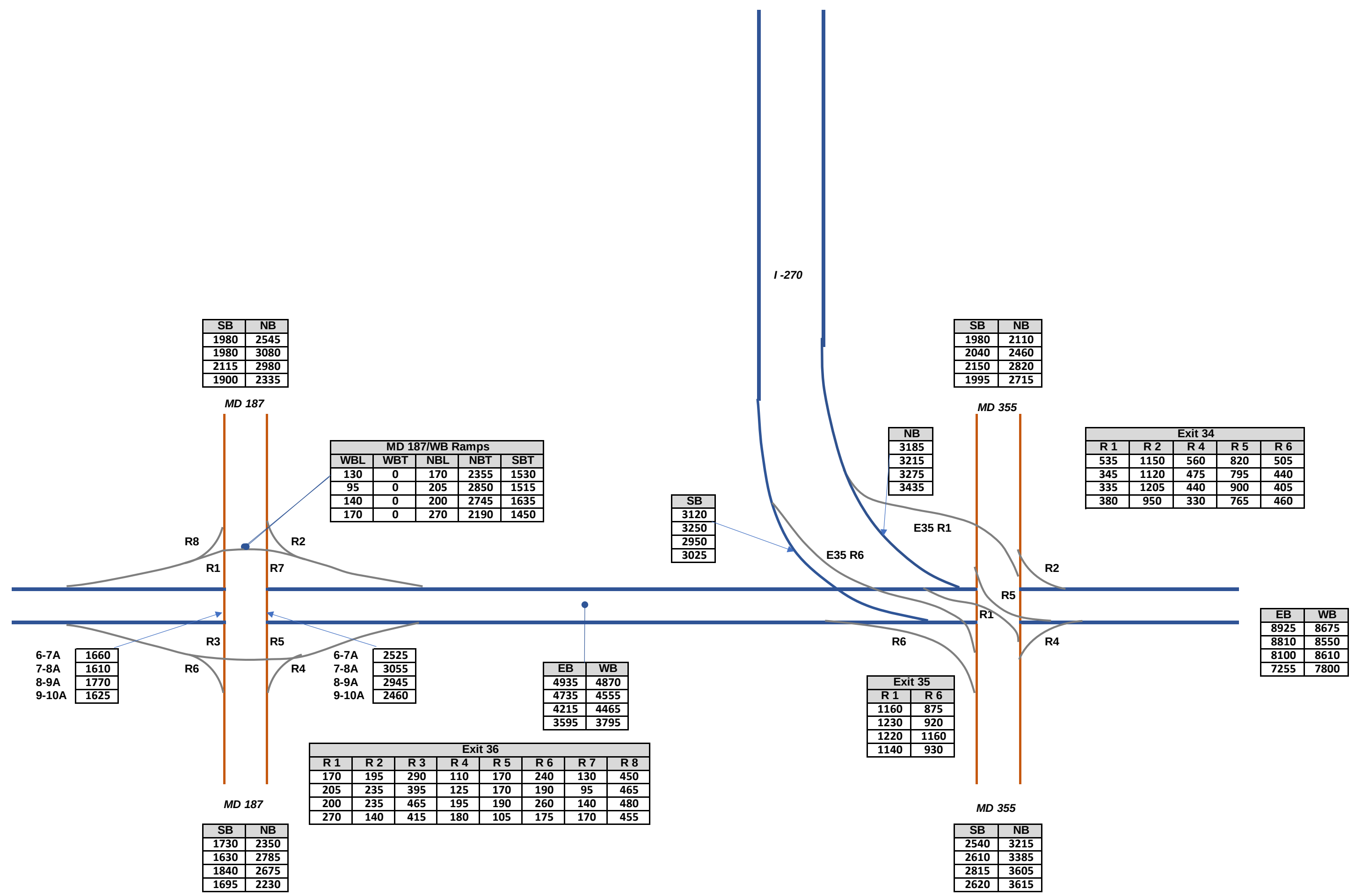
2045 Preferred Alternative Hourly PM Volume Diagram



MD 187 (north)

SB	NB
1980	2545
1980	3080
2115	2980
1900	2335

MD 187/WB Ramps				
WBL	WBT	NBL	NBT	SBT
130	0	170	2355	1530
95	0	205	2850	1515
140	0	200	2745	1635
170	0	270	2190	1450

6-7A	1660
7-8A	1610
8-9A	1770
9-10A	1625

6-7A	2525
7-8A	3055
8-9A	2945
9-10A	2460

EB	WB
4935	4870
4735	4555
4215	4465
3595	3795

Exit 36							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
170	195	290	110	170	240	130	450
205	235	395	125	170	190	95	465
200	235	465	195	190	260	140	480
270	140	415	180	105	175	170	455

MD 187 (south)

SB	NB
1730	2350
1630	2785
1840	2675
1695	2230

SB
3120
3250
2950
3025

NB
3185
3215
3275
3435

MD 355 (north)

SB	NB
1980	2110
2040	2460
2150	2820
1995	2715

Exit 34				
R 1	R 2	R 4	R 5	R 6
535	1150	560	820	505
345	1120	475	795	440
335	1205	440	900	405
380	950	330	765	460

EB	WB
8925	8675
8810	8550
8100	8610
7255	7800

Exit 35	
R 1	R 6
1160	875
1230	920
1220	1160
1140	930

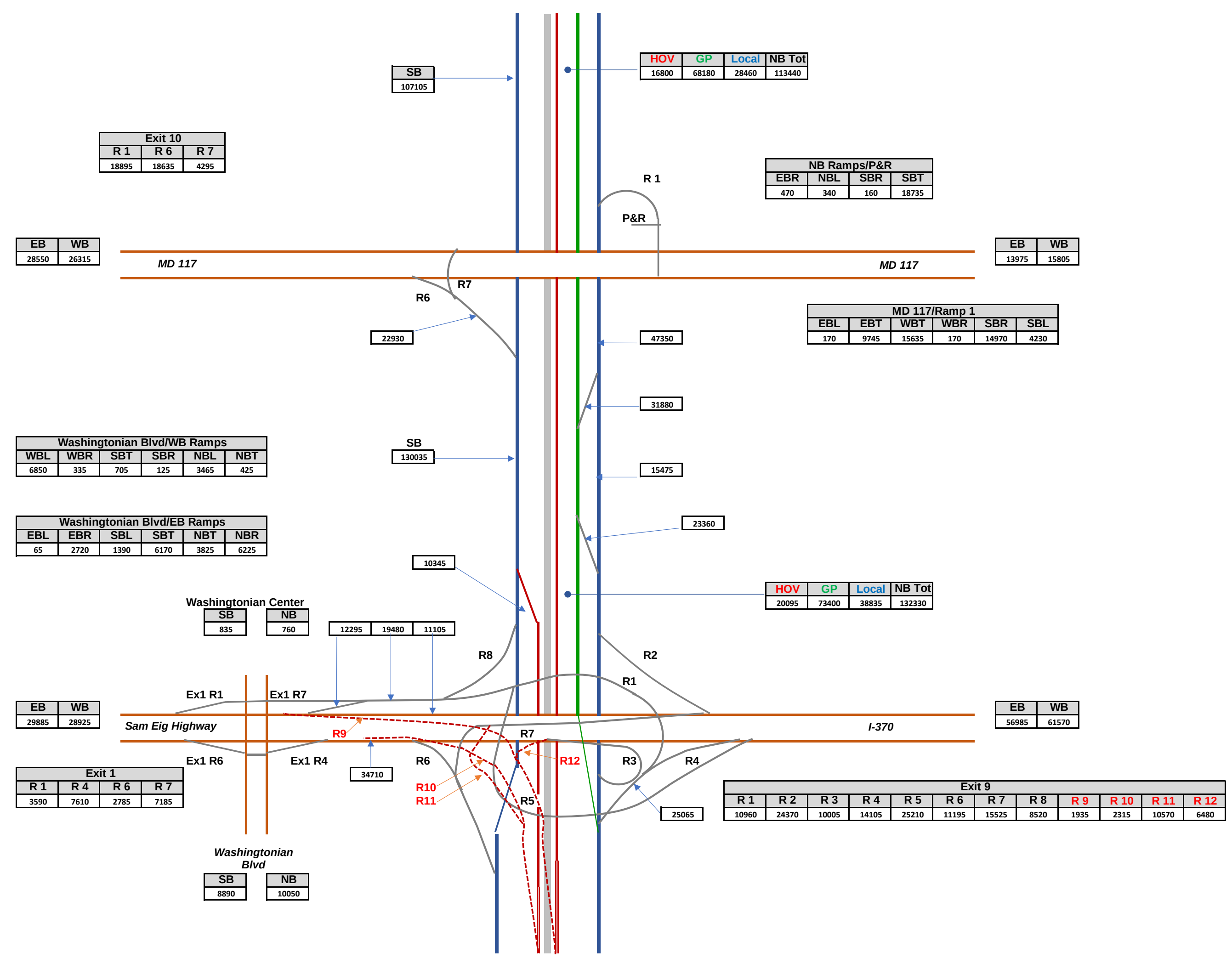
MD 355 (south)

