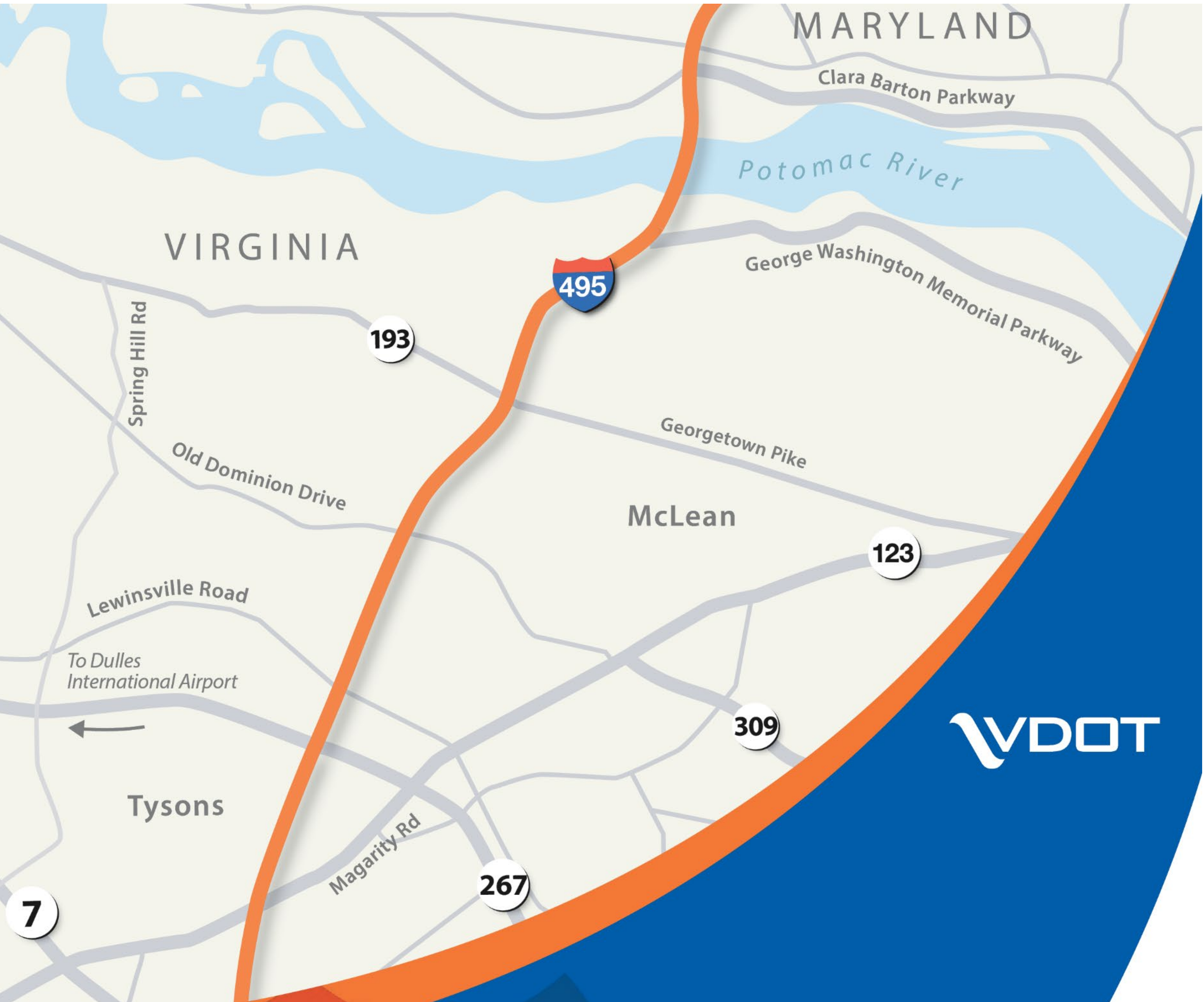


VDOT

I-495 Express Lanes Northern Extension (NEXT) Interchange Justification Report

April 2021

495 ExpressLanes NORTHERN EXTENSION

I-495 EXPRESS LANES NORTHERN EXTENSION (NEXT)

Commonwealth of Virginia

Virginia State Project Number 0495-029-419
UPC # 113414

Interchange Justification Report

Interstate Project

This document has been prepared and submitted pursuant to 23 U.S.C. 111 to obtain FHWA approval to add new access ramps/modify existing interchange ramps on a fully-controlled interstate highway.

Submitted April 2021 to:

United States Department of Transportation

Federal Highway Administration

Submitted by:

VDOT Virginia Department of Transportation

The request for reconfiguration of the interstate access points is approved for a Finding of Engineering and Operational Acceptability. This approval is conditional upon compliance with applicable federal requirements, specifically with the National Environmental Policy Act (NEPA). Completion of the NEPA process is considered acceptance of the general project location and concepts denoted in the environmental documentation.

THOMAS L NELSON JR — Digitally signed by THOMAS L NELSON JR Date: 2021.06.14 11:13:19 -04'00'	Susan H Keen 2021.06.11 15:58:14-04'00'
Thomas L Nelson, Jr., PE Division Administrator Federal Highway Administration, Virginia Division	Susan Keen, PE State Location and Design Engineer Virginia Department of Transportation
Date of Approval	Date of Approval

I-495 EXPRESS LANES NORTHERN EXTENSION (NEXT)

Commonwealth of Virginia

VIRGINIA MEGAPROJECTS

Interchange Justification Report

This document has been prepared to satisfy the requirements set forth by Federal and State Policy for changes in interstate access. It is consistent with the Virginia Department of Transportation's Location and Design Division Instructional and Informational Memorandum LD-200.9, and in accordance with FHWA's policy on *Access to the Interstate System* dated August 27, 2009, and updated May 22, 2017.

Submitted April 2021 to:

United States Department of Transportation

Federal Highway Administration

Submitted by:

VDOT Virginia Department of Transportation

Prepared under the direction and review of:

Susan Shaw Digitally signed by Susan Shaw
DN: cn=Susan Shaw, o=Virginia Department of Transportation, ou=NOVA Megaprojects, email=susan.shaw@vdot.virginia.gov, c=US
Date: 2021.06.11 13:38:14 -04'00'

Susan N. Shaw, PE, DBIA, CCM Megaprojects Director, Northern Virginia District Virginia Department of Transportation	Date

Digitally signed by Abraham Lerner
DN: C=US, E=abraham.lerner@vdot.virginia.gov, O=VDOT, OU=Virginia MegaProjects, CN=Abraham Lerner
Date: 2021.06.11 12:41:00-04'00'

Abraham Lerner, PE I-495 NEXT Project Manager Virginia Department of Transportation	Date

Oldham Michael ghx77676
2021.06.11 12:31:40 -04'00'

Michael Jason Oldham, PE Deputy Regional Operations Director Virginia Department of Transportation	Date

Stephen L Bates
2021.06.11 13:08:39-04'00'

Stephen L. Bates, PE NOVA District Location and Design Engineer Virginia Department of Transportation	Date

TABLE OF CONTENTS

APPENDICES AND ATTACHMENTS

FIGURES

TABLES

EXHIBITS (IN SEPARATE VOLUME)

1. BACKGROUND

1.1 PROPOSED ACTION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA) and Fairfax County evaluated improvement alternatives for an extension of the Interstate 495 (I-495) Express Lanes along approximately three miles of I-495, also referred to as the Capital Beltway, from their current northern terminus in the vicinity of the Old Dominion Drive overpass to the George Washington Memorial Parkway (GWMP) in the McLean area of Fairfax County. The development of improvements in this corridor followed the National Environmental Policy Act (NEPA) process, and in accordance with FHWA regulations, an Environmental Assessment (EA) has been prepared.

Under this project, I-495 would be improved to provide the following:

- Extension of the existing I-495 Express Lanes, with two Express Lanes provided in each direction from their current terminus between the I-495/Route 267 interchange and the Old Dominion Drive overpass north approximately 1.6 miles to the GWMP interchange.
- Additional general purpose (GP) auxiliary lanes between the Route 267 and Route 193 interchanges to supplement the existing four GP through lanes in each direction.
- Additional access to and from the Express Lanes network
- Improvements to I-495 interchanges between Route 123 and GWMP
- Reconstruction of I-495 overpasses in the study area at Old Dominion Drive and Live Oak Drive

These items satisfy the project Purpose and Need, described in **Chapter 2**. Together, the project is referred to as the I-495 Express Lanes Northern Extension, or I-495 NEXT Project.

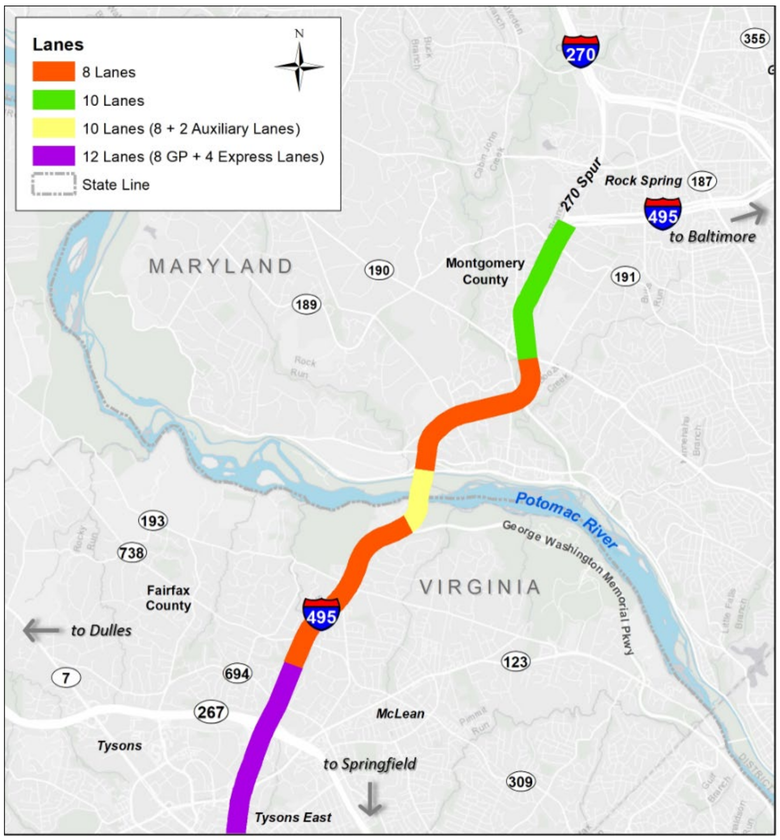
1.2 PROJECT DEVELOPMENT HISTORY

I-495 is a 64-mile, multi-lane, circumferential freeway centered around Washington, DC, and passing through Maryland and Virginia. The Virginia portion of I-495 is 22 miles, extending from the Woodrow Wilson Bridge in the City of Alexandria to the American Legion Memorial Bridge (ALMB) in Fairfax County.

Initial planning for I-495 began in 1950 and was completed in 1964. Since its completion, many modifications and improvements have been implemented, such as the addition of lanes, construction or modification of interchanges, and safety improvements. In 1992, a portion of I-495 between Route 193 and the Interstate 270 (I-270) spur in Maryland was widened to eight lanes, and the ALMB was widened to 10 lanes (eight through lanes and two auxiliary lanes), as shown in **Figure 1-3**. Despite these infrastructure improvements, population and employment growth in the Washington, DC, region and increases in regional through travel along I-495 have increased traffic demand along I-495 and parallel roadways, resulting in congested conditions, especially during weekday commute periods.

In January 1997, a Major Investment Study (MIS) was completed to evaluate a range of strategies for dealing with transportation deficiencies along the Capital Beltway corridor. The conclusion of the MIS was that highway improvements promoting high-occupancy vehicle (HOV) use, such as designated, non-tolled HOV lanes for vehicles with at least three occupants, would be the most effective transportation investment to serve current and future travel demand on the Capital Beltway (VDOT/FHWA, 2006). Following the MIS, FHWA and VDOT conducted a series of studies ultimately resulting in a Final Environmental Impact

Statement (EIS) in 2006 for the corridor between the ALMB and the I-95/I-495/I-395 interchange in Springfield. The Preferred Alternative from this EIS was a 12-lane (4-2-2-4) configuration with four outer GP lanes and two barrier-separated inner high-occupancy toll (HOT) / managed lanes in each direction. In May 2007, it was determined that a change in the northern project limits was necessary to allow for a transition area between the entrance/exit to the HOT lanes and the ALMB. A NEPA re-evaluation and an Interchange Justification Report (IJR) were completed in 2007 modifying the northern terminus of the HOT lanes from the ALMB to the current terminus south of Old Dominion Drive. Construction of the I-495 Express Lanes commenced in 2008, and the I-495 Express Lanes opened to traffic in November 2012.



Service Layer Credits: Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Figure 1-1. Current I-495 Lane Segments

In 2009, while construction was underway for the I-495 Express Lanes, the Metropolitan Washington Airports Authority (MWAA) developed the Dulles Interchange Long-Range Plan for the I-495/Route 267 interchange to determine what, if any, changes to the then-current plan for the interchange under the I-495 Express Lanes project may be necessary to accommodate other future interchange improvements. The Long-Range Plan determined that up to 11 additional ramp movements would be necessary to improve I-495 connections to and from the Dulles Airport Access Road (DAAR) and Dulles Toll Road (DTR). VDOT, in partnership with MWAA, signed a Memorandum of Understanding (MOA) in May 2009 to incorporate three of these additional ramps into the I-495 Express Lanes project (VDOT/MWAA, 2009). A NEPA Re-evaluation of the Capital Beltway Study EIS was conducted, and the additional ramps were found to be consistent with the findings of the Final EIS (FHWA, 2009). An IJR for the Dulles Interchange was prepared and approved in December 2009 (VDOT, 2009). The ramps were constructed as part of the I-495 Express Lanes project and opened to traffic in September 2012.

1.3 PREVIOUS STUDIES/RELATIONSHIP TO OTHER HIGHWAY IMPROVEMENT PLANS/PROGRAMS

A number of other studies are taking place that would have an effect on the completion of the freeway and arterial analyses completed as part of this IJR. The following studies have been initiated to support the further development and documentation of specific infrastructure and operations recommendations for the I-495 NEXT Project:

- **Beltway HOT Lanes Corridor Study and Systemwide IJR, VDOT – December 2007**. The original Beltway HOTR Lanes IJR requested approval for new and modified interstate access associated with corridor improvements related to general purpose lanes, express lanes, and interfaces with system interchanges on other regional facilities.
- **I-495 NEXT Environmental Assessment (EA), VDOT – February 2020**. This NEPA study developed the Purpose and Need, identified the scope of the project, as well as specific improvements under the Build Alternative to meet the needs of the study corridor, and documented impacts of proposed modifications to I-495 as a part of the I-495 NEXT Project. An excerpt of Chapter 1 from the EA, addressing the Purpose and Need for the project, is located in **Appendix A**.
- **I-495 and I-270 Managed Lanes Study and EIS, Maryland DOT (MDOT) – February 2020**. The purpose of this study is to address congestion and improve trip reliability on I-495 from south of the ALMB to west of MD 5 and on I-270 from I-495 to I-370, including the I-270 east and west spurs, in Montgomery County, Maryland. A wide range of preliminary alternatives were considered and have been screened down to alternatives that include HOT lanes or Express Toll Lanes (ETL) on 1-495. These alternatives include carrying the improvements across the ALMB. This study is the first element of a broader Traffic Relief Plan as announced by Maryland Governor Larry Hogan in September 2017, which considers improvements along the entire length of I-495 and I-270.

  On November 12, 2019 Maryland Governor Hogan and Virginia Governor Northam signed an accord to replace the ALMB and relieve congestion on the Capital Beltway. The new planned infrastructure across the Potomac River includes replacement of existing lanes in each direction and the addition of two new Express Lanes in each direction for approximately three miles between the GWMP in Virginia to the vicinity of River Road in Maryland. New bicycle and pedestrian access would connect trails on both sides of the Potomac River. The I-495 Express Lanes Northern Extension is an independent, stand-alone project that is being closely coordinated and would be compatible with plans for the I-495 and I-270 Managed Lanes Study.
- **Transit/Transportation Demand Management (TDM) Study, Virginia Department of Rail and Public Transportation (DRPT) and MDOT**. This study will document transit demand and facility and service needs along I-495 through the NEXT project study area and into Maryland along the I-495 managed lanes system.
- **Preliminary Engineering of I-495 Corridor Improvements ("Design Public Hearing Plans" and "RFP Conceptual Plans"), VDOT**. This effort includes preliminary engineering plans of infrastructure and facility modifications to support defined corridor needs.

- **Traffic and Revenue Study, OTP3**. This study will document traffic and revenue forecasts associated with Express Lane operations along I-495 in coordination with the I-495 NEXT Project.
- **Dulles Interchange Long-Range Plan** – Future phases of the Dulles Interchange Long-Range Plan propose additional ramps at the I-495/Route 267 interchange that are not currently included as part of the proposed project. Future ramps to be constructed within the study area include:
    - **Ramp D1**: Modified access from eastbound DAAR to southbound I-495 and Route 123
    - **Ramp G8**: Modified access from eastbound DTR to southbound I-495 GP lanes
    - **Ramp D4**: New access from northbound I-495 GP lanes to westbound DAAR
    - **Ramp G2**: Modified Access from northbound I-495 GP lanes to westbound DTR
    - **Ramp D3**: New access from southbound I-495 GP lanes to westbound DAAR
    - **Ramp G5:** Modified Access from southbound I-495 GP lanes to westbound DTR

  Construction of these new ramps is expected to occur by 2045. The near-term improvements associated with I-495 Express Lanes Northern Extension would be designed to be compatible with the planned construction of these future ramps. These connections are described further in **Section 6.2.2.**

1.4 SUPPORT AND COMMITMENT FROM VDOT, REGIONAL, AND LOCAL JURISDICTIONS

Appendix B includes the following letters of support from regional and local agencies:

- From the **County of Fairfax Board of Supervisors**, dated April 13, 2021. The letter states, "Fairfax County Board of Supervisors endorsed the I-495 NEXT project" while strongly encouraging VDOT to coordinate with Maryland to minimize the time between the opening of the two projects and encouraging further collaboration between VDOT and the County to address project concerns and implementation issues.
- From the **Metropolitan Washington Airports Authority (MWAA),** dated March 23, 2021. The letter states that the I-495 NEXT project "sets out the requirements and expectations for working within the [Airport Authority] right of way" and that MWAA is "in agreement with the responsibilities for all parties in both executing the project and addressing operation and maintenance requirements once the project is complete.

2. PURPOSE AND NEED

The purpose of this IJR is to address existing and future transportation problems on I-495 between Route 267 and the ALMB. The following transportation needs have been identified for the study area:

- Reduce congestion;
- Provide additional travel choices; and
- Improve travel reliability.

This study evaluates the effectiveness of highway improvements in meeting the identified needs. More details on the Purpose and Need for the project are included in the excerpt of Chapter 1 from the Environmental Assessment, located in **Appendix A**.

2.1 CORRIDOR NEEDS – EXISTING CONDITIONS

The following existing (2018) conditions within the corridor illustrate the need for improvements:

- Over the past 15 years (2002 to 2017), the Average Annual Daily Traffic (AADT) for I-495 at the ALMB has grown from 197,000 to 233,000, an 18 percent increase.
- I-495 within the study area is severely congested during the weekday AM and PM peak periods in both directions, especially along I-495 northbound approaching the ALMB. Congestion is experienced for nearly 10 hours on an average weekday (approximately four hours during the AM peak period and nearly six hours during the PM peak period).
- Traffic throughput volumes, especially in the northbound direction, are observed to decrease over the course of the AM and PM peak periods as congestion constrains throughput along the corridor. Throughput is much lower than the hypothetical capacity of an eight-to-ten-lane freeway.
- General characteristics of congestion on the corridor include:
  - Substantial multi-hour queues are present in both directions.
  - Heavy volumes entering and exiting I-495 at the Route 267 interchange affect traffic in both directions for extended periods.
  - Cut-through traffic on local parallel arterials creates more disturbances along the I-495 mainline, such as at the Route 193 interchange.
  - High-Occupancy Toll (HOT) traffic to and from the existing I-495 Express Lanes weaving in and out from GP lanes results in severe congestion.
- Because the existing Express Lanes end at Old Dominion Drive, multimodal travel choices for travelers are limited. No commuter bus service is offered within the study area or over the ALMB due to the absence of dedicated or managed lanes that would allow buses to travel more efficiently. Both HOV and single-occupant vehicles choosing to use the existing Express Lanes are forced to rejoin the GP lanes north of Old Dominion Drive with no options to bypass congestion or bottlenecks. Therefore, there is no advantage or incentive for travelers to choose carpooling, vanpooling, or transit options because these options are no more efficient than driving alone. Without dedicated transit or HOV/HOT lanes, single-occupant vehicle travel is the dominant mode choice within the corridor.
- Travel speeds along I-495 within the study area for both the GP and the Express Lanes are highly inconsistent and can vary substantially by hour and by day, with the slowest speeds and heaviest queues occurring along I-495 northbound during both AM and PM peak periods. Average travel

times during peak periods can be several multiples of the free-flow travel time. Furthermore, there is substantial variability in travel times, with 95th percentile travel times during peak periods that have been found to be substantially higher than the average or free-flow travel times. The following summarizes end-to-end travel times for the approximately five-mile corridor:

- In the northbound GP lanes, during the AM peak period, median travel times are approximately 13 minutes and 95th percentile travel times are approximately 22 minutes. During the PM peak period, median travel times are approximately 30 minutes and 95th percentile travel times approach nearly one hour.
- In the southbound GP lanes, during the AM peak period, median travel times are approximately 8.5 minutes and 95th percentile travel times are approximately 12 minutes. During the PM peak period, median travel times are approximately 14.5 minutes and 95th percentile travel times are nearly 25 minutes.

2.2 CORRIDOR NEEDS – FUTURE CONDITIONS

Future conditions will lead to further deteriorating traffic conditions by 2045 as follows:

- Overall and peak period traffic volumes are forecasted to increase in the future and would exceed the carrying capacity of the corridor to a greater degree.
- Between 2015 and 2045, the regional population is expected to increase by 1.4 million (26 percent growth), and the number of jobs by 1 million (32 percent growth).
- Travel times and speeds along I-495 within the study area are forecasted to worsen in the future, as increasing traffic volumes from population and employment growth cause more severe and longer durations of congestion during peak periods.
- Travel choices for both northbound and southbound travelers would continue to be limited within the study area because all Express Lanes users would be forced to merge into the GP lanes, as they do today, with no incentive to convert to a higher-occupancy mode of travel. Therefore, single-occupant vehicle travel would continue to be the dominant mode within the corridor.
- Given that the duration and extent of congestion within the study area is expected to increase, variability in travel speeds and travel times is therefore expected to worsen in the future.

2.3 PURPOSE AND NEED SUMMARY

Reduce Congestion

Regional travel demand forecasting shows increased traffic volumes and travel demands as population and employment continue to grow within the region.

Provide Additional Travel Choices

Access to high-occupancy travel modes encourages drivers to choose alternatives to single-occupancy travel as well as provide an option to single-occupancy drivers to use the Express Lanes and free up capacity on the GP lanes, and the addition of north-south pedestrian and bike facilities, which are currently lacking, improves travel choice.

Improve Travel Reliability

Duration and extent of congestion is expected to increase along with population and employment growth resulting in the need for commuters to spend additional time traveling to work. Travel times in the GP lanes are expected to continue to be increasingly unreliable, with median peak period travel times notably higher than free-flow travel times.

3. FHWA INTERSTATE ACCESS POLICY COMPLIANCE

FHWA requires the preparation of an Interchange Justification Report (IJR) for every proposed highway system modification that affects Interstate Highway access to facilitate the agency's independent evaluation of the request and to ensure that alternatives and pertinent factors have been appropriately considered. As the United States Department of Transportation's final reviewing agency and authority for all Interstate Highway access requests, FHWA has specified two justification policy points that must be addressed for all requests for new or modified access points to the existing Interstate Highway System. This report addresses both policy points for the proposed new and modified access points on the Interstate 495 (I-495) corridor between Route 267 and the ALMB. Additional factors beyond the operation, safety, and engineering acceptability of the requested change will be addressed as part of a separate of related NEPA process.

3.1 RESPONSES TO FHWA POLICY ON INTERSTATE HIGHWAY ACCESS MODIFICATIONS

3.1.1 Policy Point 1

Policy Point 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, 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)).

Response to Policy Point 1

<u>Study Area</u>

The study area for operational analyses and safety performed as a part of this IJR, described in **Chapter 4**, satisfies the FHWA requirements for roadway network analysis. The operational and safety analysis, performed as part of the change of access request, includes the GP lanes and Express Lanes and mainline freeway segments, associated ramps and collector-distributor (C-D) roads for the length of the project, plus at least the first adjacent interchange on each side of the proposed Express Lanes termini. At each of the interchanges being studied, the crossroads included the ramp terminal intersections and adjacent local street intersections. On some crossroads, multiple adjacent intersections were considered part of the influence area of the interchange and as such were included in the operational analysis given the impact to the local network. For the operational analysis in particular, the Route 267 (DTR/DAAR/Dulles Connector Road [DCR]) corridor includes its interchanges east and west of I-495 as well as at least one traffic signal in each direction at those interchanges. Additionally, local parallel east-west and north-south arterials were included for intersection analyses given the significant volume of cut-through traffic experienced on those facilities.

Operational and Safety Analyses

The traffic operations and safety analyses were performed for three analysis years: existing conditions (2018), 2025, and 2045. This analysis includes No Build and Build conditions in both 2025 and 2045. The traffic operational analyses and quantitative safety studies consistent with FHWA policy are documented in **Chapters 9** and **10**, respectively. **Chapter 8** details the forecast traffic volumes for 2025 and 2045 and the methodology used to develop them.

The proposed plan for I-495 will result in marked operational improvements to the overall system by increasing capacity and improving access on the GP lanes by transferring some of the traffic currently using the over-saturated GP lanes to the proposed Express Lanes. The Express Lanes, which are physically separated from the GP lanes, operate at desirable travel speeds. In addition, adjacent crossroad intersections to the interchanges and local network also benefit from the proposed plan as indicated by less queue spillback from the I-495 mainline and less cut-through traffic within the influence area as a result of oversaturated conditions under the No Build scenarios. A detailed assessment of traffic operations using microsimulation (VISSIM) is presented in **Chapter 9** of this document.

From a safety perspective, detailed qualitative and quantitative safety analyses were conducted for the corridor on the general purpose lanes, ramps, arterials, and intersections and are detailed in **Chapter 10**. Highway safety and design professionals used the *Highway Safety Manual* (HSM) as a resource to inform project development, design, and decision making in determining design features with the greatest potential to benefit safety. The crash prediction methods identified in the HSM use key elements for roadway design and traffic data that are fundamental to project development. Three safety analysis tools were employed:

- Enhanced Interchange Safety Analysis Tool (ISATe) for assessing general purpose freeway segments and interchanges
- Project-Developed Express Lane Safety Performance Function (SPF) for estimating future-year crashes in Express Lanes segments
- Extended Highway Safety Manual (HSM) Spreadsheets for estimating future-year crashes at arterial intersections

These tools were used to estimate the number of future-year crashes for the No Build and Build Alternatives to allow for comparison and estimate potential safety benefits.

Planning level crash analysis was performed using industry standard practice and highway safety analysis tools. This analysis evaluated the safety performance of existing conditions and assessed the differences between the 2045 No Build and Build alternatives within safety zones. These zones correspond to interchanges, freeway segments, ramp segments, intersections, and arterials affected by new ramps or access to/from the Express Lanes facility. Both qualitative and quantitative analyses were conducted to evaluate existing, No Build, and Build Alternative conditions along the I-495 corridor. The safety analyses focused on the network as a system, including mainline segments, ramps, C-D roads, intersections, and arterials.

The existing crash analysis showed that the predominant crash type along the I-495 corridor is Rear-End-type crashes. The crash rate for northbound I-495 from Route 7 to the ALMB is worse than the southbound crash rate between the same termini, as traffic congestion in the study area significantly influences safety conditions. Moreover, the crash rate for this northbound section is approximately 100 percent higher than the statewide crash rate. Crash rates in the Express Lanes are lower than statewide crash rates. More detailed information is provided in **Chapter 10**.

The quantitative safety evaluation of I-495 operations revealed an overall improvement in safety in 2045 under the Build Alternative compared to the No Build by efficiently moving a greater volume of traffic with significantly reduced congestion in both directions of the I-495 corridor. With the full Express Lanes network extended into Maryland, it is anticipated that the corridor will operate at a much-improved level of safety as compared to No Build conditions. Comprehensively, the project is a significant improvement in overall safety. The detailed results of these analysis are described in **Chapter 10** of this IJR.

Conceptual Signing Plan

A conceptual signing plan for the Build Alternative was developed to demonstrated that the improvements could be signed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). The conceptual signing plan was developed in coordination with VDOT, Fairfax County, and NPS and is included in **Appendix C** for reference.

3.1.2 Policy Point 2

Policy Point 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, 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.

Response to Policy Point 2

The proposed plan provides access to public roads for all the interchange improvements. A few partial interchanges were proposed or retained and incorporated into the access configuration to connect to the I-495 GP lanes and/or Express Lanes in the Build Alternative and Phase 1 concept because of special access conditions associated with Express Lanes and existing configuration at the I-495/Route 267 interchange:

- Within the I-495 NEXT Project area, access is provided from the northbound GP lanes to the northbound Express Lanes and from the southbound Express Lanes to the southbound GP lanes at the Route 267 interchange. These connections allow for northbound and southbound GP traffic to bypass the congested area between Route 267 and the ALMB. The reverse movements – northbound Express to northbound GP and southbound GP to southbound Express – were assumed to be provided north of the study area in Maryland.

- At the Route 267 interchange, several movements are not provided:
    - Access is not provided from northbound I-495 Express Lanes to eastbound DCR, consistent with the interchange as it exists today (no access from northbound I-495 GP lanes to eastbound DCR).
    - Access is not provided from westbound DCR to southbound I-495 Express Lanes, consistent with the interchange as it exists today (no access from westbound DCR to southbound I-495 GP lanes).
    - Access is not provided from I-495 (GP or Express) to eastbound DAAR or from westbound DAAR to I-495 (GP or Express), as DAAR terminates into the DCR just east of the I-495 interchange.
- Access to and from the Express Lanes at the Route 193 (Georgetown Pike) interchange will not be provided.
- At the GWMP interchange, the I-495 NEXT Project provides access from the northbound Express Lanes to GWMP and from GWMP to the southbound Express Lanes (south-facing movements). The north-facing Express Lanes connection movements (southbound Express Lanes to GWMP and GWMP to northbound Express Lanes) are planned to be provided by the Maryland managed lanes project, as the I-495 Express Lanes in Virginia will transition into the Maryland system north of GWMP.

4. STUDY AREA

4.1 OVERVIEW

The project extends along I-495 from approximately south of the Dulles Toll Road / Route 267 interchange to the GWMP in the vicinity of the ALMB. Although the proposed lanes would terminate at the GWMP, and the interchange provides a logical northern terminus for this study, additional improvements are anticipated to extend approximately 0.3 miles north of the GWMP to provide a tie-in to the existing road. The project also includes access ramp improvements and lane reconfigurations along portions of the DTR and DAAR on either side of I-495, from the Spring Hill Road interchange to the Route 123 interchange. The proposed improvements entail new and reconfigured Express Lane ramps and GP lane ramps at the Dulles Interchange and tie-in connections to the Route 123/I-495 interchange.

4.2 PROJECT LOCATION MAP

Figure 4-1 shows the various components of the project Study Area for the I-495 NEXT project:

- **Yellow – Project Footprint Study Area.** The I-495 NEXT Project Footprint Study Area includes I-495 from the Route 267 interchange to the ALMB, including all ramp termini of interchanges over that section.
- **Blue – Traffic Operations Analysis Study Area.** The Traffic Operations Analysis Study Area includes the full extent of the Project Footprint Study Area as well as one interchange north and south on I-495, and a number of additional intersections and interchanges which directly affect and/or are affected by operations on I-495 within the Project Footprint Study Area. The Traffic Operations Analysis Study Area should be considered the IJR area of influence and is inclusive of the traffic analysis model extents.

Figure 4-1. Project Study Area and Traffic Operations Analysis Study Area

4.3 LOGICAL TERMINI AND AREA OF INFLUENCE

FHWA regulations implementing NEPA require that:

"In order to ensure meaningful evaluation of alternatives and to avoid commitments to transportation improvements before they are fully evaluated, the action evaluated in each Environmental Impact Statement (EIS) or Finding Of No Significant Impact (FONSI) shall:

1. Connect logical termini and be of sufficient length to address environmental matters on a broad scope;
2. Have independent utility or independent significance, i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and
3. Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements."

The central basis of the above criteria is that projects have rational end points, that is, end points that are based on valid and sound reasoning, which are located in such a manner that the proposed action can function as a stand-alone project, and without precluding future improvements. The project includes an extension of the existing Express Lanes from their current northern terminus south of the Old Dominion Drive overpass to the GWMP. Although the GWMP provides a logical northern terminus for this study, additional improvements, to be constructed by others in a subsequent phase, are anticipated to extend approximately 0.3 miles north of the GWMP to provide a tie-in to the existing road network in the vicinity of the ALMB. The project also includes access ramp improvements and lane configurations along portions of the DTR and DAAR on either side of I-495, from the Spring Hill Road interchange to the Route 123 interchange. The proposed improvements entail new and reconfigured Express Lanes ramps and GP lanes ramps at the Dulles Interchange and Route 123/I-495 interchange ramp connections. The proposed project can stand alone without requiring other potential future improvements on adjoining sections of I-495 and the Dulles Toll Road. In coordination with VDOT, MDOT is currently developing a project with a separate purpose and need, the study of a new managed lanes system along I-495 in Maryland that would be generally consistent with the existing I-495 Express Lanes facility in Virginia. These two projects are being coordinated to allow for a seamless connection between the two managed lane systems even though each project has independent utility on its own. The proposed project does not constrain the consideration of alternatives for other reasonably foreseeable alternatives beyond the project limits.

The project termini are shown in **Figure 4-2**; note that the "Study Area" shown in that figure is the EA study area and not the IJR area of influence, which extends beyond the project footprint and EA study area.

The area of influence for this IJR includes the following elements:

- The southern terminus of the area of influence was identified as Route 123 as it represents one interchange south of the project footprint. It was considered part of the area of influence to serve as a network filter for traffic entering and exiting the network.
- The northern terminus of the area of influence was identified as Clara Barton Parkway in Maryland, as it represents one interchange north of the project footprint. It was considered part of the area of influence to serve as a network filter for traffic entering and exiting the network.
- I-495 connects to Route 267, which is a limited access freeway and includes the DTR to the west, DCR to the east, and DAAR running along the center of the DTR/DCR. The interchanges along

the DTR/DCR to the east and west of I-495 – the Spring Hill Road interchange and the Route 123 interchange, are included in the area of influence.

- The area of influence includes at least one signalized intersection in either direction at each interchange.
- The IJR area of influence is consistent with the Traffic Operations Analysis Study Area that was used for the EA and supporting Traffic and Transportation Technical Report (TATTR), as shown in **Figure 4-1.**

The approximately 6.5-mile length of the area of influence extends through Tysons and McLean in Fairfax County and across the ALMB into Montgomery County. It provides ample length to address transportation and environmental matters on a broad scale. Moreover, the extent of the project's environmental impacts is contained mostly within the existing footprint of the highway corridor, with little if any extension beyond the proposed limits of the project.

Figure 4-2. I-495 Express Lanes Northern Extension Project Limits

4.4 STUDY AREA BOUNDARIES AND FACILITIES INCLUDED

As noted previously, the study area boundaries include an approximately 5-mile section of I-495 between Route 267 and the GWMP, along with parallel freeway and arterial routes. The IJR area of influence extends beyond these limits and includes one interchange to the north and south along I-495 at Clara Barton Parkway and Route 123, respectively. In addition, two interchanges were included along Route 267 as part of the area of influence: Spring Hill Road and Route 123.

The core communities in the vicinity of the study area are in Fairfax County, including the unincorporated communities of Tysons and McLean. These communities will be impacted to varying degrees as part of this study. The interchanging roadways included in the study area and the intersections along these crossroads that have been analyzed are listed below.

Clara Barton Parkway at I-495

- I-495 northbound on/off-ramps
- I-495 southbound on/off-ramps

George Washington Memorial Parkway at I-495

- I-495 northbound on/off-ramps
- I-495 southbound on/off-ramps

Route 193 (Georgetown Pike) at I-495

- Spring Hill Road
- Swinks Mill Road
- Linganore Drive / Helga Place
- I-495 northbound on/off-ramps
- I-495 southbound on/off-ramps
- Balls Hill Road
- Dead Run Drive
- Douglass Drive

Route 267 (Dulles Toll Road / Dulles Airport Access Road / Dulles Connector Road) at I-495

- I-495 northbound on/off-ramps
- I-495 southbound on/off-ramps

Route 123 at I-495

- Tysons Boulevard
- I-495 northbound on/off-ramps
- I-495 southbound on/off-ramps
- Old Meadow Road / Capital One Tower Drive
- Scotts Crossing Road / Colshire Drive

Jones Branch Connector at I-495 Express Lanes

- Jones Branch Drive
- I-495 northbound Express on/off-ramps
- I-495 southbound Express on/off-ramps
- Spring Gate Drive / Capital One Access (north/west)
- Capital One Access (south/east)

Westpark Connector at I-495

- Westpark Drive
- I-495 northbound Express on/off-ramps
- I-495 southbound Express on/off-ramps

Spring Hill Road at Route 267

- International Drive / Jones Branch Drive
- Route 267 (DTR) eastbound on/off-ramps
- Route 267 (DTR) westbound on/off-ramps
- Lewinsville Road

Route 123 at Route 267

- Route 267 (DCR) eastbound off-ramp / Anderson Road
- Route 267 (DCR) eastbound on-ramp
- Route 267 (DCR) westbound on/off-ramps
- Great Falls Street / Lewinsville Road
- Old Dominion Drive
- Ingleside Avenue

Lewinsville Road

- Spring Hill Road
- Swinks Mill Road
- Balls Hill Road

Old Dominion Drive

- Spring Hill Road
- Swinks Mill Road
- Balls Hill Road
- Route 123

5. EXISTING CONDITIONS

5.1 DEMOGRAPHICS

I-495 (also known as the Capital Beltway) is a 64-mile, multi-lane, circumferential freeway centered around Washington D.C. and passing through Virginia and Maryland. The Virginia portion of I-495 is 22 miles, extending from the Woodrow Wilson Bridge in the City of Alexandria to the ALMB in Fairfax County. As the only direct transportation link between Fairfax and Montgomery Counties, and with no other transit service available, I-495 experiences heavy use by commuters driving private, single-occupant vehicles (Versel, 2013).

Communities directly adjacent to the corridor that are expected to be served by the proposed improvements to I-495 are listed in **Table 5-1**. Population data was obtained from the Fairfax County Economic, Demographic, and Statistical Research (EDSR) unit.

Table 5-1. Communities Served by the Proposed Project

Community	County	Population (2019)	Population (2024)
McLean	Fairfax	50,190	51,491
Tysons	Fairfax	28,406	36,567
Pimmit Hills	Fairfax	6,763	6,849

Source: Fairfax County Economic, Demographic, and Statistical Research (EDSR) unit, 2019.

The existing high traffic volumes on the corridor can be partially attributed to the substantial population growth that has occurred in recent years within the study area and the Washington, D.C. region as a whole. The Washington, D.C. region's population increased from 4.4 million to 5.7 million residents between 2000 and 2018. Fairfax County is the most populous locality in the region, at over 1.1 million residents. As the population has increased, regional employment has followed suit, adding almost 400,000 jobs from 2000 to 2016. Areas of McLean and Tysons surrounding the project are projected to grow on average at a rate nearly four times that of the overall county, and the fastest growing areas in Tysons are anticipated to grow to a rate exceeding thirty times that of the overall county.

5.2 LAND USE

The southern portion of the study area surrounding the I-495/Route 267 interchange is bounded by high-density commercial and residential development associated with the Tysons area. The study area between the Route 267 interchange and the GWMP interchange is comprised of suburban neighborhoods and supporting recreational areas that border the interstate, with direct access to I-495 limited to Route 193. North of the GWMP approaching the Maryland state line at the ALMB over the Potomac River is primarily open federal parkland associated with the GWMP to the east and Scott's Run Nature Preserve to the west.

Land use and development within Fairfax County is guided by the *Fairfax County Comprehensive Plan* (Fairfax County, 2017). The Comprehensive Plan includes two unique districts that are within the study area: the proposed project lies mostly within the McLean Planning District, and a portion of the southern terminus of the study area lies within Tysons Urban Center.

The McLean Planning District is in the northeast portion of Fairfax County and is bounded on the north by the Potomac River, on the southeast by Arlington County and the City of Falls Church, and on the southwest by Route 7 (Leesburg Pike). According to the *Fairfax County Comprehensive Plan*, the McLean Planning District is predominantly composed of stable, low-density residential neighborhoods and the McLean Community Business Center (Fairfax County, 2017). Commercial uses are limited, with only a few neighborhood-oriented commercial areas throughout the planning district.

The Tysons Urban Center is the largest concentration of transit-oriented development and retail in the Washington, D.C. region. Tysons is located at the confluence of I-495, Route 267, Route 7, and Route 123 (Chain Bridge Road/Dolley Madison Boulevard) and is also accessible via four Silver Line Metrorail stations: McLean, Tysons Corner, Greensboro, and Spring Hill. According to the *Fairfax County Comprehensive Plan*, Tysons is comprised of a large concentration of office and retail development that is supported by the adjacent high-density residential communities (Fairfax County, 2017).

5.3 EXISTING ROAD GEOMETRY AND ACCESS LOCATIONS

To assess the traffic impacts of the proposed project from the current northern termini of the existing I-495 Express Lanes to the ALMB, a Traffic Operations Study Area was defined to include the I-495 corridor between Route 123 in Tysons to and the I-495 overpass over Seven Locks Road in Montgomery County, Maryland.

In addition to the sections of the I-495 GP lanes and the sections of the I-495 Express Lanes, the traffic operations Study Area includes:

- Segments of the GWMP and the Clara Barton Parkway, which are under the responsibility of the National Park Service;
- Segments of the DTR and DAAR, which are under control of the Metropolitan Washington Airports Authority;
- Segments of the DCR, under the responsibility of VDOT; and
- Nine (9) interchanges.

The Traffic Operations Study Area also includes segments of primary and selected secondary roads that lie within the corridor.

A map of the project footprint area and the project Traffic Operations Study Area was previously provided in Chapter 4 as **Figure 4-2.** These facilities are described in more detail in the following sections.

5.3.1 I-495 Corridor

I-495 in Virginia

The segment of I-495 within the project footprint runs from just south of the Route 123 interchange to just north of the GWMP interchange at the ALMB (the Maryland state line). The I-495 GP lanes generally carry four through lanes in each direction, with a 12-foot paved right shoulder. South of Old Dominion Drive, to the left of the GP lanes in each direction are the I-495 Express Lanes, which are separated from the GP lanes by flexible bollards in most locations in the Study Area. The northern terminus of the Express Lanes is located just to the south of Old Dominion Drive. North of this location, the I-495 GP lanes remain four lanes in each direction south of Route 193, although a hard shoulder lane is open to traffic in the northbound direction during weekday peak periods. This single left-side shoulder lane, which began operations in 2015, is open to all traffic Monday through Friday from 6:00 AM to 11:00 AM and 2:00 PM to 8:00 PM.

Additional capacity is provided along I-495 between Route 193 and GWMP. In the northbound direction, a fifth auxiliary lane is provided along the right side between the on-ramp from Route 193 and the off-ramp to GWMP, in addition to the left-side hard shoulder lane, which terminates at the GWMP interchange. In the southbound direction, a C-D road is provided between the GWMP and Route 193 interchanges; all southbound traffic wishing to access either of these interchanges must exit north of the GWMP interchange. The C-D road carries two lanes plus an auxiliary lane between the on-ramp from GWMP and the off-ramp to Route 193; it then splits into a two-lane off-ramp to Route 193 and a single-lane on-ramp to the I-495 southbound mainline. During congested periods along the I-495 southbound mainline, counts indicate that the C-D road is often used to bypass traffic along the mainline.

I-495 in Maryland

Within the study area, the segment of I-495 in Maryland includes the ALMB over the Potomac River. Crossing the river, I-495 includes 10 total lanes, with five lanes in each direction. The cross-section drops to four lanes at the Clara Barton Parkway, as one northbound lane drops at the entrance to the Clara Barton Parkway and one southbound lane is added from the Clara Barton Parkway. The facility has 10-foot inside paved shoulders with a barrier in the median and 12-foot outside paved shoulders. North of the Clara Barton Parkway, a southbound deceleration lane is provided to serve the exit from southbound I-495 to Clara Barton Parkway, and a northbound acceleration lane is provided to serve the entrance from Clara Barton Parkway to northbound I-495. The eight-lane cross-section continues to the overpass over Seven Locks Road, which is the end of the traffic operations and safety study area.

5.3.2 I-495 Express Lanes

The existing I-495 Express Lanes opened in 2012 and feature two through lanes running in the median of I-495 in each direction at the south end of the Study Area. These lanes are separated from the GP lanes via flexible bollards. The Express Lanes are dynamically-priced, high-occupancy toll (HOT) lanes designed to increase capacity and travel time reliability by allowing transit and high occupancy vehicles (HOVs) to use the facility for free while tolling the excess capacity for single-occupancy vehicles (SOVs). Within the Study Area, ingress and egress to the northbound and southbound existing I-495 Express Lanes are provided at Westpark Drive and Jones Branch Drive in Tysons, with exclusive ramps that intersect the cross streets at signal-controlled intersections. Access is also provided from the northbound existing I-495 Express Lanes to DTR westbound, from the southbound existing I-495 Express Lanes to DTR westbound, and from DTR eastbound to the southbound existing I-495 Express Lanes.

The northern entrance to the southbound existing I-495 Express Lanes is from the left side of the southbound I-495 GP lanes, south of the Route 193 interchange and beginning just south of the bridge carrying Old Dominion Drive over I-495. The northern exit from the northbound existing I-495 Express Lanes merges onto the left side of the northbound I-495 GP lanes near this same location. At this point, the previously-mentioned left-side shoulder use lane begins.

5.3.3 Other Freeways in Study Area

The Dulles Corridor: Route 267 (DTR/DCR) and DAAR

The Route 267/Dulles Corridor is an east-west limited-access set of facilities connecting Washington Dulles International Airport (IAD) and points west with I-495 and points east. It is technically comprised of three separate facilities:

- The Dulles Access Airport Road (DAAR) is largely a four-lane divided highway that serves as a high-speed limited access highway between IAD and I-495 and points east. There are no exits from the westbound DAAR until a driver reaches IAD.
- West of Route 123, Route 267 runs along the outside of the DAAR and is referred to as the Dulles Toll Road (DTR). The main toll plaza, which features a mixture of manually-collected toll lanes and low-speed electronic toll lanes, is located just to the west of I-495 near the Spring Hill Road interchange. West of the main toll plaza, the DTR is four lanes in each direction to IAD. Several interchanges are provided in the Reston and Herndon areas, with tolls on all east-facing ramps (westbound off-ramps and eastbound on-ramps). The interchange between Route 267 and Route 123 to the east of I-495 is not tolled.