SB	NB
2540	3215
2610	3385
2815	3605
2620	3615

2045 Preferred Alternative Hourly PM Volume Diagram

N

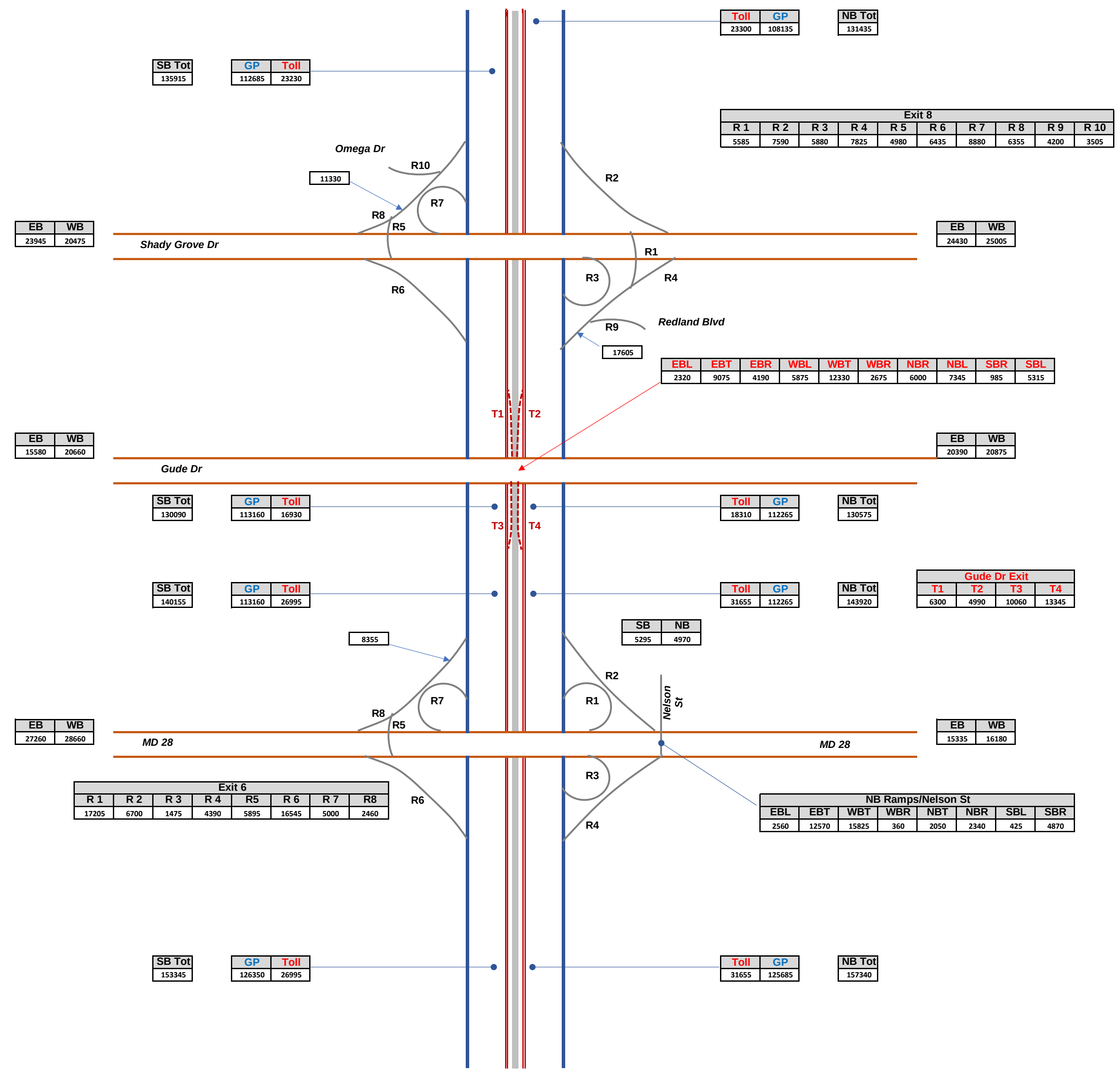
2045 Preferred Alternative ADT Volume Diagram