East of Route 123, the DAAR and DTR come together to form a single limited-access facility that is two lanes in each direction between Route 123 and I-66. This facility is referred to as the Dulles Connector Road (DCR). As there is no access provided between I-66 and Route 123, there are no trucks allowed along the DCR. The DCR provides access to I-66 eastbound and from I-66 westbound only. During the AM peak period, I-66 eastbound has variably-priced tolls for non-HOV-2+ traffic and all vehicles, including IAD traffic, are required to have a toll transponder. During the PM peak period, the same restrictions apply, but in the westbound direction.

George Washington Memorial Parkway

The GWMP, which is operated and maintained by the NPS, is a four-lane divided roadway. Trucks are prohibited on the GWMP, with the exception of a few permit-holders. The posted speed limit is 50 miles per hour (mph). It has a mountable curbs and grass shoulders for much of its length. It serves a heavily traveled commuter route for motorists to and from Arlington County and Washington, D.C., as it is the only limited-access facility into downtown Washington on the northwest side of the District. It provides access to the FHWA and Central Intelligence Agency headquarters, the Chain Bridge over the Potomac River, several bridges into downtown Washington, D.C., and Ronald Reagan Washington National Airport.

Clara Barton Parkway

The Clara Barton Parkway, which is operated and maintained by the NPS, is a four-lane roadway with limited grass shoulders. Within the study area, there a several access points to and from adjacent parking areas for the Chesapeake and Ohio Canal towpath, and other recreational, historic and cultural resources. Due to the presence of these access points, the Clara Barton Parkway is not truly a freeway but functions as a limited access expressway in the vicinity of I-495. To the east, the Clara Barton Parkway provides access to the Chain Bridge over the Potomac River, Canal Road, and a route along the Potomac River to destinations in Washington, D.C. To the west, the Clara Barton Parkway provides access to MacArthur Boulevard and some Federal facilities including the U.S. Naval Warfare Center and the David Taylor Model Basin, which is one of the largest test facilities for the development of modern ship design.

5.3.4 Interchanges and Intersecting Roadways

The interchanges, excluding those that provide access to and from the existing I-495 Express Lanes, within the traffic operations analysis Study Area include the following:

- I-495/Route 123 interchange – a full cloverleaf interchange with access provided in all directions
- I-495/Route 267 interchange – a complex interchange with a variety of ramps providing access in certain directions, including the following:
    - From northbound I-495 GP lanes to westbound DTR
    - From northbound existing I-495 Express Lanes to westbound DTR
    - From southbound I-495 GP lanes to eastbound and westbound DTR
    - From southbound existing I-495 Express Lanes to westbound DTR
    - From the eastbound DTR to northbound and southbound I-495 GP lanes
    - From the eastbound DTR to southbound existing I-495 Express Lanes
    - From the eastbound DAAR to the I-495 GP lanes
    - From westbound DCR to northbound I-495 GP lanes
- I-495/Route 193 interchange – a conventional diamond interchange, with a C-D road along southbound I-495 that connects both the GWMP interchange and the Route 193 interchange.
- I-495/GWMP interchange – a trumpet-type, three-legged interchange providing access to and from both directions of I-495 and GWMP to the east of I-495.
- I-495/Clara Barton Parkway interchange – a hybrid interchange that features directional ramps provided for certain movements in each direction.
- Route 267/Spring Hill Road interchange – a conventional diamond with access provided in all directions.
- Route 267/Route 123 interchange – a hybrid partial cloverleaf interchange providing access in all directions, except for Route 123 northbound to Route 267 westbound.

Additionally, the following interchanges that provide access to and from the existing I-495 Express Lanes within the traffic operations analysis Study Area are included:

- I-495 Express Lanes and Westpark Drive
- I-495 Express Lanes and Jones Branch Connector
- I-495 Express Lanes and Route 267, which currently includes the following connections:
    - I-495 northbound Express to westbound DTR
    - I-495 southbound Express to westbound DTR
    - Eastbound DTR to I-495 southbound Express

5.3.5 Major Traffic Operations Study Area Arterials

The major non-freeway roads in the Study Area include the several arterials and collector streets, described below:

- **Route 193 (Georgetown Pike)** – Route 193 is a primary highway in Virginia that provides access from origins in western Fairfax County and eastern Loudoun County to I-495, destinations in McLean, including the Central Intelligence Agency, and destinations in Washington, D.C. via the GWMP and Chain Bridge over the Potomac River. It is a two-lane road for most of its length, with narrow or no shoulder along much of the route. Auxiliary turn lanes exist at the I-495 interchange areas.

- **Route 123 (Dolley Madison Boulevard/Chain Bridge Road)** – Route 123 is a six-to-eight-lane major arterial and primary highway within the Study Area. It has multiple turn lanes at several major signal-controlled intersections.
- **Spring Hill Road (Route 684)** – the section of Spring Hill Road varies in cross section. At the south end of the Study Area, Spring Hill Road is a multilane highway, serving traffic in the Tysons area and providing a primary access to the DTR at an interchange. The section north of the DTR is largely a two-lane road, with some turn lanes at major intersections.
- **Old Dominion Drive (Route 738)** – the section of Old Dominion Drive in the Study Area is predominantly a two-lane road that provides a roadway connection between Route 123 and Spring Hill Road, with additional turn lanes provided at its intersection with Route 123. It passes through residential areas, crossing I-495 and connecting to Swinks Mill Road as well.
- **Swinks Mill Road (Route 685)** – the section of Swinks Mill Road in the Study Area is a two-lane street through a residential area with numerous driveways. It provides a roadway connection between Lewinsville Road and Route 193 and parallels I-495 just to the west. It primarily serves local traffic, although commuters do use this route during peak periods.
- **Balls Hill Road (Route 686)** – the section of Balls Hill Road in the Study Area provides a roadway connection from Route 123 and Route 193. Similar to Swinks Mill Road, it runs parallel to I-495 just to the east, and it is a two-lane street that serves the local community. During peak periods, commuters use Balls Hill Road to bypass the congested I-495 northbound GP lanes.
- **Lewinsville Road (Route 694)** – the section of Lewinsville Road in the Study Area is largely a two-lane street that functions as a major collector for residential and commuter traffic west of I-495. East of I-495, it is a multi-lane road with turn lanes at major intersections serving a large campus with several office buildings. It parallels the DTR to the north and is also used by commuters during peak periods.
- **Ingleside Avenue/Douglas Street** – the sections of Ingleside Avenue and Douglas Street within the study are two-lane streets that provide access to the McLean Library and the McLean Community Center and primarily serves local residents. Together, they form a road connection between Route 123 and Route 193 in the McLean area, running parallel and to the east of Balls Hill Road.

5.4 ALTERNATIVE TRAVEL MODES

The Study Area currently has in place the following multimodal facilities to serve commuters.

5.4.1 HOV Facilities

HOV-3 vehicles may ride in the I-495 Express Lanes for free using an EZ-Pass transponder that is switched to “HOV-3” mode. There are no HOV lanes along the I-495 GP mainline.

Within the traffic operations analysis Study Area, an HOV-2 lane heading westbound along the DTR is provided. This HOV-2 lane starts directly west of the DTR main toll plaza and is exclusive to HOV-2 traffic during the evening peak period (4:00 p.m. - 6:30 p.m., Monday – Friday). There is a corresponding eastbound HOV-2 lane along the DTR but terminates prior to Leesburg Pike which is outside of the I-495 NEXT traffic operations analysis Study Area.

Chapter 3 of the *Traffic and Transportation Technical Report* (included by reference as **Attachment 1** and submitted as a separate volume) provides a detailed overview of existing HOV usage in the region and study area.

5.4.2 Bus Transit

No commuter bus service is offered within the Study Area or over the ALMB, in part due to the absence of dedicated or managed lanes that would allow buses to travel more efficiently.

Currently three transit service providers operate bus service in areas adjacent to the corridor, along the routes listed below and identified in **Figure 5-1**.

Fairfax Connector Service

- Route 401/402: Backlick – Gallows
- Route 422: Boone Boulevard – Howard Avenue
- Route 423: Park Run – Westpark
- Route 424: Jones Branch Drive
- Route 432: Old Courthouse Beulah
- Route 442: Boone Boulevard – Howard Avenue
- Route 462: Dunn Loring – Navy Federal – Tysons
- Route 463: Maple Avenue – Vienna
- Route 494: Lorton – Springfield – Tysons
- Route 495: Burke Centre – Tysons
- Route 574: Reston – Tysons
- Route 599: Pentagon – Crystal City Express
- Route 721: Chain Bridge Road – McLean
- Route 724: Lewinsville Road

Potomac and Rappahannock Transportation Commission (PRTC) Service

- Linton Hall Metro Express: Gainesville – Tysons Corner
- Manassas Metro Express: Old Town Manassas – Tysons Corner
- Tysons Corner: Woodbridge - Tysons Corner

Washington Metropolitan Area Transit Authority (WMATA) Metrobus Service

- 23T: McLean – Crystal City
- 3T: Pimmit Hills
- 5A: Dulles – Washington, D.C.

5.4.3 Metrorail

The Study Area is served by the Silver Line Metrorail which opened in 2014 with five stations. Four of the five Silver Line Metrorail stations are in the vicinity of the I-495 Express Lanes Northern Extension Project; these include:

- McLean
- Tysons Corner
- Greensboro

- Spring Hill

The Metrorail service and stations in the Study Area are also shown in **Figure 5-1**.

5.4.4 Bicycle and Pedestrian Facilities

Bicycle and pedestrian facilities in the traffic operations analysis Study Area mainly consist of facilities along streets that cross I-495 on bridges.

Along Live Oak Drive and Route 738 (Old Dominion Drive), bicyclists must use the sidewalk or share the road with cars along the overpasses of I-495. Along Route 694 (Lewinsville Road), exclusive bike lanes are provided in each direction along the overpass across I-495.

Along Route 123, no bicycle or pedestrian facilities are currently provided crossing I-495.

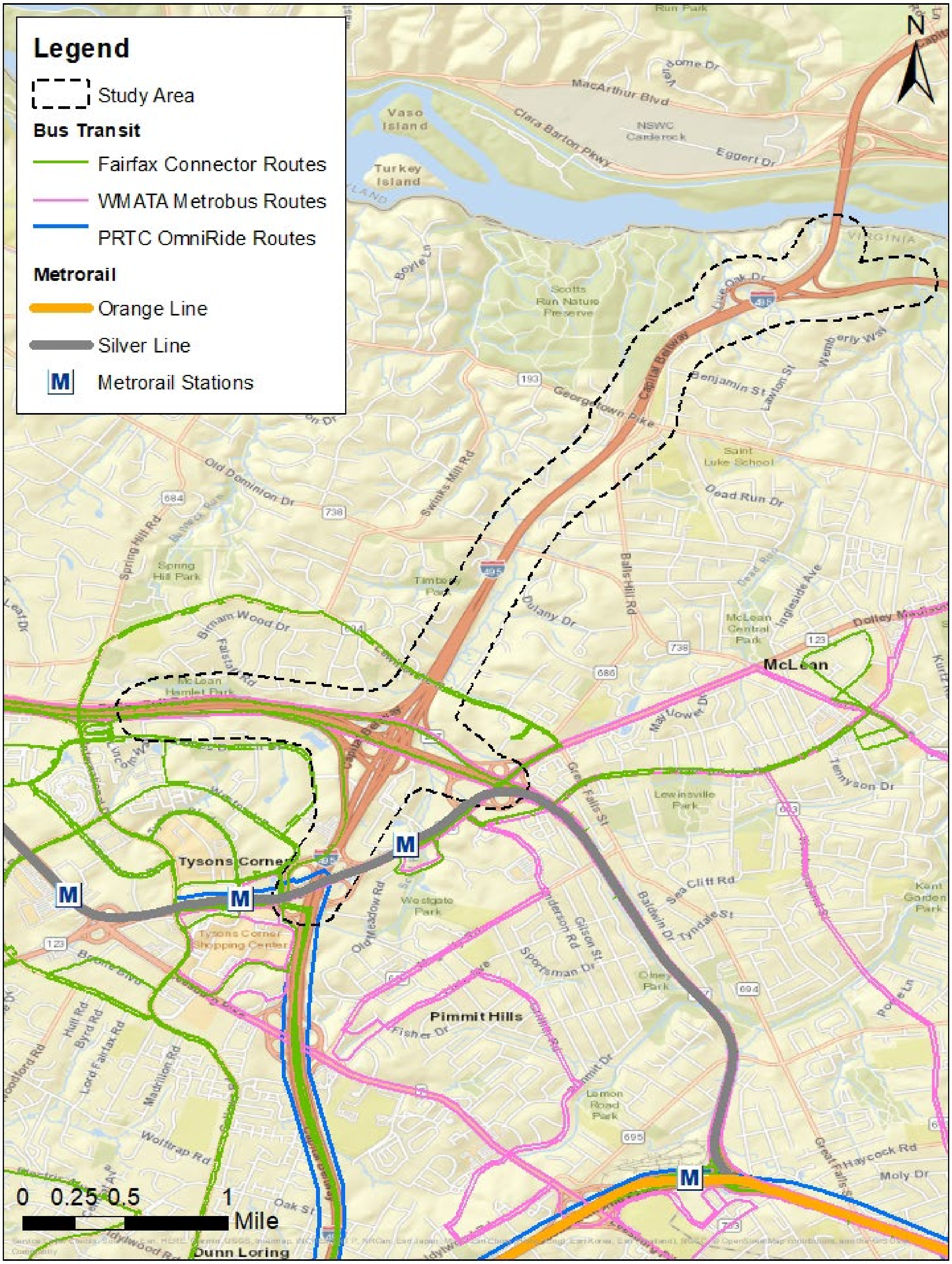


Figure 5-1. Bus and Rail Transit Service in I-495 NEXT Project Area

5.5 ENVIRONMENTAL CONDITIONS AND CONSTRAINTS

Full details on environmental conditions and constraints are provided in the Environmental Assessment.

During and after construction, pursuant to VDOT's Road and Bridge Specifications, the construction contractor will be required to minimize disturbances of vegetation, habitat, and wildlife, as well as stormwater discharge, to adjacent land uses. The project has been aligned and is being designed such that disturbances of floodplains and water resources will be as little as practicable. In addition, the implementation of temporary and permanent stormwater management measures will reduce pollution of adjacent waterways to the extent practicable, and erosion will be mitigated with the application of stormwater management Best Management Practices (BMP).

5.6 EXISTING DATA, OPERATIONAL PERFORMANCE, AND SAFETY CONDITIONS

Detailed information on existing traffic volumes, traffic operations, and safety characteristics are included in **Chapters 8, 9,** and **10**, respectively. The data in these chapters is shown as a baseline for the purposes of understanding future traffic operations and safety considerations under future scenarios. A photographic survey and existing conditions operational performance assessment for the corridor are documented in the MWCOG Congestion Survey Results and Arterials in **Appendix D**.

6. ALTERNATIVES CONSIDERED

This chapter describes the proposed project, which generally involves constructing a two-lane Express Lane facility in each direction (four lanes total) within the median of I-495 between the current Express Lanes terminus near Old Dominion Drive to the GWMP interchange. As part of the proposed project, a minimum of four general purpose lanes will be provided in each direction, with auxiliary lanes added to the GP network as well. Direct access to the Express Lane facility from intersecting roadways will be constructed at select locations along the corridor. The no-action or No Build Alternative is also discussed since it serves as a baseline for comparison.

6.1 ALTERNATIVES DEVELOPMENT AND NEPA SCREENING PROCESS

Based on the established Purpose and Need and coordination with local governments, stakeholders, and public, one Build Alternative was developed and evaluated in detail. This conceptual alternative (the Build Alternative) includes extending the Express Lane system on I-495 north to the ALMB. In addition, there may be design options considered when the project advances beyond the NEPA phase to the more detailed permitting and design phases. The evaluation of one Build Alternative in detail through the NEPA process is consistent with FHWA's Technical Advisory T 6640.8A *Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (FHWA, 1987). A No Build Alternative was also considered and is described in the **Section 6.2**. The Build Alternative is described in **Section 6.4**. Details of the alternative development process for the Build Alternative are included in **Appendix E**, Alternatives / Interchange Options Development Memorandum.

FHWA's regulations implementing NEPA identify the types of actions that normally require an Environmental Impact Statement (EIS). The I-495 NEXT project is not a type of action that requires an EIS under that regulation. Instead, this project, which is along the existing I-495 corridor, falls under the category of actions for which an Environmental Assessment (EA) is the appropriate document type.

For the purposes of the environmental analyses, computations for construction "footprint" impacts have been prepared assuming a typical section along the I-495 corridor consisting of two Express Lanes in each direction, four general purpose lanes, and a general purpose auxiliary lane in each direction. Sufficient engineering has not yet been fully completed at this stage of project development to determine the exact finalized location of improvements within the median, the outer limits of the general purpose lanes, and at system interchanges. However, to illustrate what the actual impacts may be, computations have been prepared for the actual footprint identified in the conceptual plans. This approach not only provides a maximum impact estimate but also provides flexibility for design revisions, once more detailed design efforts are undertaken, without reopening the environmental analyses. In addition, the environmental analyses take into account areas of particular sensitivity, such as streams and wetlands, where conceptual design efforts have attempted to minimize impacts or where additional efforts may need to be made during final design to further minimize impacts at select locations.

6.2 NO-BUILD ALTERNATIVE

In accordance with the implementing regulations for NEPA (40 C.F.R. § 1502.14(d)), the No Build Alternative has been retained for detailed study and serves as a benchmark for comparison with the Build Alternative. The No Build Alternative would retain the existing lane configuration through the study area and allow for routine maintenance and safety upgrades, except for those modifications to the roadway network that have been programmed and approved for implementation by 2045, as identified in the most recent *National Capital Region Constrained Long Range Plan* (CLRP).

Prepared by the National Capital Region Transportation Planning Board (NCRTPB), which is the designated Metropolitan Planning Organization for the Washington, D.C. region under the Metropolitan Washington Council of Governments (MWCOG), the current CLRP includes projected transit and traffic, demographic, and air quality conditions through the 2045 horizon year. The most recent 2045 CLRP was adopted in October 2018 (NCRTPB, 2018). The planned and programmed transportation projects within the study area, included in the MWCOG CLRP and assumed under the No Build Alternative, are identified in **Table 6-1**. A detailed overview of background improvements to the transportation network included as elements of future No Build conditions can be found in Chapter 5 of the *Traffic and Transportation Technical Report*. A selection of the major background projects is described within the section.

Table 6-1. No Build CLRP Projects within the I-495 Study Corridor

<table>
<tr><th>CLRP ID</th><th colspan="2">Project Name</th><th>Description</th><th>Completion Date*</th></tr>
<tr><td>3186/VI4IHOTA</td><td rowspan="6">I-495 / Dulles Toll Road – Airport Access Road Interchange Master Plan</td><td>DAAH/I-495 Capital Beltway Interchange Flyover Ramp Relocation (Phase IV DAAH)</td><td>Relocate ramp from Eastbound (EB) Dulles Airport Access Road to Northbound (NB) I-495 general purpose (GP)</td><td>2030</td></tr>
<tr><td>3186/VI4IHOTA</td><td>DAAH/I-495 Capital Beltway Interchange Flyover Ramp Relocation (Phase IV DAAH)</td><td>Widen ramp from EB Dulles Toll Road ramp to NB I-495 GP to two lanes</td><td>2030</td></tr>
<tr><td>3186/VI4IRMP1</td><td>DAAH/I-495 Capital Beltway Interchange Flyover Ramp Relocation (Phase IV DAAH)</td><td>Construct flyover ramp from NB I-495 GP to Westbound (WB) Dulles Airport Access Road</td><td>2030</td></tr>
<tr><td>3208/VI4IHOTB</td><td>I-495 Interchange Ramp Phase II, Ramp 3 DAAH</td><td>Construct Ramp from SB I-495 GP to WB Dulles Airport Access Road</td><td>2030</td></tr>
<tr><td>3272/VI4IAUX19</td><td>I-495 Capital Beltway Auxiliary Lanes</td><td>Add NB I-495 GP auxiliary lane between on-ramp from WB Dulles Toll Road and off-ramp to Georgetown Pike</td><td>2030</td></tr>
<tr><td>3272/VI4IAUX20</td><td>I-495 Capital Beltway Auxiliary Lanes</td><td>Add Southbound (SB) I-495 GP auxiliary lane from Georgetown Pike on-ramp to WB Dulles Toll Road off-ramp</td><td>2030</td></tr>
<tr><td>1182/1186/3281</td><td colspan="2">I-495 Managed Lanes / I-270 Managed Lanes in Maryland</td><td>Construct bi-directional Express lanes system on I-495 in Maryland between the AMLB and the Woodrow Wilson Bridge</td><td>2025**</td></tr>
<tr><td>3060</td><td colspan="2">Jones Branch Connector</td><td>Extend Jones branch Connector bridge to provide connection between Route 123 and I-495 Express Lanes</td><td>2019***</td></tr>
</table>

Source: NCRTPB, 2018 -- *CLRP dates shown as 2030 are being amended to reflect updated CLRP with 2045 as horizon year

** The I-495 Maryland managed lanes project is under study at the same time as the I-495 NEXT project. A sensitivity analysis has been conducted to assess the traffic operational impacts of the No Build and Build conditions for the I-495 NEXT project if the I-495 Maryland managed lanes system would not be completed between the ALMB and I-270 by 2025. This analysis is included as Appendix I of the *TATTR* and is summarized in **Chapter 9** of this IJR.

*** The Jones Branch Connector was under construction during the initial planning phase of the I-495 Express Lanes project, and therefore was included in the No Build Projects list rather than as part of the existing conditions.

6.2.1 Maryland Traffic Relief Plan (TRP) and I-495/I-270 P3 Program (I-495/I-270 Managed Lanes in Maryland)

The Maryland Department of Transportation State Highway Administration's (MDOT SHA) TRP was announced in 2017, a planned private-public partnership aimed at mitigating congestion along Maryland's most congested roads. The largest initiative in the TRP evaluates improvements for the I-495 and I-270 corridors. The TRP is comprised of three parts which are outlined in MDOT SHA's Fact Sheet (MD SHA, 2017) found on their project website[1]. Phase I, the most pertinent to the I-495 NEXT project, includes plans to add capacity to the Capital Beltway between the ALMB and the I-270 interchange, as well as on I-270 between I-495 and I-370. (MDOT's EIS contemplates a program of managed lane improvements that encompass the length of I-495 in Maryland, to be implemented in future phases).

Significant coordination between VDOT and MDOT has occurred throughout the planning process for the I-495 NEXT project to maintain consistency with elements of the TRP in the I-495 NEXT transportation operations analysis study area. These elements include the following:

- Two managed lanes in each direction over the ALMB and along I-495 into Maryland through the northern extents of the transportation operations analysis study area (just south of Cabin John Parkway / River Road).
- Connections between the Maryland managed lanes system and the GWMP, including a ramp from the southbound Maryland managed lanes to GWMP eastbound (inbound) and from GWMP westbound (outbound) to the northbound Maryland managed lanes.
- In the I-495 NEXT project No Build scenario, the Maryland managed lanes are assumed to terminate just south of the ALMB in Virginia in the vicinity of the GWMP interchange. **Exhibit 6-1** provides a concept for how this terminus would potentially be configured:
    - In the northbound direction, a left-side slip ramp from the GP lanes would be provided to develop one of the two northbound managed lanes into Maryland; the second northbound managed lane would be provided by the on-ramp from the GWMP westbound.
    - In the southbound direction, the two managed lanes leaving Maryland would split, with one lane becoming the off-ramp to the GWMP eastbound and the other lane merging into the I-495 southbound GP lanes.

Note that in the I-495 NEXT project Build scenario, described in the next chapter, the Maryland managed lanes and Virginia Express Lanes would form a continuous, seamless system through the study area with two barrier-separated lanes in each direction. In the I-495 NEXT project No Build condition, the Maryland managed lanes system is assumed to be in place, leaving a gap section without Express Lanes between Route 267 and the ALMB. A sensitivity analysis has been conducted to assess the traffic operational

[1] https://495-270-p3.com/program-overview/ and https://495-270-p3.com/p3-information/phase-1-solicitation/

impacts of the No Build and Build conditions for the I-495 NEXT project if the I-495 Maryland managed lanes system would not be completed between the ALMB and I-270 interchange by 2025. This analysis is included as Appendix I of the *TATTR* and is summarized in **Chapter 9** of this IJR.

Within the Maryland managed lanes system in the traffic operations analysis study area, no further connections with the GP lanes or arterial network are assumed (e.g. no Express connections to or from Clara Barton Parkway). All connections to or from the managed lanes in Maryland are assumed to be located north of and outside the I-495 NEXT traffic operations analysis study area.

6.2.2 Dulles Interchange Master Plan

The Dulles Interchange Master Plan, which is included in the regional CLRP, contains a series of proposed improvements to the I-495/Route 267 interchange. This plan includes the following elements to be constructed independent of I-495 NEXT project:

- New direct ramp connections, including the following:
    - I-495 northbound GP lanes to westbound Dulles Airport Access Road (DAAR)
    - I-495 southbound GP lanes to westbound DAAR
- New right-side flyover ramp from I-495 northbound GP lanes to westbound Dulles Toll Road, eliminating the existing left-side ramp from I-495 northbound GP.
- Capacity enhancements to ramp from eastbound Dulles Toll Road to I-495 northbound GP lanes – widening this ramp to two lanes until it joins the I-495 mainline, at which point the two lanes merge into a single auxiliary lane.
- Auxiliary lanes along I-495 north of Dulles Interchange – an auxiliary lane will be provided in each direction between the Dulles Interchange and Georgetown Pike to improve the capacity of the GP lanes. The northbound auxiliary lane is assumed to be in place by 2025 while the southbound auxiliary lane is assumed to be in place by 2045.
- C-D road system along I-495 between Route 123 and Dulles Interchange – due to the short weaving areas between these two interchanges, a C-D road system is included within the Dulles Interchange Master Plan to improve capacity and reduce conflicting movements. Note that under the I-495 NEXT project No Build conditions, a C-D road is only shown for southbound I-495. These improvements are assumed to be in place by 2045.
- C-D road system along Dulles Toll Road between Route 123 and Dulles Interchange – due to the short weaving areas between these two interchanges, an eastbound C-D road system along the Dulles Toll Road is included within the Dulles Interchange Master Plan to improve capacity and reduce conflicting movements. These improvements are assumed to be in place by 2045.

Exhibits 6-2a through **6-2c** provide a concept for the Dulles Interchange assumed for I-495 NEXT No Build conditions for 2045. Note that the I-495 NEXT Build concept relocates and reconfigures several of these ramp connections.

6.3 TSM OPTIONS

Transportation System Management (TSM) focuses on improving the operational efficiency of transportation systems without major system improvements (such as adding lanes or new ramps). Freeway TSM strategies can include signing and pavement striping improvements, traffic surveillance and control equipment, incident-management programs, HOV facilities, and ramp metering. Corridor and system-wide

TSM strategies may incorporate improvements to mass transit service, multimodal facilities, and intelligent transportation systems.

Consistent with FHWA's Interstate System Access Information Guide, Eight Policy Point Requirements, Point 2, TSM strategies were studied, many of which are already present on the I-495 corridor today:

- I-495 already has an Advanced Traffic Management System (ATMS) featuring traffic surveillance (CCTV cameras), incident management (VDOT's Safety Service Patrol), and lane control signals for the northbound left-side shoulder lane.
- South of Old Dominion Drive, barrier-separated Express Lanes have been open since 2012. The Express Lanes are free to HOV-3+ vehicles and any other vehicle willing to pay a dynamic toll. Trucks are not currently permitted in the I-495 Express Lanes. Dynamic message signs (DMS) upstream of the Express Lanes entrance and along arterial routes that have direct access to the Express Lanes provide pricing information.

The I-495 corridor, even with the TSM strategies implemented above, experiences the operational and safety issues described in the Purpose and Need (**Chapter 2**). Due to the nature of the Purpose and Need of the project, TSM options alone will not address the system linkage and operational safety issues associated with the I-495 NEXT Project. A hybrid combination of TSM strategies and Alternative Transportation Modes was also insufficient to address the system linkage and operational safety issues associated with the corridor. However, the Build Alternative identified in this IJR incorporates several TSM strategies and Alternative Transportation Modes. These strategies include:

- Express Lanes separated with flexible-post bollards for HOV-3+ vehicles and transit.
- Geometric improvements to existing ramps and interchanges

6.4 BUILD ALTERNATIVE

The Build Alternative would consist of five elements described in further detail below: extending the existing I-495 Express Lanes, adding GP auxiliary lanes, adding access to the Express Lane network, improving two interchanges, and reconstruction of overpasses:

- Extending the existing four I-495 Express Lanes from their current terminus between the I-495/Route 267 interchange and the Old Dominion Drive overpass north approximately 1.6 miles to the GWMP interchange, at which point the Express Lanes would initially tie into the Capital Beltway in the vicinity of the ALMB, but eventually tie in with the Maryland Managed Lanes system once it is constructed. Express Lanes are designed to keep traffic flowing at 45 miles per hour or faster by dynamically adjusting tolls, allowing transit, high-occupancy, and toll-paying vehicles to have a much more reliable trip. In order to reduce the limits of disturbance (LOD), the extended Express Lanes would be separated from the GP lanes by flexible post delineators (see **Figure 6-1**), consistent with the configuration of the existing I-495 Express Lanes, requiring approximately an additional four feet per direction in the overall typical section of the roadway (eight feet total). This eliminates the need to provide full shoulders and concrete barrier separation between the GP lanes and the Express Lanes in each direction.
- Additional GP auxiliary lanes between the Route 267 and Route 193 interchanges. North of the Route 193 interchange, an auxiliary lane is already provided in the northbound direction up to the GWMP; in the southbound direction, a collector-distributor (C-D) road would take the place of an

auxiliary lane. Through the entire project area, the Build Alternative would retain the existing number of GP lanes in each direction between the I-495/Route 267 interchange and the GWMP.

- Additional access to and from the Express Lanes network (described further in this section below).
- Improvements to I-495 interchanges between Route 123 and GWMP (described further in this section below).
- Reconstruction of I-495 overpasses in the study area.

Figure 6-2 shows a typical section for I-495, with two Express Lanes in either direction separated by flexible delineators. **Exhibit 6-3a** through **Exhibit 6-3e** provide a plan view of the Build Alternative.

Figure 6-1. Existing Flexible Post Delineators on I-495 Express Lanes

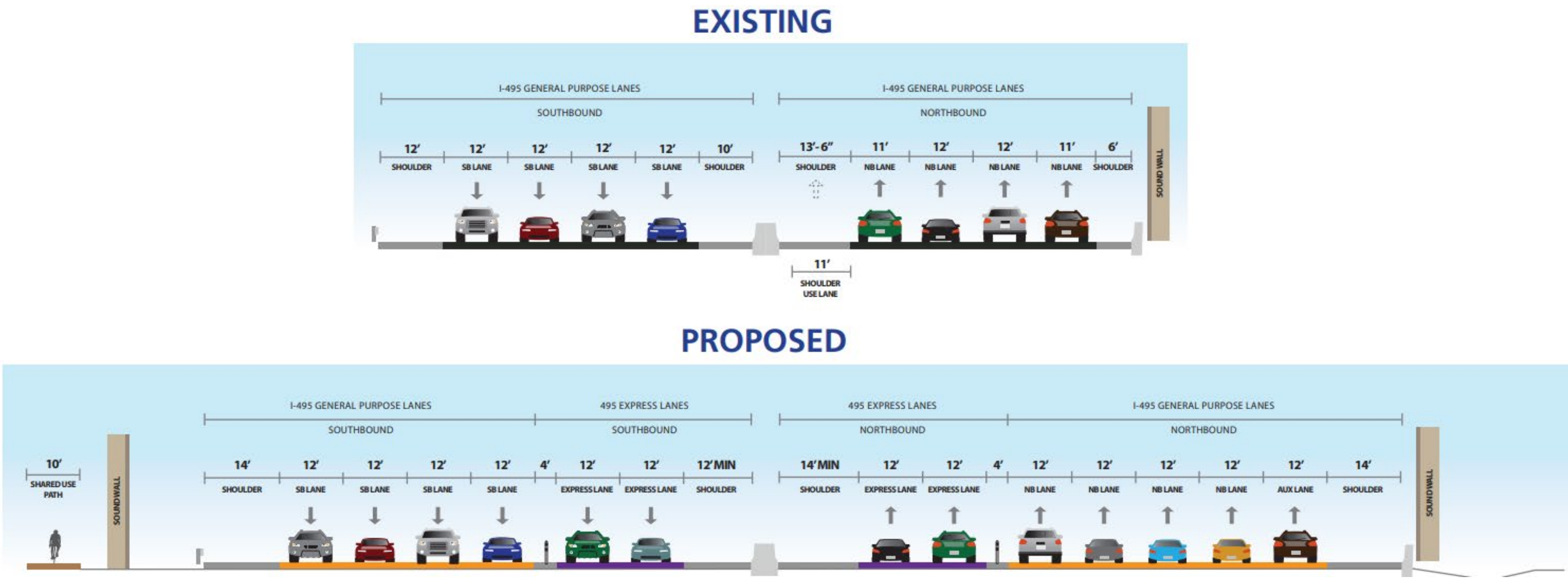


Figure 6-2. Existing and Build Alternative Typical Sections

6.4.1 Proposed Access to the Express Lanes

The Build Alternative would provide the following access to and from the Express Lanes:

- Flyover exchange ramps to provide access from the northbound I-495 GP lanes to the northbound I-495 Express Lanes, and from the southbound I-495 Express Lanes to the southbound I-495 GP lanes. These exchange ramps would be located at the Route 267 interchange.
- New Express Lanes access to and from Route 267:
  - Eastbound Route 267 (Dulles Toll Road (DTR)) to northbound I-495 Express
  - Westbound Route 267 (Dulles Connector Road (DCR)) to northbound I-495 Express
  - Southbound I-495 Express to eastbound Route 267 (DCR). This movement would tie into an eastbound C-D road along Route 267 at the Route 267/Route 123 interchange, allowing access to both the eastbound DCR and Route 123.
  - Note that the southbound I-495 Express to westbound Route 267 (DTR) movement is already provided today; additionally, the northbound I-495 Express to westbound Route 267 (DTR) and eastbound Route 267 (DTR) to southbound I-495 Express movements are also provided today.
- New Express Lanes access to and from GWMP:
  - Northbound I-495 Express to GWMP
  - GWMP to southbound I-495 Express

Note that the Maryland managed lanes system (assumed to be in place under No Build conditions) would provide access to the movements from GWMP to northbound I-495 Express and from southbound I-495 Express to GWMP.

To be conservative, the traffic analysis for the EA and IJR assumed trucks are allowed in the Express Lanes north of the Dulles Toll Road. The allowance of trucks is ultimately subject to policy decision by VDOT leadership.

6.4.2 Interchange Configurations

Route 267 Interchange

The Build Alternative includes modifications to the I-495/Route 267 interchange, including modifications to several of the GP ramp connections. Individual Ramp movements are discussed in detail below and can be seen in **Exhibit 6-3a** and **Exhibit 6-3b**. "Modified Access" refers to movements which are provided under the existing interchange configuration, while "Additional Access" refers to movements which are not provided under the existing interchange configuration. All access provided in the existing interchange configuration is maintained in some form through all phases of the Build Alternative. Proposed actions include the following:

- **GX**—Ramp GX is a one-lane ramp which provides Additional Access from northbound I-495 GP lanes, from and Route 123 at the I-495/Route 123 interchange, to northbound I-495 Express Lanes. Ramp GX would be provided via a connection from ramp G2 to ramp E1.
- **XG**—Ramp XG is a one-lane ramp which provides Additional Access from southbound I-495 Express Lanes to southbound I-495 GP lanes. Ramp XG would be provided via flyover ramp connecting ramp E2 to ramp D1.

- **E1**—Ramp E1 provides Modified Access from eastbound DTR and eastbound DAAR to northbound and southbound I-495 Express Lanes, with one lane of capacity to each Express Lane facility. Modified Access from eastbound DTR and eastbound DAAR would be provided via a C-D road which collects traffic from the DTR and DAAR upstream of the Route 267 interchange and then flies over eastbound DTR.
- **E2**—Ramp E2 is a one-lane ramp which provides Additional Access from southbound I-495 Express Lanes to eastbound DTR.
- **E3**—Ramp E3 is a one-lane ramp which provides Additional Access from westbound DCR to northbound I-495 Express Lanes. Ramp E3 merges with ramp E1 before tying into northbound I-495 Express Lanes.
- **G1**—Ramp G1 is a one-lane ramp which provides Modified Access from southbound I-495 GP lanes to eastbound DTR. Ramp G1 also provides access to Route 123 at the Route 267/Route 123 interchange via a connection to ramp D2 and subsequent connection to ramp G4.
- **G2**—Ramp G2 provides Modified Access from northbound I-495 to westbound DTR with one-lane of capacity. Ramp G2 also provides access from Route 123 at the I-495/Route 123 interchange via the proposed C-D road system at that interchange.
- **G3**—Ramp G3 is a two-lane ramp which provides Modified Access from eastbound DTR to northbound I-495 GP lanes. Ramp G3 would be extended to combine with ramps G10 and G9 about before tying into northbound I-495 GP lanes about 0.6 miles downstream of the existing tie in point.
- **G4**—Ramp G4 provides Modified Access from eastbound DTR to the Route 123 C-D road at the Route 267/Route 123 interchange. Ramp G4 also provides access to the Route 123 C-D from eastbound DAAR via a connection from ramp D2.
- **G5**—Ramp G5 is a two-lane ramp which provides Modified Access from southbound I-495 GP lanes to westbound DTR.
- **G6**—Ramp G6 provides Modified Access from southbound I-495 GP lanes to the proposed Route 123 C-D road at the I-495/Route 123 interchange with one-lane of capacity.
- **G7**—Ramp G7 is a one-lane ramp which provides Modified Access from eastbound DTR to the propose Route 123 C-D road at the I-495/Route 123 interchange.
- **G8**—Ramp G8 is a one-lane ramp which provides Modified Access from eastbound DTR to southbound I-495 GP lanes.
- **G9**—Ramp G9 is a one-lane ramp which provides Modified Access from the Route 123 C-D road at the I-495/Route 123 interchange to northbound I-495 GP lanes (provided access to the northbound GP lanes from Route 123). Ramp G9 is provided via a connection from ramp G2 to combined ramps G3 and G10.
- **G10**—Ramp G10 is a one-lane ramp which provides Modified Access from westbound DTR to northbound I-495. The Ramp G10 tie-in to I-495 general purpose lanes is provided via a connection from the westbound DTR mainline to ramp G3.
- **D1**—Ramp D1 provides Modified Access from eastbound DAAR (indirectly via eastbound DTR) to southbound I-495 GP lanes with one-lane of capacity.
- **D2**—Ramp D2 provides Modified Access from eastbound DAAR to northbound I-495 GP lanes with one-lane of capacity.
- **D3**—Ramp D3 is a one-lane ramp which provides Additional Access from southbound I-495 GP lanes to westbound DAAR.

- **D4**—Ramp D4 is a one-lane ramp which provides Additional Access from northbound I-495 GP lanes to westbound DAAR.

GWMP Interchange

The Build Alternative also includes modifications to the GWMP interchange, the northernmost interchange on I-495 in Virginia. These modifications can be seen on **Exhibit 6-3e.** All existing GP movements at the GWMP would be maintained under the Build Alternative but would be modified to accommodate additional access between I-495 Express Lanes and the GWMP, to and from the south, provided under the Build Alternative. The corresponding future ramp movements to and from the north, connecting with Maryland's proposed managed lanes at the ALMB, will be provided by others as a separate but coordinated project with independently utility and need.

7. ROADWAY GEOMETRY

The Build Alternative was developed to a level of detail to support detailed cost estimates, right-of-way needs, and to confirm adherence to design criteria. **Appendix F** contains plans, profiles, typical sections, cross sections, geometric details, and other design information. The alignments reflect AASHTO design criteria for freeways. **Table 7-1** summarizes design parameters.

Table 7-1. Design Parameters

Freeway Segment	Design Speed	Functional Classification	Design-Year Traffic 2045 (vehicles per day)
I-495 Express Lanes (*Dulles Toll Road to GWMP*)	70	Divided Highway - Interstate	77,000
I-495 General Purpose Lanes (*GWMP to ALB*)	60	Divided Highway - Interstate	239,000
Route 267 Dulles Toll Road *(Spring Hill Road to Rte 123*)	60	Divided Highway - Other Freeway or Expressway	173,000

7.1 BACKGROUND

The geometry of the Build Alternative reflects a number of key constraints and planning decisions. Foremost among these is the design concept approach to 'not preclude' the future program of improvements in the CLRP. The most notable 'not to preclude' projects include: the 2009 Dulles Interchange Master Plan (or "Dulles Interchange Long Range Plan") identified in the 2009 Dulles /I-495 Interchange IJR; Fairfax County's master plan for Tysons access to and from the DTR between Route 7 and I-495; and Maryland's Managed Lanes project that is a component of their Traffic Relief Plan. In addition, due to historic resources at the Georgetown Pike, Section 4(f) / 6(f) resources at Scott's Run Nature Preserve, and the historic nature of the GWMP, the roadway geometry and supporting infrastructure (e.g. walls and signing) were minimized in these areas using context sensitive design.

For the purposes of understanding the geometric design elements of the project, a set of design plans is included by reference showing plans, profiles, cross sections, bridge structures, and retaining walls. Refer to **Appendix F,** which shows conceptual design plans for the Build Alternative (these plans were published on February 26, 2020 as part of the Location and Design Public Hearing materials for the project – "Design Public Hearing Plans"). Note that due to the volume of plan sheets in this plan set, **Appendix F** is incorporated by reference under separate cover.

7.2 PRELIMINARY ENGINEERING DEVELOPMENT

Each interchange configuration within the project footprint was initially developed with several conceptual design options. Several factors influenced the design of the mainline and of each interchange connection within the project corridor. These included access to / from adjacent interchanges, safety improvements needed to address existing issues, right-of-way acquisition in critical areas such as residential neighborhoods and parks, improved traffic flow and operations, geometric constraints, and project costs.

Following the Public Information Meeting in May of 2019, where VDOT presented the interchange configuration options considered for the Build Alternative, the project team then identified proposed build interchange configurations at each access point to advance to the Build Alternative, based on public and stakeholder agency input, as well as based on the least impactful footprint that best the Purpose and Need. Each access point option was considered independently, as well as in combination with the other access points, when evaluated for inclusion in the Build Alternative. Additional design work continued, following publication of the 2020 Design Public Hearing Plans, in an effort to reduce impacts to adjacent properties, as well as to respond to concerns from the public, stakeholder agencies, and elected officials. For example, the geometry of the Georgetown Pike interchange was modified to provide an additional sidewalk connection along the north side of the Georgetown Pike bridge over I-495, in order to connect the proposed new shared-use path on the east side of the I-495 corridor with the trail leading to Scotts Run Nature Preserve, as requested by the Fairfax County Park Authority.

After further coordination with FHWA, VDOT leadership, and stakeholders, it was determined that the construction of improvements would be phased. Phase 1 of the Build Alternative (assumed to implemented by 2025) will reduce the initial project cost and reduce immediate right-of-way impacts by deferring several elements of the project to later phases, mostly at the DTR / DAAR interchange, the project's northern terminus at the GWMP interchange, and the southbound I-495 auxiliary lane between Georgetown Pike on-ramp and the DTR exit ramps. **Exhibit 7-1a** through **Exhibit 7-1e** provide a plan view of the proposed Phase 1 of the Build Alternative. The specifics of phasing are addressed in more detail in **Chapter 11** and in the Operationally Independent and Non-Concurrent Construction (OINCC) determination for the project, attached in **Appendix G.** Further Build Alternative improvements will be brought online in coordination with the local jurisdictions.

7.3 DESIGN EXCEPTIONS AND DESIGN WAIVERS

The proposed access modifications are being designed to meet or exceed current standards in accordance with the AASHTO Green Book, AASHTO Design Standards Interstate System and the VDOT Road Design Manual, where feasible and practicable. Design deviations from these standards were identified as necessary at several locations, due to the constrained and built-out nature of the project study area, and were incorporated in the design in order to minimize impacts to Section 4(f) / Section 6(f) resources, as well as to minimize impacts to private right-of-way, streams and wetlands. Final approval of the Build Alternative detailed design requires approval of several design exceptions and design waivers. These are listed in the Design Exceptions / Design Waivers Matrix shown in **Exhibit 7-2** and graphically shown in **Exhibit 7-3** (Phase 1) and **Exhibit 7-4** (2045 Design Year)**.** The design exceptions include shoulder width reductions, non-standard horizontal and vertical curves, vertical clearance, and interchange ramp spacing. The waivers included reduced ramp recovery areas, vertical grades on ramps. Most design exceptions occur at spot locations, although some occur over significant lengths of highway such as the design exception for no shoulder width on the left of the I-495 general purpose lanes – and to the right of the Express Lanes – due to the proposed provision of a 4-foot buffer with pylons between the general purpose and Express Lanes.

FHWA and VDOT Central Office have reviewed the latest potential substandard design elements shown in **Exhibits 7-2** through **7-4**. but have not approved any of the proposed design exceptions or design waivers at the time this IJR was prepared. Coordination of the approval process for design exceptions and design waivers will continue with FHWA and VDOT as more detailed design development occurs.

7.4 NUMBER OF MAINLINE AND CROSSROAD LANES

The Build Alternative introduces new express lanes in the northbound and southbound directions of I-495, by means of widening the existing mainline and relocating the general purpose lanes farther out from the road centerline. The proposed I-495 Express Lanes extension typical section has been designed to be consistent with the existing Capital Beltway Express facility between west of the Springfield Interchange and north of DTR / DAAR Interchange. The project does not include widening of crossroads to add additional through lanes, but provides for improved capacity for the left turn lanes at the Georgetown Pike interchange ramp termini by providing two left turn lanes in each direction across the Georgetown Pike overpass.

The project also includes reconfiguration of the existing southbound C-D road between the GWMP and Georgetown Pike to optimize the lane use based on future traffic demands, with one less lane provided than exists today. At the DTR / DAAR interchange, new ramp connections, ramp braiding, and C-D roads are provided under the Build Alternative Ultimate Configuration, as previously discussed in Chapter 6. These improvements were identified in the original 2009 Dulles Interchange Long Range Plan, and are provided to reduce weaving conflicts, address safety and operational issues, and improve access between the four limited-access facilities that converge at this location.

The number of lanes provided on the I-495 mainline and crossroads are as follows:

- I-495 general purpose lanes – 4 through lanes and one auxiliary lane per direction;
- I-495 Express Lanes extension – 2 lanes per direction (with a four-foot buffer and tubular markers / plastic bollards on the right-hand side separating the Express Lanes from the general purpose lanes);
- I-495 southbound C-D road – 1 lane between GWMP and Live Oak Drive, 2 lanes between Live Oak Drive and exit ramp to Georgetown Pike, 1 lane between Georgetown Pike exit ramp and Georgetown Pike overpass; includes braided ramps to separate weaving between GWMP and Georgetown Pike;
- DTR – 4 lanes per direction west of I-495, 2 lanes per direction east of I-495 at Route 123;
- DTR Interchange C-D roads – 2 lanes in the northbound, southbound, and eastbound directions;
- DAAR – 3 lanes per direction west of I-495 (by others, independent of the project), 2 lanes per direction east of I-495;
- GWMP – 2 lanes per direction;
- Georgetown Pike – 2 through lanes per direction in the immediate interchange area, transitioning to 1 lane per direction just beyond the project limits;
- Lewinsville Road, Dominion Drive, and Live Oak Drive overpasses – 1 lane per direction;
- Route 123 – 3 through lanes in each direction, with auxiliary lanes between successive entrance and exit ramps, and dedicated right and left turn lanes between intersections.

Note that under Phase 1, the proposed northern terminus at GWMP interchange is configured to transition to a single lane in each direction that ties back into the existing cross section of the I-495 general purpose lanes, until such time that Maryland's Traffic Relief Program project – including widening of the American Legion Bridge – is completed, to allow for two lanes in either direction across the bridge and into Maryland.

8. TRAFFIC VOLUMES

This chapter provides an overview of the assumptions and procedures used for travel demand modeling and post-processing of modeling results for traffic volume forecasts used in the traffic and safety analyses.

8.1 TRAFFIC FORECASTING METHODOLOGY

8.1.1 Travel Demand Modeling Methodology and Key Assumptions

Forecasts for future traffic demand were developed using the MWCOG travel demand model (version 2.3.75 using Round 9.1 Cooperative Forecasts for socioeconomic data). The MWCOG model was modified and developed to reflect existing conditions (year 2018) in the Study Area. This included existing conditions network modifications to reflect current traffic volumes, and these modifications were carried into subsequent 2025- and 2045-year I-495 NEXT model scenarios. Strategic modifications included highway network edits to better represent Study Area facilities as they exist (including micro-coding of ramps), modification to centroid connectors to improve loading of traffic, modifications to the default speed and capacity of certain facilities, and enhancements to penalties for crossing the Potomac River. Calibration of the model was based on guidance from the FHWA Transportation Model Improvement Program (TMIP) *Travel Model Validation and Reasonableness Checking Manual* (FHWA, 2010) and the Virginia *Travel Demand Modeling Policies and Procedures Manual* (VDOT, 2014). Updates to the model were validated by comparing daily counts versus model forecasts, peak period traffic counts to modeled data during the same periods, and AM and PM observed speeds and travel times to model speeds and travel times within the I-495 traffic operations analysis Study Area.

A detailed overview of travel demand modeling methodology is provided in the *Traffic and Transportation Technical Report*, including a memorandum detailing modifications made to the MWCOG model to better reflect existing conditions, including validation metrics.

8.1.2 Methodology/Key Assumptions for Post-Processing of Modeling Results

Relevant edits to the calibrated existing conditions model network and scripts were carried forward to all future scenarios, including separate model scenarios for No Build and Build conditions as well as model scenarios developed for the various sensitivity tests. Outputs from these models were used to estimate growth on Study Area roadway links using National Cooperative Highway Research Program (*NCHRP 765)* industry-standard practices (Transportation Research Board, 2014). The *NCHRP 765* iterative-directional method was used to convert forecasted link volumes into forecasted turning movement volumes for arterial intersections. All traffic volumes on freeways and arterials were balanced. To be conservative, the traffic analysis for the EA and IJR assumed trucks are allowed in the Express Lanes north of the Dulles Toll Road. The allowance of trucks is ultimately subject to policy decision by VDOT leadership.

Origin-Destination Routing for Traffic Analysis

Origin-destination (O-D) routing was used in the VISSIM traffic simulation models (described in **Chapter 9**). In order to produce these O-D routes, a seeding O-D matrix was developed using a combination of StreetLight Data and MWCOG model subarea matrix outputs. This seeding matrix and balanced, post-processed volume targets were then imported into PTV VISUM travel demand modeling software for each scenario. An adjusted final matrix was developed using VISUM's TFlowFuzzy methodology with the seeding O-D matrix and volume targets. The final O-D matrices were disaggregated into two vehicles classes (auto and truck) for routing in the traffic analysis microsimulation models.

8.2 TRAFFIC ANALYSIS SCENARIOS

The operational performance of the I-495 NEXT project was evaluated for three analysis years: existing conditions (2018), opening year (2025), and design year (2045). Construction of the project is expected to start in 2022 and be completed in 2025; a final determination on the project schedule will be made following the selection of a design-build contractor and once commercial close with the private concessionaire is achieved. The analysis includes No Build and Build conditions in both 2025 (opening year) and 2045 (design year). A sensitivity analysis has been conducted to assess the traffic operational impacts of the No Build and Build conditions for the I-495 NEXT project if the I-495 Maryland managed lanes system would not be completed by 2025. This analysis is included as Appendix I of the *TATTR* and is summarized in **Chapter 9** of this IJR.

The traffic volumes used for the analysis of all scenarios were developed using the methodology described in this chapter and in the *Traffic and Transportation Technical Report*.

- The traffic volumes for each roadway section for existing conditions are provided in Chapter 4 of the *Traffic and Transportation Technical Report.*
- The traffic volumes for each roadway section for 2025 and 2045 No Build and Build conditions are provided in Chapter 7 of the *Traffic and Transportation Technical Report.*
- The traffic volumes for each roadway section for the 2025 No Build and Build conditions if the I-495 Maryland managed lanes system would not be completed are provided in Appendix I of the *TATTR.*

Chapter 7 of the *TATTR* also provides charts comparing freeway volume forecasts between the No Build and Build condition. The following sections summarize the major trends for each analysis year and peak period. Chapter 1 of the EA notes that overall and peak period traffic volumes are forecasted to increase in the future and would exceed the carrying capacity of the corridor to a greater degree. These high volumes would be driven primarily by projected population and employment growth in the region. Therefore, there is a need to accommodate increased traffic volumes and travel demands for single- and high-occupancy vehicles as population and employment continue to grow within the region.

8.2.1 2025 AM Freeway Volume Comparison

- In the northbound direction, the highest traffic volumes in all scenarios are between the GWMP and Clara Barton Parkway (across the ALMB). The increases in volume from No Build to Build range from 200 vph to 700 vph (2 percent to 9 percent) across the four segments, with the largest increases in the segments between Route 267 and GWMP where the Build Alternative adds capacity from the Express Lanes.
- In the southbound direction, the highest traffic volumes in all scenarios are again between the Clara Barton Parkway and GWMP (across the ALMB). The increases in volume from No Build to Build range from 170 vph to 550 vph (2 percent to 6 percent) across the four segments, with the largest increase in the segments between GWMP and Route 267 where the Build Alternative adds capacity from the Express Lanes.

8.2.2 2025 PM Freeway Volume Comparison

- In the northbound direction, the highest traffic volumes in all scenarios are between the GWMP and Clara Barton Parkway (across the ALMB). The increases in volume from No Build to Build range from 730 vph to 1,540 vph (10 percent to 29 percent) across the four segments, with the largest increases in the segments between Route 267 and GWMP where the Build Alternative adds capacity from the Express Lanes.
- In the southbound direction, the highest traffic volumes in all scenarios are again between the Clara Barton Parkway and GWMP (across the ALMB). The increases in volume from No Build to Build range from 380 vph to 850 vph (7 percent to 12 percent) across the four segments, with the largest increase in the segments between GWMP and Route 267 where the Build Alternative adds capacity from the Express Lanes.

8.2.3 2045 AM Freeway Volume Comparison

- In the northbound direction, the highest traffic volumes in all scenarios are between the GWMP and Clara Barton Parkway (across the ALMB). The increases in volume from No Build to Build range from 280 vph to 1,080 vph (3 percent to 11 percent) across the four segments, with the largest increases in the segments between Route 267 and GWMP where the Build Alternative adds capacity from the Express Lanes.
- In the southbound direction, the highest traffic volumes in all scenarios are again between the Clara Barton Parkway and GWMP (across the ALMB). The increases in volume from No Build to Build range from 410 vph to 690 vph (4 percent to 6 percent) across the four segments, with the largest increase in the segments between GWMP and Route 267 where the Build Alternative adds capacity from the Express Lanes.

8.2.4 2045 PM Freeway Volume Comparison

- In the northbound direction, the highest traffic volumes in all scenarios are between the GWMP and Clara Barton Parkway (across the ALMB). The increases in volume from No Build to Build range from 260 vph to 1,400 vph (3 percent to 20 percent) across the four segments, with the largest increases in the segments between Route 267 and GWMP where the Build Alternative adds capacity from the Express Lanes.
- In the southbound direction, the highest traffic volumes in all scenarios are again between the Clara Barton Parkway and GWMP (across the ALMB). The increases in volume from No Build to Build range from 660 vph to 1,020 vph (7 percent to 12 percent) across the four segments, with the largest increase in the segments between GWMP and Route 267 where the Build Alternative adds capacity from the Express Lanes.

9. TRAFFIC ANALYSIS

The operational performance of the I-495 NEXT project was evaluated for three analysis years: existing conditions (2018), opening year (2025), and design year (2045). Construction of the project is expected to start in 2021, with Express Lanes service commencement in 2024 and final project completion in 2025. The analysis includes No Build and Build conditions in both 2025 (opening year) and 2045 (design year). In 2025, the Build conditions are analyzed using the Phase 1 design concept. In 2045, the Build conditions are analyzed using the Ultimate configuration concept.

Note that in the I-495 NEXT project Build scenario, described in Chapter 7, the Maryland managed lanes and Virginia Express Lanes form a continuous, seamless system through the study area with two barrier-separated lanes in each direction. In the I-495 NEXT project No Build condition, the Maryland managed lanes system is assumed to be in place, leaving a gap section without Express Lanes between Route 267 and the ALMB.

9.1 TRAFFIC OPERATIONAL ANALYSIS METHODOLOGY

9.1.1 Analysis Tools and Software

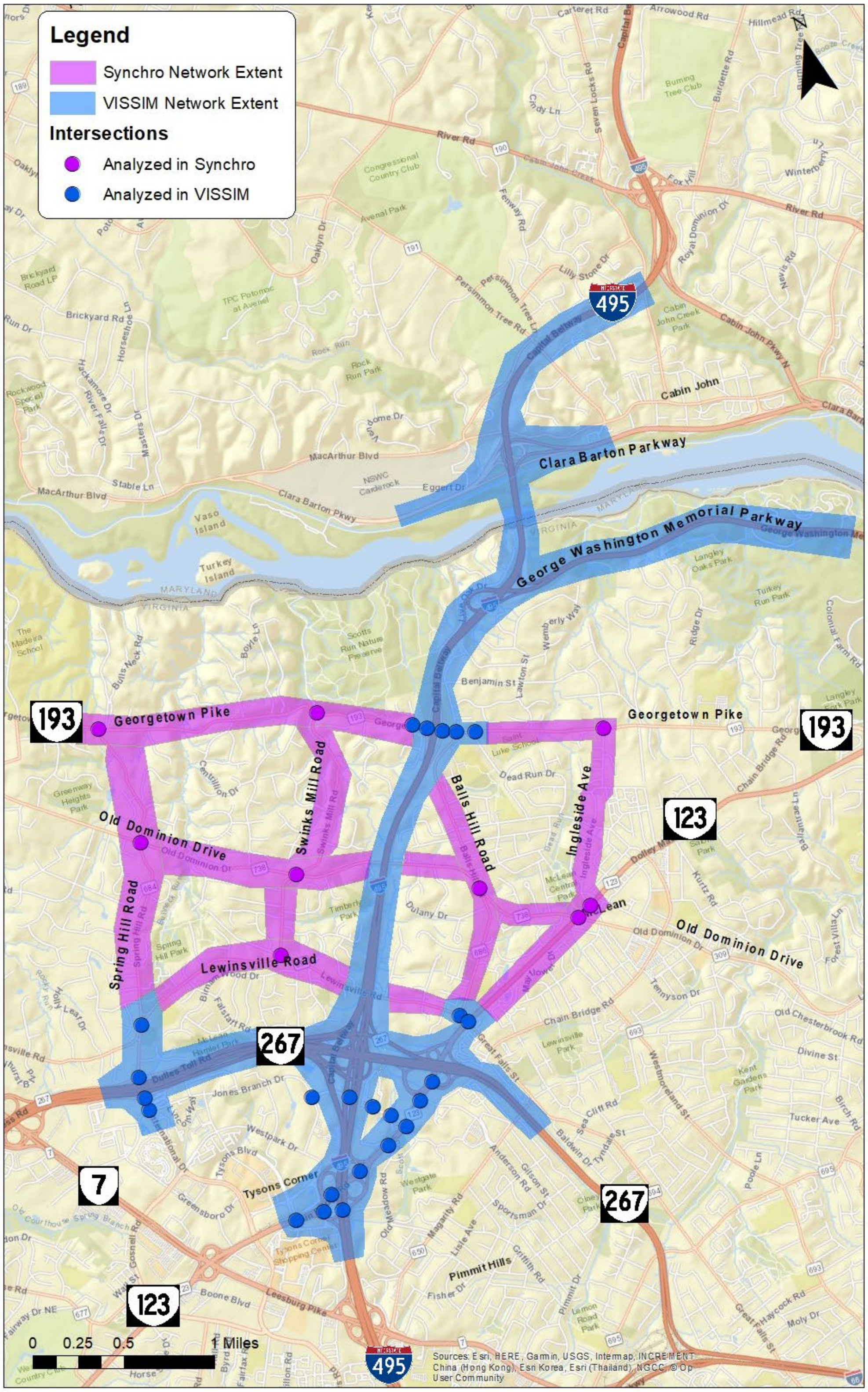
VISSIM Version 9.0 was used for a comprehensive network traffic analysis for the freeways, interchanges, and adjacent intersections within the traffic operations analysis area limits[1]. VISSIM is able to account for system-wide operations, including upstream and downstream conditions at any roadway segment, as it stochastically simulates traffic operations for individual vehicles on freeway segments and provides traffic operational data including vehicle delay, density, and travel speeds on freeway networks. VISSIM reports average density as vehicles/mile/lane, and density analysis results are depicted in similar levels of congestion to the HCM density-based level of service thresholds.

Surface street intersection operations were evaluated through a combination of Synchro 10 (in order to develop preliminary optimization for phasing and signal timing) and VISSIM (for microsimulation and analysis). The expanded arterial network beyond intersections immediately adjacent to freeway interchanges in the corridor was evaluated solely through Synchro. **Figure 9-1** provides a map of the network links and intersections that were analyzed using VISSIM versus Synchro, respectively.

All VISSIM and Synchro traffic model files are included in **Appendix H** and in digital format on a USB drive.

[1] The analysis tool selection matrix can be found within the VDOT *Traffic Operations and Safety Analysis Manual (TOSAM), Version 1.0* (VDOT, 2014).

Figure 9-1: Traffic Operations VISSIM and Synchro Analysis Areas



9.1.2 Measures of Effectiveness

The following measures of effectiveness (MOEs) were used for the operational analysis of the roadway network under existing (2018) and future Build and No Build conditions.

Freeway Performance Measures

- Simulated Average Speed (mph)
- Simulated Average Density (simulated vehicles per lane per mile but not reported as LOS)
- Simulated Volume (vehicles per hour)
- Percent of Demand Served: simulated volume (*processed volumes*) divided by actual volume (*input volumes*).
- Simulated Ramp Queue Length: reported average and maximum queue lengths (feet).
- Simulated Travel Time: reported for select network origin-destination travel paths (seconds).
- Congestion *Heat Maps*: incremental speeds reported for aggregated lanes, by time interval (mph).

Arterial/Intersection Performance Measures

Since VISSIM was used to evaluate intersections immediately adjacent to the Study Area freeway network while Synchro was used to evaluate the expanded arterial network, outputs have been reported differently for intersections, depending on which software analysis tool was used.

Synchro reports arterial intersection approach and movement delay outputs using control delay, while VISSIM reports these outputs using microsimulation delay. VDOT's TOSAM provides separate definitions for intersection control delay and microsimulation delay, both of which are measured in seconds per vehicle:

- **Control delay**: *delay associated with vehicles slowing in advance of an intersection, the time spent stopped on an intersection approach, the time spent as vehicles move up in the queue, and the time needed for vehicles to accelerate to their desired speed.* Highway Capacity Manual (HCM), 2010.
- **Microsimulation delay**[2]: *the difference between the simulated travel time and theoretical travel time if a vehicle was operating at the desired speed calculated by the microsimulation tool.*

Because VDOT's TOSAM recommends that LOS not be used to support microsimulation model results, microsimulation delay is reported and color-coded in the same way as HCM delay-based LOS and noted as "HCM-Analogous LOS." **Table 9-1** shows level of service (LOS) criteria for signalized and unsignalized intersections (both all-way and two-way, stop-controlled) as described in the HCM 2010.

[2] The HCM 2010 does not provide a definition, but microsimulation delay is calculated as described above.

Table 9-1. Level of Service Criteria for Intersections (HCM 2010)

LOS	Signalized Intersection (seconds)	Unsignalized Intersection (seconds)
A	≤10	≤10
B	10–20	10–15
C	20–35	15–25
D	35–55	25–35
E	55–80	35–50
F	≥80	≥50

9.1.3 VISSIM Calibration of the Existing (2018) Models

The purpose of a simulation model is to investigate the effects of improvement alternatives. Simulation models are an efficient tool for evaluating improvements but are most effective when the base model matches real-world conditions. VISSIM, like all simulation models, was designed to be flexible enough that an analyst can calibrate the network to match the local conditions at a reasonably accurate level. It is well established that calibration is essential. VDOT has published the TOSAM that provides detailed criteria and acceptance targets. This document was used in developing the calibration criteria that are described in greater detail in the *I-495 NEXT VISSIM Calibration Memorandum,* which was approved and signed by the VDOT Northern Virginia District Traffic Engineer on July 27, 2018 and is provided in Appendix C of the attached *Traffic and Transportation Technical Report* **(Attachment 1)**.

The guidance provided in the VDOT TOSAM were followed in making adjustments to the VISSIM model during the calibration process. These adjustments included modifications to lane change distance for connectors, driver behavior along freeways and arterials, adjustments to desired speeds for vehicles at the network termini (such as along I-495 northbound leaving the study area), etc. Detailed descriptions of the calibration process and comparisons of results with field observations are contained in the *I-495 NEXT VISSIM Calibration Technical Memorandum*.

9.1.4 Simulation Analysis and Seeding Period

The simulation analysis periods, approved by the VDOT Northern Virginia District Traffic Engineer, are listed below. These periods were analyzed using a 30-minute seeding period for the AM VISSIM models and a 60-minute period for the PM models.

- AM peak: 6:45 a.m. to 9:45 a.m. (peak hour 7:45 a.m. to 8:45 a.m.). This period captures the onset of queueing back from the ALMB and the start of the dissipation of the queue. The peak hour captures the current worst extent of queueing.
- PM peak: 2:45 p.m. to 5:45 p.m. (peak hour 3:45 p.m. to 4:45 p.m.). This peak period captures queue formation from the ALMB before the queue from points further north in Maryland spill back and create a single continuous queue. This can be observed in **Exhibit 9-1**, as prior to approximately 3:30 p.m., congestion in Virginia does not continue into Maryland. By approximately 4:00 p.m., a single continuous area of congestion is present from north of the study area through the Route 123 interchange. Between approximately 4:00 p.m. and 7:00 p.m., however, the extent of queueing stays relatively consistent to the Route 123 interchange. The congestion does not fully dissipate

until after 8:00 p.m. on average. Note that the proposed traffic analysis period is not recommended to last until this point. Rather, the proposed traffic analysis period captures the onset of queueing (from when the queue is not due to spillback from Maryland) until it reaches its maximum.

Although the peak period in the afternoon and evening typically extends beyond six hours of congestion, the proposed analysis periods will still capture the onset of congestion and maximum extents of congestion.

9.1.5 Number of Model Runs

Given the stochastic nature of the microsimulation, VISSIM models need to be run with several different random seeds. The results need to be post-processed and averaged to determine the representative state of traffic operations in the study network. To obtain a statistically valid result, the number of runs necessary for the analysis were determined based on the VDOT Sample Size Determination Tool. Average link speed was identified as the MOE and up to two (2) different locations along I-495 northbound. These were chosen based on the locations where count data was collected. Following the steps of the VDOT Sample Size Determination Tool, it was determined that 10 runs were sufficient for all the scenarios.

9.1.6 COVID-19 Sensitivity Analysis

VDOT has received inquiries / requests from the general public and local elected officials to evaluate the impacts of COVID-19 on future traffic demand forecasts for the project, and to assess the project need in terms of the anticipated traffic operations needs under a scenario where the future traffic demands are reduced. The results of this sensitivity analysis are summarized in **Section 9.2.7** and in **Appendix K**.

9.2 TRAFFIC OPERATIONAL ANALYSIS FINDINGS

9.2.1 Existing (2018) Conditions

Existing (2018) AM Peak Freeway Operations

Exhibits 9-2a through **9-2c** and **Exhibits 9-3a** through **9-3c** illustrate the density and speed results, respectively, from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the AM peak period. In each figure, the centerline diagram laid over the aerial depicts the average densities or speeds during the peak hour from 7:45 a.m. to 8:45 a.m. in both directions along the mainline segments. The average densities and speeds are color-coded based on the congestion levels and ranges of speeds as depicted in the legend. The boxes on the top and bottom depict the densities and speeds in each direction for the entire peak period from 6:45 a.m. to 9:45 a.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix E of the *Traffic and Transportation Technical Report*. **Table 9-2** provides a list of all freeway mainline segments with densities classified as "congested" (density greater than 35 vehicles per mile per lane) or "severely congested" (density greater than 45 vpmpl) in the Existing (2018) AM peak hour.

Table 9-2. Existing (2018) AM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	South of off-ramp to NB Route 123	Weave	46	35.1	Congested
NB I-495 (GP)	Between on-ramp from EB DTR/DAAR and on-ramp from WB DTR	Merge	36	43.8	Congested

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	Between on-ramp from WB DTR and on-ramp from NB I-495 Express Lanes	Merge	35	48.8	Severely Congested
NB I-495 (GP)	Between on-ramp from NB I-495 Express Lanes and off-ramp to Route 193	Basic	29	62.4	Severely Congested
NB I-495 (GP)	Between on-ramp from NB I-495 Express Lanes and off-ramp to Route 193	Basic	27	66.9	Severely Congested
NB I-495 (GP)	Between on-ramp from NB I-495 Express Lanes and off-ramp to Route 193	Diverge	21	71.8	Severely Congested
NB I-495 (GP)	Between off-ramp to Georgetown Pike and on-ramp from Route 193	Basic	18	79.4	Severely Congested
NB I-495 (GP)	Between on-ramp from Route 193 and off-ramp to GWMP	Weave	12	106.6	Severely Congested
NB I-495 (GP)	Between off-ramp to GWMP and on-ramp from GWMP	Basic	21	74.8	Severely Congested
NB I-495 (GP)	Between on-ramp from GWMP and off-ramp to Clara Barton Parkway (ALMB)	Weave	22	73.4	Severely Congested
NB I-495 (GP)	Between off-ramp to Clara Barton Parkway and on-ramp from WB Clara Barton Parkway	Basic	45	41.8	Congested
SB I-495 (GP)	Between off-ramp to WB Clara Barton Parkway and on-ramp from Clara Barton Parkway	Basic	44	45.8	Severely Congested
SB I-495 (GP)	Between on-ramp from Route 193/GWMP C-D Road and on-ramp from Route 193	Merge	38	47.1	Severely Congested
SB I-495 (GP)	North of off-ramp to WB DTR	Diverge	52	35.8	Congested
EB DTR	Upstream of off-ramp to Spring Hill Road	Diverge	18	57.2	Severely Congested
EB DTR	Between on-ramp from SB Route 123 and off-ramp to NB Route 123	Weave	19	46.3	Severely Congested

Existing (2018) AM Density

In the AM peak period, northbound I-495 approaching the ALMB experiences congested-to-severely congested conditions for the entire peak period, beginning at the weave on the ALMB and continuing to the DTR interchange. At the interchange of Route 123 and I-495, the Route 123 eastbound off-ramp spills back to the northbound I-495 mainline.

Southbound I-495 between River Road and Route 193 experiences heavy congestion in the peak hour and in the shoulder hour with some segments operating under congested to severely congested levels. Congestion during the shoulder hour worsens compared to the peak hour as congestion clears upstream and more demand reaches the study area.

Existing (2018) AM Speeds

Average VISSIM speeds show similar patterns as seen in the density diagrams, with speeds along northbound I-495 starting to break down approaching the ALMB and spill back to the Route 267 interchange. Average speeds in this segment are below 35 mph with some segments operating below 20 mph (queue condition). Average speeds along southbound I-495 range from 50 to 55 mph during the peak hour. In the shoulder hour, speeds drop below 35 mph in some segments between River Road and Clara Barton Parkway

Existing (2018) AM Travel Time
Existing AM peak period average travel times are shown in **Table 9-3**. Travel time measurements have been aggregated by direction of travel and facility type.

Table 9-3. Existing (2018) AM Peak Period Travel Times

Route	Via General Purpose Lanes	Via Express Lanes
Northbound I-495 (Route 123 to River Road)	13:04	11:45
Southbound I-495 (River Road to Route 123)	7:46	7:27
Eastbound Route 267 (Spring Hill Road to Route 123)	2:03	-
Westbound Route 267 (Route 123 to Spring Hill Road)	1:53	-

Existing (2018) AM Peak Intersection Operations

Intersections Evaluated in VISSIM
With the exception of three intersections that operate at LOS F and one that operates at LOS E, almost 80 percent of the intersections within the study area operate at an adequate LOS during the AM peak hour from 7:45 a.m. – 8:45 a.m. as indicated in **Figure 9-2** and in **Table 9-4**. It is important to note that while many of these intersections operate at adequate overall microsimulation LOS, many of the individual approaches operate at failing conditions (see Appendix F of the *Traffic and Transportation Technical Report* for arterial intersection delay and LOS details).

Intersections Evaluated in Synchro
The expanded arterial network beyond intersections immediately adjacent to freeway interchanges in the corridor was evaluated solely through Synchro. With the exception of the Old Dominion Drive and Balls Hill Road intersection which operates at LOS F, all intersections operate at an adequate LOS (LOS D or better) during the AM peak as indicated in **Table 9-5**.

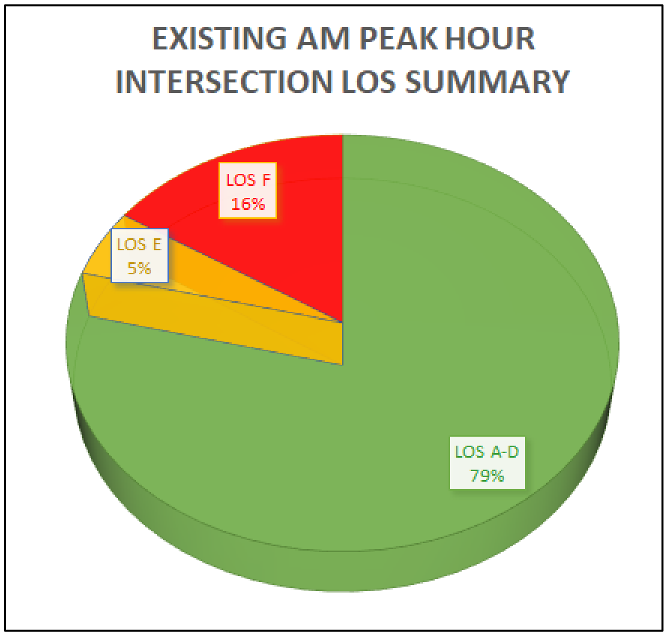


Figure 9-2. Summary of Arterial HCM-Analogous LOS for AM Existing (2018) Conditions

Table 9-4. VISSIM Intersection Microsimulation Delay and HCM-Analogous LOS – Existing (2018) AM Peak Hour

Intersection	Approach	Average Approach Microsimulation Delay (seconds/vehicle)	Approach HCM-Analogous LOS	Intersection Microsimulation Delay (seconds/vehicle)	Intersection HCM-Analogous LOS
Route 123 and Tysons Boulevard	NB	24.0	C	30.6	C
	SB	26.8	C		
	EB	64.1	E		
	WB	47.6	D		
Westpark Drive and Tysons Connector	NB	16.9	B	17.2	B
	SB	12.3	B		
	WB	19.1	B		
Tysons Connector and Express Lanes Ramps	NB	16.1	B	13.5	B
	SB	11.4	B		
	EB	9.8	A		
Route 123 and Capital One Tower Drive/Old Meadow Road	NB	119.0	F	74.3	E
	SB	19.7	B		
	EB	149.9	F		
	WB	59.6	E		
Route 123 and Scotts Crossing Boulevard/Colshire Drive	NB	16.1	B	19.7	B
	SB	19.1	B		
	EB	39.5	D		
	WB	61.3	E		
Route 123 and Route 267 Eastbound Off-Ramp/Anderson Road	NB	42.5	D	46.8	D
	SB	44.9	D		
	EB	43.7	D		
	WB	77.2	E		
Route 123 and Lewinsville Road/Great Falls Street	NB	124.0	F	100.9	F
	SB	78.4	E		
	EB	54.0	D		
	WB	122.2	F		
Lewinsville Road and Balls Hill Road	SB	167.4	F	26.5	C
	EB	23.7	C		
	WB	4.3	A		
Jones Branch Drive and Jones Branch Connector	NB	19.9	B	14.5	B
	SB	8.3	A		
	WB	15.4	B		
Jones Branch Connector and Express Lanes Ramps	NB	13.2	B	11.4	B
	SB	11.0	B		
	EB	10.1	B		
International Drive and Spring Hill Road/Jones Branch Drive	NB	53.7	D	48.0	D
	SB	42.2	D		
	EB	54.5	D		
	WB	64.5	E		

Intersection	Approach	Average Approach Microsimulation Delay (seconds/vehicle)	Approach HCM-Analogous LOS	Intersection Microsimulation Delay (seconds/vehicle)	Intersection HCM-Analogous LOS
Spring Hill Road and DTR Eastbound Ramps	NB	27.4	C	168.0	F
	SB	51.8	D		
	EB	311.4	F		
Spring Hill Road and DTR Westbound Ramps	NB	13.3	B	32.5	C
	SB	19.5	B		
	WB	74.6	E		
Spring Hill Road and Lewinsville Road	NB	60.4	E	52.4	D
	SB	80.7	F		
	EB	52.7	D		
	WB	33.3	C		
Route 193 and Helga Place/Linganore Drive	NB	6.7	A	56.1	F
	SB	56.1	F		
	EB	44.0	E		
	WB	0.5	A		
Route 193 and I-495 Southbound Ramps	SB	25.1	C	24.3	C
	EB	24.7	C		
	WB	22.5	C		
Route 193 and I-495 Northbound Ramps	NB	83.2	F	27.8	C
	EB	15.3	B		
	WB	19.7	B		
Route 193 and Balls Hill Road	NB	58.8	E	27.8	C
	SB	26.3	C		
	EB	19.3	B		
	WB	17.9	B		
Route 193 and Dead Run Drive	NB	8.7	A	9.3	A
	EB	1.0	A		
	WB	0.8	A		

Table 9-5. Synchro Intersection Delay and LOS – Existing (2018) AM Peak Hour

Intersection	Approach	Approach Delay (s/veh)	Approach LOS	Intersection Delay (s/veh)	Intersection LOS
Old Dominion Drive at Spring Hill Road	NB	21.5	C	13.9	B
	SB	26	C		
	EB	11.9	B		
	WB	7.9	A		
Old Dominion Drive at Swinks Mill Road	NB	48.9	D	29.3	C
	SB	38	D		
	EB	25	C		
	WB	8.5	A		

Intersection	Approach	Approach Delay (s/veh)	Approach LOS	Intersection Delay (s/veh)	Intersection LOS
Old Dominion Drive at Balls Hill Road	NB	121	F	101.9	F
	SB	112	F		
	EB	82.1	F		
	WB	113.3	F		
Route 123 at Old Dominion Drive	NB	17.6	B	39.5	D
	SB	29.4	C		
	EB	81.7	F		
	WB	77.7	E		
Georgetown Pike at Swinks Mill Road	NB	106.9	F	33.1	D
	SB	0.0	A		
	EB	0	A		
	WB	3.4	A		
Georgetown Pike at Spring Hill Road	NB	18.2	A	1.1	A
	EB	0	A		
	WB	1.2	A		
Lewinsville Road at Swinks Mill Road	SB	40.6	E	6.1	A
	EB	2.6	A		
	WB	0	A		
Route 123 at Ingleside Avenue	NB	0.3	A	0.9	A
	SB	0.6	A		
	EB	13.5	B		
	WB	10.4	B		
Douglass Drive at Route 193 (Georgetown Pike)	NB	36.8	E	7.4	A
	SB	24.8	C		
	EB	0.6	A		
	WB	1.9	A		

Existing (2018) PM Peak Freeway Operations

Exhibits 9-4a through **9-4c** and **Exhibits 9-5a** through **9-5c** illustrate the density and speed results, respectively, from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the PM peak period. Similar to the AM peak figures, the centerline diagram depicts the average densities or speeds during the peak hour from 3:45 p.m. to 4:45 p.m. in both directions along the mainline segments. The average densities and speeds are color-coded based on the congestion levels and ranges of speeds as depicted in the legend. The boxes on the top and bottom depict the densities and speeds in each direction for the entire peak period from 2:45 p.m. to 5:45 p.m. Detailed tabular results can be found in Appendix E of the *Traffic and Transportation Technical Report*. **Table 9-6** provides a list of all freeway mainline segments with densities classified as "congested" (density greater than 35 vehicles per mile per lane) or "severely congested" (density greater than 45 vpmpl) in the Existing (2018) PM peak hour.

Table 9-6. Existing (2018) PM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	Between off-ramp to NB Route 123 and on-ramp from NB Route 123	Basic	12	91.4	Severely Congested
NB I-495 (GP)	Between on-ramp from NB Route 123 and off-ramp to SB Route 123	Weave	7	126.5	Severely Congested
NB I-495 (GP)	Between off-ramp to SB Route 123 and on-ramp from SB Route 123	Basic	8	132.0	Severely Congested
NB I-495 (GP)	North of on-ramp from SB Route 123	Merge	7	119.6	Severely Congested
NB I-495 (GP)	Between Route 123 and Route 267	Basic	9	120.4	Severely Congested
NB I-495 (GP)	South off off-ramp to WB DTR	Diverge	6	133.6	Severely Congested
NB I-495 (GP)	Between off-ramp to WB DTR and on-ramp from EB DTR/DAAR	Basic	6	124.0	Severely Congested
NB I-495 (GP)	Between on-ramp from EB DTR/DAAR and on-ramp from WB DTR	Merge	5	116.2	Severely Congested
NB I-495 (GP)	Between on-ramp from WB DTR and on-ramp from NB I-495 Express Lanes	Merge	5	124.2	Severely Congested
NB I-495 (GP)	Between on-ramp from NB I-495 Express Lanes and off-ramp to Route 193	Basic	7	135.4	Severely Congested
NB I-495 (GP)	Between on-ramp from NB I-495 Express Lanes and off-ramp to Route 193	Diverge	7	113.8	Severely Congested
NB I-495 (GP)	Between off-ramp to Georgetown Pike and on-ramp from Route 193	Basic	7	123.6	Severely Congested
NB I-495 (GP)	Between on-ramp from Route 193 and off-ramp to GWMP	Weave	8	113.4	Severely Congested
NB I-495 (GP)	Between off-ramp to GWMP and on-ramp from GWMP	Basic	12	111.4	Severely Congested
NB I-495 (GP)	Between on-ramp from GWMP and off-ramp to Clara Barton Parkway (ALMB)	Weave	19	69.8	Severely Congested
NB I-495 (GP)	Between off-ramp to Clara Barton Parkway and on-ramp from WB Clara Barton Parkway	Basic	13	107.9	Severely Congested
NB I-495 (GP)	North of on-ramp from WB Clara Barton Parkway	Merge	9	118.6	Severely Congested
NB I-495 (GP)	Between Clara Barton Parkway and River Road	Basic	13	110.2	Severely Congested
SB I-495 (GP)	Between River Road and Clara Barton Parkway	Basic	20	74.9	Severely Congested
SB I-495 (GP)	Between off-ramp to WB Clara Barton Parkway and on-ramp from Clara Barton Parkway	Basic	15	98.4	Severely Congested
SB I-495 (GP)	Between Clara Barton Parkway and GWMP	Weave	31	48.4	Severely Congested
SB I-495 (GP)	Between off-ramp to Route 193 and on-ramp from Route 193/GWMP C-D Road	Basic	28	66.4	Severely Congested

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
SB I-495 (GP)	Between on-ramp from Route 193/GWMP C-D Road and on-ramp from Route 193	Merge	24	61.7	Severely Congested
SB I-495 (GP)	Between on-ramp from Route 193 and off-ramp to I-495 SB Express Lanes	Merge	20	80.5	Severely Congested
SB I-495 (GP)	North of off-ramp to WB DTR	Diverge	21	66.2	Severely Congested
SB I-495 (GP)	North of off-ramp to WB DTR	Diverge	13	88.4	Severely Congested
SB I-495 (GP)	South of on-ramp from NB Route 123	Weave	17	69.2	Severely Congested

Existing (2018) PM Density

In the PM peak period, northbound I-495 is severely congested due to two points of congestion. The first congestion point is located outside of the study area at I-270 in Maryland, and the second point is located between the Route 193 and the GWMP interchanges where the part-time shoulder lane drops on the left side while vehicles from the Route 193 interchange are also merging onto northbound I-495 on the right side. This pinch from both sides creates friction in the through lanes and worsens as the slowdown from I-270 in Maryland merges to this location. The resulting queue extends beyond the Route 123 interchange. The corridor operates under severe congestion, not only during the peak hour, but for the entire peak period.

Similarly, along southbound I-495, segments between River Road and the Route 267 interchange operate under severe congestion. The remaining segments between the Route 123 and Route 267 interchanges operate under light-to-moderate density levels.

Existing (2018) PM Speeds

Average VISSIM speeds show similar patterns as seen in the density diagrams with speeds below 25 mph along northbound I-495 throughout the study area. Some segments operate below 20 mph (queue condition). The speeds are lower for the entire peak period for all northbound I-495 segments. Average speeds along southbound I-495 range from 10 to 35 mph between the Route 267 interchange and River Road.

Existing (2018) PM Travel Time

Existing PM peak period average travel times are shown in **Table 9-7**. Travel time measurements have been aggregated by direction of travel and facility type.

Table 9-7. Existing PM Peak Period Travel Times

Route	Via General Purpose Lanes	Via Express Lanes
Northbound I-495 (Route 123 to River Road)	39:07	27:32
Southbound I-495 (River Road to Route 123)	17:15	14:14

Route	Via General Purpose Lanes	Via Express Lanes
Eastbound Route 267 (Spring Hill Road to Route 123)	2:42	-
Westbound Route 267 (Route 123 to Spring Hill Road)	1:57	-

Existing (2018) PM Peak Intersection Operations

Intersections Evaluated in VISSIM

As shown in **Figure 9-3** and in **Table 9-8**, there are more intersections that operate at failing conditions during the PM peak hour from 3:45 p.m. to 4:45 p.m. than during the AM peak hour. Out of the total 19 intersections evaluated, five operate at failing conditions of LOS F, while three intersections operate at near-failing conditions of LOS E. The remaining intersections operate at an acceptable LOS D or better during the PM peak hour. It is important to note that while many of these intersections operate at adequate overall control LOS, many of the individual approaches operate at failing conditions. Additional detail on arterial traffic operations, including intersection approach delay and LOS is summarized in Appendix F of the *Traffic and Transportation Technical Report*.

Intersections Evaluated in Synchro

The expanded arterial network beyond intersections immediately adjacent to freeway interchanges in the corridor was evaluated solely through Synchro. As during the AM peak hour, only the Old Dominion Drive and Balls Hill Road intersection operates at LOS F, as indicated in **Table 9-9**. The remaining intersections operate at an adequate LOS (LOS D or better) during the PM peak hour. Although the intersections operate at an adequate overall control LOS, many of the individual approaches operate at failing conditions.

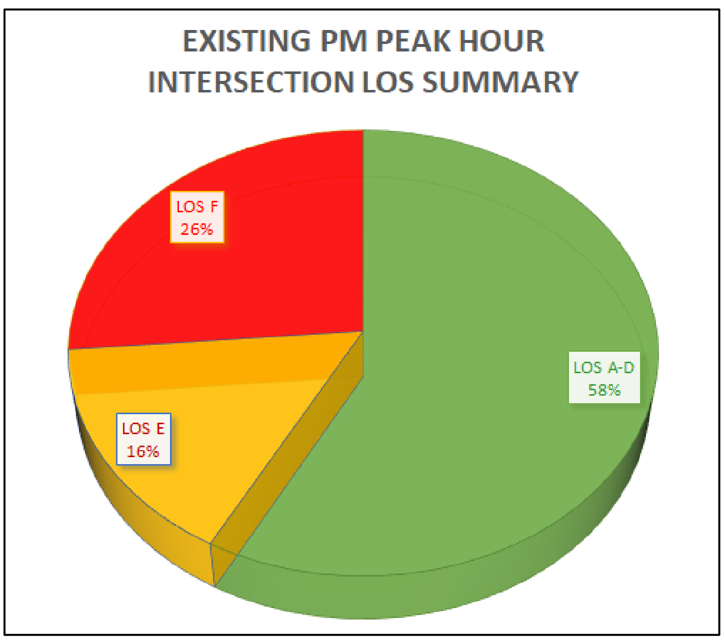


Figure 9-3. Summary of Arterial HCM-Analogous LOS for PM Existing (2018) Conditions

Table 9-8. VISSIM Intersection Microsimulation Delay and HCM-Analogous LOS – Existing (2018) PM Peak Hour

Intersection	Approach	Average Approach Microsimulation Delay (seconds/vehicle)	Approach HCM-Analogous LOS	Intersection Microsimulation Delay (seconds/vehicle)	Intersection HCM-Analogous LOS
Route 123 and Tysons Boulevard	NB	73.5	E	73.9	E
	SB	45.4	D		
	EB	96.9	F		
	WB	151.8	F		
Westpark Drive and Tysons Connector	NB	5.3	A	5.7	A
	SB	5.3	A		
	WB	12.0	B		
Tysons Connector and Express Lanes Ramps	NB	14.8	B	5.8	A
	SB	5.7	A		
	EB	5.1	A		
Route 123 and Capital One Tower Drive/Old Meadow Road	NB	39.7	D	39.8	D
	SB	22.0	C		
	EB	64.6	E		
	WB	84.8	F		
Route 123 and Scotts Crossing Boulevard/Colshire Drive	NB	8.9	A	18.9	B
	SB	17.2	B		
	EB	27.3	C		
	WB	88.3	F		
Route 123 and Route 267 Eastbound Off-Ramp/Anderson Road	NB	26.5	C	37.2	D
	SB	27.3	C		
	EB	50.6	D		
	WB	125.9	F		
Route 123 and Lewinsville Road/Great Falls Street	NB	80.6	F	91.9	F
	SB	117.5	F		
	EB	53.3	D		
	WB	111.8	F		
Lewinsville Road and Balls Hill Road	SB	45.7	D	113.9	F
	EB	225.9	F		
	WB	7.3	A		
Jones Branch Drive and Jones Branch Connector	NB	11.3	B	7.0	A
	SB	3.2	A		
	WB	15.7	B		
Jones Branch Connector and Express Lanes Ramps	NB	11.9	B	12.2	B
	SB	9.6	A		
	EB	12.5	B		
International Drive and Spring Hill Road/Jones Branch Drive	NB	67.2	E	60.9	E
	SB	62.7	E		
	EB	55.5	E		
	WB	59.1	E		
Spring Hill Road and DTR Eastbound Ramps	NB	7.6	A	14.8	B
	SB	4.6	A		
	EB	75.6	E		

Intersection	Approach	Average Approach Microsimulation Delay (seconds/vehicle)	Approach HCM-Analogous LOS	Intersection Microsimulation Delay (seconds/vehicle)	Intersection HCM-Analogous LOS
Spring Hill Road and DTR Westbound Ramps	NB	27.5	C	28.9	C
	SB	21.7	C		
	WB	56.1	E		
Spring Hill Road and Lewinsville Road	NB	82.4	F	62.4	E
	SB	74.2	E		
	EB	63.4	E		
	WB	40.3	D		
Route 193 and Helga Place/Linganore Drive	NB	0.0	A	245.1	F
	SB	245.1	F		
	EB	54.9	F		
	WB	0.7	A		
Route 193 and I-495 Southbound Ramps	SB	29.6	C	33.7	C
	EB	46.3	D		
	WB	28.1	C		
Route 193 and I-495 Northbound Ramps	NB	290.7	F	52.4	D
	EB	16.3	B		
	WB	45.3	D		
Route 193 and Balls Hill Road	NB	1,028.7	F	210.7	F
	SB	20.0	B		
	EB	7.7	A		
	WB	130.4	F		
Route 193 and Dead Run Drive	NB	140.4	F	141.4	F
	EB	0.2	A		
	WB	463.6	F		

Table 9-9. Synchro Intersection Delay and LOS – Existing (2018) PM Peak Hour

Intersection	Approach	Approach Delay (s/veh)	Approach Delay (s/veh)	Intersection Delay (s/veh)	Intersection LOS
Old Dominion Drive at Spring Hill Road	NB	28.5	C	16.5	B
	SB	19.1	B		
	EB	9.9	A		
	WB	15.7	B		
Old Dominion Drive at Swinks Mill Road	NB	31.2	C	19.2	B
	SB	21.9	C		
	EB	13.4	B		
	WB	17.1	B		
Old Dominion Drive at Balls Hill Road	NB	135	F	167.5	F
	SB	247.8	F		
	EB	179.1	F		
	WB	115.8	F		

Intersection	Approach	Approach Delay (s/veh)	Approach Delay (s/veh)	Intersection Delay (s/veh)	Intersection LOS
Route 123 at Old Dominion Drive	NB	27	C	47.3	D
	SB	40.2	D		
	EB	77.2	E		
	WB	86.1	F		
Georgetown Pike at Swinks Mill Road	NB	14.1	B	3.8	A
	SB	0	A		
	EB	0	A		
	WB	2.4	A		
Georgetown Pike at Spring Hill Road	NB	13.2	B	1.3	A
	EB	0	A		
	WB	1.2	A		
Lewinsville Road at Swinks Mill Road	SB	68.2	F	9.3	A
	EB	2.8	A		
	WB	0	A		
Route 123 at Ingleside Avenue	NB	3.3	A	2.6	A
	SB	0.2	A		
	EB	23.2	C		
	WB	10.7	A		
Douglass Drive at Route 193 (Georgetown Pike)	NB	104.5	F	20.3	C
	SB	42.6	E		
	EB	0.5	A		
	WB	3.7	A		

Summary of Existing (2018) Operational Deficiencies

Based on the traffic simulation results, the travel demand is higher than the existing capacity for much of the study area under existing conditions. This is reflected in the high densities and low speeds found in many segments in the peak directions. General characteristics of congestion on the corridor include:

- **Substantial multi-hour queues in both directions.**
  - Bottlenecks created by major merge areas, as experienced in the northern terminus of the study area.
  - Congestion from downstream impacting study area network, including areas in Maryland north of the ALMB and congestion in Tysons south of the study area.
  - Bottlenecks created due to lane drops, such as the I-495 northbound GP merge where the shoulder lane terminates.
  - Bi-directional demand and weaving result in congestion in both directions during both peak periods, such as weaving along I-495 northbound GP between the on-ramp from Route 193 and the off-ramp to GWMP.
  - The on-ramp from the GWMP to I-495 northbound frequently queues back onto the GWMP outbound/westbound mainline for several miles to as far back as the GWMP/Route 123 interchange.
  - As shown in **Exhibit 9-1**, in the northbound direction along I-495, the AM peak period lasts almost four hours, and the PM peak period lasts for more than six hours. In the

southbound direction, the AM peak period lasts approximately two hours and the PM peak period lasts for approximately five hours.