2045 Preferred Alternative ADT Volume Diagram

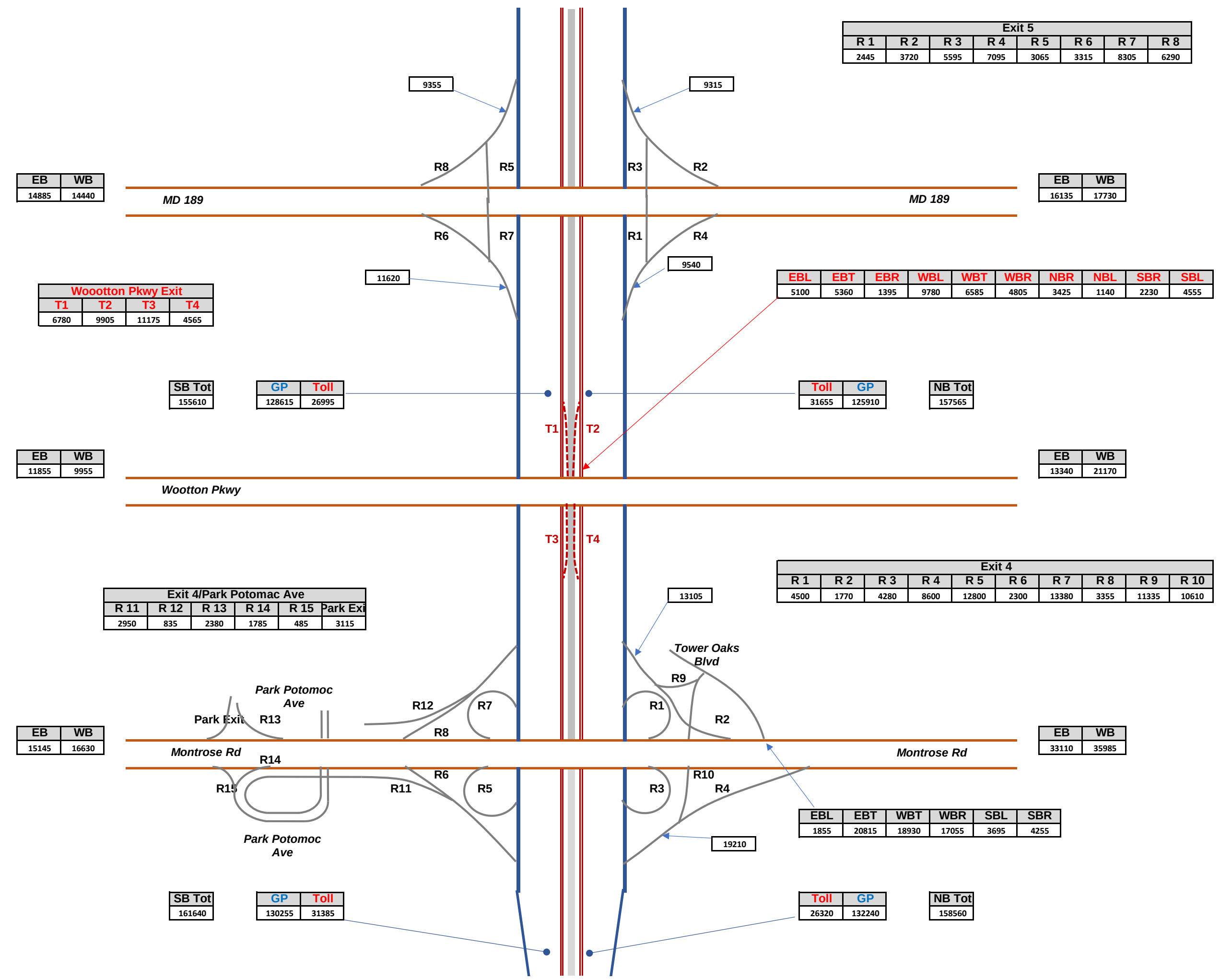
N

2045 Preferred Alternative ADT Volume Diagram



2045 Preferred Alternative ADT Volume Diagram

2045 Preferred Alternative ADT Volume Diagram



Exit 5							
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
2445	3720	5595	7095	3065	3315	8305	6290

EB	WB
14885	14440

EB	WB
16135	17730

Woootton Pkwy Exit			
T1	T2	T3	T4
6780	9905	11175	4565

EBL	EBT	EBR	WBL	WBT	WBR	NBR	NBL	SBR	SBL
5100	5360	1395	9780	6585	4805	3425	1140	2230	4555

SB Tot
155610

GP	Toll
128615	26995

Toll	GP
31655	125910

NB Tot
157565

EB	WB
11855	9955

EB	WB
13340	21170

Exit 4									
R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10
4500	1770	4280	8600	12800	2300	13380	3355	11335	10610

Exit 4/Park Potomac Ave					
R 11	R 12	R 13	R 14	R 15	Park Exi
2950	835	2380	1785	485	3115