- **Heavy volumes entering and exiting I-495 at the Route 267 interchange affect traffic in both directions for extended periods.**
    - Heavy demand from Route 267 entering an already congested segment of I-495 results in more congestion and queue spill-backs. The I-495 northbound GP on-ramp from DTR/DAAR eastbound frequently spills back to the DTR/DAAR mainlines due to heavy demand and congestion along I-495 northbound GP. The I-495 southbound GP on-ramp from DTR/DAAR eastbound creates weaving issues along I-495 southbound, as the off-ramp to Route 123 and destinations in Tysons is just downstream of this location.
- **Cut-through traffic on local parallel arterials creates more disturbance along mainline.**
    - Vehicles detouring to avoid I-495 congestion create more disturbance to the flow of traffic by exiting to use parallel arterial facilities, such as Balls Hill Road and Swinks Mill Road, and then entering again at downstream locations along I-495, such as at Route 193.
- **High-Occupancy Toll (HOT) traffic to and from the I-495 Express Lanes and weaving in and out from GP lanes results in congestion.**
    - The speed differential as well as weaving in and out from the I-495 Express Lanes that have ingress and egress just north of the Route 267 interchange create congestion in the GP lanes.

Major Points of Congestion

- Northbound I-495
    - Hours of congestion: 7:00 a.m. to 11:00 a.m. and 1:30 p.m. to 8:00 p.m.
    - Congestion within the study area is largely due to downstream congestion from beyond the ALMB and starts between Route 193 and GWMP where the part-time shoulder lane drops on the left side and vehicles from Route 193 are merging on the right side. The slowdown from the Clara Barton Parkway interchange also impacts this segment.
    - Queues spill back beyond the DTR interchange in the AM and PM peak periods. Cut-through traffic trying to avoid I-495 congestion by entering from the Route 193 ramp creates congestion that starts as early as 1:30 p.m.
    - After 3 p.m., congestion from I-270 in Maryland starts to spill back and worsen existing queues, extending back to beyond the Route 123 interchange, where queues then generally stabilize and are sustained through the peak period.
    - Route 267, Route 193, and GWMP experience queuing on ramps, mainline segments, and arterial intersections due to northbound I-495 congestion, sometimes extending for miles in the case of GWMP.
- Southbound I-495
    - Hours of congestion: 8:00 a.m. to 10:00 a.m. and 2:00 p.m. to 7:00 p.m.
    - In the AM peak period, congestion begins at the Route 193 ramp where the C-D road from the GWMP merges on to southbound I-495 and is also used as a bypass lane for through traffic.
    - In the PM peak period, multiple localized bottlenecks combined with downstream congestion cause queue spillbacks in Tysons back to the DTR interchange. The traffic weaving between the on-ramp from eastbound Route 267 and the off-ramps to Route 123

adds to this congestion, resulting in congestion spilling back onto the Route 267 ramps and mainline.

- Route 193 ramp congestion due to the C-D road merge happens independently and starts earlier in the PM peak period, creating a separate bottleneck along southbound I-495. Vehicles merging on the right from the GWMP and Route 193 that weave across to access the I-495 Express Lanes add to this congestion. Downstream congestion causes more vehicles to try to enter the Express Lanes, resulting in more congestion upstream of the Express Lanes.

- **Table 9-10** provides a tabulation of modeled queue lengths for targeted locations with observed significant queueing issues for both the existing AM and PM peak periods. This information is also provided in the VISSIM Calibration Memorandum in in Appendix C of the *Traffic and Transportation Technical Report*.

Table 9-10. Existing (2018) Significant Queue Locations and Modeled Queue Length

Interchange	Location	VISSIM Max Queue (feet)	
		AM Peak Period	PM Peak Period
I-495 / Route 267 Interchange	Ramp from DTR EB to I-495 NB GP	7,631	4,941
	Ramp from DAAR EB to I-495 NB GP	1,386	4,098
	Ramp from DTR EB to I-495 SB GP	320	2,602
I-495 / Route 193 Interchange	Ramp from Route 193 to I-495 NB GP	650	1,137
	Route 193 EB approaching I-495 NB GP ramps	2,383	1,600
	Route 193 WB approaching I-495 NB GP ramps	322	2,407
	Balls Hill Rd NB approaching Route 193	461	1,505
I-495 / George Washington Parkway Interchange	Ramp from GW Parkway NB/WB to I-495 NB GP	3,176	7,997
Route 267 / Spring Hill Road Interchange	Spring Hill Rd NB approaching Lewinsville Rd	454	3,938
Route 267 / Route 123 Interchange	Ramp from DTR EB to Route 123 NB	1,684	848
	Route 123 NB approaching Great Falls St	2,456	1,450

9.2.2 2025 Conditions: No Build vs. Build (Phase 1)

2025 AM Peak Freeway Operations

2025 AM Densities

Exhibits 9-6 through **9-7** illustrate the density results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the AM peak period:

- **Exhibits 9-6a** through **9-6c** show 2025 No Build AM peak period freeway densities.
- **Exhibits 9-7a** through **9-7c** show 2025 Build AM peak period freeway densities.

In each figure, the centerline diagram laid over the aerial depicts the average densities during the peak hour from 7:45 a.m. to 8:45 a.m. in both directions along the mainline segments. The average densities are color-coded based on the congestion levels as depicted in the legend. The boxes on the top and bottom depict the densities in each direction for the entire peak period from 6:45 a.m. to 9:45 a.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix G of the *Traffic and Transportation Technical Report***.**

In the AM peak period, it can be seen from the exhibits that in the northbound GP lanes most segments in the Build condition operate under light-to-heavy density traffic for the entire study corridor, which represents a significant improvement over the No Build condition, in which segments between Route 267 and Clara Barton Parkway operate under significant congestion. With the proposed project (Build Alternative), the Express Lanes are continuous which helps with the operations along the corridor as it reduces traffic on the GP lanes and eliminates the friction between left side merges and diverges.

In the southbound GP lanes, most segments operate under light to heavy traffic conditions for the entire corridor in the Build condition, as compared to several segments operating under severe congestion between Clara Barton Parkway and GWMP in the No-Build condition. The proposed project connects the Maryland managed lanes with the existing southbound Express Lanes in Virginia. This helps with the traffic operations in the Build as it eases congestion along the GP lanes; whereas in the No-Build condition, all Maryland managed lanes traffic must merge with the GP lanes near the GWMP interchange, creating a bottleneck.

Table 9-11 provides a list of all freeway mainline segments with densities classified as "congested" (density greater than 35 vehicles per mile per lane) or "severely congested" (density greater than 45 vpmpl) in the 2025 No Build AM peak hour. **Table 9-12** provides the same list for the 2025 Build AM peak hour. These tables show a much greater number of congested segments under No Build conditions, especially along the I-495 GP lanes in both directions. **Figure 9-4** provides pie charts comparing the number of congested segments under 2025 AM No Build versus Build conditions broken out into basic, weave, and ramp junction (merge or diverge) segments. This figure shows that for all three segment types, there is an increase in the number of segments classified as "light to moderate" and a decrease in the number of segments classified as congested or severely congested.

Table 9-11. 2025 No Build AM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	North of on-ramp from NB I-495 Express Lanes	Basic	46	40.2	Congested
NB I-495 (GP)	Between DTR and Georgetown Pike	Basic	31	62.5	Severely Congested
NB I-495 (GP)	South of off-ramp to Georgetown Pike	Diverge	28	51.9	Severely Congested
NB I-495 (GP)	Between ramps to/from Georgetown Pike	Basic	25	65.9	Severely Congested
NB I-495 (GP)	Between Georgetown Pike and GWMP	Weave	16	91.1	Severely Congested
NB I-495 (GP)	Between ramps to I-495 Express Lanes (MD) and GWMP	Diverge	24	66.8	Severely Congested
NB I-495 (GP)	Between ramps to/from GWMP	Basic	28	65.9	Severely Congested
NB I-495 (GP)	Between GWMP and Clara Barton Parkway	Weave	29	59.3	Severely Congested

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	Between ramp to/from WB/EB Clara Barton Parkway	Basic	50	37.7	Congested
SB I-495 (GP)	Between ramps to/from C-D Road/I-495 Express Lanes (MD)	Basic	29	57.0	Severely Congested
SB I-495 (GP)	Between ramps from I-495 Express Lanes (MD) and C-D Road	Merge	22	71.7	Severely Congested
SB I-495 (GP)	Between ramps from I-495 Express Lanes (MD) and C-D Road	Basic	22	82.3	Severely Congested
SB I-495 (GP)	Between ramps from C-D Road and Georgetown Pike	Merge	37	53.2	Severely Congested
SB I-495 (GP)	Between ramps from/to Georgetown Pike/SB I-495 Express Lanes	Merge	48	43.9	Congested
SB I-495 (GP)	South of ramp to SB I-495 Express Lanes	Basic	53	35.6	Congested
SB I-495 (GP)	Between DTR and Route 123	Weave	35	37.8	Congested
EB DTR	West of ramp to Spring Hill Road	Diverge	9	95.6	Severely Congested
EB DTR	Between ramps to/from Spring Hill Road/Dulles Airport Access Road (DAAR)	Basic	23	44.8	Congested
EB DTR	Between ramps from DAAR and Spring Hill Road	Merge	22	45.0	Congested
EB DTR	Between Spring Hill Road and I-495	Weave	22	38.6	Congested
WB DTR	Between ramps to DAAR and NB Route 123	Diverge	30	59.0	Severely Congested
WB DTR	Between ramps to NB/SB Route 123	Diverge	26	55.6	Severely Congested

Table 9-12. 2025 Build AM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	Between ramps from/to NB/SB Route 123	Weave	37	36.3	Congested
NB I-495 (GP)	Between ramp to/from WB/EB Clara Barton Parkway	Basic	50	36.1	Congested
SB I-495 (GP)	Between ramps to GWMP and Georgetown Pike	Basic	50	36.2	Congested
SB I-495 (GP)	Between DTR and Route 123	Weave	32	41.1	Congested
EB DTR	West of ramp to Spring Hill Road	Diverge	13	81.9	Severely Congested
WB DTR	Between ramps to DAAR/NB Route 123	Diverge	36	50.1	Severely Congested
WB DTR	Between ramps to NB/SB Route 123	Diverge	37	41.0	Congested

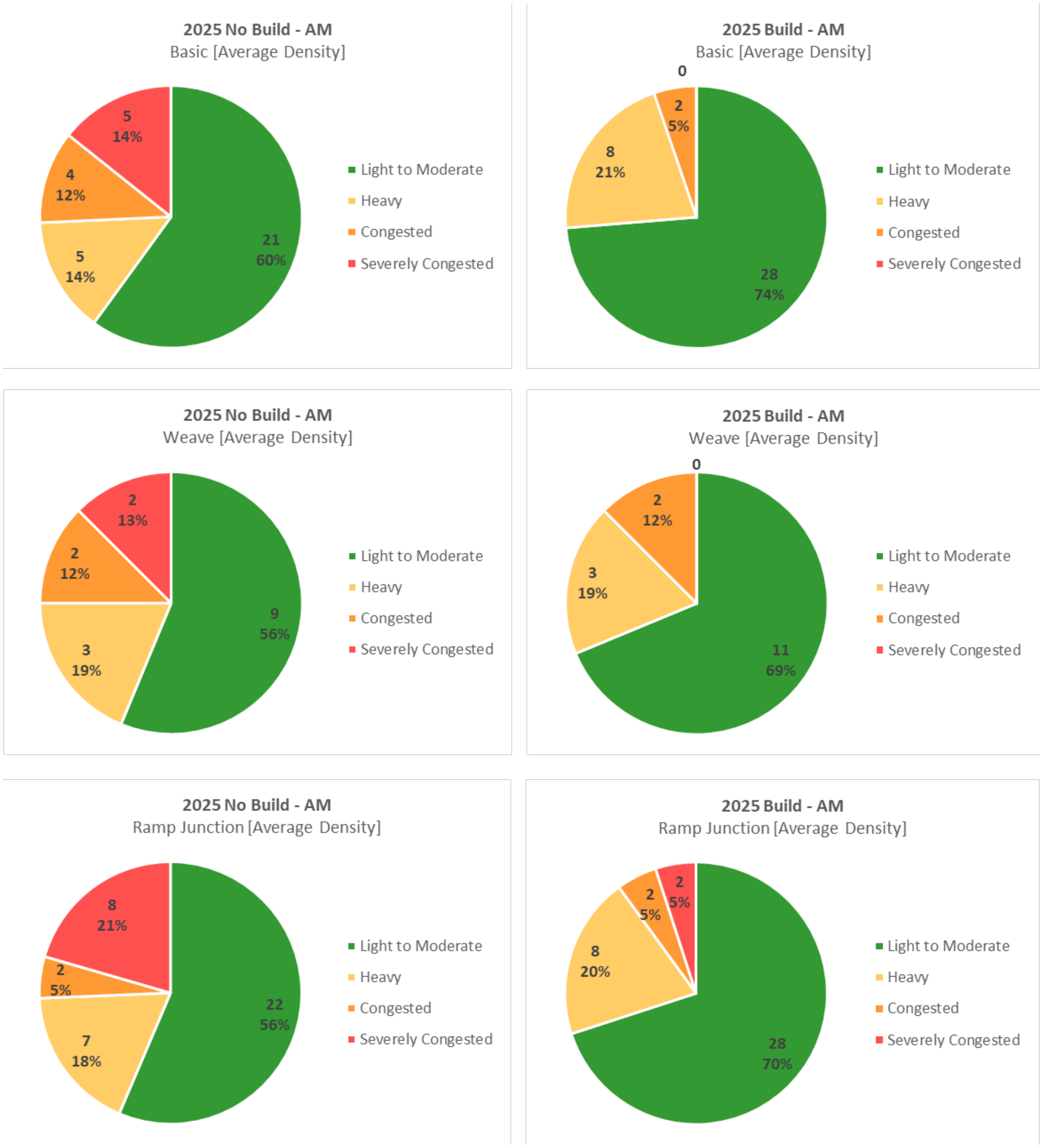


Figure 9-4. 2025 AM No Build vs. Build Comparison of Congestion Levels on Basic, Weave, and Ramp Junction Freeway Mainline Segments

<u>2025 AM Speeds</u>

Exhibits 9-8 through **9-9** illustrate the speed results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the AM peak period:

- **Exhibits 9-8a** through **9-8c** show 2025 No Build AM peak period freeway speeds.
- **Exhibits 9-9a** through **9-9c** show 2025 Build AM peak period freeway speeds.

In each figure, the centerline diagram laid over the aerial depicts the average speeds during the peak hour from 7:45 a.m. to 8:45 a.m. in both directions along the mainline segments. The average speeds are color-coded based on the ranges of speeds as depicted in the legend. The boxes on the top and bottom depict the speeds in each direction for the entire peak period from 6:45 a.m. to 9:45 a.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix G of the *Traffic and Transportation Technical Report***.**

As illustrated in **Exhibits 9-8** and **9-9**, the diagrams for average speeds in the AM peak period show similar patterns as seen in the density diagrams. Average speeds for the Build scenario in the GP lanes during the AM peak period in the northbound direction are at or near the posted speed limit, with a slight slowdown across the ALMB. In the No Build condition, however there is significant congestion between northbound Express Lanes terminus and ALMB. Consistent with the high-density levels, speeds range between 25 and 35 mph in those segments. In both the No Build and Build conditions, speeds are much higher north of the ALMB due to congestion relief provided by the Maryland managed lanes system.

In the southbound direction, all GP segments operate at free-flow conditions for most of the study corridor in the Build condition, with the exception of a slight slowdown near the Route 123 interchange. In the No Build condition, there is a slowdown north of the entrance to the southbound Express Lanes (between Route 193 and Route 267) due to weaving approaching the Express Lanes. Furthermore, in the No Build condition, due to the southbound Maryland managed lanes system terminating near the GWMP interchange, a merge bottleneck is created that spills back upstream in the southbound GP lanes across the ALMB.

Both directions of the Express Lanes operate at or near the posted speed limit.

Figure 9-5 provides a “heat map” comparison of average speeds between 2025 No Build and Build conditions for the AM peak period along the I-495 GP and Express lanes. Time of day during the peak period is provided on the horizontal axis while location along the corridor is provided along the vertical axis; the colors signify average speeds for each scenario. The figure is consistent with the speed Exhibits and indicates a more significant presence of congestion in the No Build scenario in both directions of the I-495 GP lanes as compared to the Build scenario. The Express Lanes operate at or near the posted speed limit under both No Build and Build conditions, although slight slowdowns are observed in the No Build condition approaching the Express Lanes end terminus points (northbound where the Virginia Express Lanes system ends near Old Dominion Drive and southbound where the Maryland managed lanes system ends just south of GWMP).

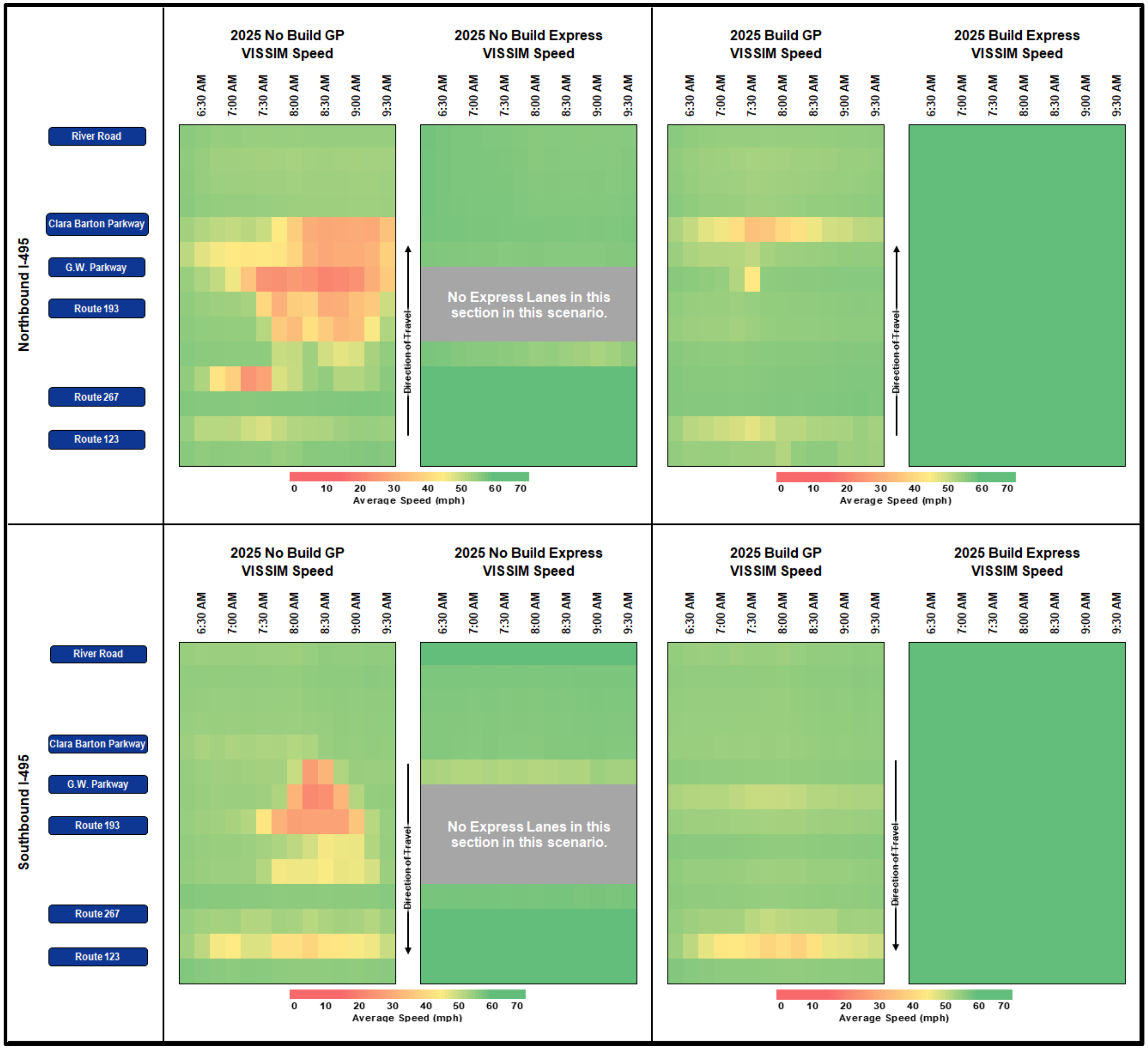


Figure 9-5. AM Peak Period Average Speeds along I-495 for 2025 No Build and 2025 Build Conditions

<u>2025 AM Travel Times</u>

A comparison of AM peak period travel times for 2025 No Build and 2025 Build scenarios is shown in **Table 9-13**. Travel time measurements have been aggregated by direction of travel and facility type.

Table 9-13. 2025 AM Peak Period Travel Time Comparison

Route	GP Travel Times (Minutes: Seconds)		Express Lanes Travel Times (Minutes: Seconds)	
	2025 No Build	2025 Build	2025 No Build	2025 Build
Northbound I-495 (Route 123 to River Road)	9:37	6:53	7:43	6:12
Southbound I-495 (River Road to Route 123)	7:49	6:56	7:00	6:07
Eastbound Route 267 (Spring Hill Road to Route 123)	3:23	1:49	-	-
Westbound Route 267 (Route 123 to Spring Hill Road)	1:55	1:55	-	-

2025 Build AM peak period travel times improve or remain consistent as compared to No Build across all freeway facilities in the Traffic Operations Study Area.

- The average travel time in the northbound GP lanes improves by approximately 3 minutes (a 24 percent improvement) in the Build condition. The majority of the travel time savings are between Old Dominion Drive and Clara Barton Parkway, which is consistent with the speed results shown in the previous section.
- Vehicles traveling in the northbound Express Lanes see a 20 percent travel time improvement in the Build condition. The travel time improvement in the Build condition is between Lewinsville Road and GWMP, where in the No Build condition, vehicles need to travel on the congested GP lanes.
- In the southbound direction, GP travel times in the Build improve by 11 percent and Express Lanes travel time improve by 13 percent. Similar to northbound, providing a continuous Express Lanes system helps with the traffic operations.
- Along eastbound Route 267 (DTR) there is 47 percent improvement in travel time. With the improved operations along northbound I-495, the ramp from eastbound DTR to northbound I-495 does not spill back to eastbound DTR, improving operations along eastbound DTR.
- In the westbound direction, travel times along Route 267 (DTR) are essentially identical between No Build and Build.

<u>2025 AM Ramp Queues</u>

Table 9-14 provides a summary of freeway ramp queues exceeding available storage under 2025 No Build or Build conditions during the AM peak period. A full comparison of queuing at all freeway ramp locations is provided in **Appendix I.** As shown, ramp queues exceed storage in four locations under No Build conditions and three locations under Build conditions. The locations exceeding storage under Build conditions are as follows:

Northbound I-495 GP ramp to northbound/eastbound Route 123 – this queue is due to spillback along Route 123 near the McLean Metrorail station and adjacent developments, in this case specifically the intersection of Route 123 and Capital One Tower Drive/Old Meadow Road. This queue is also present under No Build conditions. Heavy inbound demand into the Tysons area is forecasted to continue to grow in future years. Forecasted traffic demand at this intersection is consistent between the No Build and Build scenarios, but throughput is reduced in the No Build scenario due to freeway congestion. The series of large signalized intersections east of the I-495 GP ramp terminal is an existing congested area currently under study by Fairfax County DOT (Scott's Crossing area) and in coordination with VDOT. This location is discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4.**

- Westbound Dulles Toll Road to Spring Hill Road – this queue is due to spillback along southbound Spring Hill Road from its intersection with International Drive south of the Dulles Toll Road. Heavy inbound demand into the Tysons area is forecasted to continue to grow in future years. Forecasted traffic demand at this intersection is consistent between the No Build and Build scenarios, but throughput is reduced in the No Build scenario due to freeway congestion. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Spring Hill Road / north Tysons area) and in coordination with VDOT. This location is discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4.**
- Westbound Dulles Toll Road to southbound/westbound Route 123 – similar to the queue for the northbound I-495 GP ramp to northbound/eastbound Route 123, this queue is due to spillback along Route 123 near the McLean Metrorail station and adjacent developments. Heavy inbound demand into the Tysons areas is forecasted to continue to grow in future years. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Scott's Crossing area and Route 123/Lewinsville Road area). This location is discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4.** This queue is also present and longer under No Build conditions.

Maps showing the location of ramp queues exceeding storage in the 2025 Build AM condition can be found in **Exhibits 9-10a** through **9-10d**.

Table 9-14. 2025 AM Ramp Queues Exceeding Storage

Ramp Name	2025 No Build AM			2025 Build AM		
	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?
I-495 NB GP to Route 123 EB	2,059	2,040	Yes	2,406	2,040	Yes
DTR EB to I-495 NB GP	10,573	1,650	Yes	404	1,650	No
DTR WB to Spring Hill	499	1,400	No	2,396	1,400	Yes
DTR WB to Route 123 SB	6,225	1,060	Yes	6,163	1,060	Yes
DTR EB to Route 123 SB / Anderson	1,606	1,430	Yes	400	1,430	No

<u>2025 AM Person Throughput</u>

Figure 9-6 and **Figure 9-7** display AM peak period person throughput along I-495 northbound and southbound, respectively (GP and Express combined). These figures show the estimated number of persons moved across a three-hour period based on simulated vehicle throughput and assumed vehicle occupancies for GP and Express Lanes. GP lanes are assumed to carry 1.1 persons per vehicle, based on the estimated non-HOV lane auto occupancy MWCOG has estimated across various interstate facilities in Northern Virginia (MWCOG, 2014). Express Lanes are assumed to carry 1.44 person per vehicle, based on a historic 18 percent HOV-3 utilization in the existing I-495 Express Lanes and assuming the remaining 82 percent of vehicles take on the non-HOV lane auto occupancy. These figures show that person throughput increases in the Build scenario across the length of the I-495 corridor in both directions due to the added capacity from the Express Lanes and increased occupancy of vehicles in those lanes.

- In the northbound direction, the highest person throughputs are across the ALMB. Increases in throughput from No Build to Build range from 4 to 17 percent, with the greatest increase in the segments between Route 267 and GWMP where the new Express Lanes significantly add capacity.
- In the southbound direction, the highest person throughputs are again across the ALMB. Increases in throughput from No Build to Build range from 6 to 21 percent, with the greatest increases again in the segments between GWMP and Route 267 where the new Express Lanes significantly add capacity.

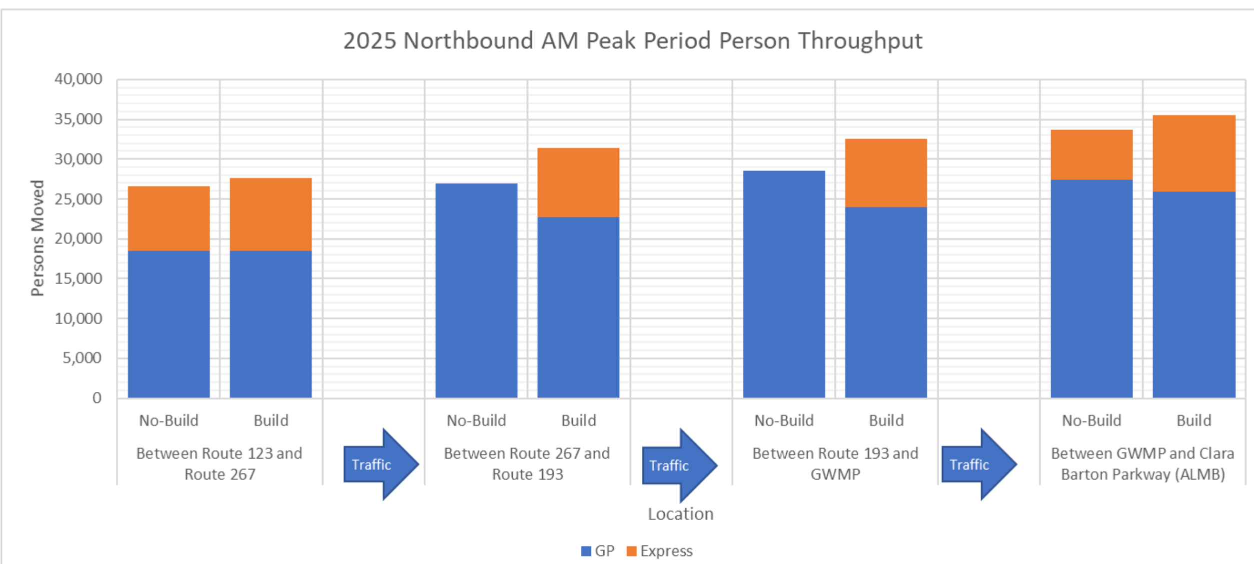


Figure 9-6. 2025 No Build and Build – AM Peak Period Person Throughput, I-495 Northbound

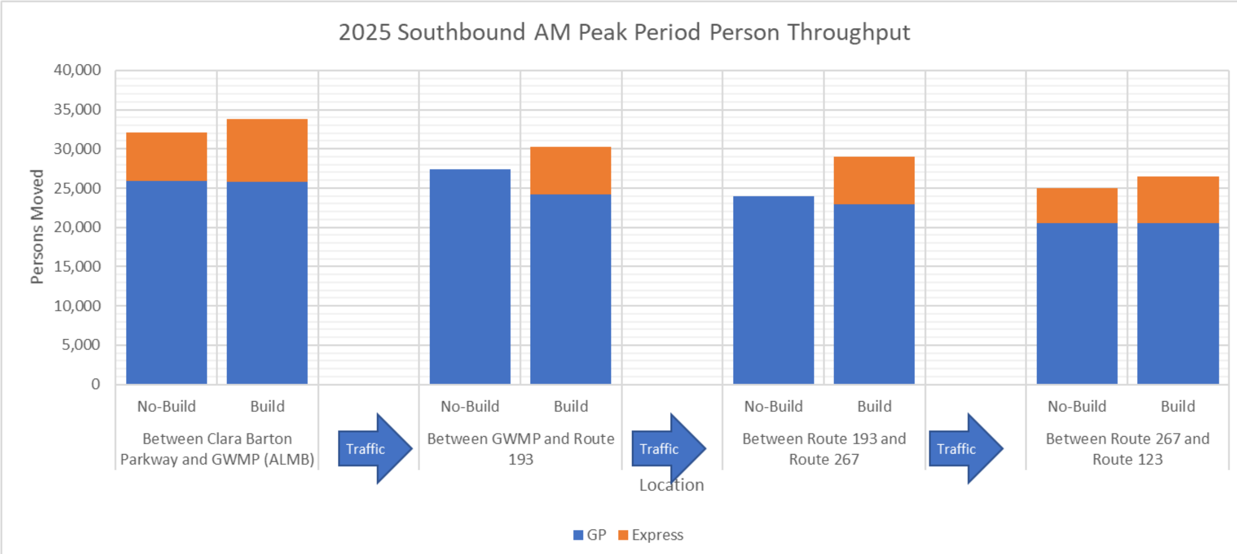


Figure 9-7. 2025 No Build and Build – AM Peak Period Person Throughput, I-495 Southbound

2025 AM Peak Intersection Operations

<u>2025 AM Intersection Delay and Level of Service</u>

Intersections in the Traffic Operations Study Area evaluated in VISSIM generally see similar operations in the 2025 AM peak hour under both No Build and Build conditions. **Figure 9-8** provides pie charts of overall intersection HCM-analogous LOS for No Build and Build conditions. The figure shows that both scenarios see the same percentage of intersections operating under failing conditions (19 percent).

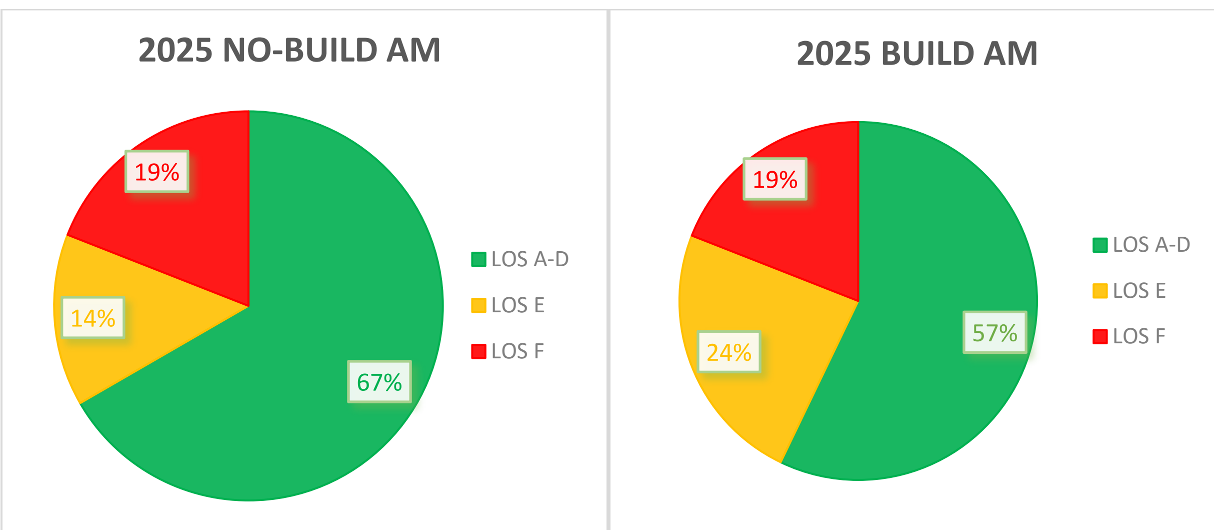


Figure 9-8. Summary of Arterial HCM-Analogous LOS, 2025 AM No Build vs. Build Conditions

Table 9-15 compares the overall intersection HCM-analogous LOS between the two scenarios for each intersection. A detailed breakdown of intersection delay and LOS, including delay and LOS by approach, is provided in Appendix H of the *Traffic and Transportation Technical Report***.**

The following intersections operate under failing conditions under both 2025 No Build and Build conditions:

- Route 123 and Route 267 eastbound off-ramp/Anderson Road
- Route 123 and Lewinsville Road/Great Falls Street
- Spring Hill Road and Dulles Toll Road eastbound ramps

All three of these intersections are in the Tysons area and see continued growth in demand tied to commercial and residential growth in Tysons. These locations are all discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

In the 2025 AM peak hour, there is one intersection operating at LOS F in the Build condition that is not at LOS F in the No Build condition. The signalized intersection of Route 123 and Capital One Tower Drive / Old Meadow Road is failing under 2025 Build conditions with an overall intersection delay of approximately 83 seconds; under No Build conditions, this intersection operates with a delay of approximately 78 seconds. This minor increase in delay is attributable to increased throughput along I-495, allowing more vehicles to access Route 123 in Tysons. This location is discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

The unsignalized intersection of Route 193 and Helga Place/Linganore Drive is failing under 2025 No Build conditions due to heavy delays on the southbound approach; this stop-controlled approach sees few gaps for traffic to enter the mainline Route 193 traffic stream due to heavy congestion in along eastbound Route 193 (spilling back from the northbound on-ramp to I-495). In the Build scenario, this eastbound congestion along Route 193 is relieved due to improved operations along northbound I-495, which reduces queue spillback on the on-ramp from Route 193.

Table 9-15. VISSIM Intersection Microsimulation Delay and HCM-Analogous LOS – 2025 No Build vs. Build AM Peak Hour

Intersection Control	Intersection	2025 No-Build AM		2025 Build AM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Route 123 and Tysons Boulevard	32.6	C	33.3	C
Signalized	Westpark Drive and Tysons Connector	21.4	C	22.7	C
Signalized	Tysons Connector and Express Lanes Ramps	13.9	B	14.1	B
Signalized	Route 123 and Capital One Tower Drive/ Old Meadow Road	77.9	E	83.0	F
Signalized	Route 123 and Scotts Crossing Boulevard/ Colshire Drive	74.6	E	78.4	E
Signalized	Route 123 and Route 267 Eastbound Off-Ramp/ Anderson Road	106.8	F	86.8	F

Intersection Control	Intersection	2025 No-Build AM		2025 Build AM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Route 123 and Lewinsville Road/ Great Falls Street	136.3	F	155.0	F
Signalized	Lewinsville Road and Balls Hill Road	22.5	C	22.0	C
Signalized	Jones Branch Drive and Jones Branch Connector	17.6	B	18.0	B
Signalized	Jones Branch Connector and Express Lanes Ramps	64.7	E	65.0	E
Signalized	Jones Branch Drive and Capital One (West)	17.0	B	17.6	B
Signalized	Jones Branch Drive and Capital One (East)	5.4	A	5.3	A
Signalized	International Drive and Spring Hill Road/ Jones Branch Drive	48.3	D	49.1	D
Signalized	Spring Hill Road and Dulles Toll Road Eastbound Ramps	159.8	F	150.7	F
Signalized	Spring Hill Road and Dulles Toll Road Westbound Ramps	31.9	C	77.1	E
Signalized	Spring Hill Road and Lewinsville Road	54.1	D	57.6	E
Unsignalized	Route 193 and Helga Place/ Linganore Drive	139.6	F	39.5	E
Signalized	Route 193 and I-495 Southbound Ramps	25.4	C	23.9	C
Signalized	Route 193 and I-495 Northbound Ramps	20.5	C	20.7	C
Signalized	Route 193 and Balls Hill Road	21.1	C	23.0	C
Unsignalized	Route 193 and Dead Run Drive	9.6	A	9.5	A

The expanded arterial network beyond intersections immediately adjacent to freeway interchanges in the corridor was evaluated solely through Synchro. **Table 9-16** compares the overall intersection delay and LOS between the two scenarios for each intersection.

Under both No Build and Build conditions, the following intersections are failing:

- Old Dominion Drive and Balls Hill Road (signalized)

- Route 193 and Swinks Mill Road (unsignalized)
- Route 193 and Douglass Drive (unsignalized)

Note that under Build conditions, while the two unsignalized intersections along Route 193 are experiencing failing conditions due to significant delays on stop-controlled approaches, a significant reduction in delay is achieved as compared to No Build conditions.

Table 9-16. 2025 Synchro Intersection Delay and LOS – 2025 No Build vs. Build AM Peak Hour

Intersection Control	Intersection Name	2025 No-Build AM		2025 Build AM	
		Intersection Delay (Sec/veh)	LOS	Intersection Delay (Sec/veh)	LOS
Signalized	Old Dominion Drive at Spring Hill Road	10.9	B	10.9	B
Signalized	Old Dominion Drive at Swinks Mill Road	16.2	B	16.2	B
Signalized	Old Dominion Drive at Balls Hill Road	101.5	F	101.5	F
Signalized	Route 123 at Old Dominion Drive	43.7	D	43.7	D
Unsignalized	Route 193 at Swinks Mill Road	221.4	F	101.9	F
Unsignalized	Route 193 at Spring Hill Road	18.0	C	16.7	C
Unsignalized	Lewinsville Road at Swinks Mill Road	46.7	E	47.6	E
Unsignalized	Route 123 at Ingleside Avenue	20.2	C	19.9	C
Unsignalized	Douglass Drive at Route 193	153.7	F	115.3	F

Figure 9-9 provides a summary comparison of overall intersection delay for Build conditions as compared to No Build conditions at each intersection in the Traffic Operations Study Area for the 2025 AM scenario. The figure shows whether an intersection shows an improvement in operations (increase in LOS in Build conditions if below LOS D for No Build conditions, or a significant reduction in delay if still operating at LOS F in Build conditions), a degradation in operations (decrease in LOS in Build conditions or significant increase in delay if operating at LOS F already in No Build conditions), or if operations remain generally consistent between the two scenarios. The figure calls out intersections operating at LOS F in the Build condition. Note that the intersections that see a degradation in delay are in locations currently under study by Fairfax County Department of Transporation (FCDOT) in coordination with VDOT. These locations are discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

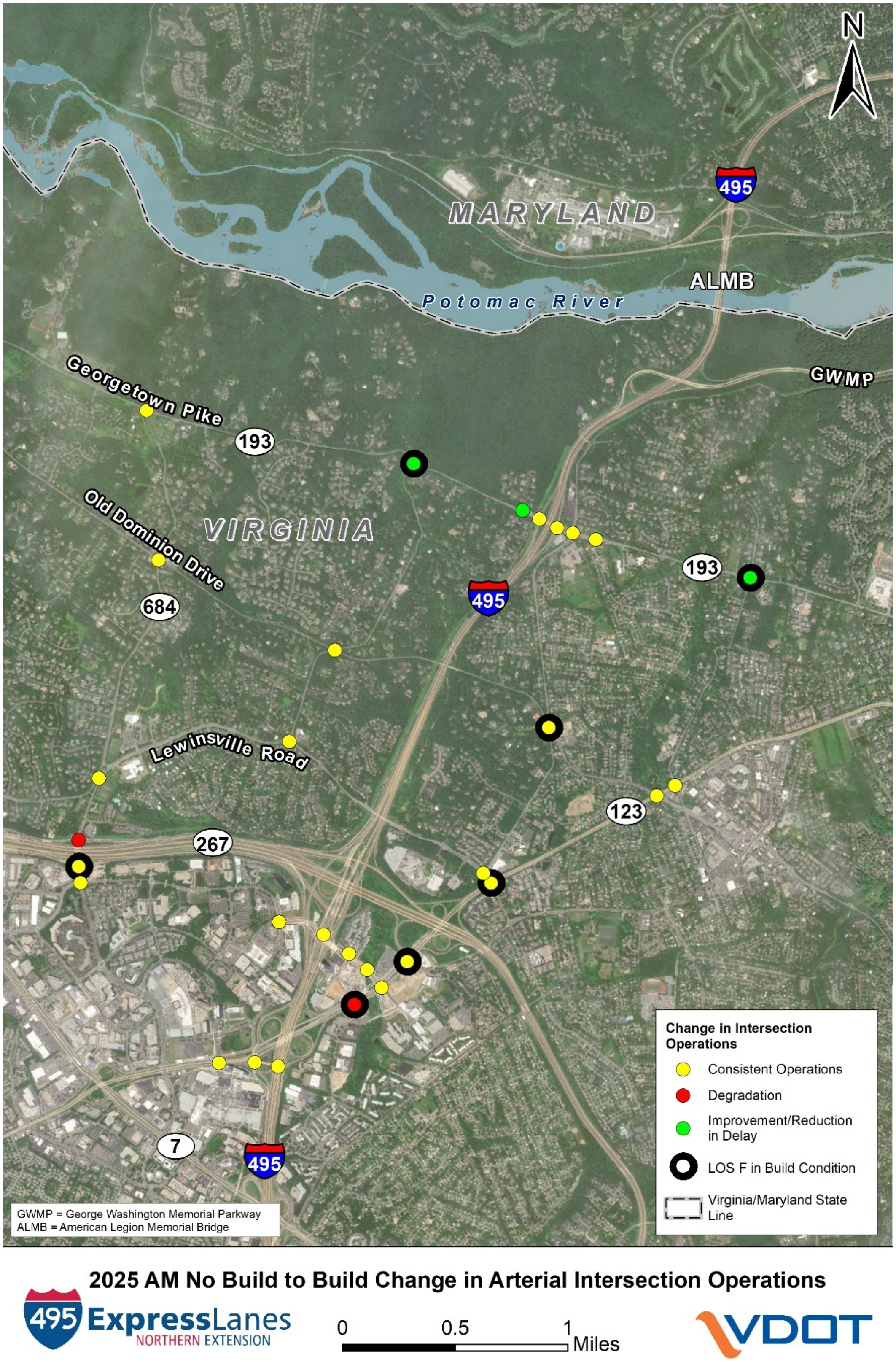


Figure 9-9. 2025 AM No Build to Build Change in Arterial Intersection Operations

<u>2025 AM Intersection Queues</u>

Overall, 85 intersection movements were identified as having queues exceeding available storage under Build conditions during the 2025 AM peak period, while 80 were identified under No Build conditions. **Table 9-17** provides a summary of intersection queues exceeding available storage during the AM peak period under 2025 Build conditions that are not exceeding available storage under 2025 No Build conditions. A full comparison of queuing at all intersection approach locations is provided in **Appendix I.** The locations that only exceed storage under Build conditions are as follows:

- Westpark Drive and Tysons Connector – westbound approach: max queues were observed to just slightly exceed storage, representing a queue spillback to the upstream signal with the I-495 Express Lanes ramps. This could be mitigated by providing additional green time to the westbound approach.
- Route 123 and Lewinsville Road / Great Falls Street – eastbound right-turn: max queues were observed to just slightly exceed storage, representing a queue spillback to the upstream signal of Lewinsville Road and Balls Hill Road. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Route 123/Lewinsville Road area) in coordination with VDOT. See **Section 9.2.4.**
- Spring Hill Road and Dulles Toll Road westbound ramps – westbound approach: this queue was identified in the 2025 AM ramp queues exceeding storage in the Build condition. This queue is due to spillback along southbound Spring Hill Road from its intersection with International Drive south of the Dulles Toll Road. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Spring Hill Road / north Tysons area) in coordination with VDOT. See **Section 9.2.4.**
- Spring Hill Road and Lewinsville Road - eastbound approach: this queue is tied to congestion along southbound Spring Hill Road. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Spring Hill Road / Lewinsville Road area) in coordination with VDOT. See **Section 9.2.4.**
- Georgetown Pike and I-495 southbound ramps: westbound through movement: max queues were observed to just slightly exceed storage, representing a queue spillback to the upstream signal with the I-495 northbound ramps. This could be mitigated by providing additional green time to the westbound approach.

Maps showing the location of all intersection queues exceeding storage in the 2025 Build AM condition only can be found in **Exhibits 9-10a** through **9-10d**.

Table 9-17. 2025 AM Intersection Queues Exceeding Storage

Intersection	Approach	Movement	2025 No Build AM			2025 Build AM		
			Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?	Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?
Westpark Drive and Tysons Connector	WB	LT	419	490	No	514	490	Yes
	WB	RT	435	490	No	529	490	Yes
Route 123 and Lewinsville Road/ Great Falls Street	EB	RT	154	155	No	174	155	Yes
Spring Hill Road and Dulles Toll Road Westbound Ramps	WB	LT	457	1,400	No	1,607	1,400	Yes
	WB	TH	457	1,400	No	1,607	1,400	Yes

Intersection	Approach	Movement	2025 No Build AM			2025 Build AM		
			Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?	Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?
	WB	RT	487	1,400	No	1,638	1,400	Yes
Spring Hill Road and Lewinsville Road	EB	LT	1,004	1,020	No	1,115	1,020	Yes
	EB	TH	1,004	1,020	No	1,115	1,020	Yes
Georgetown Pike and I-495 Southbound Ramps	WB	TH	339	345	No	355	345	Yes

*Note: queues are reported using the analysis software denoted for each intersection (Synchro or VISSIM) in **Figure 9-1.***

2025 PM Peak Freeway Operations

2025 PM Densities

Exhibits 9-11 through **9-12** illustrate the density results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the PM peak period:

- **Exhibits 9-11a** through **9-11c** show 2025 No Build PM peak period freeway densities.
- **Exhibits 9-12a** through **9-12c** show 2025 Build PM peak period freeway densities.

In each figure, the centerline diagram laid over the aerial depicts the average densities during the peak hour from 3:45 p.m. to 4:45 p.m. in both directions along the mainline segments. The average densities are color-coded based on the congestion levels as depicted in the legend. The boxes on the top and bottom depict the densities in each direction for the entire peak period from 2:45 p.m. to 5:45 p.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix G of the *Traffic and Transportation Technical Report***.**

In the PM peak period, it can be seen from the exhibits that in the northbound GP lanes, all of the segments in the Build condition operate under light-to-moderate density traffic for the entire study corridor, which represents an improvement over the No Build condition. In the No Build condition, with the background projects in place including the Maryland managed lanes, there is still a significant improvement in operations along northbound I-495 compared to existing conditions; with the proposed project in the Build condition, there is further improvement.

In the southbound GP lanes, with the exception of one segment near Route 123 in Tysons, all of the freeway segments in the Build condition operate under light-to-congested traffic conditions, which represents a significant improvement over the No Build condition. The Build condition provide a continuous Express Lane system, which increases capacity and improves traffic operations. Also, in the Build condition, there is some shift in demand from GP to Express Lanes for the southbound I-495 to westbound DTR movement. This shift in the volume also helps in relieving the congestion experienced along southbound I-495 in the No Build.

Northbound and southbound Express Lanes segments operate under light to moderate traffic conditions in both the No Build and Build conditions.

Table 9-18 provides a list of all freeway mainline segments with densities classified as "congested" (density greater than 35 vpmpl) or "severely congested" (density greater than 45 vpmpl) in the 2025 No Build PM peak hour. **Table 9-19** provides the same list for the 2025 Build PM peak hour. These tables show a much greater number of congested segments under No Build conditions, especially along the I-495 GP lanes in both directions. **Figure 9-10** provides pie charts comparing the number of congested segments under 2025 PM No Build versus Build conditions broken out into basic, weave, and ramp junction (merge or diverge) segments. This figure shows that for all three segment types, there is an increase in the number of segments classified as "light to moderate" and a decrease in the number of segments classified as congested or severely congested.

Table 9-18. 2025 No Build PM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	Between ramps to I-495 Express Lanes (MD) and GWMP	Diverge	33	35.2	Congested
NB I-495 (GP)	Between ramps to/from GWMP	Basic	31	46.2	Severely Congested
NB I-495 (GP)	Between GWMP and Clara Barton Parkway	Weave	39	36.6	Congested
SB I-495 (GP)	Between River Road and Clara Barton Parkway	Basic	39	55.0	Severely Congested
SB I-495 (GP)	Between ramps to/from WB Clara Barton Parkway	Basic	30	68.9	Severely Congested
SB I-495 (GP)	Between Clara Barton Parkway and GWMP	Weave	27	58.3	Severely Congested
SB I-495 (GP)	Between ramps to/from C-D Road/I-495 Express Lanes (MD)	Basic	22	93.1	Severely Congested
SB I-495 (GP)	Between ramps from I-495 Express Lanes (MD) and C-D Road	Merge	24	68.7	Severely Congested
SB I-495 (GP)	Between ramps from I-495 Express Lanes (MD) and C-D Road	Basic	23	91.6	Severely Congested
SB I-495 (GP)	Between ramps from C-D Road and Georgetown Pike	Merge	27	71.7	Severely Congested
SB I-495 (GP)	Between ramps from/to Georgetown Pike/SB I-495 Express Lanes	Merge	27	80.5	Severely Congested
SB I-495 (GP)	South of ramp to SB I-495 Express Lanes	Basic	26	78.0	Severely Congested
SB I-495 (GP)	Between Georgetown Pike and DTR	Diverge	23	87.7	Severely Congested
SB I-495 (GP)	North of ramp to WB DTR	Diverge	22	71.0	Severely Congested
SB I-495 (GP)	South of ramp from NB Route 123	Weave	16	74.0	Severely Congested

Table 9-19. 2025 Build PM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
SB I-495 (GP)	North of ramp to WB DTR	Diverge	37	40.9	Congested
SB I-495 (GP)	South of ramp from NB Route 123	Weave	16	76.9	Severely Congested

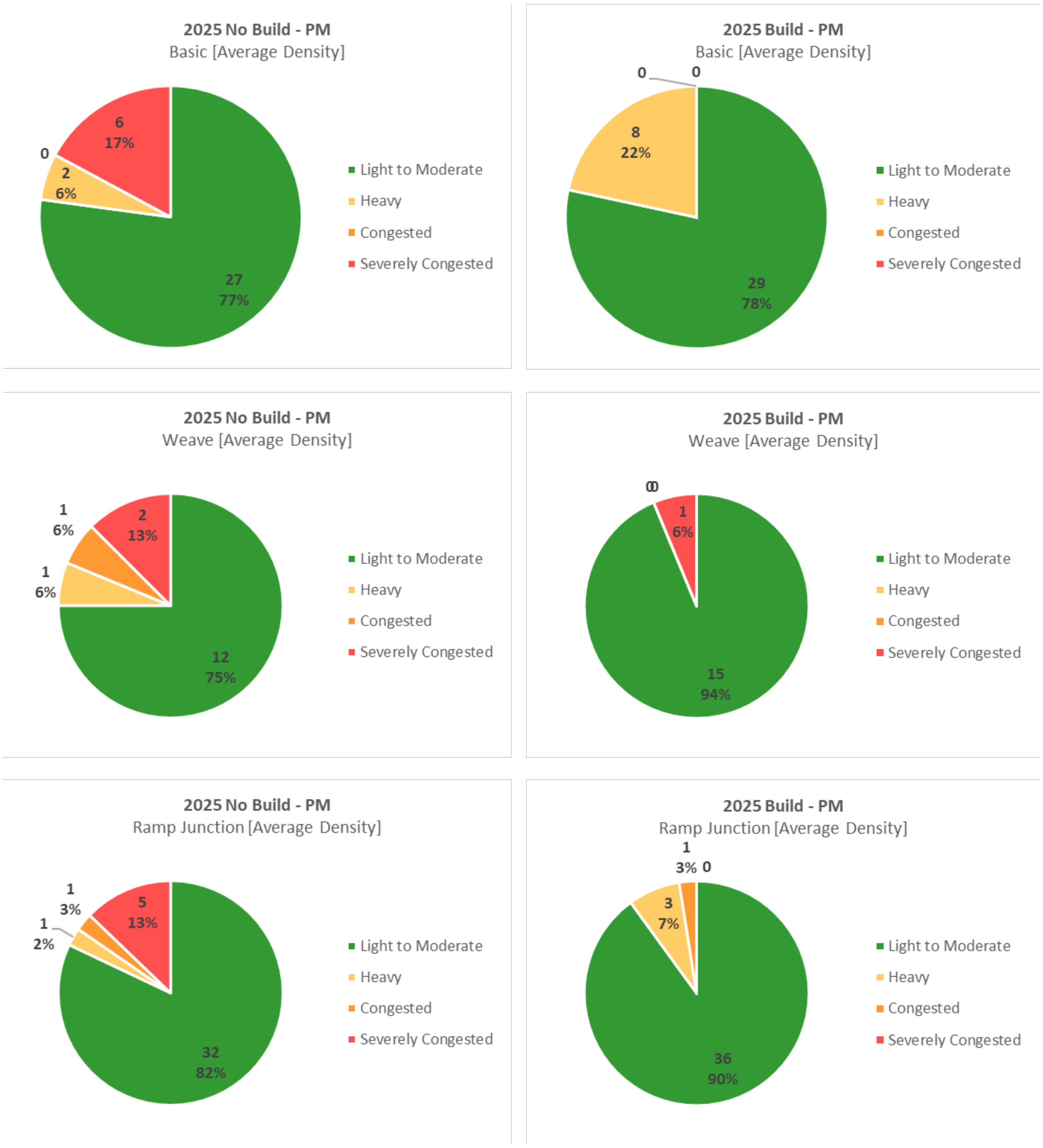


Figure 9-10. 2025 PM No Build vs. Build Comparison of Congestion Levels on Basic, Weave, and Ramp Junction Freeway Mainline Segments

<u>2025 PM Speeds</u>

Exhibits 9-13 through **9-14** illustrate the speed results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the PM peak period:

- **Exhibits 9-13a** through **9-13c** show 2025 No Build PM peak period freeway speeds.
- **Exhibits 9-14a** through **9-14c** show 2025 Build PM peak period freeway speeds

In each figure, the centerline diagram laid over the aerial depicts the average speeds during the peak hour from 3:45 p.m. to 4:45 p.m. in both directions along the mainline segments. The average speeds are color-coded based on the ranges of speeds as depicted in the legend. The boxes on the top and bottom depict the speeds in each direction for the entire peak period from 2:45 p.m. to 5:45 p.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix G of the *Traffic and Transportation Technical Report***.**

As illustrated in **Exhibits 9-13** and **9-14**, the diagrams for average speeds in the PM peak period show similar patterns as seen in the density diagrams. Average speeds for the Build scenario in the GP lanes during the PM peak period in the northbound direction are at or near the posted speed limit. In the No Build condition, however there is significant congestion between northbound Express Lanes terminus and ALMB, at which point the Maryland managed lanes system begins. Consistent with the high density levels for these segments in the No Build condition, speeds range between 25 and 35 mph in these segments in the No Build condition. In both the No Build and Build conditions, speeds are much higher north of the ALMB due to congestion relief provided by the Maryland managed lanes system.

In the southbound direction, most GP segments operate at near free-flow conditions for most of the study corridor in the Build condition, with the exception of a slight slowdown near the Route 123 interchange due to congestion in Tysons. In the No Build condition, there is a slowdown north of the left-side entrance to the southbound Express Lanes (between Route 193 and Route 267) and downstream right-side exit to westbound DTR due to weaving approaching both the Express Lanes and DTR, as both of these movements have heavy volumes. This congestion is also worsened in the No Build scenario due to the southbound Maryland managed lanes system terminating near the GWMP interchange, creating a merge that spills back upstream in the GP lanes across the ALMB.

Both directions of the Express Lanes operate at or near the posted speed limit.

Figure 9-11 provides a "heat map" comparison of average speeds between 2025 No Build and Build conditions for the PM peak period along the I-495 GP lanes. Time of day during the peak period is provided on the horizontal axis while location along the corridor is provided along the vertical axis; the colors signify average speeds for each scenario. The figure is consistent with the speed Exhibits and indicates a more significant presence of congestion in the No Build scenario in both directions of the I-495 GP lanes. The Express Lanes operate at or near the posted speed limit under both No Build and Build conditions, although slight slowdowns are observed in the No Build condition approaching the Express Lanes end terminus points (northbound where the Virginia Express Lanes system ends near Old Dominion Drive and southbound where the Maryland managed lanes system ends just south of GWMP).

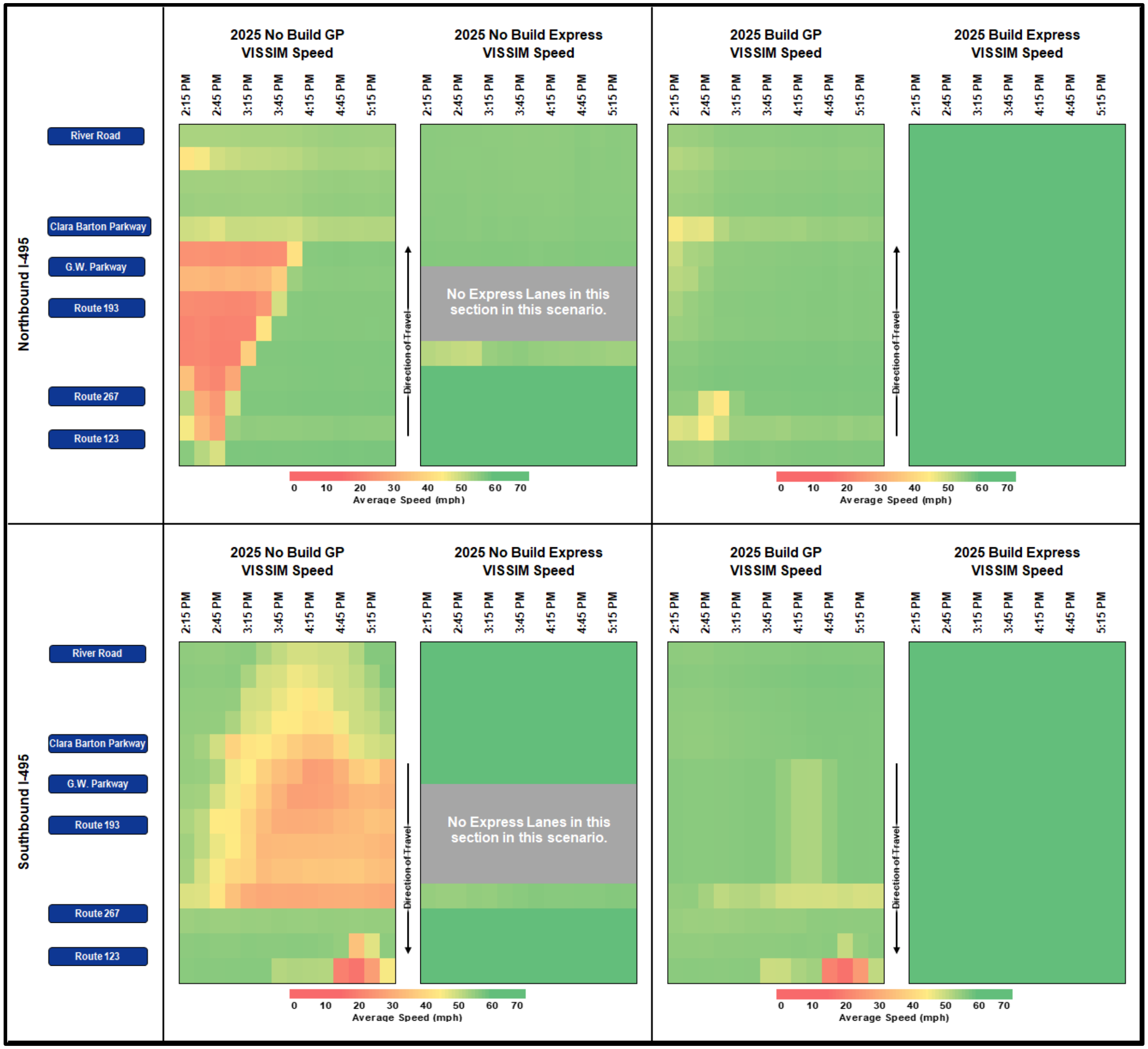


Figure 9-11. PM Peak Period Average Speeds along I-495 for 2025 No Build and 2025 Build Conditions

<u>2025 PM Travel Times</u>

A comparison of PM peak period travel times for 2025 No Build and 2025 Build scenarios is shown in **Table 9-20**. Travel time measurements have been aggregated by direction of travel and facility type.

Table 9-20. 2025 PM Peak Period Travel Time Comparison

Route	GP Travel Times (Minutes: Seconds)		Express Lanes Travel Times (Minutes: Seconds)	
	2025 No Build	2025 Build	2025 No Build	2025 Build
Northbound I-495 (Route 123 to River Road)	10:36	6:45	8:02	6:05
Southbound I-495 (River Road to Route 123)	15:59	8:05	8:11	6:09
Eastbound Route 267 (Spring Hill Road to Route 123)	1:49	1:49	-	-
Westbound Route 267 (Route 123 to Spring Hill Road)	1:50	1:50	-	-

2025 Build PM peak period travel times improve or remain consistent as compared to No Build across all freeway facilities in the Traffic Operations Study Area.

- The average travel time in the northbound GP lanes improves by nearly 4 minutes (a 36 percent improvement). The majority of the travel time savings are between Old Dominion Drive and Clara Barton Parkway, which is consistent with the speed results shown in the previous section.
- Vehicles traveling on the northbound Express Lanes see a 24 percent travel time improvement. The travel time improvement in the Build condition is between Lewisville Road and GWMP, where in the No Build condition, vehicles need to travel on the congested GP lanes.
- In the southbound direction, GP travel times in the Build improve by nearly 8 minutes (49 percent) and Express Lanes travel time improve by 11 percent. Providing a continuous Express Lanes system, as well as some shift in the volume for the southbound I-495 to westbound DTR movement from GP lanes to Express Lanes, helps relieve the congestion.
- Along eastbound and westbound Route 267 (DTR), travel times are essentially identical between No Build and Build.

<u>2025 PM Ramp Queues</u>

Table 9-21 provides a summary of freeway ramp queues exceeding available storage under 2025 No Build or Build conditions during the PM peak period. A full comparison of queuing at all freeway ramp locations is provided in **Appendix I.** As shown, ramp queues exceed storage in two locations under No Build conditions and three locations under Build conditions. The locations exceeding storage under Build conditions are as follows:

- Northbound/eastbound Route 123 to southbound I-495 GP lanes – this queue is due to spillback from external congestion along the southbound I-495 GP lanes leaving the Tysons area. This PM period ramp queue is observed in existing conditions. Along the southbound I-495 GP lanes, at the southern extents of the VISSIM network, external congestion (representing downstream congestion beyond the study area) is simulated using reduced speed areas in VISSIM, and these reduced speed areas are held consistent between No Build and Build. The increase in congestion shown in the Build scenario is due to reduced throughput in the No Build scenario, despite similar forecasted travel demand. Note that there is a CLRP project to widen the I-495 Outer Loop (southbound) between I-66 and Route 7, which should help mitigate this congestion. Given that this improvement is beyond the VISSIM network extents, it was not included in the I-495 NEXT VISSIM models.

- Southbound/westbound Route 123 to southbound I-495 GP lanes – see description above; this queue is tied to mainline I-495 congestion that is external to the study area. This queue is also present and longer under No Build conditions.
- Westbound Clara Barton Parkway to southbound I-495 GP lanes – this queue is tied to congestion in the southbound GP lanes across the ALMB; this queue is present and longer under No Build conditions.

Maps showing the location of ramp queues exceeding storage in the 2025 Build PM condition can be found in **Exhibits 9-15a** through **9-15d**.

Table 9-21. 2025 PM Ramp Queues Exceeding Storage

Ramp Name	2025 No Build PM			2025 Build PM		
	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?
Route 123 EB to I-495 SB GP	1,058	1,400	No	3,134	1,400	Yes
Route 123 WB to I-495 SB GP	5,557	1,590	Yes	5,452	1,590	Yes
Clara Barton WB to I-495 SB GP	7,122	2,095	Yes	6,887	2,095	Yes

2025 PM Person Throughput

Figure 9-12 and **Figure 9-13** display PM peak period person throughput along I-495 northbound and southbound, respectively (GP and Express combined). These figures show the estimated number of persons moved across a three-hour period based on simulated vehicle throughput and assumed vehicle occupancies for GP and Express Lanes. GP lanes are assumed to carry 1.1 persons per vehicle, based on the estimated non-HOV lane auto occupancy MWCOG has estimated across various interstate facilities in Northern Virginia (MWCOG, 2014). Express Lanes are assumed to carry 1.44 person per vehicle, based on a historic 18 percent HOV-3 utilization in the existing I-495 Express Lanes and assuming the remaining 82 percent of vehicles take on the non-HOV lane auto occupancy. These figures show that person throughput increases in the Build scenario across the length of the I-495 corridor in both directions due to the added capacity from the Express Lanes and increased occupancy of vehicles in those lanes.

- In the northbound direction, the highest person throughputs are across the ALMB. Increases in throughput from No Build to Build range from 8 to 37 percent, with the greatest increase in the segments between Route 267 and GWMP where the new Express Lanes significantly add capacity.
- In the southbound direction, the highest person throughputs are again across the ALMB. Increases in throughput from No Build to Build range from 10 to 47 percent, with the greatest increases again

in the segments between GWMP and Route 267 where the new Express Lanes significantly add capacity.

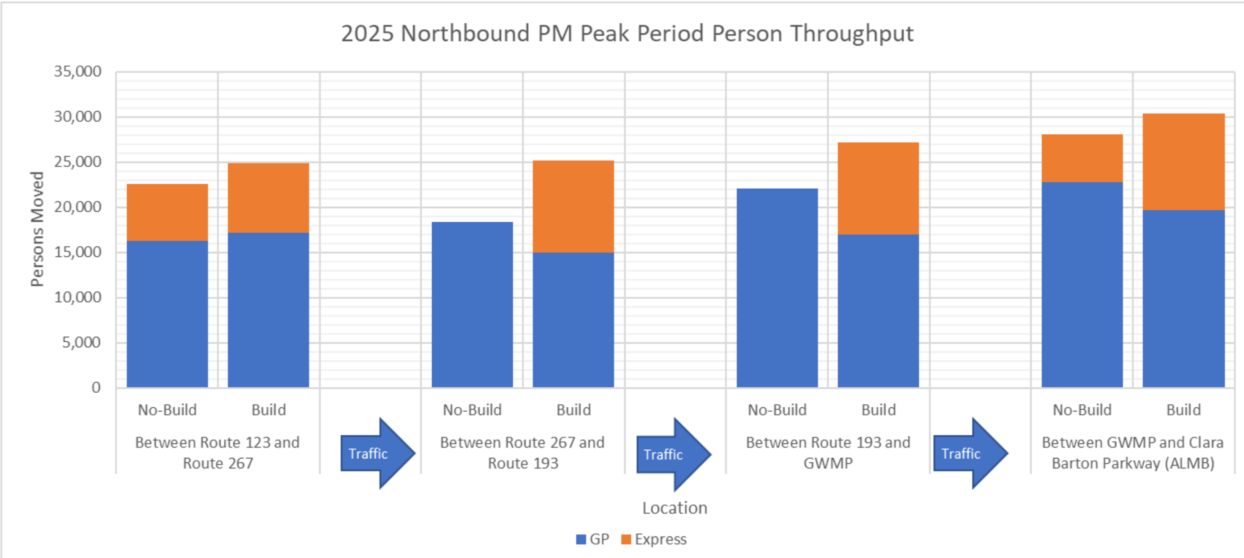


Figure 9-12. 2025 No Build and Build – PM Peak Period Person Throughput, I-495 Northbound

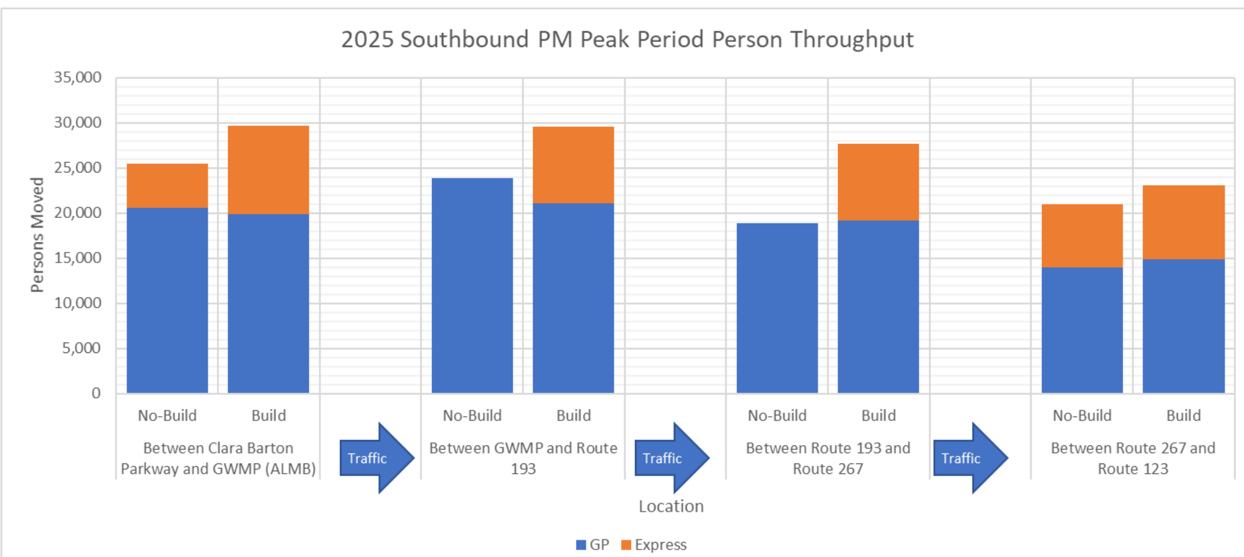


Figure 9-13. 2025 No Build and Build – PM Peak Period Person Throughput, I-495 Southbound

2025 PM Peak Intersection Operations

2025 PM Intersection Delay and Level of Service

Intersections in the Traffic Operations Study Area evaluated in VISSIM generally see improved operations in the 2025 PM peak hour in the Build condition as compared to No Build conditions. **Figure 9-14** provides pie charts of overall intersection HCM-analogous LOS for No Build and Build conditions. The figure shows under Build conditions, 33 percent of intersections are at LOS F while 43 percent are at LOS F under No Build conditions. Additionally, more than half of all intersections are LOS D or better in the Build condition, while only 33 percent are at LOS D or better in the No Build condition.

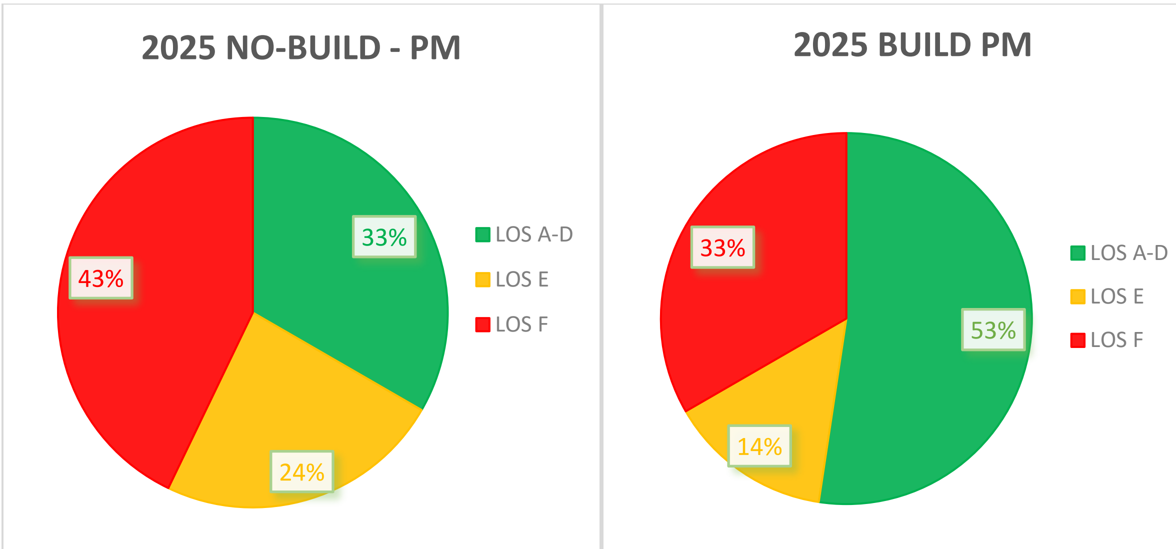


Figure 9-14. Summary of Arterial HCM-Analogous LOS, 2025 PM No Build vs. Build Conditions

Table 9-22 compares the overall intersection HCM-analogous LOS between the two scenarios for each intersection. A detailed breakdown of intersection delay and LOS, including delay and LOS by approach, is provided in Appendix H of the *Traffic and Transportation Technical Report*.

The following intersections operate under failing conditions under both 2025 No Build and Build conditions:

- Route 123 and Tysons Boulevard
- Route 123 and Capital One Tower Drive / Old Meadow Road
- Route 123 and Lewinsville Road/Great Falls Street
- Lewinsville Road and Balls Hill Road
- Jones Branch Connector and I-495 Express Lanes ramps
- International Drive and Spring Hill Road / Jones Branch Drive
- Route 193 and Dead Run Drive (unsignalized)

Most of these intersections are in the Tysons area and see continued growth in demand tied to commercial and residential growth in Tysons. These locations in Tysons are discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

In the 2025 PM peak hour, there are no intersections operating at LOS F in the Build condition that are not also at LOS F in the No Build Condition.

The signalized intersection of Route 123 and the Route 267 eastbound off-ramp / Anderson Road is failing under 2025 No Build conditions but improves to LOS E under 2025 Build conditions. However, the overall delay improves from approximately 86 seconds to approximately 79 seconds, representing a fairly minor improvement in operations.

The unsignalized intersection of Route 193 and Helga Place/Linganore Drive is failing under 2025 No Build conditions due to heavy delays on the southbound approach; this stop-controlled approach sees few gaps for traffic to enter the mainline Route 193 traffic stream due to heavy congestion in along eastbound Route 193 (spilling back from the northbound on-ramp to I-495). In the Build scenario, this eastbound congestion along Route 193 is relieved due to improved operations along northbound I-495, which reduces queue spillback on the on-ramp from Route 193.

The unsignalized intersection of Route 193 and Dead Run Drive, which operates at LOS F in both the 2025 No Build and Build condition, sees an increase in intersection delay in the Build condition. As this is an unsignalized intersection, this increase in delay is attributable to the stop-controlled side street movement (the northbound approach from Dead Run Drive). Delay in VISSIM is shown to increase for this approach in the Build scenario due to a *reduction* in queue spillback along westbound Route 193; in the No Build scenario, stopped traffic along westbound Route 193 due to queue spillback from the I-495 interchange allows for vehicles from Dead Run Drive to turn into stopped traffic. The total forecasted volume at this intersection decreases by 16 percent in the Build scenario.

Table 9-22. VISSIM Intersection Microsimulation Delay and HCM-Analogous LOS – 2025 No Build vs. Build PM Peak Hour

Intersection Control	Intersection	2025 No-Build PM		2025 Build PM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Route 123 and Tysons Boulevard	174.5	F	177.1	F
Signalized	Westpark Drive and Tysons Connector	11.4	B	10.4	B
Signalized	Tysons Connector and Express Lanes Ramps	7.6	A	7.4	A
Signalized	Route 123 and Capital One Tower Drive/ Old Meadow Road	177.1	F	178.7	F
Signalized	Route 123 and Scotts Crossing Boulevard/ Colshire Drive	76.9	E	71.9	E
Signalized	Route 123 and Route 267 Eastbound Off-Ramp/ Anderson Road	85.9	F	78.7	E
Signalized	Route 123 and Lewinsville Road/ Great Falls Street	116.3	F	113.9	F
Signalized	Lewinsville Road and Balls Hill Road	116.6	F	117.1	F
Signalized	Jones Branch Drive and Jones Branch Connector	16.2	B	16.6	B
Signalized	Jones Branch Connector and Express Lanes Ramps	149.3	F	144.7	F

Intersection Control	Intersection	2025 No-Build PM		2025 Build PM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Jones Branch Drive and Capital One (West)	21.0	C	20.5	C
Signalized	Jones Branch Drive and Capital One (East)	8.3	A	7.2	A
Signalized	International Drive and Spring Hill Road/ Jones Branch Drive	89.0	F	99.8	F
Signalized	Spring Hill Road and Dulles Toll Road Eastbound Ramps	20.2	C	20.1	C
Signalized	Spring Hill Road and Dulles Toll Road Westbound Ramps	61.8	E	39.8	D
Signalized	Spring Hill Road and Lewinsville Road	75.0	E	76.5	E
Unsignalized	Route 193 and Helga Place/ Linganore Drive	157.9	F	28.0	D
Signalized	Route 193 and I-495 Southbound Ramps	61.7	E	42.5	D
Signalized	Route 193 and I-495 Northbound Ramps	19.9	B	21.5	C
Signalized	Route 193 and Balls Hill Road	65.0	E	35.5	D
Unsignalized	Route 193 and Dead Run Drive	58.6	F	71.5	F

The expanded arterial network beyond intersections immediately adjacent to freeway interchanges in the corridor was evaluated solely through Synchro. **Table 9-23** compares the overall intersection delay and LOS between the two scenarios for each intersection.

Under both No Build and Build conditions, the following intersections are failing:

- Old Dominion Drive and Balls Hill Road (signalized)
- Lewinsville Road and Swinks Mill Road (unsignalized)
- Route 193 and Douglass Drive (unsignalized)

Two of these three intersections are also failing in the 2025 AM peak hour under both No Build and Build conditions. Note that under Build conditions, while the intersection of Route 193 and Douglass Drive is still failing, a significant reduction in delay is achieved as compared to No Build conditions.

Table 9-23. 2025 Synchro Intersection Delay and LOS – 2025 No Build vs. Build PM Peak Hour

Intersection Control	Intersection Name	2025 No Build PM		2025 Build PM	
		Intersection Delay (Sec/veh)	LOS	Intersection Delay (Sec/veh)	LOS
Signalized	Old Dominion Drive at Spring Hill Road	10.8	B	10.8	B
Signalized	Old Dominion Drive at Swinks Mill Road	12.1	B	12.1	B
Signalized	Old Dominion Drive at Balls Hill Road	189.4	F	181.5	F
Signalized	Route 123 at Old Dominion Drive	41.9	D	41.7	D
Unsignalized	Route 193 at Swinks Mill Road	23.4	C	15.8	C
Unsignalized	Georgetown Pike at Spring Hill Road	13.3	B	12.7	B
Unsignalized	Lewinsville Road at Swinks Mill Road	85.8	F	87.9	F
Unsignalized	Route 123 at Ingleside Avenue	24.9	C	24.9	C
Unsignalized	Douglass Drive at Route 193	280.2	F	144.2	F

Figure 9-15 provides a summary comparison of overall intersection delay for Build conditions as compared to No Build conditions at each intersection in the Traffic Operations Study Area for the 2025 PM scenario. The figure shows whether an intersection shows an improvement in operations (increase in LOS in Build conditions if below LOS D for No Build conditions, or a significant reduction in delay if still operating at LOS F in Build conditions), a degradation in operations (decrease in LOS in Build conditions or significant increase in delay if operating at LOS F already in No Build conditions), or if operations remain generally consistent between the two scenarios. The figure calls out intersections operating at LOS F in the Build condition. Note that the intersections that see a degradation in delay are in locations currently under study by FCDOT in coordination with VDOT. These locations are discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

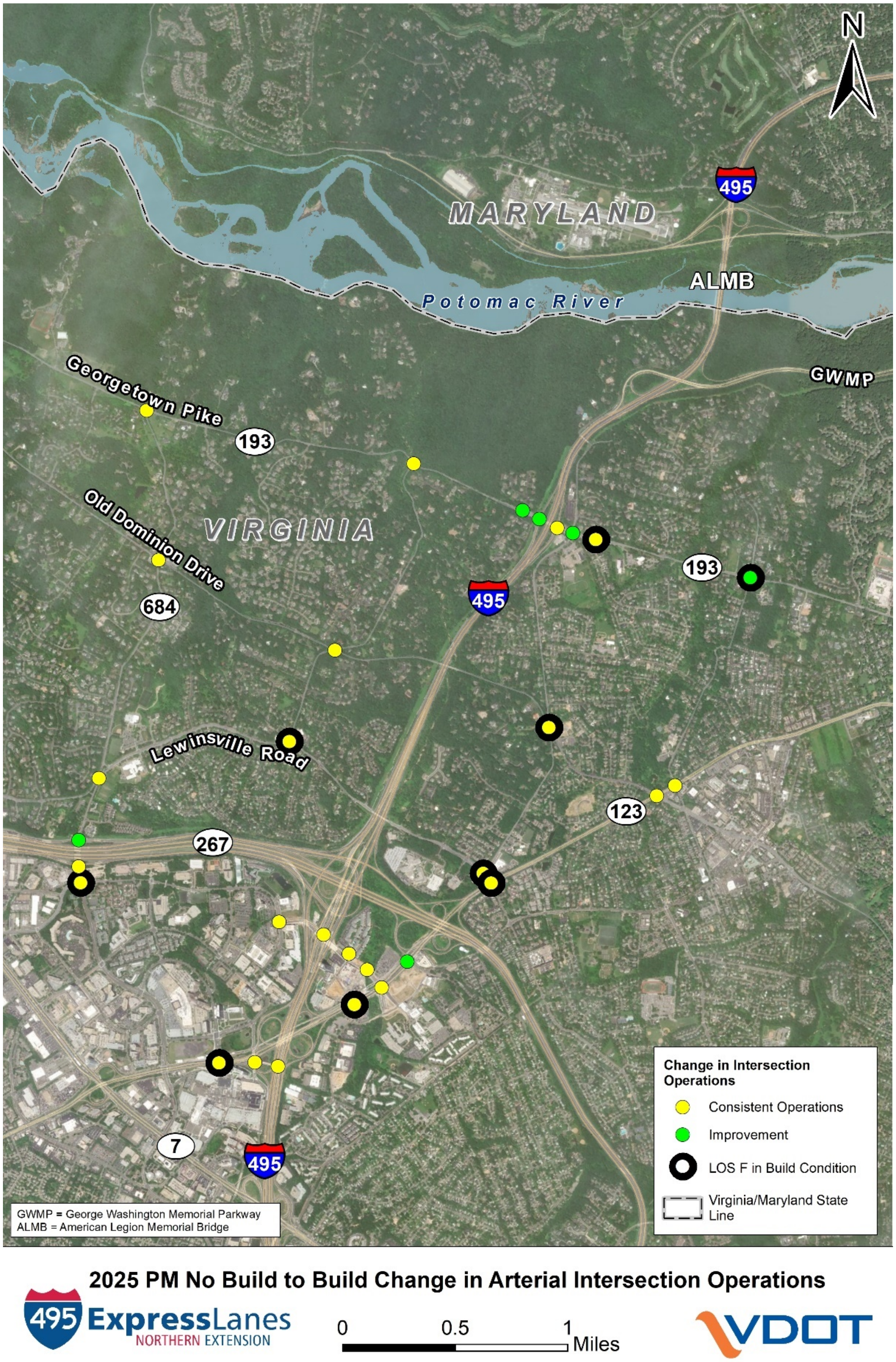


Figure 9-15. 2025 PM No Build to Build Change in Arterial Intersection Operations

2025 PM Intersection Queues

Overall, 78 intersection movements were identified as having queues exceeding available storage under Build conditions during the 2025 PM peak period, while 87 were identified under No Build conditions. **Table 9-24** provides a summary of intersection queues exceeding available storage during the PM peak period under 2025 Build conditions that are not exceeding available storage under 2025 No Build conditions. A full comparison of queuing at all intersection approach locations is provided in **Appendix I.** The locations only exceeding storage under Build conditions are as follows:

- Route 123 and Scotts Crossing Boulevard/Colshire Drive – westbound approach: max queues were observed to just slightly exceed storage. This area is currently in the process of being redeveloped, with a new grid network of streets planned to the south and east of Route 123 to accommodate new high-density developments. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Route 123/McLean Metrorail Station area) in coordination with VDOT. See **Section 9.2.4.**

Maps showing the location of all intersection queues exceeding storage in the 2025 Build PM condition only can be found in **Exhibits 9-15a** through **9-15d**.

Table 9-24. 2025 PM Intersection Queues Exceeding Storage

Intersection	Approach	Movement	2025 No Build PM			2025 Build PM		
			Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?	Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?
Route 123 and Scotts Crossing Boulevard/ Colshire Drive	WB	LT	410	415	No	490	415	Yes
	WB	TH	410	415	No	490	415	Yes

*Note: queues are reported using the analysis software denoted for each intersection (Synchro or VISSIM) in **Figure 9-1.***

9.2.3 2045 Conditions: No Build vs. Build

2045 AM Peak Freeway Operations

2045 AM Densities

Exhibits 9-16 through **9-17** illustrate the density results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the AM peak period:

- **Exhibits 9-16a** through **9-16c** show 2045 No Build AM peak period freeway densities.
- **Exhibits 9-17a** through **9-17c** show 2045 Build AM peak period freeway densities.

In each figure, the centerline diagram laid over the aerial depicts the average densities during the peak hour from 7:45 a.m. to 8:45 a.m. in both directions along the mainline segments. The average densities are color-coded based on the congestion levels as depicted in the legend. The boxes on the top and bottom depict the densities in each direction for the entire peak period from 6:45 a.m. to 9:45 a.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix G of the *Traffic and Transportation Technical Report***.**

In the AM peak period, it can be seen from the exhibits that under No Build conditions, severe congestion is observed in both directions of the I-495 GP lanes upstream of the ALMB. The congestion in the northbound GP lanes spills back onto the eastbound DTR and eastbound DAAR, while the congestion in the southbound GP lanes spills back past Cabin John Parkway. In the No Build condition, the southbound GP segment between Georgetown Pike and River Road operates under severe congestion due to the merge from the terminus of the southbound Maryland managed lanes system; this severe congestion meters traffic from getting downstream, artificially improving operations in the downstream southbound segments. The proposed project (Build condition) significantly alleviates this congestion, and as a result, more demand is processed which results in slightly higher density levels compared to No Build conditions. In the northbound direction, the Build condition shows significantly reduced density levels along the GP lanes between Route 267 an the ALMB as compared to No Build conditions, as well as reduced density levels along the eastbound DTR and DAAR due to a reduction in queue spillback.

All the segments along the northbound and southbound Express Lanes operate under light to moderate traffic congestion in both the scenarios with the exceptions of the segments approaching the Express Lanes termini in the No Build condition.

Table 9-25 provides a list of all freeway mainline segments with densities classified as “congested” (density greater than 35 vpmpl) or “severely congested” (density greater than 45 vpmpl) in the 2045 No Build AM peak hour. **Table 9-26** provides the same list for the 2045 Build AM peak hour. These tables show a much greater number of congested segments under No Build conditions, especially along the I-495 GP lanes in both directions. **Figure 9-16** provides pie charts comparing the number of congested segments under 2045 AM No Build versus Build conditions broken out into basic, weave, and ramp junction (merge or diverge) segments. This figure shows that for all three segment types, there is a decrease in the number of segments classified as congested or severely congested.