EB	WB
15145	16630

EB	WB
33110	35985

EBL	EBT	WBT	WBR	SBL	SBR
1855	20815	18930	17055	3695	4255

SB Tot
161640

GP	Toll
130255	31385

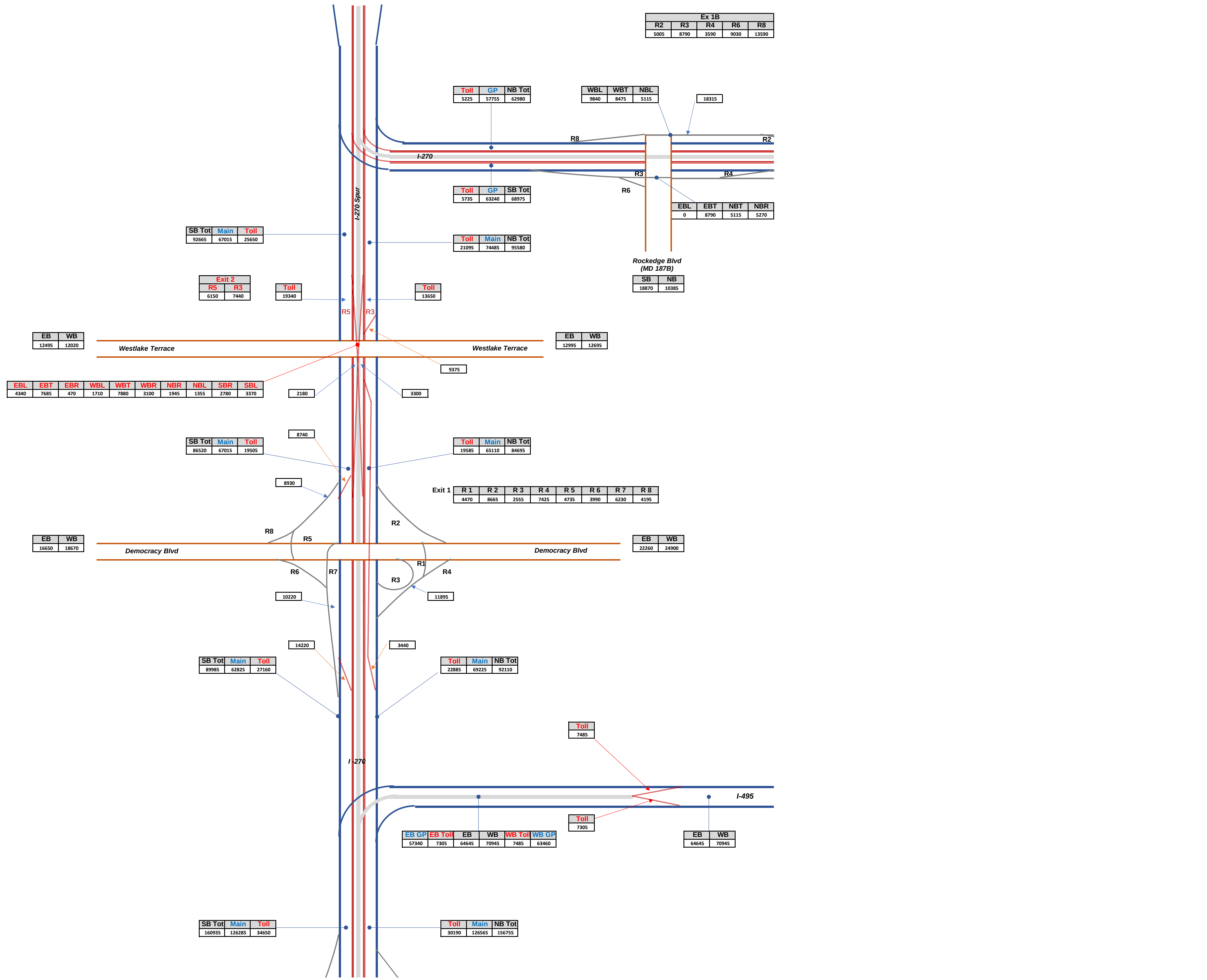
Toll	GP
26320	132240

NB Tot
158560

2045 Preferred Alternative ADT Volume Diagram

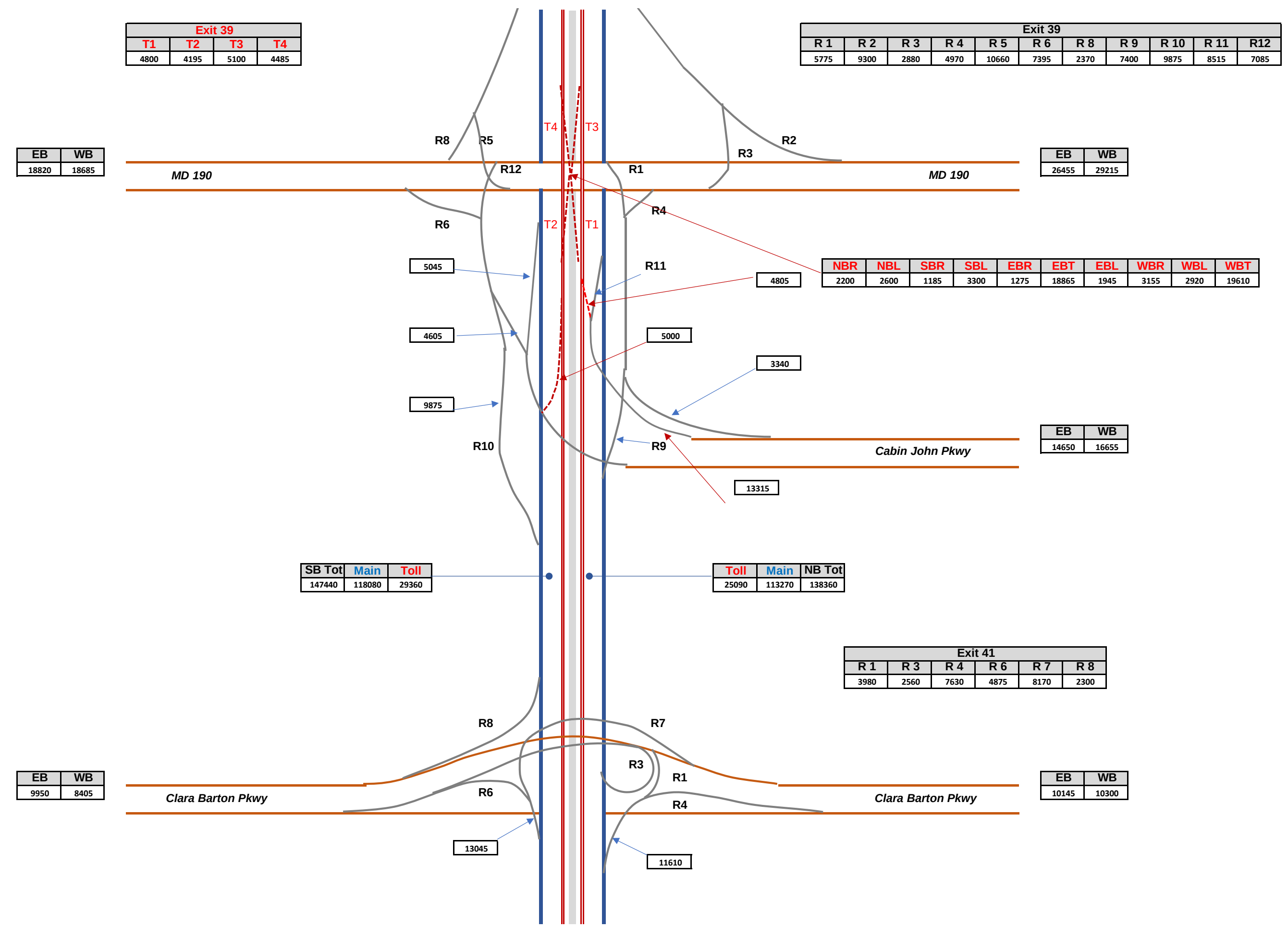
N

2045 Preferred Alternative ADT Volume Diagram



2045 Preferred Alternative ADT Volume Diagram

2045 Preferred Alternative ADT Volume Diagram



Exit 39			
T1	T2	T3	T4
4800	4195	5100	4485

Exit 39										
R 1	R 2	R 3	R 4	R 5	R 6	R 8	R 9	R 10	R 11	R12
5775	9300	2880	4970	10660	7395	2370	7400	9875	8515	7085

EB	WB
18820	18685

EB	WB
26455	29215

NBR	NBL	SBR	SBL	EBR	EBT	EBL	WBR	WBL	WBT
2200	2600	1185	3300	1275	18865	1945	3155	2920	19610

EB	WB
14650	16655

SB Tot	Main	Toll
147440	118080	29360

Toll	Main	NB Tot
25090	113270	138360

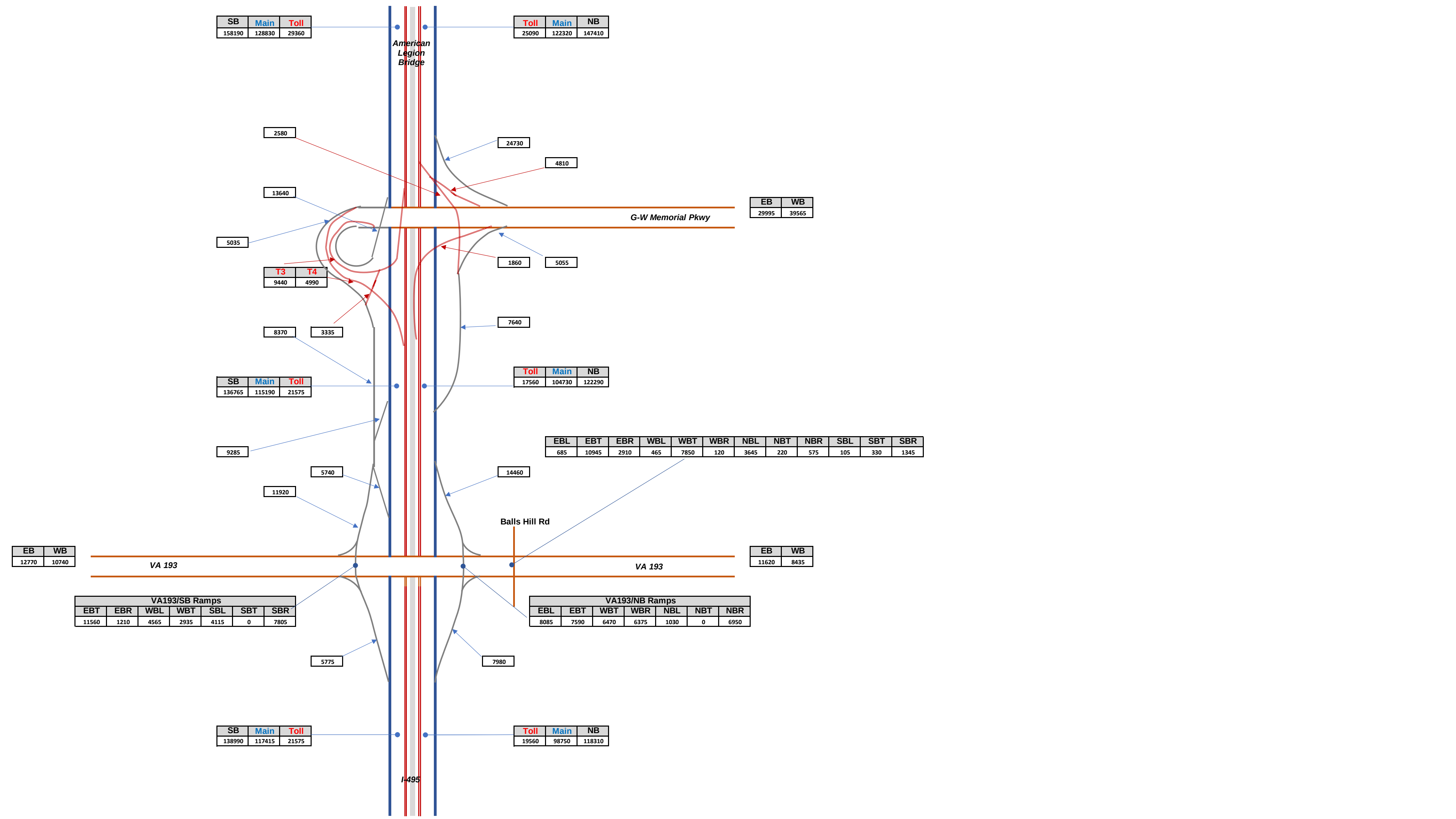
Exit 41					
R 1	R 3	R 4	R 6	R 7	R 8
3980	2560	7630	4875	8170	2300

EB	WB
9950	8405

EB	WB
10145	10300

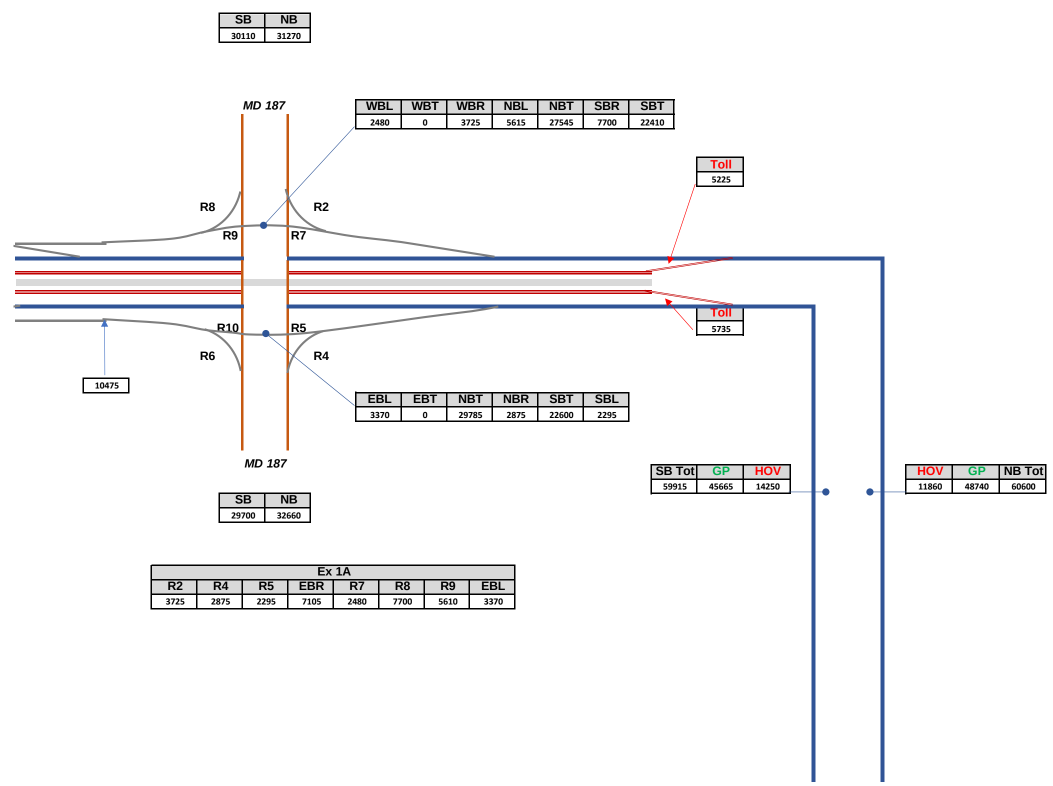
2045 Preferred Alternative ADT Volume Diagram

2045 Preferred Alternative ADT Volume Diagram



2045 Preferred Alternative ADT Volume Diagram

2045 Preferred Alternative ADT Volume Diagram



2045 Preferred Alternative ADT Volume Diagram

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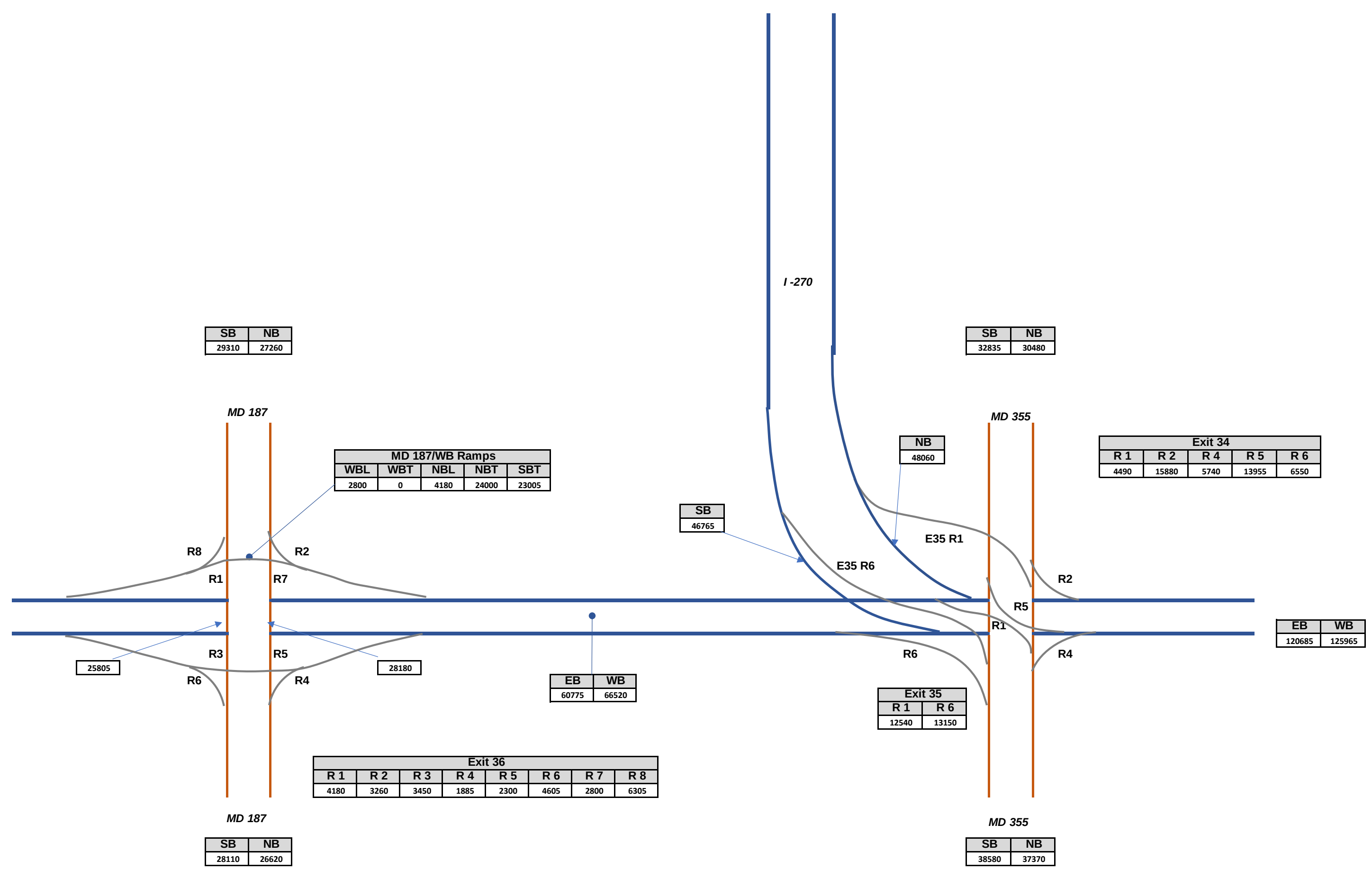
2045 Preferred Alternative ADT Volume Diagram