Table 9-25. 2045 No Build AM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	South of off-ramp to NB Route 123	Weave	17	86.7	Severely Congested
NB I-495 (GP)	Between ramps to/from NB Route 123	Basic	36	44.2	Congested
NB I-495 (GP)	Between ramps from/to NB/SB Route 123	Weave	24	58.5	Severely Congested
NB I-495 (GP)	North of combined C-D Road on-ramp from DTR/DAAR	Merge	15	84.0	Severely Congested
NB I-495 (GP)	Between DTR and Georgetown Pike	Weave	14	101.6	Severely Congested
NB I-495 (GP)	Between ramps to/from Georgetown Pike	Basic	19	78.1	Severely Congested
NB I-495 (GP)	Between Georgetown Pike and GWMP	Weave	13	109.0	Severely Congested
NB I-495 (GP)	Between ramps to I-495 Express Lanes (MD) and GWMP	Diverge	14	106.3	Severely Congested
NB I-495 (GP)	Between ramps to/from GWMP	Basic	21	83.0	Severely Congested
NB I-495 (GP)	Between GWMP and Clara Barton Parkway	Weave	19	85.7	Severely Congested

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	Between ramp to/from WB/EB Clara Barton Parkway	Basic	45	39.6	Congested
SB I-495 (GP)	Between River Road and Clara Barton Parkway	Basic	15	103.0	Severely Congested
SB I-495 (GP)	North of off-ramp to WB Clara Barton Parkway	Diverge	15	89.1	Severely Congested
SB I-495 (GP)	Between ramps to/from WB Clara Barton Parkway	Basic	15	103.1	Severely Congested
SB I-495 (GP)	Between Clara Barton Parkway and GWMP	Weave	14	98.0	Severely Congested
SB I-495 (GP)	Between ramps to/from C-D Road/I-495 Express Lanes (MD)	Basic	15	99.7	Severely Congested
SB I-495 (GP)	Between ramps from I-495 Express Lanes (MD)/C-D Road	Merge	17	94.3	Severely Congested
SB I-495 (GP)	Between ramps from I-495 Express Lanes (MD)/C-D Road	Basic	21	86.0	Severely Congested
SB I-495 (GP)	Between ramps from C-D Road/Georgetown Pike	Merge	29	70.5	Severely Congested
SB I-495 (Express)	South of ramp to GWMP	Merge	32	47.4	Severely Congested
EB DTR	West of ramp to Spring Hill Road	Diverge	6	144.0	Severely Congested
EB DTR	Between ramps to/from Spring Hill Road/Dulles Airport Access Road (DAAR)	Basic	7	133.4	Severely Congested
EB DTR	Between ramps from DAAR and Spring Hill Road	Merge	7	132.8	Severely Congested
EB DTR	Between Spring Hill Road and I-495	Weave	6	132.4	Severely Congested
EB DTR	Between ramps to SB/NB I-495	Diverge	4	155.4	Severely Congested
EB DAAR	West of combined ramp to I-495	Diverge	30	37.3	Congested
WB DTR	East of off-ramp to Dulles Airport Access Road (DAAR)	Diverge	11	112.1	Severely Congested
WB DTR	Between ramps to DAAR and NB Route 123	Diverge	18	92.5	Severely Congested
WB DTR	Between ramps to NB/SB Route 123	Diverge	15	89.2	Severely Congested
WB DTR	Between ramps to DAAR and Spring Hill Road	Diverge	41	40.6	Congested
WB GWMP	East of ramp to NB I-495	Basic	27	45.8	Severely Congested

Table 9-26. 2045 Build AM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	South of off-ramp to Route 123	Weave	47	36.5	Congested
NB I-495 (GP)	Between DTR and Georgetown Pike	Weave	35	50.4	Severely Congested
NB I-495 (GP)	Between ramps to/from Georgetown Pike	Basic	41	48.1	Severely Congested
NB I-495 (GP)	Between Georgetown Pike and GWMP	Weave	32	54.4	Severely Congested
NB I-495 (GP)	Between ramps to/from GWMP	Basic	30	65.0	Severely Congested
NB I-495 (GP)	Between GWMP and Clara Barton Parkway	Weave	27	66.9	Severely Congested
NB I-495 (GP)	Between ramp to/from WB/EB Clara Barton Parkway	Basic	44	45.2	Severely Congested
NB I-495 (GP)	Between Clara Barton Parkway and River Road	Basic	53	37.3	Congested
SB I-495 (GP)	Between River Road and Clara Barton Parkway	Basic	52	39.2	Congested
SB I-495 (GP)	Between River Road and Clara Barton Parkway	Diverge	37	47.0	Severely Congested
SB I-495 (GP)	Between ramps to Clara Barton Parkway	Basic	32	62.6	Severely Congested
SB I-495 (GP)	Between Clara Barton Parkway and GWMP	Weave	26	72.5	Severely Congested
SB I-495 (GP)	Between ramps to GWMP/Georgetown Pike	Diverge	50	41.2	Congested
SB I-495 (GP)	Between ramps to/from Georgetown Pike/SB I-495 C-D Road	Basic	53	37.8	Congested
SB I-495 (GP)	Between ramps to WB DAAR and I-495/Route 123 C-D Road	Diverge	31	37.2	Congested
EB DTR	West of ramp to Spring Hill Road	Diverge	24	60.2	Severely Congested
EB DTR	Between ramps to Spring Hill Road/Dulles Airport Access Road (DAAR)	Merge	39	37.5	Congested
EB DTR	Between ramps to Route 123/NB I-495	Basic	36	35.3	Congested
WB DTR	East of ramp to Dulles Airport Access Road (DAAR)	Diverge	8	135.1	Severely Congested
WB DTR	Between ramps to DAAR/NB Route 123	Diverge	15	104.8	Severely Congested
WB DTR	Between ramps to NB/SB Route 123	Diverge	12	105.8	Severely Congested
WB DTR	Between Route 123 and I-495	Weave	19	51.3	Severely Congested

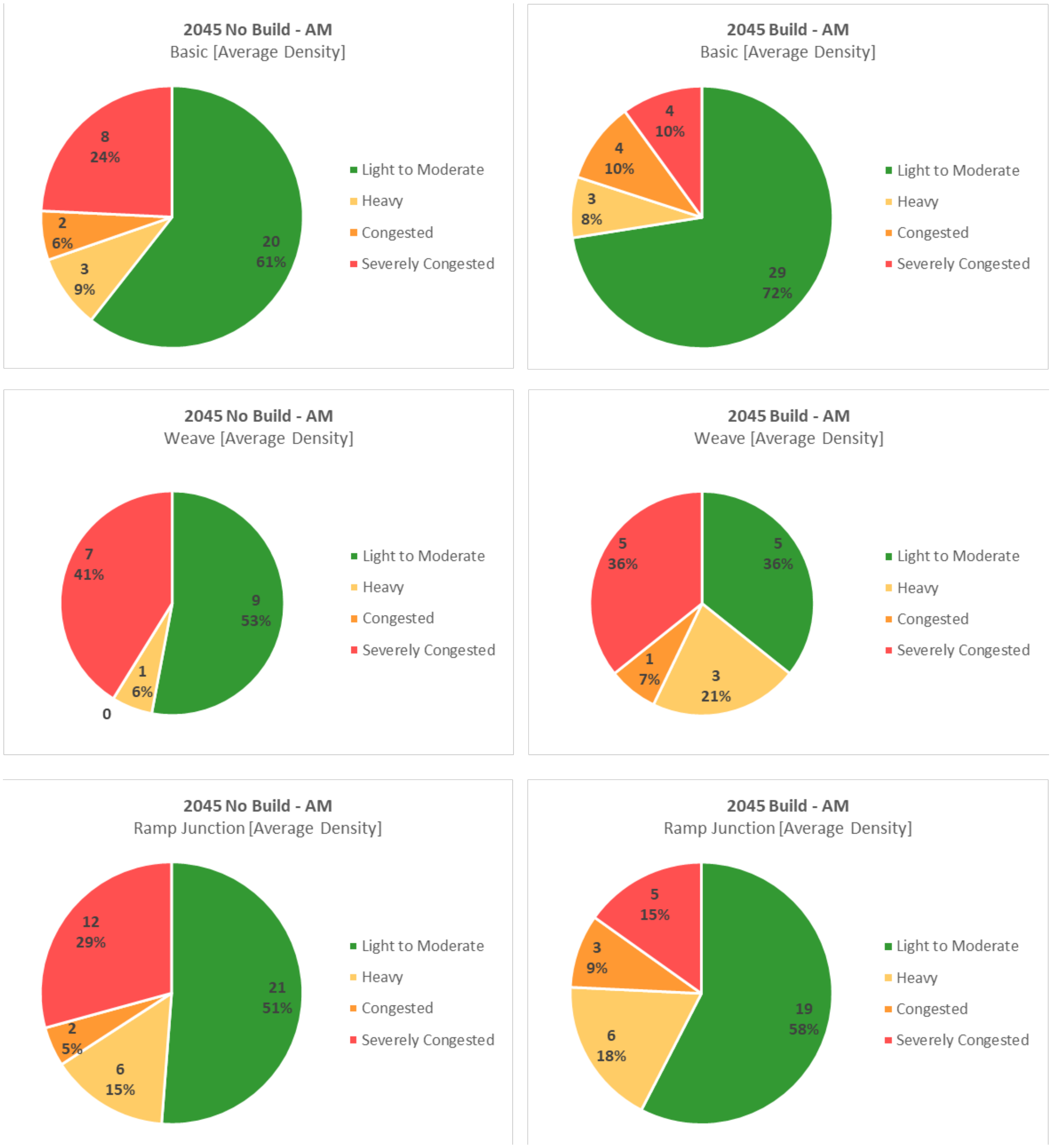


Figure 9-16. 2045 AM No Build vs. Build Comparison of Congestion Levels on Basic, Weave, and Ramp Junction Freeway Mainline Segments

<u>2045 AM Speeds</u>

Exhibits 9-18 through **9-19** illustrate the speed results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the AM peak period:

- **Exhibits 9-18a** through **9-18c** show 2045 No Build AM peak period freeway speeds.
- **Exhibits 9-19a** through **9-19c** show 2045 Build AM peak period freeway speeds.

In each figure, the centerline diagram laid over the aerial depicts the average speeds during the peak hour from 7:45 a.m. to 8:45 a.m. in both directions along the mainline segments. The average speeds are color-coded based on the ranges of speeds as depicted in the legend. The boxes on the top and bottom depict the speeds in each direction for the entire peak period from 6:45 a.m. to 9:45 a.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix G of the *Traffic and Transportation Technical Report***.**

As illustrated in **Exhibits 9-18** and **9-19**, the diagrams for average speeds in the AM peak period generally show similar patterns as seen in the density diagrams. In the northbound GP lanes, in the No Build condition, the corridor is severely congested from south of Route 193 (Georgetown Pike) to the Clara Barton Parkway across the ALMB. In the Build condition, some of this congestion remains, but it is significantly alleviated as compared to No Build, and higher speeds are observed. In both the No Build and Build conditions, speeds are much higher north of the ALMB due to congestion relief provided by the Maryland managed lanes system.

In the southbound GP lanes, in the No Build condition, severe congestion is observed between the entrance to the network and Route 193. As noted in the previous section, this congestion is due to the merge from the terminus of the southbound Maryland managed lanes system, as all traffic must rejoin the GP lanes at this point. This creates significant queue spillback in the southbound GP lanes and meters traffic at this point, resulting in artificially high speeds and limited congestion south of Route 193. In the Build condition, the continuous Express Lanes system significantly relieves congestion along the southbound GP lanes as that merge point is eliminated; some congestion across the ALMB remains, with low speeds observed spilling back into Maryland during the peak hour.

Both directions of the Express Lanes operate at or near the posted speed limit.

Figure 9-17 provides a "heat map" comparison of average speeds between 2045 No Build and Build conditions for the AM peak period along the I-495 GP and Express lanes. Time of day during the peak period is provided on the horizontal axis while location along the corridor is provided along the vertical axis; the colors signify average speeds for each scenario. The figure is consistent with the speed Exhibits and indicates a more significant presence of congestion in the No Build scenario in both directions of the I-495 GP lanes as compared to the Build scenario. The Express Lanes operate at or near the posted speed limit under both No Build and Build conditions, although slight slowdowns are observed in the No Build condition approaching the Express Lanes end terminus points (northbound where the Virginia Express Lanes system ends near Old Dominion Drive and southbound where the Maryland managed lanes system ends just south of GWMP). The southbound Maryland managed lanes are especially congested in the No Build condition just south of the terminus near GWMP due to congestion in the southbound GP lanes.

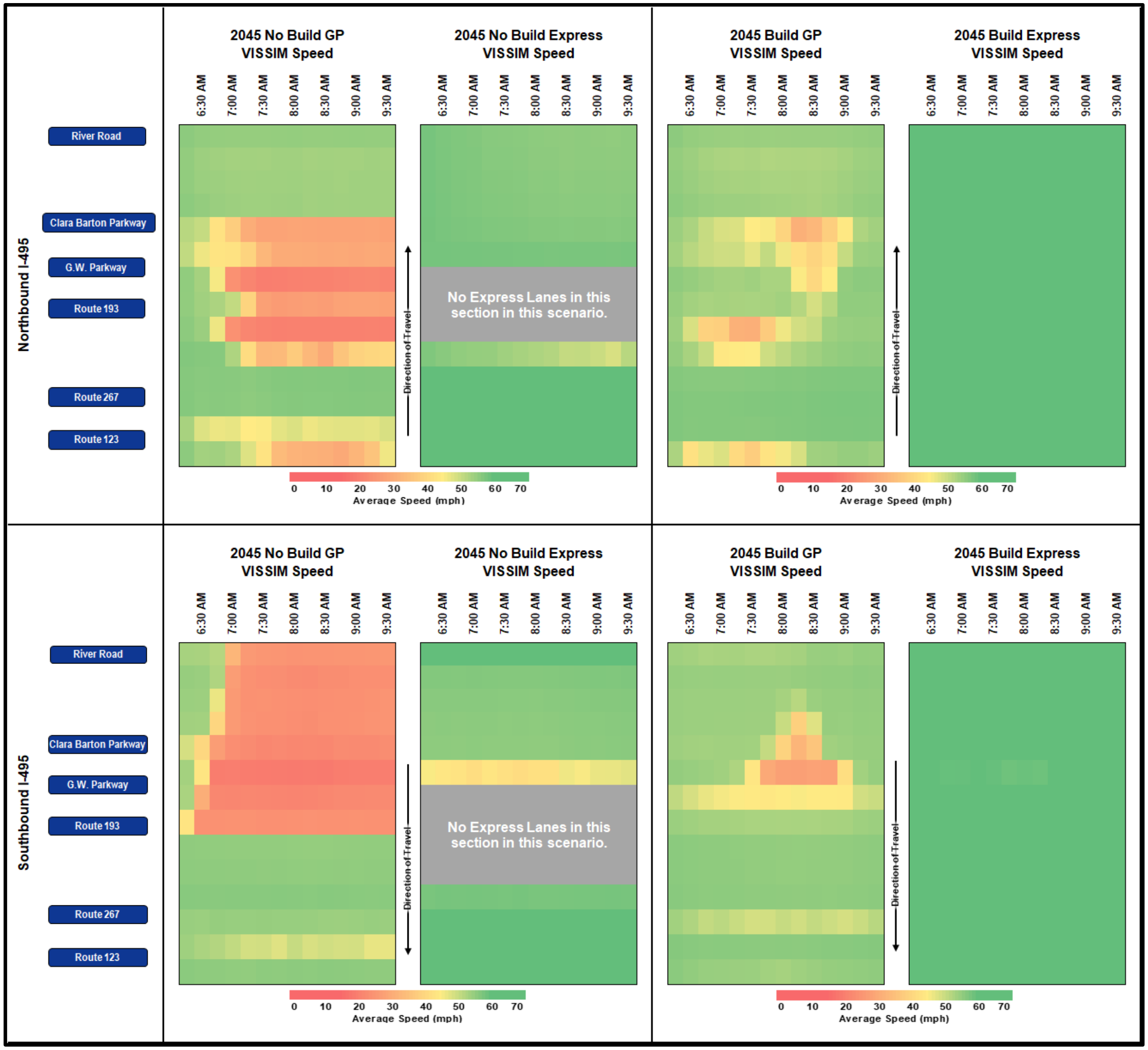


Figure 9-17. AM Peak Period Average Speeds along I-495 for 2045 No Build and 2045 Build Conditions

2045 AM Travel Times

A comparison of AM peak period travel times for 2045 No Build and 2045 Build scenarios is shown in **Table 9-27**. Travel time measurements have been aggregated by direction of travel and facility type.

Table 9-27. 2045 AM Peak Period Travel Time Comparison

Route	GP Travel Times (Minutes: Seconds)		Express Lanes Travel Times (Minutes: Seconds)	
	2045 No Build	2045 Build	2045 No Build	2045 Build
Northbound I-495 (Route 123 to River Road)	11:59	8:03	9:37	5:43
Southbound I-495 (River Road to Route 123)	16:15	7:32	8:04	5:41
Eastbound Route 267 (Spring Hill Road to Route 123)	7:21	1:51	-	-
Westbound Route 267 (Route 123 to Spring Hill Road)	1:56	2:01	-	-

2045 Build AM peak period travel times improve or remain consistent as compared to No Build across all freeway facilities in the Traffic Operations Study Area

- The average travel time in the northbound GP lanes improves by approximately 4 minutes (a 33 percent improvement) in the Build condition. The majority of the travel time savings are between Old Dominion Drive and Clara Barton Parkway, which is consistent with the speed results shown in the previous section.
- Vehicles traveling in the northbound Express Lanes see a nearly 4-minute improvement (41 percent) in the Build condition. The travel time improvement in the Build condition is between Lewinsville Road and GWMP, where in the No Build condition, vehicles need to travel on the congested GP lanes.
- In the southbound direction, GP travel times in the Build improve by nearly 9 minutes (54 percent) and Express Lanes travel time improve by approximately 2.5 minutes (30 percent). Similar to northbound, providing a continuous Express Lanes system helps with the traffic operations.
- Along eastbound Route 267 (DTR) there is a 5.5-minute (75 percent) improvement in travel time. With the improved operations along northbound I-495, the ramp from eastbound DTR to northbound I-495 does not spill back to eastbound DTR, significantly improving operations along eastbound DTR.
- In the westbound direction, travel times along Route 267 (DTR) are generally consistent between No Build and Build.

2045 AM Ramp Queues

Table 9-28 provides a summary of freeway ramp queues exceeding available storage under 2045 No Build or Build conditions during the AM peak period. A full comparison of queuing at all freeway ramp locations is provided in **Appendix I.** As shown, ramp queues exceed storage in nine locations under No Build conditions and four locations under Build conditions. The locations exceeding storage under Build conditions are as follows:

- Eastbound Dulles Toll Road to northbound I-495 GP lanes – this queue is tied to heavy demand for this movement, which joins with the movements from westbound Dulles Toll Road and the northbound I-495 C-D road. This queue is present and longer under No Build conditions; additionally, this queue dissipates much more rapidly under Build conditions due to improved operations along the northbound I-495 GP lanes. This queue dissipation is evident in the difference in travel times along the eastbound Dulles Toll Road. The Build condition also provides significantly more storage for this queue.
- Westbound Clara Barton Parkway to southbound I-495 GP lanes – this queue is tied to congestion in the southbound GP lanes across the ALMB; this queue is present and longer under No Build conditions.
- Eastbound Dulles Toll Road to Spring Hill Road – this queue is due to spillback along southbound Spring Hill Road from its intersection with International Drive south of the Dulles Toll Road. Heavy inbound demand into the Tysons area is forecasted to continue to grow in future years. Forecasted traffic demand at this intersection is consistent between the No Build and Build scenarios, but throughput is reduced in the No Build scenario due to freeway congestion. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Spring Hill Road / north Tysons area) and in coordination with VDOT. This location is discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4.**
- Westbound Dulles Toll Road to southbound/westbound Route 123 – similar to the queue for the northbound I-495 GP ramp to northbound/eastbound Route 123, this queue is due to spillback along Route 123 near the McLean Metrorail station and adjacent developments. Heavy inbound demand into the Tysons areas is forecasted to continue to grow in future years. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Scott's Crossing area and Route 123/Lewinsville Road area). This location is discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4.** This queue is also present and essentially the same length under No Build conditions.

Maps showing the location of ramp queues exceeding storage in the 2045 Build AM condition can be found in **Exhibits 9-20a** through **9-20d**.

Table 9-28. 2045 AM Ramp Queues Exceeding Storage

Ramp Name	2045 No Build AM			2045 Build AM		
	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?
I-495 NB GP to Route 123 EB	7,243	2,040	Yes	1,513	1,515	No
DTR EB to I-495 NB GP	10,580	1,650	Yes	10,575	4,070	Yes
DAAR EB to I-495 NB GP	5,858	1,270	Yes	0	2,135	No
I-495 NB GP to Route 193	4,995	1,225	Yes	152	1,225	No
Route 193 to I-495 NB GP	1,106	930	Yes	0	930	No
Clara Barton EB to I-495 SB GP	3,142	1,100	Yes	237	1,100	No
Clara Barton WB to I-495 SB GP	7,123	2,095	Yes	2,821	2,095	Yes

Ramp Name	2045 No Build AM			2045 Build AM		
	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?
DTR EB to Spring Hill	5,309	1,895	Yes	6,926	1,895	Yes
DTR WB to Route 123 SB	6,231	1,060	Yes	6,241	1,060	Yes

2045 AM Person Throughput

Figure 9-18 and **Figure 9-19** display AM peak period person throughput along I-495 northbound and southbound, respectively (GP and Express combined). These figures show the estimated number of persons moved across a three-hour period based on simulated vehicle throughput and assumed vehicle occupancies for GP and Express Lanes. GP lanes are assumed to carry 1.1 persons per vehicle, based on the estimated non-HOV lane auto occupancy MWCOG has estimated across various interstate facilities in Northern Virginia (MWCOG, 2014). Express Lanes are assumed to carry 1.44 person per vehicle, based on a historic 18 percent HOV-3 utilization in the existing I-495 Express Lanes and assuming the remaining 82 percent of vehicles take on the non-HOV lane auto occupancy. These figures show that person throughput increases in the Build scenario across the length of the I-495 corridor in both directions due to the added capacity from the Express Lanes and increased occupancy of vehicles in those lanes.

- In the northbound direction, the highest person throughputs are across the ALMB. Increases in throughput from No Build to Build range from 6 to 33 percent, with the greatest increase in the segments between Route 267 and GWMP where the new Express Lanes significantly add capacity.
- In the southbound direction, the highest person throughputs are again across the ALMB. Increases in throughput from No Build to Build range from 29 to 35 percent, with the greatest increases again in the segments between GWMP and Route 267 where the new Express Lanes significantly add capacity. Note that the southbound throughput in the No Build scenario is heavily constrained due to the merge with the southbound Maryland managed lanes terminus; this reduces throughput along the length of the corridor.

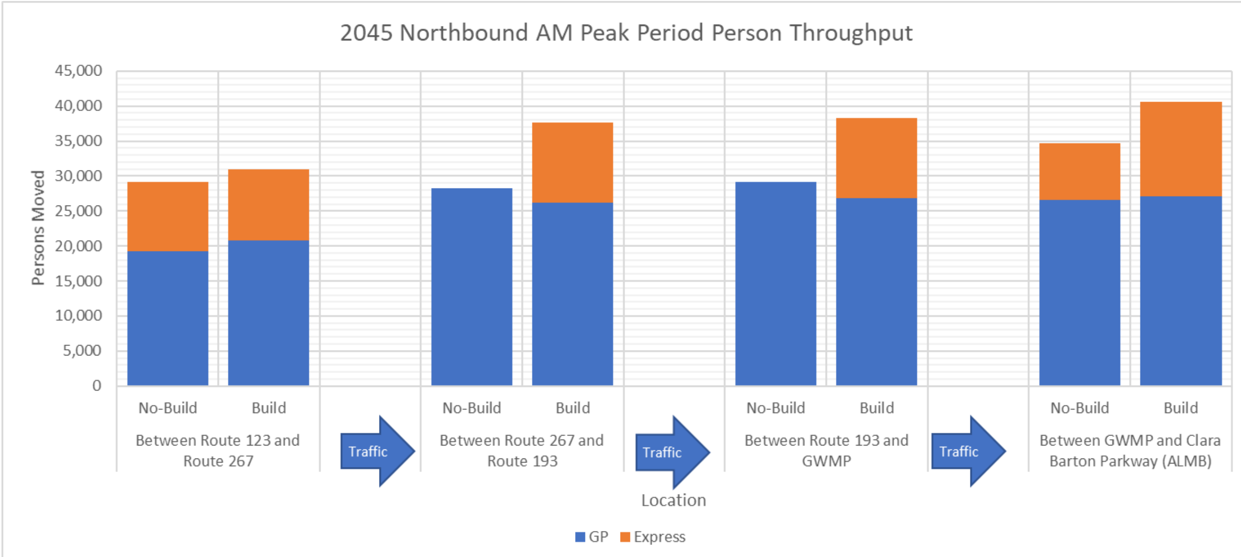


Figure 9-18. 2045 No Build and Build – AM Peak Period Person Throughput, I-495 Northbound

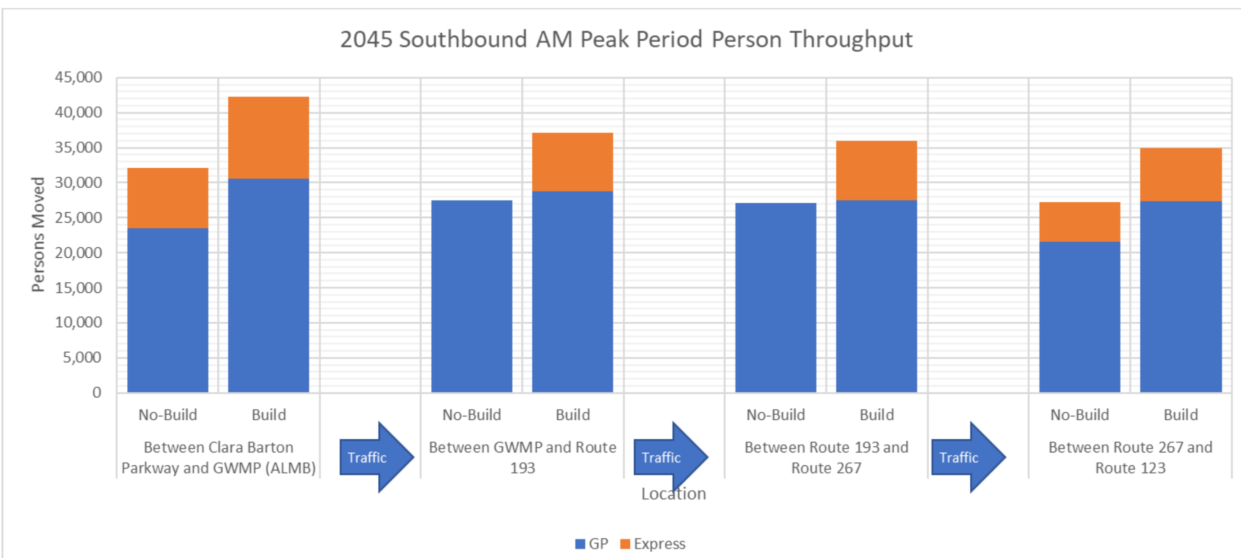


Figure 9-19. 2045 No Build and Build – AM Peak Period Person Throughput, I-495 Southbound

2045 AM Peak Intersection Operations

2045 AM Intersection Delay and Level of Service

Intersections in the Traffic Operations Study Area evaluated in VISSIM generally see improved operations in the 2045 AM peak hour under Build conditions as compared to No Build conditions. **Figure 9-20** provides pie charts of overall intersection HCM-analogous LOS for No Build and Build conditions. The figure shows that, in the Build condition, a lower percentage of intersections are failing (29 percent versus 33 percent) and a higher percentage of intersections are operating at an acceptable LOS (A to D; 58 percent versus 48 percent).

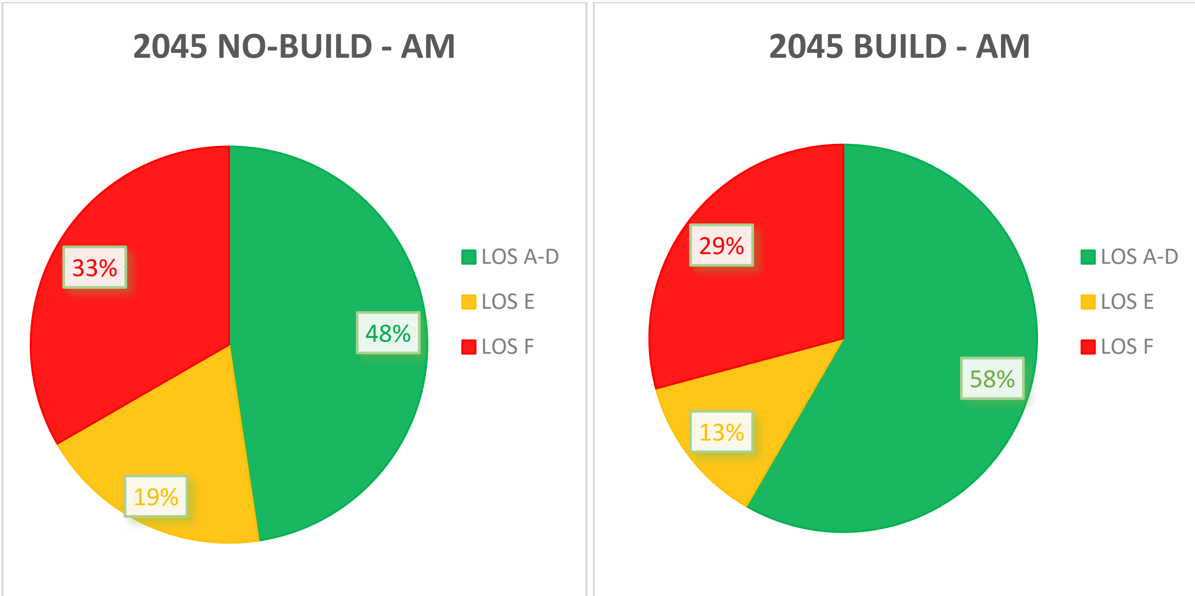


Figure 9-20. Summary of Arterial HCM-Analogous LOS, 2045 AM No Build vs. Build Conditions

Table 9-29 compares the overall intersection HCM-analogous LOS between the two scenarios for each intersection. A detailed breakdown of intersection delay and LOS, including delay and LOS by approach, is provided in Appendix H of the *Traffic and Transportation Technical Report***.**

The following signalized intersections operate under failing conditions under both 2045 No Build and Build conditions:

- Route 123 and Lewinsville Road/Great Falls Street
- Lewinsville Road and Balls Hil. Road
- Spring Hill Road and Dulles Toll Road eastbound ramps

All three of these intersections are in the Tysons area and see continued growth in demand tied to commercial and residential growth in Tysons. These locations are all discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

The following intersections are failing under No Build conditions but see improved operations (LOS E or better) under Build conditions:

- Route 123 and Capital One Tower Drive / Old Meadow Road
- Route 123 and Route 267 eastbound off-ramp / Anderson Road
- Jones Branch Connector and Express Lanes ramps

These improvements are likely attributable to improved operations along Route 123. New traffic signals are proposed in the Build condition with the off-ramps from I-495; coordination among these signals improves operations in the Build condition. Note that heavy arterial congestion is still observed along arterials in Tysons in the Build condition, including along several side street approaches.

In the Build condition, some arterial locations experience a deterioration in operations due to improved throughput from freeways that were previously metered in the No Build condition. This is most prevalent along Spring Hill Road near its interchange with Route 267, where the intersections of Spring Hill Road with the Dulles Toll Road westbound ramps and with Lewinsville Road are both failing in the Build condition due to queue spillback along southbound Spring Hill Road approaching Jones Branch Drive/International Drive. While demand for these intersections is not forecasted to change significantly between the No Build and Build conditions, throughput from upstream locations (such as I-495 southbound) is not constrained upstream in the Build condition. This location is discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

The unsignalized intersection of Route 193 and Helga Place/Linganore Drive is failing under both 2045 No Build and Build conditions due to heavy delays on the southbound approach; this stop-controlled approach sees few gaps for traffic to enter the mainline Route 193 traffic stream due to heavy congestion in along eastbound Route 193 (spilling back from the northbound on-ramp to I-495). In the Build scenario, this eastbound congestion along Route 193 is relieved due to improved operations along northbound I-495, which reduces queue spillback on the on-ramp from Route 193. This is also reflected in the improved operations in the Build condition at all three signalized intersections along Route 193, most notably at the intersection with Balls Hill Road, where the northbound approach sees a significant improvement in operations.

Table 9-29. VISSIM Intersection Microsimulation Delay and HCM-Analogous LOS – 2045 No Build vs. Build AM Peak Hour

Intersection Control	Intersection	2045 No-Build AM		2045 Build AM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Route 123 and Tysons Boulevard	45.4	D	29.5	C
Signalized	Westpark Drive and Tysons Connector	31.8	C	35.2	D
Signalized	Tysons Connector and Express Lanes Ramps	24.0	C	26.5	C
Signalized	Route 123 and EB DTR/SB I-495 C-D Road	*	*	14.6	B
Signalized	Route 123 and NB I-495 Ramp	*	*	43.2	D
Signalized	Route 123 and Capital One Tower Drive/ Old Meadow Road	105.9	F	69.8	E
Signalized	Route 123 and Scotts Crossing Boulevard/ Colshire Drive	55.4	E	71.3	E
Signalized	Route 123 and Route 267 Eastbound Off-Ramp/ Anderson Road	145.6	F	79.3	E
Signalized	Route 123 & Route 267 Eastbound On-Ramp	*	*	155.7	F

Intersection Control	Intersection	2045 No-Build AM		2045 Build AM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Route 123 and Lewinsville Road/ Great Falls Street	211.0	F	234.3	F
Signalized	Lewinsville Road and Balls Hill Road	102.8	F	90.6	F
Signalized	Jones Branch Drive and Jones Branch Connector	19.3	B	18.9	B
Signalized	Jones Branch Connector and Express Lanes Ramps	100.2	F	33.5	C
Signalized	Jones Branch Drive and Capital One (West)	36.1	D	35.6	D
Signalized	Jones Branch Drive and Capital One (East)	26.0	C	26.5	C
Signalized	International Drive and Spring Hill Road/ Jones Branch Drive	45.7	D	45.8	D
Signalized	Spring Hill Road and Dulles Toll Road Eastbound Ramps	123.0	F	217.9	F
Signalized	Spring Hill Road and Dulles Toll Road Westbound Ramps	26.2	C	85.7	F
Signalized	Spring Hill Road and Lewinsville Road	57.2	E	138.7	F
Unsignalized	Route 193 and Helga Place/ Linganore Drive	231.7	F	72.7	F
Signalized	Route 193 and I-495 Southbound Ramps	40.2	D	39.1	D
Signalized	Route 193 and I-495 Northbound Ramps	69.1	E	54.8	D
Signalized	Route 193 and Balls Hill Road	59.7	E	25.1	C
Unsignalized	Route 193 and Dead Run Drive	14.3	B	14.3	B

*This intersection is not provided under the No Build conditions.

The expanded arterial network beyond intersections immediately adjacent to freeway interchanges in the corridor was evaluated solely through Synchro. **Table 9-30** compares the overall intersection delay and LOS between the two scenarios for each intersection.

Under both No Build and Build conditions, the following intersections are failing:

- Old Dominion Drive and Balls Hill Road (signalized)
- Route 193 and Swinks Mill Road (unsignalized)

- Route 193 and Douglass Drive (unsignalized)

Note that under Build conditions, while the two unsignalized intersections along Route 193 are experiencing failing conditions due to significant delays on stop-controlled approaches, a significant reduction in delay is achieved as compared to No Build conditions. This is consistent with the VISSIM findings at adjacent intersections along the Route 193 corridor, where operations improve significantly in the Build condition.

Table 9-30. 2045 Synchro Intersection Delay and LOS – 2045 No Build vs. Build AM Peak Hour

Intersection Control	Intersection Name	2045 No-Build AM		2045 Build AM	
		Intersection Delay (Sec/veh)	LOS	Intersection Delay (Sec/veh)	LOS
Signalized	Old Dominion Drive at Spring Hill Road	11.3	B	11.2	B
Signalized	Old Dominion Drive at Swinks Mill Road	15.6	B	14.6	B
Signalized	Old Dominion Drive at Balls Hill Road	97.1	F	87.0	F
Signalized	Route 123 at Old Dominion Drive	48.8	D	45.0	D
Unsignalized	Route 193 at Swinks Mill Road	187.8	F	59.3	F
Unsignalized	Route 193 at Spring Hill Road	23.9	C	23.5	C
Unsignalized	Lewinsville Road at Swinks Mill Road	2.6	A	2.6	A
Unsignalized	Route 123 at Ingleside Avenue	22.8	C	23.2	C
Unsignalized	Douglass Drive at Route 193	478.6	F	236.7	F

Figure 9-21 provides a summary comparison of overall intersection delay for Build conditions as compared to No Build conditions at each intersection in the Traffic Operations Study Area for the 2045 AM scenario. The figure shows whether an intersection shows an improvement in operations (increase in LOS in Build conditions if below LOS D for No Build conditions, or a significant reduction in delay if still operating at LOS F in Build conditions), a degradation in operations (decrease in LOS in Build conditions or significant increase in delay if operating at LOS F already in No Build conditions), or if operations remain generally consistent between the two scenarios. The figure calls out intersections operating at LOS F in the Build condition. Note that the intersections that see a degradation in delay are in locations currently under study by FCDOT in coordination with VDOT. These locations are discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

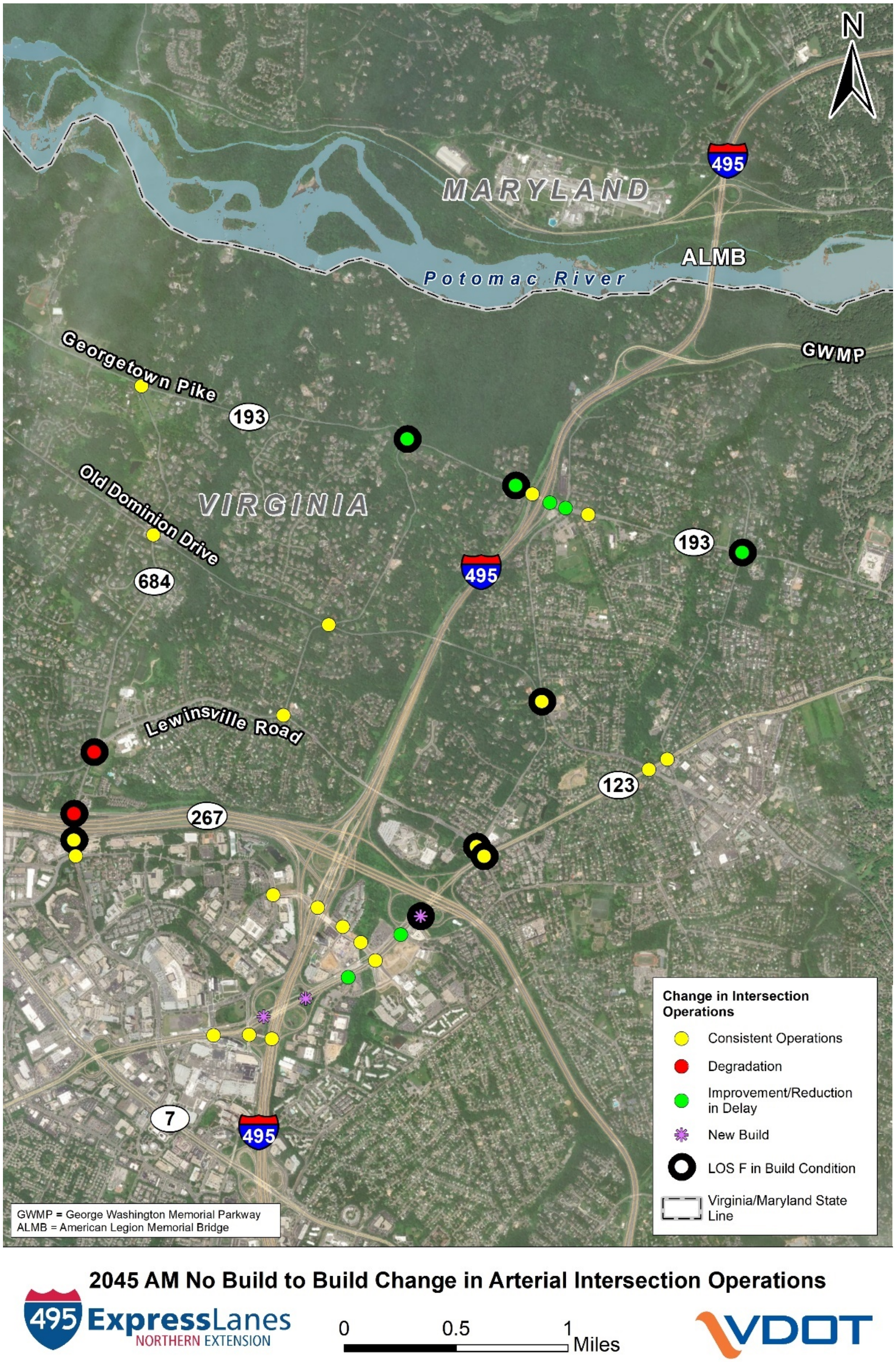


Figure 9-21. 2045 AM No Build to Build Change in Arterial Intersection Operations

2045 AM Intersection Queues

Overall, 111 intersection movements were identified as having queues exceeding available storage under Build conditions during the 2045 AM peak period, while 107 were identified under No Build conditions. **Table 9-31** provides a summary of intersection queues exceeding available storage during the AM peak period under 2045 Build conditions that are not exceeding available storage under 2045 No Build conditions. A full comparison of queuing at all intersection approach locations is provided in **Appendix I.** The locations only exceeding storage under Build conditions are as follows:

- Route 123 and Scotts Crossing Boulevard / Colshire Drive – northbound and southbound approaches: these queues are tied to arterial congestion along Route 123 in the McLean Metrorail station area and adjacent developments. Heavy inbound demand into the Tysons areas is forecasted to continue to grow in future years. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Scott's Crossing area and Route 123/Lewinsville Road area) in coordination with VDOT. Note that under No Build conditions, severe congestion on the freeway network, particularly along the southbound I-495 GP lanes, is metering traffic into this area, while under Build conditions, the reduced congestion increases throughput into this area (while demand remains relatively consistent between the two scenarios). See **Section 9.2.4.**
- Route 123 and Lewinsville Road / Great Falls Street – eastbound right-turn: max queues were observed to just slightly exceed storage, representing a queue spillback to the upstream signal of Lewinsville Road and Balls Hill Road. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Route 123/Lewinsville Road area) in coordination with VDOT. This location is also noted under 2025 AM intersection queues. See **Section 9.2.4.**
- Lewinsville Road and Balls Hill Road – eastbound approach: this queue is tied to the spillback described immediately above. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Route 123/Lewinsville Road area) in coordination with VDOT. See **Section 9.2.4.**
- Jones Branch Connector and Express Lanes ramps – eastbound right-turn: queues exceed the storage of the short right-turn bay provided at this intersection but do not spill back to the upstream intersection.
- Spring Hill Road and Dulles Toll Road eastbound ramps – northbound approach: max queues were observed to just slightly exceed storage. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Spring Hill Road / Lewinsville Road area) in coordination with VDOT. See **Section 9.2.4.**
- Spring Hill Road and Lewinsville Road - eastbound approach: this queue is tied to congestion along southbound Spring Hill Road. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Spring Hill Road / Lewinsville Road area). This queue is also noted under 2025 AM intersection queues. See **Section 9.2.4.**

Maps showing the location of all intersection queues exceeding storage in the 2025 Build AM condition only can be found in **Exhibits 9-20a** through **9-20d**.

Table 9-31. 2045 AM Intersection Queues Exceeding Storage

Intersection	Approach	Movement	2045 No Build AM			2045 Build AM		
			Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?	Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?
Route 123 and Scotts Crossing Boulevard/ Colshire Drive	NB	TH	552	605	No	688	605	Yes
	NB	RT	552	605	No	688	605	Yes
	SB	RT	612	720	No	815	720	Yes
Route 123 and Route 267 Eastbound Off-Ramp/ Anderson Road	EB	RT	654	300	Yes	1,150	300	Yes
Route 123 and Lewinsville Road/ Great Falls Street	EB	RT	126	155	No	222	155	Yes
Lewinsville Road and Balls Hill Road	EB	TH	406	420	No	547	420	Yes
Jones Branch Connector and Express Lanes Ramps	EB	RT	54	155	No	450	155	Yes
Spring Hill Road and Dulles Toll Road Eastbound Ramps	NB	TH	257	330	No	368	330	Yes
Spring Hill Road and Lewinsville Road	EB	LT	717	1,020	No	1,292	1,020	Yes
	EB	TH	717	1,020	No	1,292	1,020	Yes

Note: queues are reported using the analysis software denoted for each intersection (Synchro or VISSIM) in ***Figure 9-1.***

2045 PM Peak Freeway Operations

2045 PM Densities

Exhibits 9-21 through **9-22** illustrate the density results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the PM peak period:

- **Exhibits 9-21a** through **9-21c** show 2045 No Build PM peak period freeway densities.
- **Exhibits 9-22a** through **9-22c** show 2045 Build PM peak period freeway densities.

In each figure, the centerline diagram laid over the aerial depicts the average densities during the peak hour from 3:45 p.m. to 4:45 p.m. in both directions along the mainline segments. The average densities are color-coded based on the congestion levels as depicted in the legend. The boxes on the top and bottom depict the densities in each direction for the entire peak period from 2:45 p.m. to 5:45 p.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in **Appendix G** of the *Traffic and Transportation Technical Report*.

In the PM peak period, it can be seen from the exhibits that under No Build conditions, severe congestion is observed in both directions of the I-495 GP lanes upstream of the ALMB. In the northbound direction, the Build condition shows significantly reduced density levels along the GP lanes between Route 267 and the ALMB as compared to No Build conditions due to the removal of the merge from the northbound Express Lanes terminus and additional capacity provided by the Express Lanes. In the No Build condition, the southbound GP segment between Georgetown Pike and River Road operates under severe congestion due to the merge from the terminus of the southbound Maryland managed lanes system; the Build condition sees reduced congestion in the southbound GP lanes in this area due to the removal of this merge and additional capacity of the Express Lanes. In the Build condition, downstream southbound GP segments such as those near Route 123 in Tysons see higher freeway densities due to increased throughput from the improved upstream capacity.

Northbound and southbound Express Lanes segments operate under light to moderate traffic conditions in both the No Build and Build conditions, with the exceptions of the segments approaching the Express Lanes termini in the No Build condition.

Table 9-32 provides a list of all freeway mainline segments with densities classified as “congested” (density greater than 35 vpmpl) or “severely congested” (density greater than 45 vpmpl) in the 2045 No Build PM peak hour. **Table 9-33** provides the same list for the 2045 Build PM peak hour. These tables show a much greater number of congested segments under No Build conditions, especially along the I-495 GP lanes in both directions. **Figure 9-22** provides pie charts comparing the number of congested segments under 2045 PM No Build versus Build conditions broken out into basic, weave, and ramp junction (merge or diverge) segments. This figure shows that for all three segment types, there is a decrease in the number of segments classified as congested or severely congested.