2045 Preferred Alternative ADT Volume Diagram

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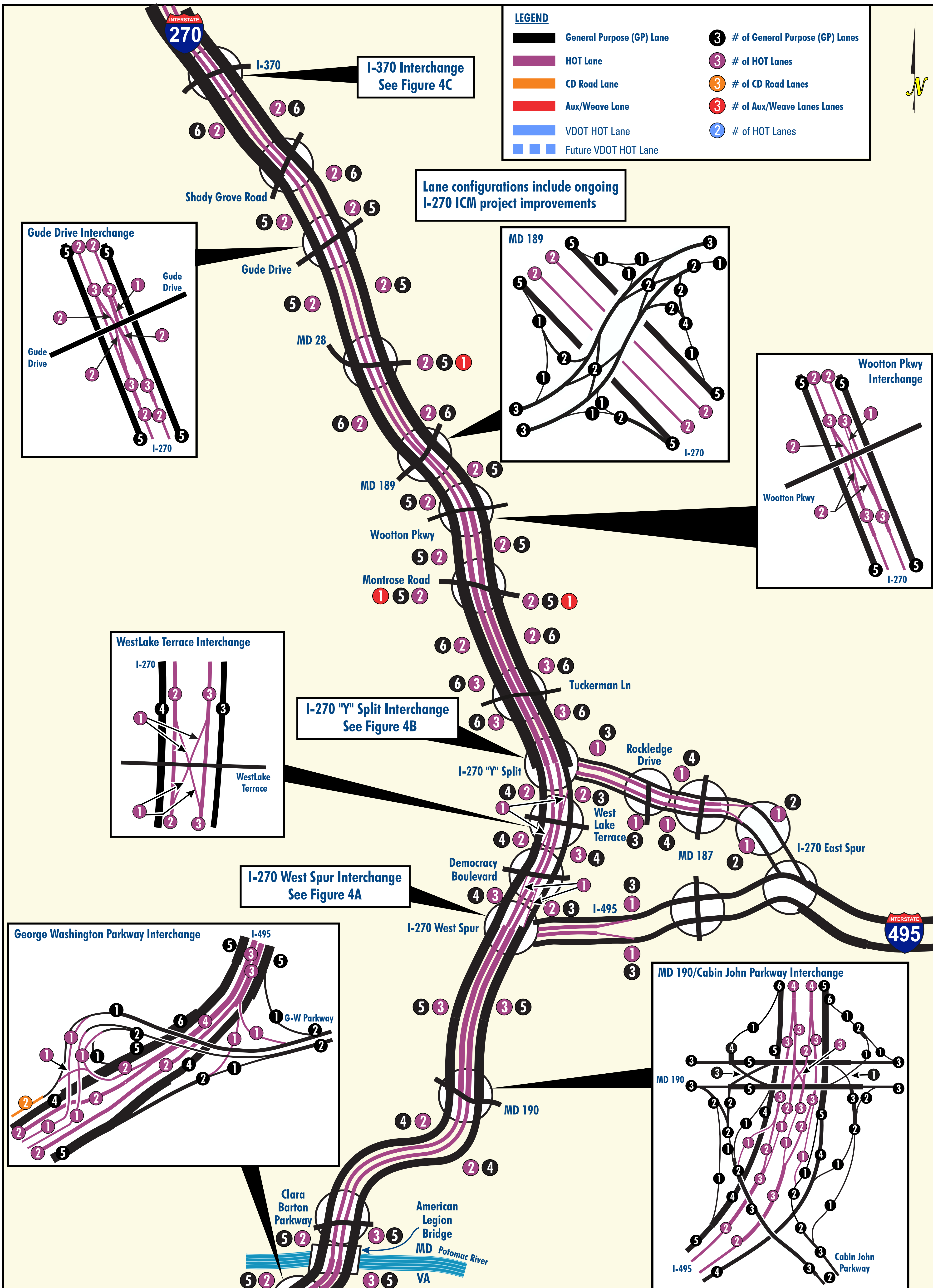
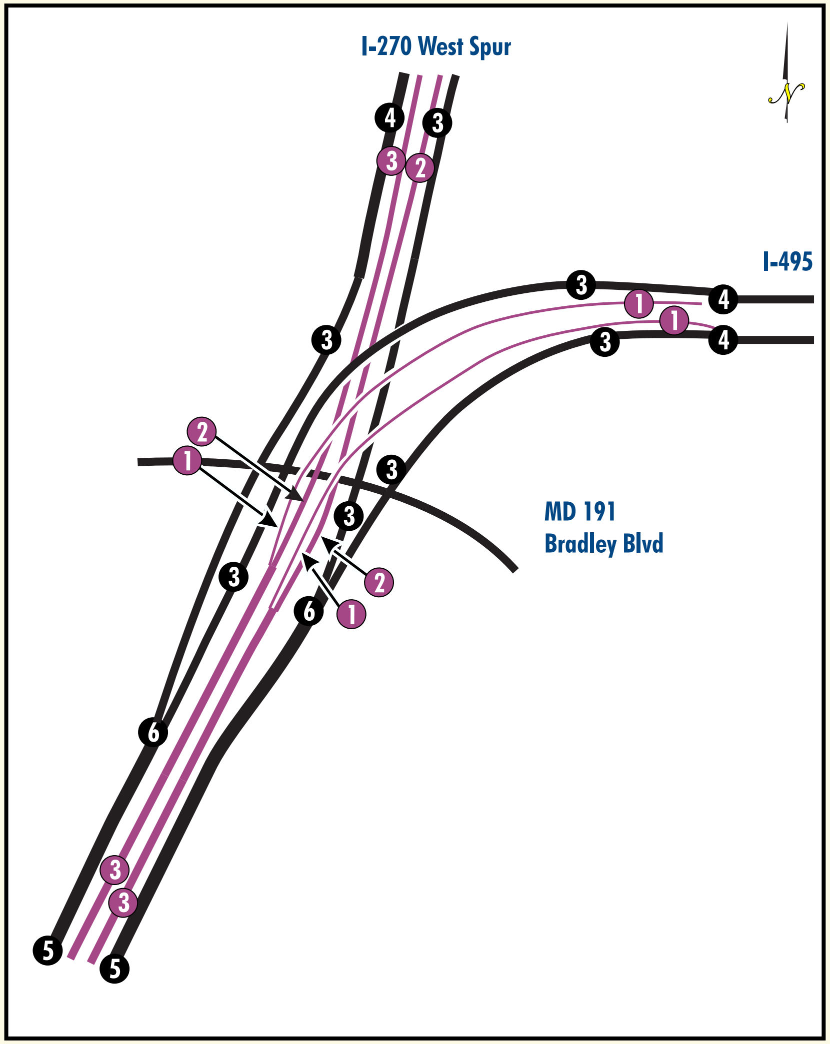
Appendix C
Preferred Alternative Lane Diagrams