Table 9-32. 2045 No Build PM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	South of off-ramp to NB Route 123	Weave	19	71.5	Severely Congested
NB I-495 (GP)	Between ramps to/from NB Route 123	Basic	18	84.7	Severely Congested
NB I-495 (GP)	Between ramps from/to NB/SB Route 123	Weave	15	86.3	Severely Congested
NB I-495 (GP)	Between ramps to/from SB Route 123	Basic	18	82.6	Severely Congested
NB I-495 (GP)	Between Route 123 and Dulles Toll Road	Weave	13	99.0	Severely Congested
NB I-495 (GP)	Between ramps to/from WB DTR/DAAR and NB I-495 Express Lanes	Basic	8	125.2	Severely Congested
NB I-495 (GP)	Between ramps from NB I-495 Express Lanes and DTR/DAAR C-D Road	Merge	9	126.2	Severely Congested
NB I-495 (GP)	North of combined C-D Road on-ramp from DTR/DAAR	Merge	8	134.8	Severely Congested
NB I-495 (GP)	Between DTR and Georgetown Pike	Weave	9	128.1	Severely Congested
NB I-495 (GP)	Between ramps to/from Georgetown Pike	Basic	12	105.1	Severely Congested
NB I-495 (GP)	Between Georgetown Pike and GWMP	Weave	13	98.1	Severely Congested
NB I-495 (GP)	Between ramps to I-495 Express Lanes (MD) and GWMP	Diverge	10	123.5	Severely Congested
NB I-495 (GP)	Between ramps to/from GWMP	Basic	16	96.5	Severely Congested

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	Between GWMP and Clara Barton Parkway	Weave	24	65.3	Severely Congested
NB I-495 (GP)	Between ramp to/from WB/EB Clara Barton Parkway	Basic	24	60.8	Severely Congested
NB I-495 (GP)	North of ramp from EB Clara Barton Parkway	Merge	15	79.9	Severely Congested
NB I-495 (GP)	Between Clara Barton Parkway and River Road	Basic	17	84.0	Severely Congested
SB I-495 (GP)	Between River Road and Clara Barton Parkway	Basic	12	111.9	Severely Congested
SB I-495 (GP)	North of off-ramp to WB Clara Barton Parkway	Diverge	12	87.8	Severely Congested
SB I-495 (GP)	Between ramps to/from WB Clara Barton Parkway	Basic	13	99.3	Severely Congested
SB I-495 (GP)	South of on-ramp from NB Route 123	Weave	16	75.8	Severely Congested

Table 9-33. 2045 Build PM Peak Hour Congested Freeway Segments

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
NB I-495 (GP)	South of off-ramp to Route 123	Weave	40	35.7	Congested
NB I-495 (GP)	Between Route 123 and Dulles Toll Road	Basic	34	41.6	Congested
NB I-495 (GP)	Between Route 123 and Dulles Toll Road	Diverge	24	46.0	Severely Congested
NB I-495 (GP)	Between ramps to/from I-495/Route 123 C-D Road and EB Dulles Airport Access Road (DAAR)	Basic	16	65.2	Severely Congested
NB I-495 (GP)	South of on-ramp from EB DAAR	Merge	9	113.7	Severely Congested
NB I-495 (GP)	Between DTR and Georgetown Pike	Weave	10	122.3	Severely Congested
NB I-495 (GP)	Between ramps to/from Georgetown Pike	Basic	15	95.0	Severely Congested
NB I-495 (GP)	Between Georgetown Pike and GWMP	Weave	15	84.2	Severely Congested
NB I-495 (GP)	Between ramps to/from GWMP	Basic	16	97.4	Severely Congested
NB I-495 (GP)	Between GWMP and Clara Barton Parkway	Weave	21	73.3	Severely Congested
NB I-495 (GP)	Between ramp to/from WB/EB Clara Barton Parkway	Basic	22	65.9	Severely Congested
NB I-495 (GP)	North of ramp from EB Clara Barton Parkway	Merge	15	83.8	Severely Congested
NB I-495 (GP)	Between Clara Barton Parkway and River Road	Basic	17	83.8	Severely Congested
SB I-495 (GP)	North of ramp from WB Route 123	Merge	32	40.4	Congested
SB I-495 (GP)	Between ramps from WB/EB Route 123	Merge	18	81.6	Severely Congested

Facility	Segment	Type	Average Speed (mph)	Average Density (vpmpl)	Congestion Level
SB I-495 (GP)	South of ramp from EB Route 123	Weave	13	105.7	Severely Congested

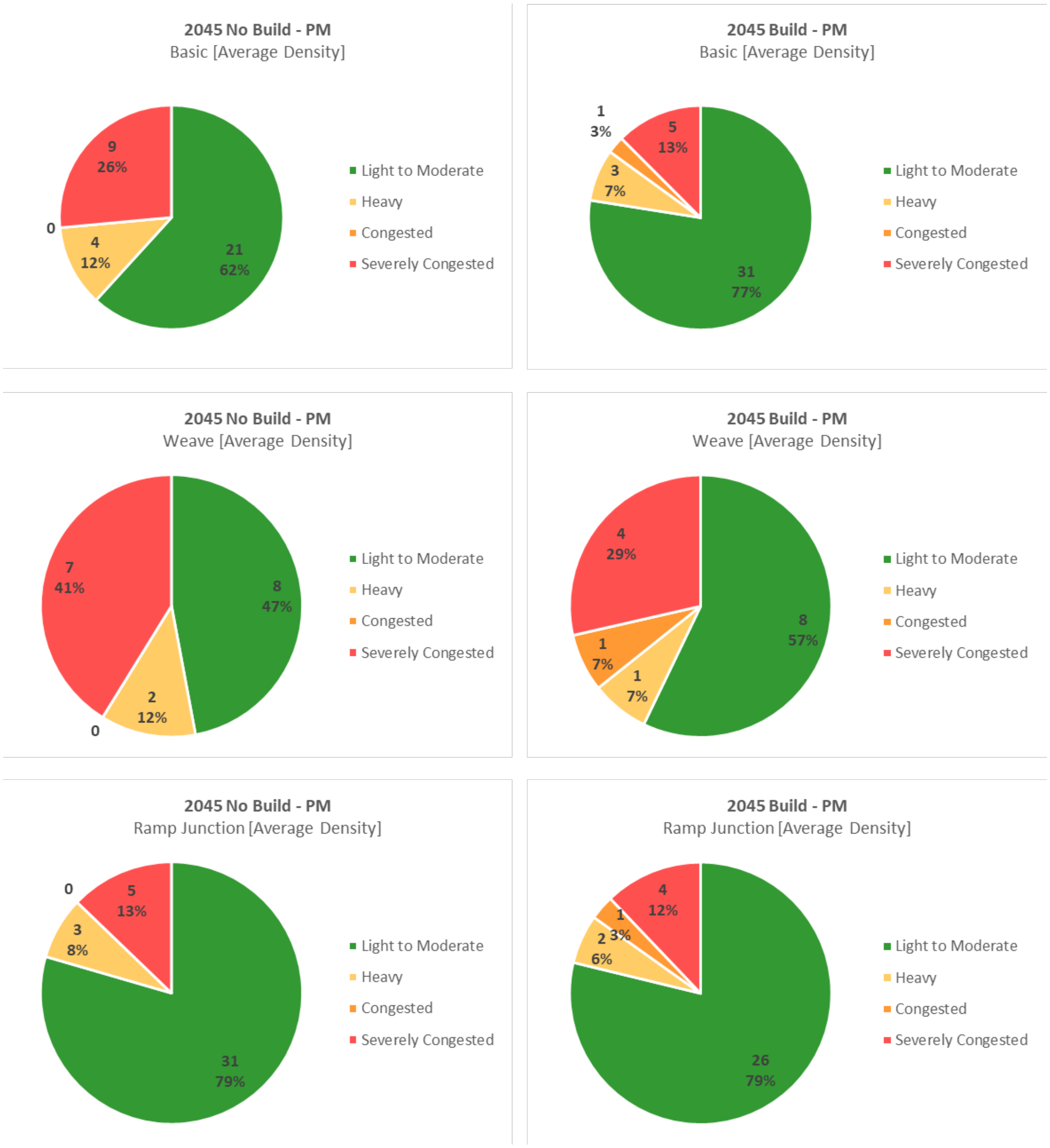


Figure 9-22. Comparison of Congestion Levels on Basic, Weave, and Ramp Junction Freeway Mainline Segments – 2045 PM No Build vs. Build

2045 PM Speeds

Exhibits 9-23 through **9-24** illustrate the speed results from the VISSIM models for the I-495 and Route 267 mainline segments in the study area for the PM peak period:

- **Exhibits 9-23a** through **9-23c** show 2025 No Build PM peak period freeway speeds.
- **Exhibits 9-24a** through **9-24c** show 2025 Build PM peak period freeway speeds

In each figure, the centerline diagram laid over the aerial depicts the average speeds during the peak hour from 3:45 p.m. to 4:45 p.m. in both directions along the mainline segments. The average speeds are color-coded based on the ranges of speeds as depicted in the legend. The boxes on the top and bottom depict the speeds in each direction for the entire peak period from 2:45 p.m. to 5:45 p.m., including the shoulder periods before and after the peak hour. Detailed tabular results can be found in Appendix G of the *Traffic and Transportation Technical Report*.

As illustrated in **Exhibits 9-23** and **9-24**, the diagrams for average speeds in the PM peak period show similar patterns as seen in the density diagrams. In the northbound GP lanes, in the No Build condition, severe congestion is observed spilling back from the ALMB through the Route 267 interchange and essentially through the extents of the Traffic Operations Study Area; this congestion is worsened by spillback from the northbound GP lanes in Maryland later in the peak period, creating a single continuous area of congestion through the corridor. In the Build condition, the congestion in Maryland remains generally unchanged, but the extent of the queue spillback and duration on the Virginia side, especially south of Route 193, is not as significant as the No Build condition.

In the southbound GP lanes, in the No Build condition, severe congestion is observed north of the ALMB due to spillback from the merge with the terminus of the southbound Maryland managed lanes system and weaving on the bridge itself; higher speeds are observed south of this point. In the Build condition, the queue spillback into Maryland is essentially eliminated due to the continuity of the Express Lanes system and elimination of the merge from the No Build condition. In the Build condition, given that more throughput is able to reach downstream locations, lower speeds are observed at the southern extents of the Traffic Operations Study Area in Tysons.

Both directions of the Express Lanes operate at or near the posted speed limit.

Figure 9-23 provides a "heat map" comparison of average speeds between 2045 No Build and Build conditions for the PM peak period along the I-495 GP lanes. Time of day during the peak period is provided on the horizontal axis while location along the corridor is provided along the vertical axis; the colors signify average speeds for each scenario. The figure is consistent with the speed Exhibits and indicates a more significant presence of congestion in the No Build scenario in both directions of the I-495 GP lanes. The Express Lanes operate at or near the posted speed limit under both No Build and Build conditions, although slowdowns are observed in the No Build condition approaching the Express Lanes end terminus points (northbound where the Virginia Express Lanes system ends near Old Dominion Drive and southbound where the Maryland managed lanes system ends just south of GWMP). The northbound Virginia Express Lanes are especially congested in the No Build condition just south of the terminus at Old Dominion Drive due to congestion in the northbound GP lanes. Note that in the Build condition, congestion still remains in the northbound GP lanes due to the forecasted travel demand, but this GP lanes congestion has been relieved as compared to the No Build condition.

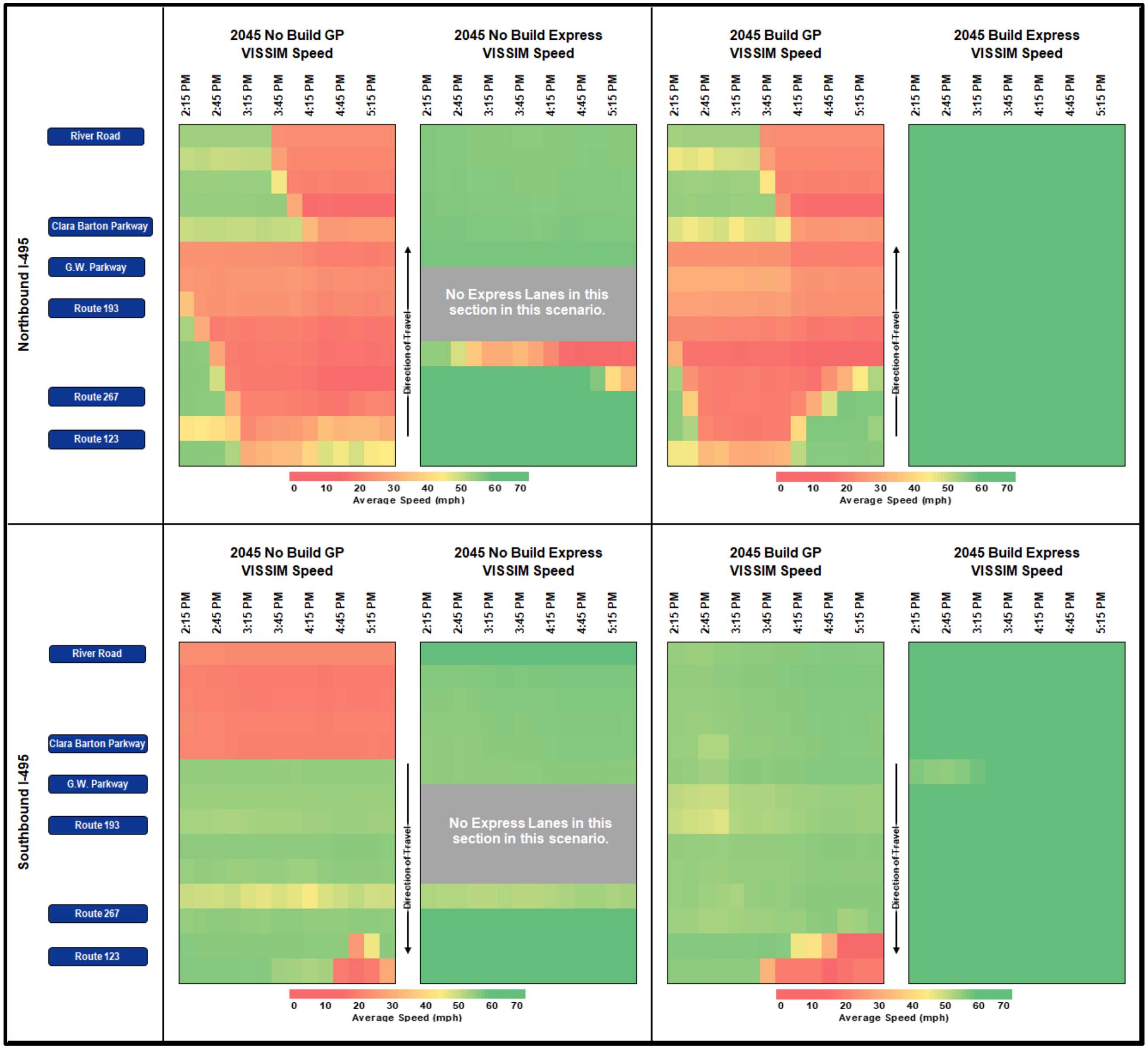


Figure 9-23. PM Peak Period Average Speeds along I-495 for 2045 No Build and 2045 Build Conditions

2045 PM Travel Times

A comparison of PM peak period travel times for 2045 No Build and 2045 Build scenarios is shown in **Table 9-34**. Travel time measurements have been aggregated by direction of travel and facility type.

Table 9-34. 2045 PM Peak Period Travel Time Comparison

Route	GP Travel Times (Minutes: Seconds)		Express Lanes Travel Times (Minutes: Seconds)	
	2045 No Build	2045 Build	2045 No Build	2045 Build
Northbound I-495 (Route 123 to River Road)	28:18	23:42	15:59	5:39
Southbound I-495 (River Road to Route 123)	15:16	7:46	6:42	5:49
Eastbound Route 267 (Spring Hill Road to Route 123)	1:48	1:52	-	-
Westbound Route 267 (Route 123 to Spring Hill Road)	1:50	1:52	-	-

2045 Build PM peak period travel times improve or remain consistent as compared to No Build across all freeway facilities in the Traffic Operations Study Area.

- The average travel time in the northbound GP lanes improves by approximately 4.5 minutes (a 16 percent improvement). The majority of the travel time savings are south of GWMP, which is consistent with the speed results shown in the previous section.
- Vehicles traveling on the northbound Express Lanes see a 10-minute (65 percent) travel time improvement. The travel time improvement in the Build condition is between Lewisville Road and GWMP, where in the No Build condition, vehicles need to travel on the congested GP lanes.
- In the southbound direction, GP travel times in the Build improve by 7.5 minutes (49 percent improvement) and Express Lanes travel times improve by 1 minute (13 percent). Providing a continuous Express Lanes system, eliminating the merge from the terminus of the southbound Maryland managed lanes system, helps relieve the congestion.
- Along eastbound and westbound Route 267 (DTR), travel times are essentially identical between No Build and Build.

2045 PM Ramp Queues

Table 9-35 provides a summary of freeway ramp queues exceeding available storage under 2045 No Build or Build conditions during the PM peak period. A full comparison of queuing at all freeway ramp locations is provided in **Appendix I.** As shown, ramp queues exceed storage in three locations under No Build conditions and two locations under Build conditions. The locations exceeding storage under Build conditions are as follows:

- Northbound/eastbound Route 123 to southbound I-495 GP lanes – this queue is due to spillback from external congestion along the southbound I-495 GP lanes leaving the Tysons area. This PM period ramp queue is observed in existing conditions. Along the southbound I-495 GP lanes, at the southern extents of the VISSIM network, external congestion (representing downstream congestion beyond the study area) is simulated using reduced speed areas in VISSIM, and these reduced speed areas are held consistent between No Build and Build. The increase in congestion shown in the Build scenario is due to reduced throughput in the No Build scenario, despite similar forecasted travel demand. Note that there is a CLRP project to widen the I-495 Outer Loop (southbound) between I-66 and Route 7, which should help mitigate this congestion. Given that this improvement is beyond the VISSIM network extents, it was not included in the I-495 NEXT VISSIM models.

- Eastbound Dulles Toll Road to southbound I-495 GP lanes – see description above; this queue is tied to external congestion along the southbound I-495 GP lanes leaving the Tysons area. Note that in No Build conditions, it is likely that upstream congestion along the southbound I-495 GP lanes is metering traffic to this location, reducing queue spillback for the eastbound Dulles Toll Road.

Maps showing the location of ramp queues exceeding storage in the 2045 Build PM condition can be found in **Exhibits 9-25a** through **9-25d**.

Table 9-35. 2045 PM Ramp Queues Exceeding Storage

Ramp Name	2045 No Build PM			2045 Build PM		
	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?	95th % Ramp Queue (ft)	Ramp Storage (ft)	Storage Exceeded?
Route 123 EB to I-495 SB GP	4,640	1,400	Yes	2,268	1,400	Yes
DTR EB to I-495 SB GP	0	1,580	No	5,770	2,975	Yes
Route 193 to I-495 NB GP	1,066	930	Yes	25	930	No
Clara Barton WB to I-495 SB GP	7,124	2,095	Yes	68	2,095	No

2045 PM Person Throughput

Figure 9-24 and **Figure 9-25** display PM peak period person throughput along I-495 northbound and southbound, respectively (GP and Express combined). These figures show the estimated number of persons moved across a three-hour period based on simulated vehicle throughput and assumed vehicle occupancies for GP and Express Lanes. GP lanes are assumed to carry 1.1 persons per vehicle, based on the estimated non-HOV lane auto occupancy MWCOG has estimated across various interstate facilities in Northern Virginia (MWCOG, 2014). Express Lanes are assumed to carry 1.44 person per vehicle, based on a historic 18 percent HOV-3 utilization in the existing I-495 Express Lanes and assuming the remaining 82 percent of vehicles take on the non-HOV lane auto occupancy. These figures show that person throughput increases in the Build scenario across the length of the I-495 corridor in both directions due to the added capacity from the Express Lanes and increased occupancy of vehicles in those lanes.

- In the northbound direction, the highest person throughputs are across the ALMB. Increases in throughput from No Build to Build range from 10 to 35 percent, with the greatest increase in the segments between Route 267 and GWMP where the new Express Lanes significantly add capacity.
- In the southbound direction, the highest person throughputs are again across the ALMB. Increases in throughput from No Build to Build range from 16 to 32 percent, with the greatest increases again in the segments between GWMP and Route 267 where the new Express Lanes significantly add capacity.

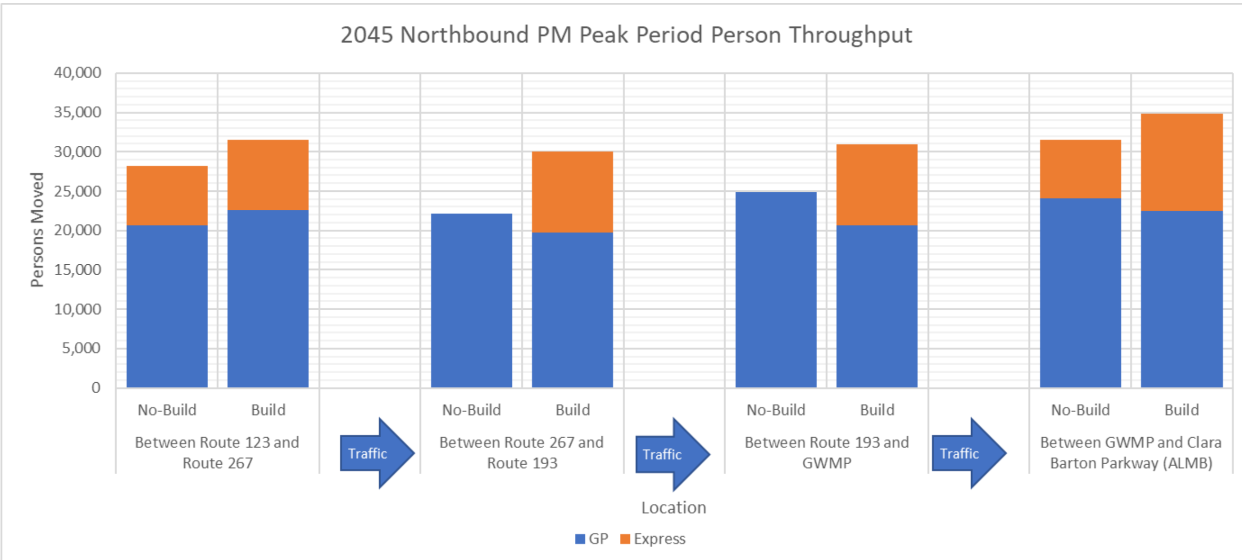


Figure 9-24. 2045 No Build and Build – PM Peak Period Person Throughput, I-495 Northbound

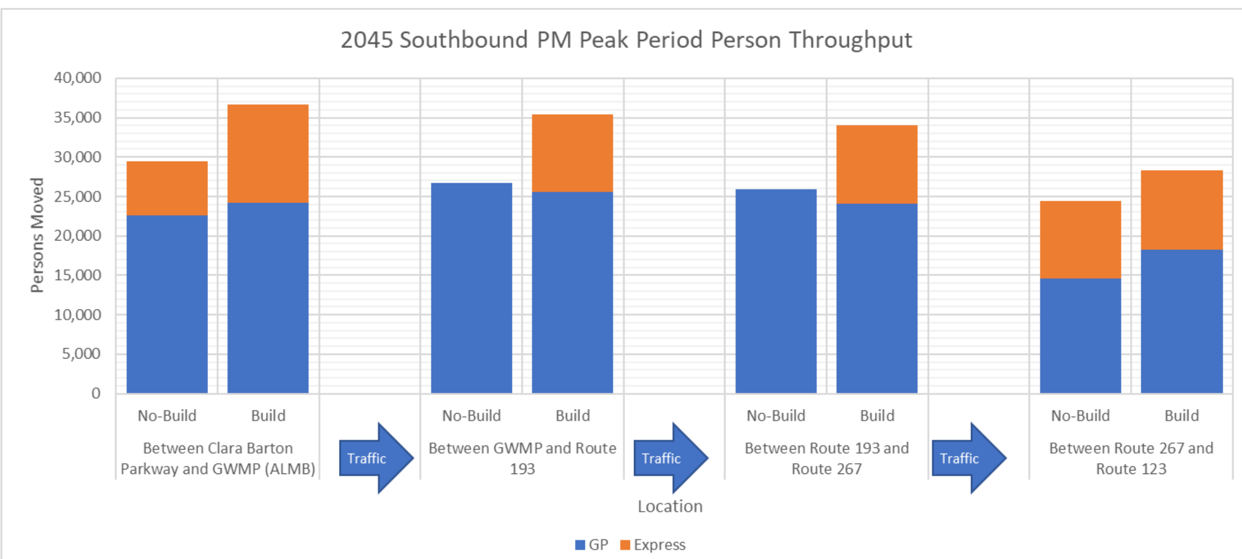


Figure 9-25. 2045 No Build and Build – PM Peak Period Person Throughput, I-495 Southbound

2045 PM Peak Intersection Operations

2045 PM Intersection Delay and Level of Service

Intersections in the Traffic Operations Study Area evaluated in VISSIM generally see improved operations in the 2045 PM peak hour under Build conditions as compared to No Build conditions. **Figure 9-26** provides pie charts of overall intersection HCM-analogous LOS for No Build and Build conditions. The figure shows that, in the Build condition, a lower percentage of intersections are failing (33 percent versus 46 percent) and a higher percentage of intersections are operating at an acceptable LOS (A to D; 46 percent versus 33 percent).

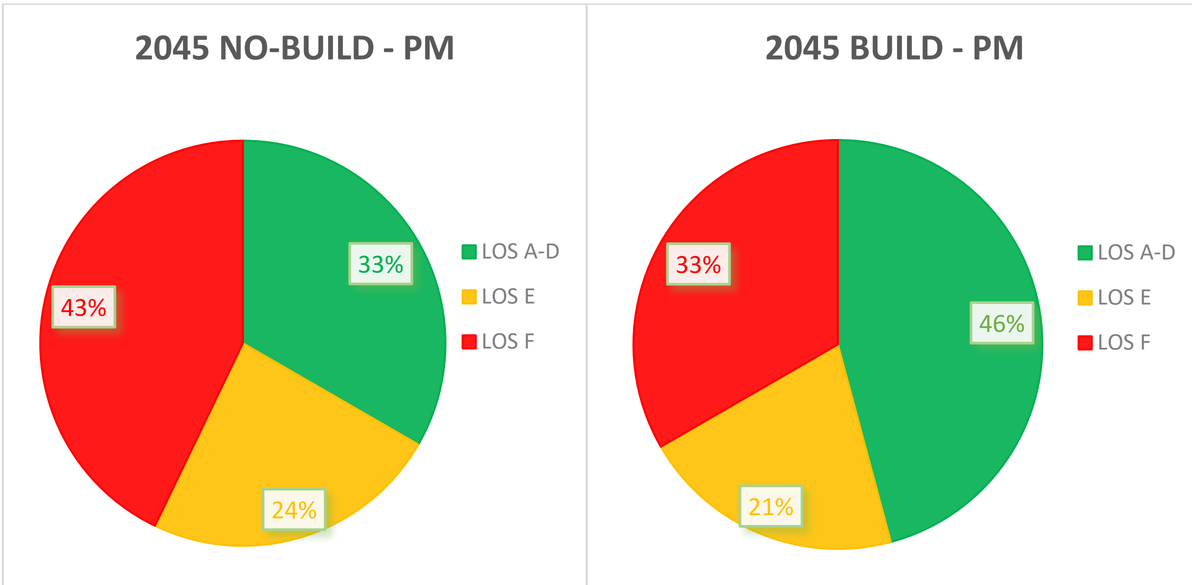


Figure 9-26. Summary of Arterial HCM-Analogous LOS, 2045 PM No Build vs. Build Conditions

Table 9-36 compares the overall intersection HCM-analogous LOS between the two scenarios for each intersection. A detailed breakdown of intersection delay and LOS, including delay and LOS by approach, is provided in Appendix H of the *Traffic and Transportation Technical Report***.**

The following signalized intersections operate under failing conditions under both 2045 No Build and Build conditions:

- Route 123 and Tysons Boulevard
- Route 123 and Route 267 eastbound off-ramp / Anderson Road
- Route 123 and Lewinsville Road/Great Falls Street
- Lewinsville Road and Balls Hill Road
- Jones Branch Connector and I-495 Express Lanes ramps
- Jones Branch Connector and Capital One driveway (West)

All of these intersections are in the Tysons area and see continued growth in demand tied to commercial and residential growth in Tysons. These locations in Tysons are discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

The following intersections are failing under No Build conditions but see improved operations (LOS E or better) under Build conditions:

- Route 123 and Capital One Tower Drive / Old Meadow Road
- Route 123 and Scotts Crossing Boulevard / Colshire Drive
- Jones Branch Connector and Express Lanes ramps

These improvements are likely attributable to improved operations along Route 123. New traffic signals are proposed in the Build condition with the off-ramps from I-495; coordination among these signals improves operations in the Build condition. Note that heavy arterial congestion is still observed along arterials in Tysons in the Build condition, including along several side street approaches.

In the Build condition, some arterial locations experience a deterioration in operations due to improved throughput from freeways that were previously metered in the No Build condition. This is most prevalent along the Jones Branch Connector / Scotts Crossing Boulevard, where three intersections are failing in the Build condition. While demand for these intersections is not forecasted to change significantly between the No Build and Build conditions, throughput from upstream locations (such as the I-495 GP lanes) is not constrained upstream in the Build condition. The degradation at these intersections is due to queue spillback along eastbound Scotts Crossing Boulevard approaching Route 123. The series of large signalized intersections east of the I-495 GP ramp terminal is an existing congested area currently under study by Fairfax County DOT (Scott's Crossing area) and in coordination with VDOT. Queue spillback along southbound Route 123 from this area also affects the intersections of Route 123/Lewinsville Road/Great Falls Street and Lewinsville Road/Balls Hill Road. Both of these locations are discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**.

The unsignalized intersection of Route 193 and Helga Place/Linganore Drive is failing under both 2045 No Build and Build conditions due to heavy delays on the southbound approach; this stop-controlled approach sees few gaps for traffic to enter the mainline Route 193 traffic stream due to heavy congestion in along eastbound Route 193 (spilling back from the northbound on-ramp to I-495). In the Build scenario, this eastbound congestion along Route 193 is relieved due to improved operations along northbound I-495, which reduces queue spillback on the on-ramp from Route 193. Along Route 193, the signalized intersections all operate at LOS E or better under No Build and Build conditions; in the Build condition, a significant improvement in operations is realized along the northbound approach from Balls Hill Road at Route 193, which is failing under No Build conditions.

Table 9-36. VISSIM Intersection Microsimulation Delay and HCM-Analogous LOS – 2045 No Build vs. Build PM Peak Hour

Intersection Control	Intersection	2045 No-Build PM		2045 Build PM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Route 123 and Tysons Boulevard	206.0	F	209.9	F
Signalized	Westpark Drive and Tysons Connector	15.8	B	18.8	B
Signalized	Tysons Connector and Express Lanes Ramps	13.8	B	13.7	B
Signalized	Route 123 and EB DTR/SB I-495 C-D Road	*	*	6.9	A
Signalized	Route 123 and NB I-495 Ramp	*	*	23.7	C
Signalized	Route 123 and Capital One Tower Drive/ Old Meadow Road	80.2	F	77.5	E

Intersection Control	Intersection	2045 No-Build PM		2045 Build PM	
		Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS	Intersection Microsimulation Delay (s/veh)	Intersection HCM-Analogous LOS
Signalized	Route 123 and Scotts Crossing Boulevard/ Colshire Drive	80.3	F	71.4	E
Signalized	Route 123 and Route 267 Eastbound Off-Ramp/ Anderson Road	192.9	F	89.3	F
Signalized	Route 123 & EB DTR Ramps	*	*	198.6	F
Signalized	Route 123 and Lewinsville Road/ Great Falls Street	230.1	F	260.2	F
Signalized	Lewinsville Road and Balls Hill Road	168.7	F	212.1	F
Signalized	Jones Branch Drive and Jones Branch Connector	76.6	E	143.9	F
Signalized	Jones Branch Connector and Express Lanes Ramps	132.6	F	138.0	F
Signalized	Jones Branch Drive and Capital One (West)	93.5	F	99.5	F
Signalized	Jones Branch Drive and Capital One (East)	72.3	E	70.7	E
Signalized	International Drive and Spring Hill Road/ Jones Branch Drive	47.6	D	51.4	D
Signalized	Spring Hill Road and Dulles Toll Road Eastbound Ramps	21.6	C	23.6	C
Signalized	Spring Hill Road and Dulles Toll Road Westbound Ramps	31.6	C	38.1	D
Signalized	Spring Hill Road and Lewinsville Road	67.2	E	69.1	E
Unsignalized	Route 193 and Helga Place/ Linganore Drive	125.6	F	15.9	C
Signalized	Route 193 and I-495 Southbound Ramps	24.5	C	21.6	C
Signalized	Route 193 and I-495 Northbound Ramps	60.3	E	63.6	E
Signalized	Route 193 and Balls Hill Road	40.7	D	18.4	B
Unsignalized	Route 193 and Dead Run Drive	40.6	E	13.8	B

*This intersection is not provided under the No Build conditions.

The expanded arterial network beyond intersections immediately adjacent to freeway interchanges in the corridor was evaluated solely through Synchro. **Table 9-37** compares the overall intersection delay and LOS between the two scenarios for each intersection.

Under both No Build and Build conditions, the following intersections are failing:

- Old Dominion Drive and Balls Hill Road (signalized)
- Route 193 and Douglass Drive (unsignalized)

These same two intersections are failing in the 2045 PM peak hour under both No Build and Build conditions. Note that under Build conditions, while the intersection of Route 193 and Douglass Drive is still failing, a significant reduction in delay is achieved as compared to No Build conditions. This is consistent with the VISSIM findings at adjacent intersections along the Route 193 corridor, where operations improve significantly in the Build condition.

Table 9-37. 2045 Synchro Intersection Delay and LOS – 2045 No Build vs. Build PM Peak Hour

Intersection Control	Intersection Name	2045 No-Build PM		2045 Build PM	
		Intersection Delay (Sec/veh)	LOS	Intersection Delay (Sec/veh)	LOS
Signalized	Old Dominion Drive at Spring Hill Road	11.0	B	9.9	A
Signalized	Old Dominion Drive at Swinks Mill Road	11.7	B	10.1	B
Signalized	Old Dominion Drive at Balls Hill Road	209.9	F	174.6	F
Signalized	Route 123 at Old Dominion Drive	35.2	D	36.4	D
Unsignalized	Route 193 at Swinks Mill Road	25.8	D	18.1	C
Unsignalized	Route 193 at Spring Hill Road	20.1	C	19.6	C
Unsignalized	Lewinsville Road at Swinks Mill Road	2.6	A	2.6	A
Unsignalized	Route 123 at Ingleside Avenue	28.5	D	26.1	D
Unsignalized	Douglass Drive at Route 193	898.5	F	513.1	F

Figure 9-27 provides a summary comparison of overall intersection delay for Build conditions as compared to No Build conditions at each intersection in the Traffic Operations Study Area for the 2045 PM scenario. The figure shows whether an intersection shows an improvement in operations (increase in LOS in Build conditions if below LOS D for No Build conditions, or a significant reduction in delay if still operating at LOS F in Build conditions), a degradation in operations (decrease in LOS in Build conditions or significant increase in delay if operating at LOS F already in No Build conditions), or if operations remain generally consistent between the two scenarios. The figure calls out intersections operating at LOS F in the Build condition. Note that the intersections that see a degradation in delay are in locations currently under study by FCDOT in coordination with VDOT. These locations are discussed further under "Intersection Mitigation Considerations" in **Section 9.2.4**

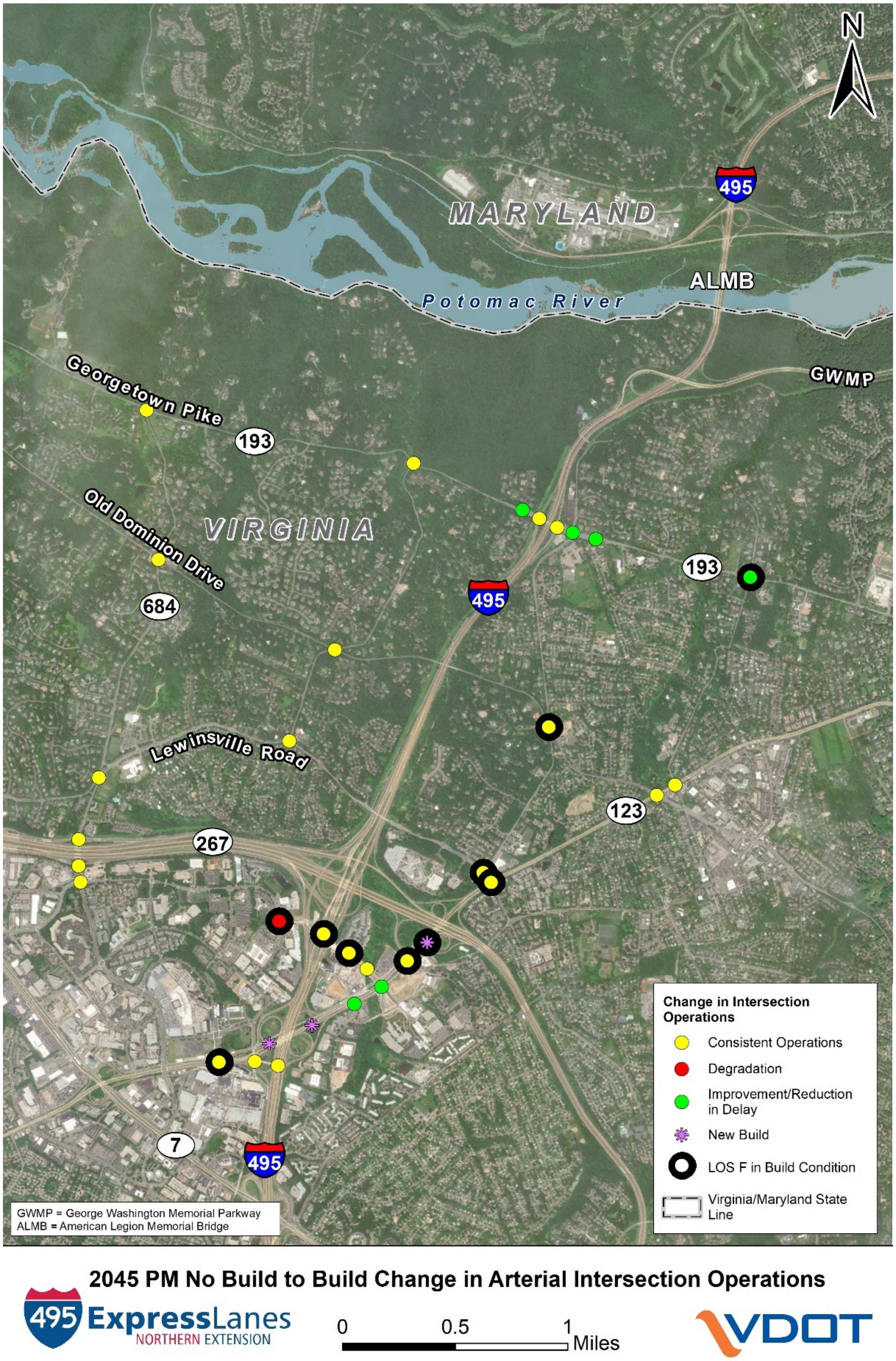


Figure 9-27. 2045 PM No Build to Build Change in Arterial Intersection Operations

2045 PM Intersection Queues

Overall, 109 intersection movements were identified as having queues exceeding available storage under Build conditions during the 2045 PM peak period, while 107 were identified under No Build conditions. **Table 9-38** provides a summary of intersection queues exceeding available storage during the PM peak period under 2045 Build conditions that are not exceeding available storage under 2045 No Build conditions. A full comparison of queuing at all intersection approach locations is provided in **Appendix I.** The locations only exceeding storage under Build conditions are as follows:

- Route 123 and Tysons Boulevard – southbound right-turn: max queues slightly exceed available storage given heavy volumes along the Route 123 mainline.
- Lewinsville Road and Balls Hill Road – southbound left-turn: this queue is tied to congestion at the Route 123 and Lewinsville Road intersection. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Route 123/Lewinsville Road area) in coordination with VDOT. See **Section 9.2.4.**
- Jones Branch Drive and Jones Branch Connector – southbound through movement and westbound right-turn: these queues are tied to queue spillback along eastbound Scotts Crossing Road/Jones Branch Connector in the Build scenario, although traffic demand remains generally consistent between No Build and Build conditions. This queue spillback stems from intersection operations issues along Route 123 in an existing congested area currently under study by Fairfax County DOT Scott's Crossing area and Route 123/Lewinsville Road area) in coordination with VDOT. See **Section 9.2.4.**
- Jones Branch Connector and I-495 Express Lanes Ramps – westbound approach: this queue is tied to spillback from the closely-spaced downstream intersection of Jones Branch Connector and Jones Branch Drive. Queueing from the off-ramps is not observed to impact Express Lanes operations.
- Jones Branch Connector and Capital One Drive (West) – westbound approach: this queue is tied to spillback from the closely-spaced downstream intersection of Jones Branch Connector and the I-495 Express Lanes ramps.
- Spring Hill Road and Dulles Toll Road westbound ramps – southbound approach: max queues were observed to just slightly exceed storage. This series of intersections is an existing congested area currently under study by Fairfax County DOT (Spring Hill Road / Lewinsville Road area) in coordination with VDOT. See **Section 9.2.4.**
- Route 193 and Helga Place / Linganore Drive – westbound through movement: max queues were observed to just slightly exceed storage. This is a queue for a free-flow movement at a two-way stop controlled intersection; the queue is tied to the lane drop along westbound Route 193 at this intersection, but the queue does not spill back to impact operations at the upstream traffic signal with the I-495 southbound ramps and does not affect the I-495 southbound mainline.

Maps showing the location of all intersection queues exceeding storage in the 2045 Build PM condition only can be found in **Exhibits 9-25a** through **9-25d**.

Table 9-38. 2045 PM Intersection Queues Exceeding Storage

Intersection	Approach	Movement	2045 No Build PM			2045 Build PM		
			Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?	Max Queue Length (feet)	Storage Length (feet)	Storage Exceeded?
Route 123 and Tysons Boulevard	**SB**	**RT**	723	750	No	825	750	Yes
Lewinsville Road and Balls Hill Road	**SB**	**LT**	907	950	No	1,240	950	Yes
Jones Branch Drive and Jones Branch Connector	**SB**	**TH**	0	350	No	1,341	350	Yes
	WB	**RT**	0	55	No	537	55	Yes
Jones Branch Connector and Express Lanes Ramps	**WB**	**RT**	646	725	No	726	725	Yes
Jones Branch Drive and Capital One (West)	**WB**	**TH**	290	345	No	348	345	Yes
International Drive and Spring Hill Road/ Jones Branch Drive	**NB**	**RT**	508	565	No	589	565	Yes
Spring Hill Road and Dulles Toll Road Westbound Ramps	**SB**	**TH**	445	460	No	495	460	Yes
	SB	**RT**	450	460	No	500	460	Yes
Route 193 and Helga Place/ Linganore Drive	**WB**	**TH**	349	385	No	407	385	Yes

Note: queues are reported using the analysis software denoted for each intersection (Synchro or VISSIM) in ***Figure 9-1.***

9.2.4 Intersection Mitigation Considerations

As noted above, the simulation results indicate that a number of intersection locations would have queues that may exceed available storage under both No Build and Build conditions for the 2025 and 2045 AM and PM peak hours. Locations in the Build scenario where queues are exceeded are for study area intersections in the Tysons area (along Route 123 east I-495 or along Spring Hill Road on either side of the Dulles Toll Road). The Fairfax County Comprehensive Plan (2017 Edition) Tysons Urban Center amendment[3] includes documentation of "Required Additional Transportation Improvements" to accommodate varying levels of development (Table 7) and "Transportation Infrastructure Resulting from Changes in Land Use Distribution and Resulting from Further Analysis and Planning of the Grid of Streets (Table 7B). These improvements were not analyzed for this IJR as they are not included in the CLRP.

Fairfax County DOT, in close coordination with VDOT, has several ongoing studies related to those documented infrastructure needs, exploring mitigation solutions at the following locations:

- **Route 123 between I-495 and Route 267:** Fairfax County is studying potential improvements to enhance access into the area near the McLean Metrorail station, including the Capital One complex. These potential improvements include new direct connections from eastbound Dulles Toll Road into this area, additional roadway network links (grid of streets), and modifications to the Route 123 mainline.
  - These improvements are not yet programmed in the CLRP. No geometric improvements were assumed for No Build and Build conditions (2025 or 2045) aside from right-in/right-

3 https://www.fairfaxcounty.gov/tysons/sites/tysons/files/assets/documents/pdf/comprehensive_plan/fc_comp_plan2017ed_tysons_amended04_04_2017.pdf

out access to new streets between Scotts Crossing Road and Route 267 and new signalized intersections along Scotts Crossing Road, representing new connections to the grid of streets in the area based on development plans approved by the Fairfax County Board of Supervisors.

- **Route 123 and Lewinsville Road (and Lewinsville Road / Balls Hill Road):** Fairfax County is studying potential improvements to alleviate congestion and improve safety among this series of closely-spaced intersections. This includes short-term, at-grade improvements in the form of additional intersection capacity, access modifications, and signal phasing improvements. The study is also evaluating long-term improvements at the intersections of Route 123 with Lewinsville Road/Great Falls Street and Old Dominion Drive. The project will move forward with public involvement once the preferred alternative is identified.
    - These improvements are not yet programmed in the CLRP. No geometric improvements were assumed for No Build and Build conditions (2025 or 2045).
- **Spring Hill Road and International Drive / Jones Branch Drive:** separate from the Spring Hill Road/Lewinsville Road study, Fairfax County is studying improvements to enhance connectivity to Tysons from the Dulles Toll Road between the Route 7 and Spring Hill Road interchanges. These improvements could include a C-D or frontage road system along the DTR with additional direct access points to Tysons, which could relieve congestion along Spring Hill Road at the DTR interchange.
    - The C-D road and new Tysons connection improvements are programmed in the CLRP, but the specifics of which improvements will be implemented are still subject to further study by Fairfax County. The geometric assumptions included for 2045 No Build and Build conditions are described in Section 5.3.4 of the attached *Traffic and Transportation Technical Report*. The improvements to be implemented, based on additional study from FCDOT, would be targeted at relieving demand along Spring Hill Road and at the congested Spring Hill Road/Jones Branch Drive/International Drive intersection.
    - In 2021, Fairfax County and VDOT are coordinating on a draft Interchange Modification Report (IMR) to provide an additional access ramp directly from Jones Branch Drive, east of Spring Hill Road, to eastbound DTR; this ramp connection would alleviate demand at the at the congested Spring Hill Road/Jones Branch Drive/International Drive intersection. This ramp is envisioned to tie into the existing eastbound DTR on-ramp from Spring Hill Road.
- **Spring Hill Road and Lewinsville Road:** Fairfax County is studying potential improvements to alleviate congestion and improve safety at this intersection. The project is currently moving forward with public involvement to share the findings of the analysis of the preferred alternative.
    - These improvements are not yet programmed in the CLRP. No geometric improvements were assumed for No Build and Build conditions (2025 or 2045).

VDOT will be conducting a supplemental analysis of intersections in the Tysons area in collaboration with Fairfax County and their ongoing efforts at these locations. VDOT will continue to work with Fairfax County to analyze improvements in the Tysons area as these studies advance.

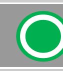
9.2.5 Traffic Operational Analysis Findings Summary

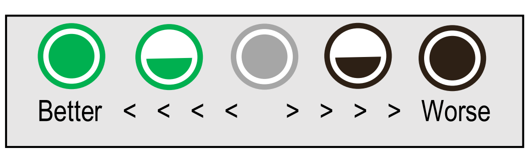
2025 AM Overall Performance Comparison

- Total demand along I-495 (GP plus Express) is forecasted to increase in the Build scenario along the length of the I-495 corridor. The greatest increases in demand are in the segments between Route 267 and GWMP, where Express Lanes are only present in the Build scenario and thus represent a substantial capacity increase from No Build conditions. Peak hour volumes are forecasted to increase in the Build scenario by between 2 to 9 percent in the northbound direction and between 2 to 6 percent in the southbound direction.
- In the northbound direction along the I-495 GP lanes, congestion is observed under No Build conditions between Route 267 and Clara Barton Parkway (across the ALMB) due to heavy merging and weaving volumes on and near the bridge. Under Build conditions, a significant reduction in congestion is observed due to the additional capacity provided by the Express Lanes and the reduced weaving due to the continuity of the Express Lanes. The average travel time in the northbound GP lanes improves by approximately 3 minutes (a 24 percent improvement) in the Build condition.
- In the southbound direction along the I-495 GP lanes, congestion is observed under No Build conditions south of the ALMB and north of Route 267 due to weaving approaching the entrance to the Express Lanes system as well as merging from vehicles exiting the Maryland managed lanes system south of the ALMB. This congestion is largely mitigated under Build conditions. The average travel time in the southbound GP lanes improves by approximately 1 minute (an 11 percent improvement).
- Both directions of the Express Lanes operate at or near the posted speed limit. To travel the length of the corridor via Express Lanes under No Build conditions, vehicles must utilize the congested GP lanes between Route 267 and GWMP as Express Lanes are not present.
- Along eastbound Route 267 (DTR) there is 47 percent improvement in travel time. With the improved operations along northbound I-495, the ramp from eastbound DTR to northbound I-495 does not spill back to eastbound DTR, improving operations along eastbound DTR. Travel times along the westbound DTR remain unchanged.
- Over the course of the AM peak period, total persons moved along I-495 are forecasted to increase from No Build to Build conditions by between 4 and 17 percent in the northbound direction and between 6 and 21 percent in the southbound direction, depending upon location along the corridor.
- Arterial intersection operations are largely consistent between No Build and Build conditions, as both scenarios see the same percentage of intersections operating under failing conditions. These failing intersections are in the Tysons area and see continued growth in demand tied to commercial and residential growth in Tysons.

Table 9-39 presents an overall performance comparison table for the Build alternative versus the No Build alternative for 2025 AM conditions. The table shows that the Build alternative improves overall operations along the I-495 corridor given the improvement in travel times, reduction in congestion, and increase in persons moved.