I-495/I-270 MANAGED LANES STUDY

Alternative 9 Proposed Lane Configuration
Add 4 HOT Managed (PM) Lanes
I-495 from SR 193 to I-270 at I-370

Date:	Figure:
May 2022	4



LEGEND

	General Purpose (GP) Lane	3	# of General Purpose (GP) Lanes
	HOT Lane	3	# of HOT Lanes

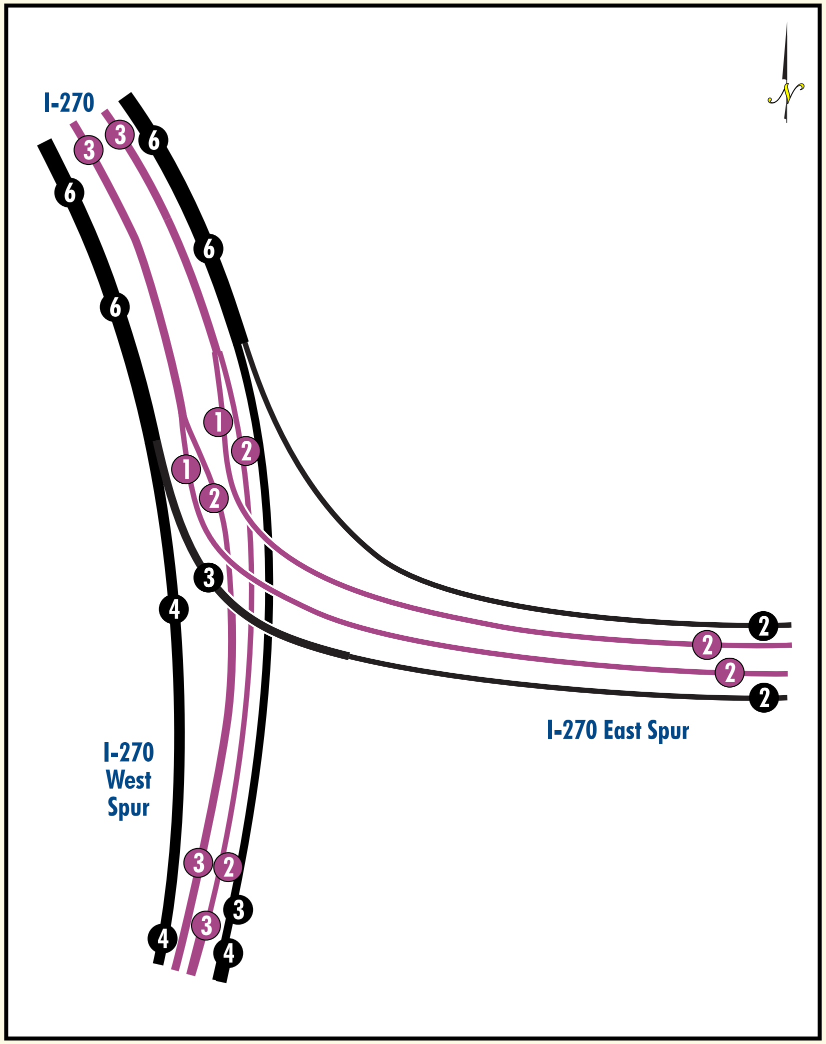
OP·LANES MARYLAND

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION

I-495/I-270 MANAGED LANES STUDY

Alternative 9
Proposed Lane Configuration Options
I-270 West Spur Interchange

Date:	Figure:
January 2022	4A



LEGEND

General Purpose (GP) Lane	3 # of General Purpose (GP) Lanes
HOT Lane	3 # of HOT Lanes

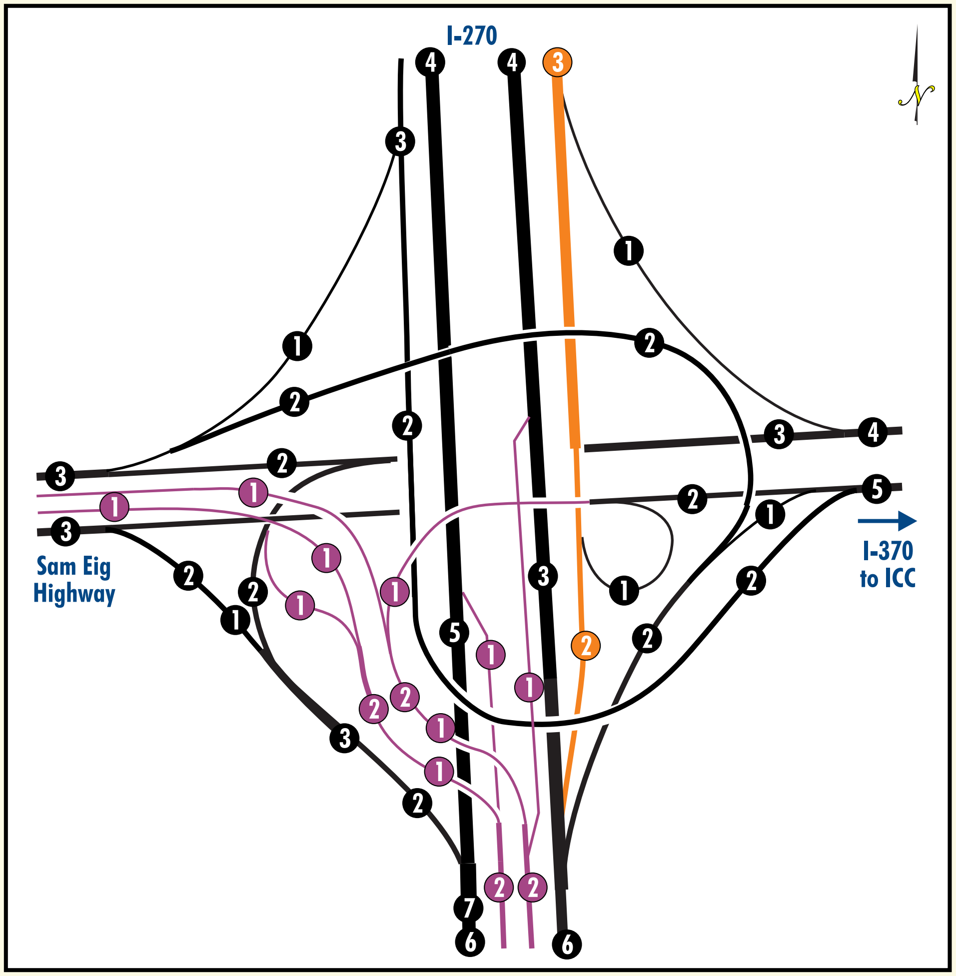
OP•LANES MARYLAND

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION

I-495/I-270 MANAGED LANES STUDY

Alternative 9
Proposed Lane Configuration Options
I-270 "Y" Split Interchange

Date:	Figure:
January 2022	4B



LEGEND

General Purpose (GP) Lane — # of General Purpose (GP) Lanes

HOT Lane — # of HOT Lanes

CD Road Lane — # of CD Road Lanes

HOV Lane — # of HOV Lanes

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I-495/I-270 MANAGED LANES STUDY

Alternative 9
Proposed Lane Configuration Options
I-270 at I-370 Interchange

Date:	Figure:
January 2022	4C

Appendix D

Design Criteria Documents

Road-way	From	To	Func-tional Classif-ication	Access Control	Terrain	Min. Design Speed (MPH)	Design Vehicle	Min. Cross Slope	Max. Grade	Max Super	Lane Width	Shoulder Width (See Notes 1 & 2) Left	Right
I-495	George Washing-ton Memorial Parkway	I-270 West Spur	Urban Interstate	Yes	Rolling	60	WB-67	2%	4%	6%	12 feet	10 feet	10 feet
I-495 HOT Lanes	George Washing-ton Memorial Parkway	I-270 West Spur	Urban Interstate	Yes	Rolling	60	WB-67	2%	4%	6%	12 feet	10 feet	4 feet
I-270	I-270 West Spur	I-370	Urban Interstate	Yes	Rolling	60	WB-67	2%	4%	6%	12 feet	10 feet	10 feet
I-270 HOT Lanes	I-495	I-370	Urban Interstate	Yes	Rolling	60	WB-67	2%	4%	6%	12 feet	10 feet	4 feet
I-270 West Spur	I-495	I-270	Urban Interstate	Yes	Rolling	60	WB-67	2%	4%	6%	12 feet	10 feet	10 feet
I-270 East Spur	I-270	I-495	Urban Interstate	Yes	Rolling	60	WB-67	2%	4%	6%	12 feet	10 feet	10 feet
I-370	West Access Ramps	I-270	Urban Interstate	Yes	Rolling	55	WB-67	2%	5%	4%	12 feet	Curb & Gutter	Curb & Gutter
I-370	East Access Ramps	I-270	Urban Interstate	Yes	Rolling	60	WB-67	2%	4%	6%	12 feet	6 feet	10 feet
Clara Barton Parkway	North Access Ramps	South Access Ramps	Principal Arterial/ Parkway	Yes	Rolling	55	Bus-40	2%	6%	6%	12 feet	1 foot with Curb	1 foot with Curb
Cabin John Parkway	North Access Ramps	South Access Ramps	Principal Arterial/ Parkway	Yes	Rolling	60	Bus-40	2%	4%	6%	12 feet	4 feet	12 feet

Road-way	From	To	Func-tional Classif-ication	Access Control	Terrain	Min. Design Speed (MPH)	Design Vehicle	Min. Cross Slope	Max. Grade	Max Super	Lane Width	Shoulder Width (See Notes 1 & 2) Left	Right
Demo-cracy Boule-vard	West Access Ramps	I-270	Minor Arterial	Yes	Rolling	40	WB-62	2%	8%	4%	11 feet	Curb & Gutter	Curb
Demo-cracy Boule-vard	East Access Ramps	I-270	Principal Arterial (Other)	Yes	Rolling	40	WB-62	2%	8%	4%	11 feet	Curb & Gutter	Curb
Mon-trose Road	West Access Ramps	I-270	Minor Arterial	Yes	Rolling	45	WB-62	2%	7%	4%	11 feet	Curb & Gutter	Curb
Mon-trose Road	East Access Ramps	I-270	Principal Arterial (Other)	Yes	Rolling	45	WB-62	2%	7%	4%	11 feet	Curb & Gutter	Curb
MD 189 Falls Road	West Access Ramps	I-270	Minor Arterial	Yes	Rolling	40	WB-62	2%	8%	4%	12 feet	Curb & Gutter	4 feet with Curb & Gutter
MD 189 Falls Road	East Access Ramps	I-270	Minor Arterial	Yes	Rolling	40	WB-62	2%	8%	4%	12 feet	Curb & Gutter	Curb & Gutter
MD 28 Mont-gomery Avenue	West Access Ramps	East Access Ramps	Urban Principal Arterial (Other)	Yes	Rolling	35	WB-62	2%	8%	4%	12 feet	Curb & Gutter	Curb & Gutter
Shady Grove Road	West Access Ramps	I-270	Urban Principal Arterial (Other)	Yes	Rolling	45	WB-62	2%	7%	4%	11 feet	Curb & Gutter	Curb
Shady Grove Road	East Access Ramps	I-270	Principal Arterial (Other)	Yes	Rolling	45	WB-62	2%	7%	4%	11 feet	Curb & Gutter	Curb

Apppendix D: Geometric Design Criteria (Page 3 of 3)

Road-way	From	To	Func-tional Classif-ication	Access Control	Terrain	Min. Design Speed (MPH)	Design Vehicle	Min. Cross Slope	Max. Grade	Max Super	Lane Width	Shoulder Width (See Notes 1 & 2)	
												Left	Right
West-lake Terrace	Overpass	Over-pass	Business B-3 B-3	No	Rolling	35	WB-62	2%	8%	4%	11 feet	Curb & Gutter	Curb
Wooton Parkway	Overpass	Over-pass	Arterial	No	Rolling	45	WB-62	2%	7%	4%	12 feet	Curb & Gutter	Curb & Gutter
West Gude Drive	Overpass	Over-pass	Minor Arterial	No	Rolling	40	WB-62	2%	8%	4%	12 feet	Curb & Gutter	Curb & Gutter

Ramp Design Criteria

Ramp Type	Functional Classification	Access Control	Terrain	Min. Design Speed (MPH)	Design Vehicle	Min. Cross Slope	Max. Grade	Max Super	Lane Width	Shoulder Width	
										Left	Right
Loop Ramp	Urban Interstate	Yes	Rolling	20	WB-67	2%	7%	8%	See Note 2 below tables	See Note 2 below tables	See Note 2 below tables
Directional Ramp	Urban Interstate	Yes	Rolling	30	WB-67	2%	7%	8%	See Note 2 below tables	See Note 2 below tables	See Note 2 below tables

Notes for geometric design criteria tables:

1. Where GPLs and PMLs are adjacent, they may be separated with a 4-foot-wide buffer with pylons or similar separator in lieu of providing a 12-foot shoulder on the left of the GPLs.

2. Ramp lane widths and shoulder widths shall be designed in accordance with AASHTO, *A Policy on Geometric Design of Highways and Streets*.

3. Bridge vertical clearances shall be designed in accordance with MDOT or VDOT guidelines based on the location of the structure.

Appendix E

Design Exceptions

(Under Development)