Table 9-39. Overall Performance Comparison for 2025 AM No Build and Build Alternative

Measure of Effectiveness	Description	Facility	2025 AM No Build Value	2025 AM Build Value	Build Performance Compared to No Build
Travel Times	End-to-end travel time along the facility through the Traffic Operations Study Area, measured in Minutes	I-495 NB GP	10	7	
		I-495 NB Express	8	6	
		I-495 SB GP	8	7	
		I-495 SB Express	7	6	
		Dulles Toll Road EB	3	2	
		Dulles Toll Road WB	2	2	
Extent and Duration of Congestion	Visual assessment of freeway mainline queue length and duration of congestion	I-495 NB GP			
		I-495 SB GP			
Congested Freeway Segments	Number of congested or severely congested freeway mainline segments	All freeway facilities (I-495 GP and Express Lanes, DTR, DAAR, and GWMP)	23	8	
Ramp Queueing	Number of ramp queues exceeding storage	All freeway facilities	4	3	
Person Throughput	Additional persons moved during peak period of Build condition and percentage increase	I-495 NB (All)	+4,500 (17%)		
		I-495 SB (All)	+5,000 (21%)		
Arterial Operations	Number of intersections operating at LOS F	Entire Study Area	7	7	
	Number of intersections operating at LOS D or better		19	17	



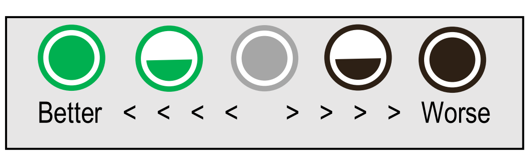
2025 PM Overall Performance Comparison

- Total demand along I-495 (GP plus Express) is forecasted to increase in the Build scenario along the length of the I-495 corridor. The greatest increases in demand are in the segments between Route 267 and GWMP, where Express Lanes are only present in the Build scenario and thus represent a substantial capacity increase from No Build conditions. Peak hour volumes are forecasted to increase in the Build scenario by between 10 to 29 percent in the northbound direction and between 7 to 12 percent in the southbound direction.
- In the northbound direction along the I-495 GP lanes, congestion is observed under No Build conditions between Route 267 and Clara Barton Parkway (across the ALMB) due to heavy merging and weaving volumes on and near the bridge, especially early in the peak period. Under Build conditions, a significant reduction in congestion is observed due to the additional capacity provided by the Express Lanes and the reduced weaving due to the continuity of the Express Lanes. The average travel time in the northbound GP lanes improves by approximately 4 minutes (a 36 percent improvement) in the Build condition.
- In the southbound direction along the I-495 GP lanes, congestion is observed under No Build conditions south of the ALMB and north of Route 267 due to weaving approaching the left-side entrance to the southbound Express Lanes (between Route 193 and Route 267) and downstream right-side exit to westbound DTR, as both of these movements have heavy volumes. This congestion is also worsened in the No Build scenario due to the southbound Maryland managed lanes system terminating near the GWMP interchange, creating a merge that spills back upstream in the GP lanes across the ALMB. This congestion is largely mitigated under Build conditions. The average travel time in the southbound GP lanes improves by nearly 8 minutes (a 49 percent improvement).
- Both directions of the Express Lanes operate at or near the posted speed limit. To travel the length of the corridor via Express Lanes under No Build conditions, vehicles must utilize the congested GP lanes between Route 267 and GWMP as Express Lanes are not present.
- Along eastbound and westbound Route 267 (DTR), travel times are essentially identical between No Build and Build.
- Over the course of the PM peak period, total persons moved along I-495 are forecasted to increase from No Build to Build conditions by between 8 and 37 percent in the northbound direction and between 10 and 47 percent in the southbound direction, depending upon location along the corridor.
- Arterial intersection operations see an improvement under Build conditions, as the percentage of intersections operating at failing conditions drops from 43 percent (No Build) to 33 percent (Build), and more than half of all intersections are LOS D or better in the Build condition, while only 33 percent are at LOS D or better in the No Build condition. Most of the failing intersections are in the Tysons area and see continue growth in demand tied to commercial and residential growth in Tysons.

Table 9-40 presents an overall performance comparison table for the Build alternative versus the No Build alternative for 2025 PM conditions. The table shows that the Build alternative improves overall operations along the I-495 corridor given the improvement in travel times, reduction in congestion, and increase in persons moved. Arterial operations are also shown to improve in the PM peak hour under the Build alternative.

Table 9-40. Overall Performance Comparison for 2025 PM No Build and Build Alternative

Measure of Effectiveness	Description	Facility	2025 PM No Build Value	2025 PM Build Value	Build Performance Compared to No Build
Travel Times	End-to-end travel time along the facility through the Traffic Operations Study Area, measured in Minutes	I-495 NB GP	11	7	●
		I-495 NB Express	8	6	●
		I-495 SB GP	16	8	●
		I-495 SB Express	8	6	●
		Dulles Toll Road EB	2	2	○
		Dulles Toll Road WB	2	2	○
Extent and Duration of Congestion	Visual assessment of freeway mainline queue length and duration of congestion	I-495 NB GP			●
		I-495 SB GP			●
Congested Freeway Segments	Number of congested or severely congested freeway mainline segments	All freeway facilities (I-495 GP and Express Lanes, DTR, DAAR, and GWMP)	15	2	●
Ramp Queueing	Number of ramp queues exceeding storage	All freeway facilities	2	3	◒
Person Throughput	Additional persons moved during peak period of Build condition and percentage increase	I-495 NB (All)	+6,800 (37%)		●
		I-495 SB (All)	+8,800 (47%)		●
Arterial Operations	Number of intersections operating at LOS F	Entire Study Area	12	10	◒
	Number of intersections operating at LOS D or better		13	17	●



2045 AM Overall Performance Comparison

- Total demand along I-495 (GP plus Express) is forecasted to increase in the Build scenario along the length of the I-495 corridor. The greatest increases in demand are in the segments between Route 267 and GWMP, where Express Lanes are only present in the Build scenario and thus represent a substantial capacity increase from No Build conditions. Peak hour volumes are forecasted to increase in the Build scenario by between 3 to 11 percent in the northbound direction and between 4 to 6 percent in the southbound direction.
- In the northbound direction along the I-495 GP lanes, congestion is observed under No Build conditions between Route 267 and Clara Barton Parkway (across the ALMB) due to heavy merging and weaving volumes on and near the bridge. Under Build conditions, a significant reduction in congestion is observed due to the additional capacity provided by the Express Lanes and the reduced weaving due to the continuity of the Express Lanes. The average travel time in the northbound GP lanes improves by approximately 4 minutes (a 33 percent improvement) in the Build condition.
- In the southbound direction along the I-495 GP lanes, severe congestion is observed under No Build conditions north of Route 193 through the northern extents of the Traffic Operations Study Area due to queue spillback from the merge at the southern Terminus of the Maryland managed lanes system. This congestion is significantly alleviated under Build conditions. The average travel time in the southbound GP lanes improves by nearly 9 minutes (a 54 percent improvement).
- Both directions of the Express Lanes operate at or near the posted speed limit, with the exceptions of the termini segments in the No Build conditions which much merge into the GP lanes. To travel the length of the corridor via Express Lanes under No Build conditions, vehicles must utilize the congested GP lanes between Route 267 and GWMP, as Express Lanes are not present.
- Along eastbound Route 267 (DTR) there is 75 percent improvement in travel time. With the improved operations along northbound I-495, the ramp from eastbound DTR to northbound I-495 does not spill back to eastbound DTR, improving operations along eastbound DTR. Travel times along the westbound DTR remain unchanged.
- Over the course of the AM peak period, total persons moved along I-495 are forecasted to increase from No Build to Build conditions by between 6 and 33 percent in the northbound direction and between 29 and 35 percent in the southbound direction, depending upon location along the corridor.
- Arterial intersection operations see an improvement under Build conditions, as the percentage of intersections operating at failing conditions drops from 33 percent (No Build) to 29 percent (Build), and more than half of all intersections are LOS D or better in the Build condition, while only 48 percent are at LOS D or better in the No Build condition. Most of the failing intersections are in the Tysons area and see continue growth in demand tied to commercial and residential growth in Tysons. Improved arterial operations are observed along Route 193, most notably at the intersection with Balls Hill Road, where the northbound approach sees a significant improvement in operations.

Table 9-41 presents an overall performance comparison table for the Build alternative versus the No Build alternative for 2045 AM conditions. The table shows that the Build alternative improves overall operations along the I-495 corridor given the improvement in travel times, reduction in congestion, and increase in persons moved.

Table 9-41. Overall Performance Comparison for 2045 AM No Build and Build Alternative

Measure of Effectiveness	Description	Facility	2045 AM No Build Value	2045 AM Build Value	Build Performance Compared to No Build
Travel Times	End-to-end travel time along the facility through the Traffic Operations Study Area, measured in Minutes	I-495 NB GP	12	8	●
		I-495 NB Express	10	6	●
		I-495 SB GP	16	8	●
		I-495 SB Express	8	6	●
		Dulles Toll Road EB	7	2	●
		Dulles Toll Road WB	2	2	○
Extent and Duration of Congestion	Visual assessment of freeway mainline queue length and duration of congestion	I-495 NB GP			●
		I-495 SB GP			●
Congested Freeway Segments	Number of congested or severely congested freeway mainline segments	All freeway facilities (I-495 GP and Express Lanes, DTR, DAAR, and GWMP)	31	22	●
Ramp Queueing	Number of ramp queues exceeding storage	All freeway facilities	9	4	●
Person Throughput	Additional persons moved during peak period of Build condition and percentage increase	I-495 NB (All)	+9,300 (33%)		●
		I-495 SB (All)	+9,600 (35%)		●
Arterial Operations	Number of intersections operating at LOS F	Entire Study Area	10	10	○
	Number of intersections operating at LOS D or better		16	20	●

Better < < < < > > > > Worse

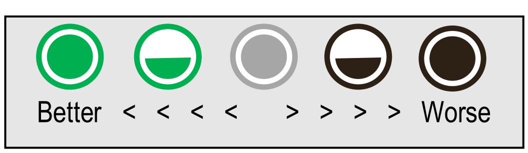
2045 PM Overall Performance Comparison

- Total demand along I-495 (GP plus Express) is forecasted to increase in the Build scenario along the length of the I-495 corridor. The greatest increases in demand are in the segments between Route 267 and GWMP, where Express Lanes are only present in the Build scenario and thus represent a substantial capacity increase from No Build conditions. Peak hour volumes are forecasted to increase in the Build scenario by between 3 to 20 percent in the northbound direction and between 7 to 12 percent in the southbound direction.
- In the northbound direction along the I-495 GP lanes, severe congestion is observed under No Build conditions spilling back from the ALMB through the Route 267 interchange and essentially through the extents of the Traffic Operations Study Area; this congestion is worsened by spillback from the northbound GP lanes in Maryland later in the peak period, creating a single continuous area of congestion through the corridor. In the Build condition, the congestion in Maryland remains generally unchanged, but the extent of the queue spillback and duration on the Virginia side, especially south of Route 193, is not as significant as the No Build condition. This is attributable to the additional capacity provided by the Express Lanes and reduced weaving due to the continuity of the Express Lanes system. The average travel time in the northbound GP lanes improves by approximately 4.5 minutes (a 16 percent improvement) in the Build condition.
- In the southbound direction along the I-495 GP lanes, severe congestion is observed under No Build conditions north of Route 193 through the northern extents of the Traffic Operations Study Area due to queue spillback from the merge at the southern Terminus of the Maryland managed lanes system. This congestion is significantly alleviated under Build conditions. The average travel time in the southbound GP lanes improves by approximately 7.5 minutes (a 49 percent improvement).
- Both directions of the Express Lanes operate at or near the posted speed limit, with the exceptions of the termini segments in the No Build conditions which much merge into the GP lanes. To travel the length of the corridor via Express Lanes under No Build conditions, vehicles must utilize the congested GP lanes between Route 267 and GWMP as Express Lanes are not present.
- Along eastbound and westbound Route 267 (DTR), travel times are essentially identical between No Build and Build.
- Over the course of the PM peak period, total persons moved along I-495 are forecasted to increase from No Build to Build conditions by between 10 and 35 percent in the northbound direction and between 16 and 32 percent in the southbound direction, depending upon location along the corridor.
- Arterial intersection operations see an improvement under Build conditions, as the percentage of intersections operating at failing conditions drops from 43 percent (No Build) to 33 percent (Build), and 46 percent of intersections are LOS D or better in the Build condition, while only 33 percent are at LOS D or better in the No Build condition. Most of the failing intersections are in the Tysons area and see continue growth in demand tied to commercial and residential growth in Tysons. Along Route 193, the signalized intersections all operate at LOS E or better under No Build and Build conditions; in the Build condition, a significant improvement in operations is realized along the northbound approach from Balls Hill Road at Route 193, which is failing under No Build conditions.

Table 9-42 presents an overall performance comparison table for the Build alternative versus the No Build alternative for 2045 PM conditions. The table shows that the Build alternative improves overall operations along the I-495 corridor given the improvement in travel times, reduction in congestion, and increase in persons moved. Arterial operations are also shown to improve in the PM peak hour under the Build alternative.

Table 9-42. Overall Performance Comparison for 2045 PM No Build and Build Alternative

Measure of Effectiveness	Description	Facility	2045 PM No Build Value	2045 PM Build Value	Build Performance Compared to No Build
Travel Times	End-to-end travel time along the facility through the Traffic Operations Study Area, measured in Minutes	I-495 NB GP	28	24	◒
		I-495 NB Express	16	6	●
		I-495 SB GP	15	8	●
		I-495 SB Express	7	6	◒
		Dulles Toll Road EB	2	2	○
		Dulles Toll Road WB	2	2	○
Extent and Duration of Congestion	Visual assessment of freeway mainline queue length and duration of congestion	I-495 NB GP			◒
		I-495 SB GP			●
Congested Freeway Segments	Number of congested or severely congested freeway mainline segments	All freeway facilities (I-495 GP and Express Lanes, DTR, DAAR, and GWMP)	21	16	●
Ramp Queueing	Number of ramp queues exceeding storage	All freeway facilities	3	2	◒
Person Throughput	Additional persons moved during peak period of Build condition and percentage increase	I-495 NB (All)	+7,800 (35%)		●
		I-495 SB (All)	+8,700 (32%)		●
Arterial Operations	Number of intersections operating at LOS F	Entire Study Area	11	10	◒
	Number of intersections operating at LOS D or better		14	18	●



9.2.6 2025 Opening Year Prior to Maryland Managed Lanes Sensitivity Analysis

This section describes the results of a sensitivity analysis conducted assuming that the background CLRP project of I-495 managed lanes north of the ALMB (the Maryland managed lanes project) is not completed before the I-495 NEXT project. Detailed analysis results are included within Appendix I of the *Traffic and Transportation Technical Report.*

2025 Prior to Maryland Managed Lanes AM Peak Period Summary

- Total demand along I-495 (GP plus Express) is forecasted to increase in the Build scenario along the length of the I-495 corridor. The greatest increases in demand are in the segments between Route 267 and GWMP, where Express Lanes are only present in the Build scenario and thus represent a substantial capacity increase from No Build conditions. Peak hour volumes are forecasted to increase in the Build scenario by between 1 to 8 percent in the northbound direction and between 1 to 4 percent in the southbound direction. In the "Pre-Maryland" scenarios, capacity is constrained across the ALMB given the assumption of the Express Lanes terminating south of the bridge.
- In the northbound direction along the I-495 GP lanes, congestion and queueing is observed in both scenarios from Clara Barton Parkway (across the ALMB) spilling back to the Route 267 interchange. The onset of congested speeds is observed to be slightly earlier during the Build scenario, resulting in a longer duration of congestion and longer queue spillback during the peak period. In the both scenarios, the observed northbound GP congestion is attributable to weaving and merging across the ALMB, including the heavy on-ramp movement from GWMP as well as the on-ramp from Route 193. In the Build condition, there is an additional left-side merge just south of the ALMB for the terminus of the northbound Express Lanes; this creates additional merging and weaving across the bridge (the section of the facility that is already experiencing the highest demand), worsening upstream congestion. Additionally, in the Build scenario, due to the new Express Lanes being in place between Route 267 and GWMP, the left-side shoulder lane which is typically open to traffic during this period (and is assumed to be open in the No Build scenario) is no longer open. This results in more rapid onset of queue spillback south of Route 193 in the Build scenario. Overall end-to-end travel times between Route 123 and Clara Barton Parkway in the northbound GP lanes increase by approximately 4 minutes (a 39 percent deterioration) in the Build condition. The most significant increases in travel time are for the segments between Lewinsville Road and GWMP.
- In the southbound direction along the I-495 GP lanes, congestion and queueing is observed north of the ALMB and back into Maryland, while limited congestion is observed south of the bridge. The bridge acts as a bottleneck, metering southbound traffic into Virginia and generally resulting in higher speeds south of the bridge. Travel times are essentially consistent between the No Build and Build conditions.
- Both directions of the Express Lanes operate at or near the posted speed limit, with the exceptions of the termini segments which must merge into the GP lanes. To travel the length of the corridor via Express Lanes under No Build conditions, vehicles must utilize the congested GP lanes between Route 267 and GWMP as Express Lanes are not present; all vehicles must use the GP lanes north of GWMP in both scenarios. End-to-end trips between Route 123 and Clara Barton Parkway using the Express Lanes in the northbound direction are 4 minutes faster in the Build scenario (44 percent

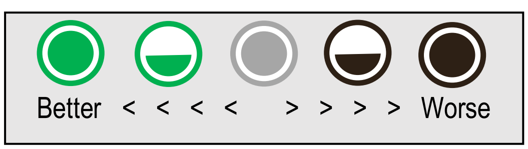
improvement) and in the southbound direction are approximately 30 seconds faster in the Build scenario (8 percent improvement).

- Along eastbound Route 267 (DTR), there is 23 percent deterioration in travel time in the Build condition. Along westbound DTR, travel times are essentially identical between No Build and Build.
- Over the course of the AM peak period, total persons moved along I-495 are forecasted to increase from No Build to Build conditions by between 0 and 10 percent in the northbound direction and between 1 and 8 percent in the southbound direction, depending upon location along the corridor. Person throughput increases in the Build scenario between Route 267 and GWMP due to the added capacity from the Express Lanes and increased occupancy of vehicles in those lanes. Across the ALMB, person throughputs are generally consistent between the No Build and Build scenarios.
- Arterial intersection operations remain generally consistent between No Build and Build conditions in the AM peak period. The Build scenario sees a lower percentage of intersections operating at failing conditions (24 percent versus 29 percent) but also sees a slightly lower percentage of intersections operating at LOS D or better (52 percent versus 59 percent). Most of the failing intersections are in the Tysons area and see continue growth in demand tied to commercial and residential growth in Tysons.

Table 9-43 presents an overall performance comparison table for the Build alternative versus the No Build alternative for 2025 AM conditions prior to the Maryland managed lanes system being in place.

Table 9-43. Overall Performance Comparison for 2025 AM No Build and Build Alternative Prior to Maryland Managed Lanes System Being in Place

Measure of Effectiveness	Description	Facility	2025 AM No Build Value	2025 AM Build Value	Build Performance Compared to No Build
Travel Times	End-to-end travel time along the facility through the Traffic Operations Study Area, measured in Minutes	I-495 NB GP	10	14	
		I-495 NB Express	10	5	
		I-495 SB GP	5	5	
		I-495 SB Express	5	4	
		Dulles Toll Road EB	3	4	
		Dulles Toll Road WB	2	2	
Extent and Duration of Congestion	Visual assessment of freeway mainline queue length and duration of congestion	I-495 NB GP			
		I-495 SB GP			
Person Throughput	Additional persons moved during peak period of Build condition and percentage increase	I-495 NB (All)	+2,400 (10%)		
		I-495 SB (All)	+2,300 (8%)		
Arterial Operations	Number of intersections operating at LOS F	Entire Study Area	9	8	
	Number of intersections operating at LOS D or better		18	17	



2025 Prior to Maryland Managed Lanes PM Peak Period Summary

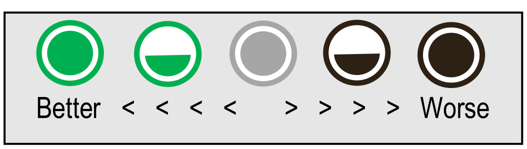
- Total demand along I-495 (GP plus Express) is forecasted to increase in the Build scenario along the length of the I-495 corridor. The greatest increases in demand are in the segments between Route 267 and GWMP, where Express Lanes are only present in the Build scenario and thus represent a substantial capacity increase from No Build conditions. Peak hour volumes are forecasted to increase in the Build scenario by between 1 to 18 percent in the northbound direction and between 1 to 4 percent in the southbound direction. In the "Pre-Maryland" scenarios, capacity is constrained across the ALMB given the assumption of the Express Lanes terminating south of the bridge.
- In the northbound direction along the I-495 GP lanes, congestion and queueing is observed in both scenarios for essentially the entire peak period from Clara Barton Parkway (across the ALMB) spilling back through the extents of the Traffic Operations Study Area. Downstream external congestion from northbound I-495 in Maryland spills back early in the peak period, forming essentially a continuous end-to-end area of congestion. The average end-to-end travel time between Route 123 and Clara Barton Parkway in the northbound GP lanes increases by approximately 6 minutes (an 18 percent deterioration) in the Build condition. This deterioration is attributable to the increased merging and weaving across the ALMB due to the left-side merge from the new northbound Express Lanes terminus. The most significant increases in travel time are for the segments between Lewinsville Road and GWMP.
- In the southbound direction along the I-495 GP lanes, congestion and queueing is observed in both scenarios north of the ALMB and back into Maryland, while limited congestion is observed south of the bridge. The bridge acts as a bottleneck, metering southbound traffic into Virginia and generally resulting in higher speeds south of the bridge. In the Build scenario, some relief to the congestion in Maryland is provided later in the peak period due to the additional capacity provided south of the ALMB. Travel times from Clara Barton Parkway to Route 123 improve by approximately 30 seconds (a 7 percent improvement) in the Build condition, with nearly all of this improvement being north of GWMP.
- Both directions of the Express Lanes operate at or near the posted speed limit, with the exceptions of the termini segments which much merge into the GP lanes. To travel the length of the corridor via Express Lanes under No Build conditions, vehicles must utilize the congested GP lanes between Route 267 and GWMP as Express Lanes are not present; all vehicles must use the GP lanes north of GWMP in both scenarios. End-to-end trips between Route 123 and Clara Barton Parkway using the Express Lanes in the northbound direction are 14 minutes faster in the Build scenario (65 percent improvement) and in the southbound direction are 30 seconds faster in the Build scenario (11 percent improvement).
- Along eastbound and westbound Route 267 (DTR), travel times are essentially identical between No Build and Build.
- Over the course of the PM peak period, total persons moved along I-495 are forecasted to increase from No Build to Build conditions by between 0 and 21 percent in the northbound direction and between 4 and 17 percent in the southbound direction, depending upon location along the corridor. Person throughput increases in the Build scenario between Route 267 and GWMP due to the added capacity from the Express Lanes and increased occupancy of vehicles in those lanes. Across the ALMB, person throughputs are generally consistent between the No Build and Build scenarios.

- Arterial intersection operations see an improvement under Build conditions, as the percentage of intersections operating at failing conditions drops from 38 percent (No Build) to 28 percent (Build), and 48 percent of intersections are LOS D or better in the Build condition, while only 43 percent are at LOS D or better in the No Build condition. Most of the failing intersections are in the Tysons area and see continue growth in demand tied to commercial and residential growth in Tysons. Along Route 193, all intersections see a reduction in delay in the Build scenario compared to the No Build scenario.

Table 9-44 presents an overall performance comparison table for the Build alternative versus the No Build alternative for 2025 PM conditions prior to the Maryland managed lanes system being in place.

Table 9-44. Overall Performance Comparison for 2025 PM No Build and Build Alternative Prior to Maryland Managed Lanes System Being in Place

Measure of Effectiveness	Description	Facility	2025 AM No Build Value	2025 AM Build Value	Build Performance Compared to No Build
Travel Times	End-to-end travel time along the facility through the Traffic Operations Study Area, measured in Minutes	I-495 NB GP	32	37	
		I-495 NB Express	20	7	
		I-495 SB GP	6.5	7	
		I-495 SB Express	5	4.5	
		Dulles Toll Road EB	2	2	
		Dulles Toll Road WB	2	2	
Extent and Duration of Congestion	Visual assessment of freeway mainline queue length and duration of congestion	I-495 NB GP			
		I-495 SB GP			
Person Throughput	Additional persons moved during peak period of Build condition and percentage increase	I-495 NB (All)	+3,300 (21%)		
		I-495 SB (All)	+3,900 (17%)		
Arterial Operations	Number of intersections operating at LOS F	Entire Study Area	10	8	
	Number of intersections operating at LOS D or better		16	16	



9.2.7 COVID-19 Sensitivity Analysis Summary

VDOT has received inquiries / requests from the general public and local elected officials to evaluate the impacts of COVID-19 on future traffic demand forecasts for the I-495 NEXT project, as well as to assess / validate the project need in terms of the potential traffic operations under a scenario where the future traffic demands are reduced compared to pre-COVID-19 traffic conditions. **Appendix K** provides the methodology and results for a conservative analysis of the impacts of the COVID-19 pandemic on travel in the Washington, DC, region and specifically, the resulting changes in travel on I-495 in the vicinity of the I-495 NEXT project and over the ALMB.

The analysis was performed by modifying the existing conditions I-495 NEXT travel demand model to reflect the reduction in trips observed on VDOT interstate facilities in Fall 2020. The changes in trip-making between the original existing base model and the modified COVID-19 reduced traffic scenario model were applied to the future analysis years to understand the potential impact to travel in the corridor if the changes in travel due to the pandemic were to continue into the future. VDOT believes that this would be a conservative view of the traffic response to the "new normal" after the pandemic. While some future travel would potentially be reduced as some workers continue to work from home, there would likely be a rebound towards the prior traffic patterns in the corridor above the traffic levels in Fall 2020, based on patterns observed from regional permanent traffic count stations as well as from big data sources.

The I-495 NEXT VISSIM traffic simulation models used for the project traffic analysis, as presented in the TATTR and this IJR, were updated to incorporate the modified future-year forecasted travel volumes assuming that trip-making patterns observed during the pandemic carry forward to future years. Even with trip-making patterns reduced to the levels observed in Fall 2020 during the COVID-19 pandemic, given the forecasted increase in land use and regional / interstate travel demand, congestion would still be anticipated to be present in the future in the I-495 GP lanes in both directions. Notably, the analysis results showed that in 2025, prior to the Maryland managed lanes project opening, with the COVID-19 modified forecasts, congestion would still be present in both directions of the I-495 GP lanes, with severe congestion in the northbound direction approaching the ALMB. By 2045, even with the Maryland managed lanes system in place and with the COVID-19 modified forecasts, congestion would be present in both directions of the I-495 GP lanes in the No Build condition. The I-495 NEXT project would provide significant relief to congestion in the GP lanes in both directions in the Build condition, even if reduced traffic volumes associated with COVID-19 persisted in the future.

VDOT Guidance on Horizon Year Forecasts due to COVID-19

In early 2021, VDOT Transportation Planning and Mobility Division published Instruction and Informational Memorandum IIM-TMPD-7.0 on traffic forecasting, including guidance on best practices related to the COVID-19 pandemic. The IIM notes the following: *"There may be a need to adjust or reduce the traffic forecasts for the horizon year (ex. 2040, 2045). However, until more is known about the possible long-term effect of the COVID-19 pandemic on future travel, the future horizon year traffic forecasts for current plans should not be changed."*

10. SAFETY AND CRASH ANALYSIS

10.1 INTRODUCTION AND BACKGROUND

The project Traffic Operations Study Area is regularly characterized by heavy congestion, most especially in the area of the GWMP interchange and the ALMB on the northern portion of the corridor and the Route 267 interchange on the southern end. This congestion, most prevalent during the morning and evening peak periods, creates strong potential for crashes, especially multi-vehicle crashes such as rear end and sideswipe collisions. This congestion also regularly causes drivers to seek alternate routes on surrounding arterials, collectors, and residential streets in an attempt to reduce or avoid delay. This re-routing creates increased safety risks on those diversion routes that can also have negative safety impacts.

A combination of qualitative and quantitative analyses was used to evaluate safety in the corridor. AASHTO *Highway Safety Manual* (HSM) methodologies were used to quantitatively evaluate safety throughout the study area. The predictive crash methods detailed in the HSM allow safety professionals to assist roadway designers in the quantitative evaluation of various design options. Detailed documentation of all safety and crash analysis is provided in the attached *Traffic and Transportation Technical Report*.

10.2 SAFETY ANALYSIS METHODS AND TOOLS

A safety analysis was conducted consistent with VDOT IIM-LD-200.9 (VDOT, 2017). It included an analysis of existing highway safety conditions and reported motor vehicle crashes on roads in the Study Area for a period of five years. It also included the development of qualitative and quantitative measures to evaluate future proposed alternatives and assess the safety effects of interstate access modifications on I-495 and the adjacent arterial network within the Study Area.

- Quantitative measures include the number of police-reported crashes (for existing conditions); annual crash frequencies expressed in terms of crashes per year; and reported crash rates expressed in terms of reported crashes per million vehicle miles traveled for roadway segments or million vehicles entering for intersections. Quantitative tools, which use multiple years of crash and traffic volume data, assist in the determination of crash patterns at specific locations and crash trends over time. They can also be used to assist in the identification of locations with relatively lower safety performance.
- Qualitative assessments assist in the identification of locations where roadway geometric conditions may pose significant demands on drivers and may contribute to potential driver errors that can result in crashes. Qualitative assessments are useful in identifying safety risks that can be addressed during the development of alternatives.

10.2.1 Existing Conditions Safety Analysis Methodology

The existing conditions quantitative safety analysis utilized historical crash data from the most recently-available five years' worth of data (2013-2017). It included the development of the following measures:

- Crash density and severity histograms (developed for the mainline);
- Crash heat maps for various crash types (developed for the mainline);
- Crash density maps (developed for the mainlines); and
- Crash rates (fatal, injury, property damage only (PDO) and total) (developed for the mainline and intersections).

10.2.2 Future Conditions Safety Analysis Methodology

Qualitative Analysis

The qualitative analysis relied on a review of existing geometry, traffic conditions, a human factor approach to assess the driving task, consideration of driver expectancies, and where the potential was high for driver expectancy violations to occur. The qualitative assessment focused on locations there were identified high crash frequencies, high crash rates, or specific crash patterns based on an analysis of crash and traffic data from the latest available five full calendar years (i.e., 2013-2017). This included a review of the following:

- Proposed roadway signing and pavement marking plans
- Proposed new roadway and ramp alignments
- Long-range planned projects and roadway improvements

Concept plans have been reviewed and potential safety issues that warrant mitigation were identified.

Quantitative Analysis

Several quantitative analysis tools exist for use in applying the HSM Part C: Predictive Methods. These quantitative analysis tools use a combination of historical crash data and detailed geometric features of the roadway. For the purposes of future alternatives analysis on the I-495 corridor, a combination of three quantitative tools were employed:

- **Enhanced Interchange Safety Analysis Tool (ISATe).** ISATe is a safety analysis tool used to evaluate freeway and interchange systems. ISATe predicts crashes by crash location, i.e., mainline freeway segments, ramp segments, and ramp terminals. Inputs to the tool include both geometric and operational characteristics of roadway and ramp facilities. ISATe also analyzes ramp terminal crossroad intersections based on the number of lanes and arrangement of lanes and type of traffic control. For the purposes of mainline and interchange safety analysis and conditions on the I-495 corridor, ISATe was used to evaluate the 2025 No Build, 2025 Build, 2045 No Build, and 2045 Build Alternatives, with the exception of the Existing and Proposed Express Lanes.
- **Developed Express Lane Safety Performance Function (SPF).** As the HSM (First Edition) does not have a crash prediction methodology for estimating the safety performance of separated/managed lanes, additional SPF development was necessary to fully assess the project Build Alternative. Using historical and available crash data, as well as traffic volume data and roadway geometric data for the existing segments of I-495 Express Lanes, an I-495 Express Lanes-specific SPF was developed. The SPF allows for estimation of future-year crashes for both existing Express Lane sections on I-495 (included in the No Build Alternative) and for new Express Lane sections that will be included in the Build Alternative.
- **Extended HSM Spreadsheets.** Extended HSM Spreadsheets were used to conduct safety analysis for arterial intersections within the Traffic Operations Study Area. The HSM spreadsheets are applicable for Rural Two-Lane, Two-Way Roads (HSM Chapter 10); Rural Multilane Highways (HSM Chapter 11); and Urban and Suburban Arterials (HSM Chapter 12). The tool predicts crashes by roadway segment and intersection.

The HSM methodologies also predict crash severity for each crash type using the KABCO scale (K – fatal crashes; A, B, C – injury crashes of decreasing severity; O – Property Damage Only (PDO) crashes); in some cases, crashes are also predicted by single vehicle and multiple vehicle crash types.

The safety analysis tools use crash prediction methods outlined in Part C: Predictive Methods (Volume 2) of the HSM. HSM safety prediction relies on SPFs, which express the predicted crash frequency for a basic roadway element (i.e., freeway or ramp segment, roadway segment, or intersection) defined by a specific volume, set of base geometric conditions, and in the case of intersections, traffic control conditions. Crash modification factors (CMF) express the relative change in crash frequency that could be expected with a change in one of the base geometric or traffic control conditions for the alternative being analyzed.

HSM Part C: Predictive Methods estimates the long-term crash frequency of a No Build or proposed Build Alternative. The first step in the predictive safety analysis process is predicting the number of crashes that will occur at a location based on the SPFs and CMFs. The incorporation of historical crash data, when available, is the second step in the predictive safety analysis process, resulting in the expected crash frequency. This process is known as the Empirical Bayes (EB) method. The expected crash frequency is the estimate of long-term average crash frequency of a segment, intersection, or network under a given set of geometric conditions and traffic volumes (e.g., Average Annual Daily Traffic (AADT)). If the expected crash frequency is greater than the predicted crash frequency, the crash location has potential for safety improvement (PSI) or an expected excess average crash frequency.

If reported crash data are either not available or not applicable, then the EB method is not used. This will be the case in situations where traffic volume, traffic control type, or geometric configuration at a site changes significantly over time so the historical crash data would no longer adequately represent the proposed condition. In this situation, an estimate of expected average crash frequency would not be calculated, so the evaluation of the safety condition would be limited to the evaluation of the estimate of predicted average crash frequency using the predictive crash models.

To be used most effectively, quantitative safety analysis tools require calibration on a state-by-state basis to accurately represent the number of crashes that can be reasonably expected on a roadway corridor. However, even lacking such calibration, the HSM tools can be used for relative evaluation of the predicted-to-expected crash frequency for existing conditions and also for comparisons between the predicted crash frequencies of design alternatives. Uncalibrated safety models were used to analyze safety in the I-495 corridor; calibration factors are not yet available for Virginia roadways. Therefore, a comparative approach using uncalibrated results was used to assess design alternatives from a safety perspective. HSM tools are limited to general purpose facilities, and tools to predict crash frequencies on Express Lanes have not yet been developed. Therefore, as noted, the project team developed crash prediction SPFs for Express Lanes using volume and geometry data from existing Express Lanes facilities in the region.

10.3 SAFETY DATA COLLECTION

Data for the safety analysis consisted of crash data, traffic data, and roadway inventory data. The sources of these data are described in the following sections.

10.3.1 Crash Data

One of the primary measures to assess safety conditions of existing roads is related to the frequency and rate of reported crashes. The safety analysis was largely based on historic crash data from VDOT for freeway segments, arterial segments, and intersections in the study area. VDOT maintains a clearinghouse of data for police-reported traffic crashes on roads maintained by VDOT, and crash data is uploaded and made available via a tool on VDOT’s website. Crash data was gathered for the five-year period from

January 1, 2013 to December 31, 2017. Historic crash data was collected for freeway (GP and Express) mainline, merge, and diverge segments in both directions.

To compliment the crash data from VDOT, crash data were solicited and obtained from MDSHA and the National Parks Service (NPS) for roads under their jurisdiction, including sections of Clara Barton Parkway in Maryland and the GWMP. Crash data for the section of I-495 in Maryland from and including the ALMB to the Seven Locks Road overpass were obtained from MDSHA crash data inventory. The crash data from MDSHA and NPS did not have the same level of detail as the VDOT data; therefore, they were analyzed qualitatively.

10.3.2 Traffic Data Collection

Traffic and roadway data were obtained to assist in documentation of existing safety conditions. VDOT maintains a clearinghouse of Average Annual Daily Traffic (AADT) count data for interstate, primary, and secondary roads in Virginia (VDOT, 2019c). Data is accessible for approximately the last 15 years. Consistent with conventional traffic and safety analysis, AADT data for the previous five years (2013-2017) were compiled for freeway segments and intersections in the study area. Traffic data was solicited from and obtained from the VDOT, Transurban (which operates and maintains the I-495 Express Lanes), MDSHA, and NPS.

The AADT was used to determine crash rates for freeway segments, ramps, and intersections within the study area. These rates were then compared to average local, state, and nationwide crash rates for similar highway facilities. This comparison provides a picture of the relative safety conditions within the study area. Average Daily Traffic (ADT) was provided for the future scenarios using volume forecasts developed by the study team.

10.3.3 Roadway Inventory Data

Existing geometric information, which includes the number of travel lanes, among other elements, for the freeways, ramps, roadways and intersections in the study was collected for the quantitative assessment and evaluation of future geometric modification and predictive crash analysis. The numerical values of those geometric features were gathered using Google Earth Pro™.

Quantitative safety analyses require additional data that is not typically collected during the qualitative crash data collection process. The quantitative crash analysis tool for freeways and interchanges requires the collection and use of detailed design-level factors for freeway facilities, such as:

- Lane widths, in feet
- Shoulder widths (inside and outside), in feet
- Distance to barrier (freeway/ramps), in feet
- Median width, in feet
- Clear zone width, in feet
- Horizontal curve radius (especially on ramps), in feet
- Presence of shoulder rumble strips, yes or no
- Weaving length, in feet
- Location of ramp, left-hand or right-hand
- Ramp entrance and exit

For arterial intersections, in addition to projected volumes, both geometry and societal factors are taken into account, such as:

- Nearby schools, bus stops, and alcohol sales establishments
- Presence of red light cameras
- Presence of intersection lighting
- Intersection control type and signal phasing where applicable
- Approach lanes and lane types

Roadway inventory data for the I-495 mainline facility was collected from multiple sources. Existing and No-Build conditions roadway data elements were collected using Google Earth Pro™. For proposed future conditions, roadway data was obtained from the roadway design files prepared by the study team. Where specific design details for the future conditions were unknown, the study team made assumptions based on an assessment of existing conditions and preferred design standards for the design element in question.

10.4 EXISTING CONDITIONS CRASH HISTORY AND SAFETY ANALYSIS

This section provides a summary of existing conditions total crashes along I-495, crash frequencies and rates for individual freeway sections of I-495, and trends for crash severity and type for individual freeway sections of I-495. It also contains a summary of crash history data for the Route 267 and GWMP corridors as well as arterial intersections. A detailed review of crash history throughout the entire Traffic Operations Study Area, including point maps of individual crash locations, is provided in the *Existing Conditions Technical Report* (VDOT, 2019a).

10.4.1 I-495 Corridor Crash History Summary

Existing Conditions Crash History Totals

Over the five-year period analysis period, there were a total of 1,736 crashes reported on the 4.6-mile section of I-495 (northbound and southbound) between the Route 7 interchange and the ALMB over the Potomac River. This section of I-495 includes the I-495 GP lanes, approximately 2.85 miles of the I-495 Express Lanes between Route 7 and the current northern terminus north of the Dulles Toll Road interchange, and approximately 22 ramps to and from I-495. During this five-year period, there were no fatal crashes, 455 injury crashes, and 1,281 property damage only (PDO) crashes reported in the freeway corridor.

Of the 1,736 of crashes reported within the study area between 2013 and 2017, the predominant crash type along the I-495 corridor is Rear-End-type crashes. Approximately 59 percent of all crashes were Rear-End collisions, compared to 22 percent Side-Swipe (same direction) crashes, 8 percent Angle crashes, 8 percent Run-Off-Road crashes, and 3 percent Other crashes.

Existing Conditions Crash Frequencies by Freeway Facility

The following summarizes crash frequencies along the I-495 corridor in terms of total crashes per mile per year.

- Crash frequencies are much lower in the Express Lanes than the GP lanes, with reported crash frequencies in the northbound direction ranging between 0 and 1.8 crashes per year per quarter-mile section and in the southbound direction ranging from 0 to 1.6 crashes per year per quarter-mile section.

- In the northbound GP lanes, nearly all segments analyzed average at least 10 crashes per year per quarter-mile section. The highest crash frequencies were near the Route 193 interchange, where one quarter-mile segment experiences more than 17 crashes per year, and near the merge from the GWMP on-ramp, which experiences nearly 20 crashes per year in a single quarter-mile segment.
- In the southbound GP lanes, crash frequencies are lower than in the northbound direction, likely due to less severe congestion experienced. Crash frequencies range from approximately 3 to 12 crashes per year per quarter-mile segment, with the highest crash rates near the southbound off-ramps to Route 267 (9.8 crashes per year) and near the southbound off-ramps to Route 123 (12.0 crashes per year).
- The southbound I-495 GP lanes within the study area included only two quarter-mile sections that had 9 or more crashes per year. By comparison, the northbound I-495 GP lanes within the study area had 15 quarter-mile sections that had 9 or more crashes per year. There were 594 reported crashes on the southbound GP lanes within the study area and 1,106 reported crashes on the northbound GP lanes.

Existing Conditions Crash Rates by Freeway Facility

The following summarizes crash rates along the I-495 corridor in terms of total crashes per 100 million vehicle miles traveled (VMT). Crash rates consider the influence of vehicular flows on crash occurrence and can be considered a normalization accounting for traffic volumes. **Figure 10-1** shows the crash rates for the northbound and southbound Express Lanes, while **Figure 10-2** provides the crash rates for the northbound and southbound GP lanes.

- In the northbound Express Lanes, one section exceeds a crash rate of 150 crashes per 100 million VMT; in the southbound Express Lanes, six sections exceed this rate. Within the Traffic Operations Study Area, there are more merges, diverges and weaving areas associated with the southbound Express Lanes compared to the northbound Express Lanes. Notably, there is one section of the southbound Express Lanes where two ramps merge in close proximity followed by a downstream off-ramp. This section had the highest crash rate of all the Express Lanes sections. The southbound Express Lanes also have more frequent changes in horizontal and vertical alignment, in addition to more access points.
- In the northbound GP lanes, there were eight sections that had reported crash rates exceeding 150 crashes per 100 million VMT. One northbound GP section had a crash rate of over 500 crashes per 100 million VMT: the section including the left-hand exit ramp to westbound Route 267 and the merge of the on-ramp from eastbound Route 267. Frequently queueing from downstream in the northbound GP lanes extends into this area. Consequently, the geometric conditions, coupled with the heavy traffic flows (for both of these ramp movements) and congestion all contribute to this location's very high crash rate.
- In the southbound GP lanes, there were no sections that have reported crash rates exceeding 150 crashes per million VMT.

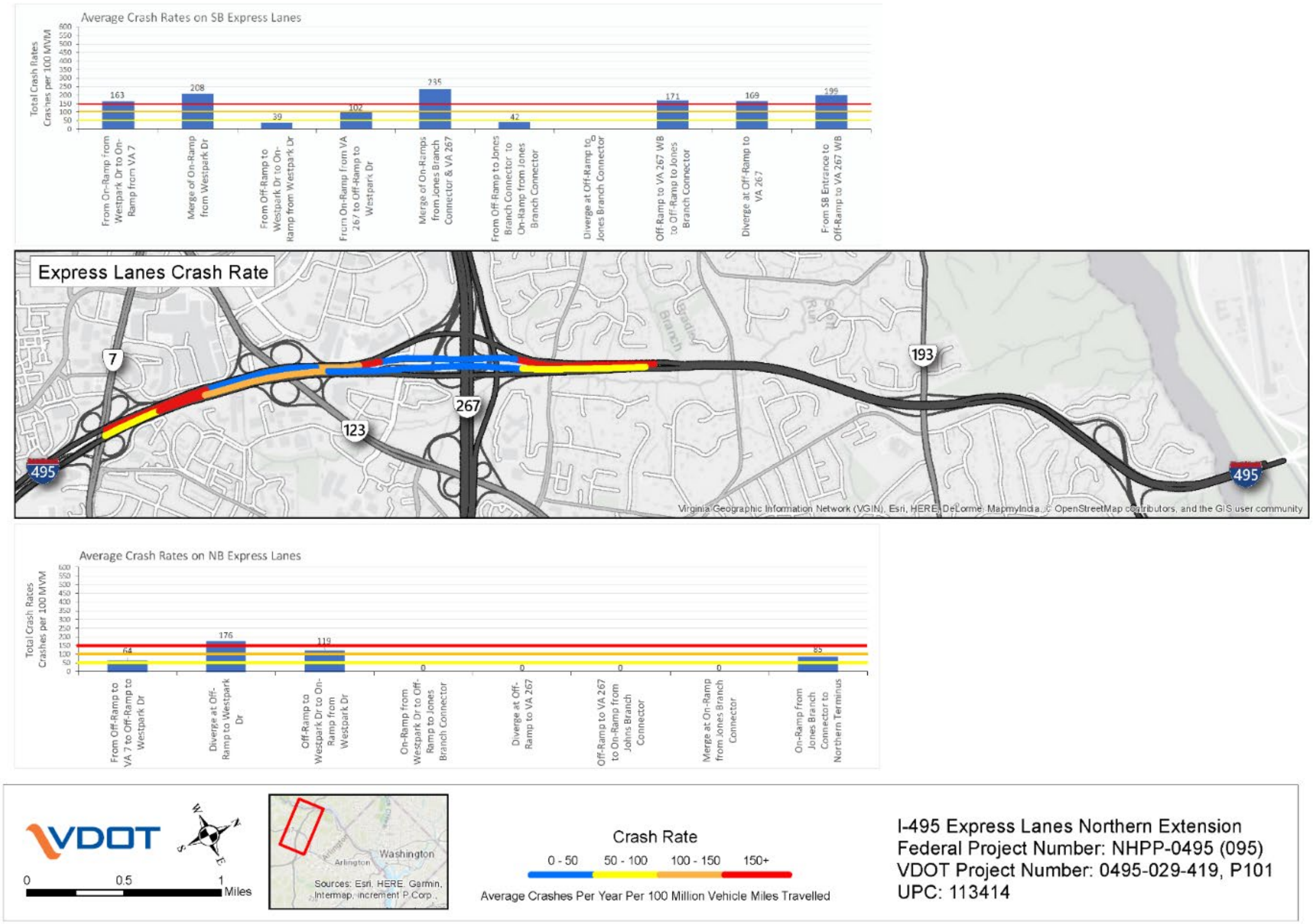


Figure 10-1. Crash Rates per Million VMT for I-495 Northbound and Southbound Express Lanes (2013-2017)

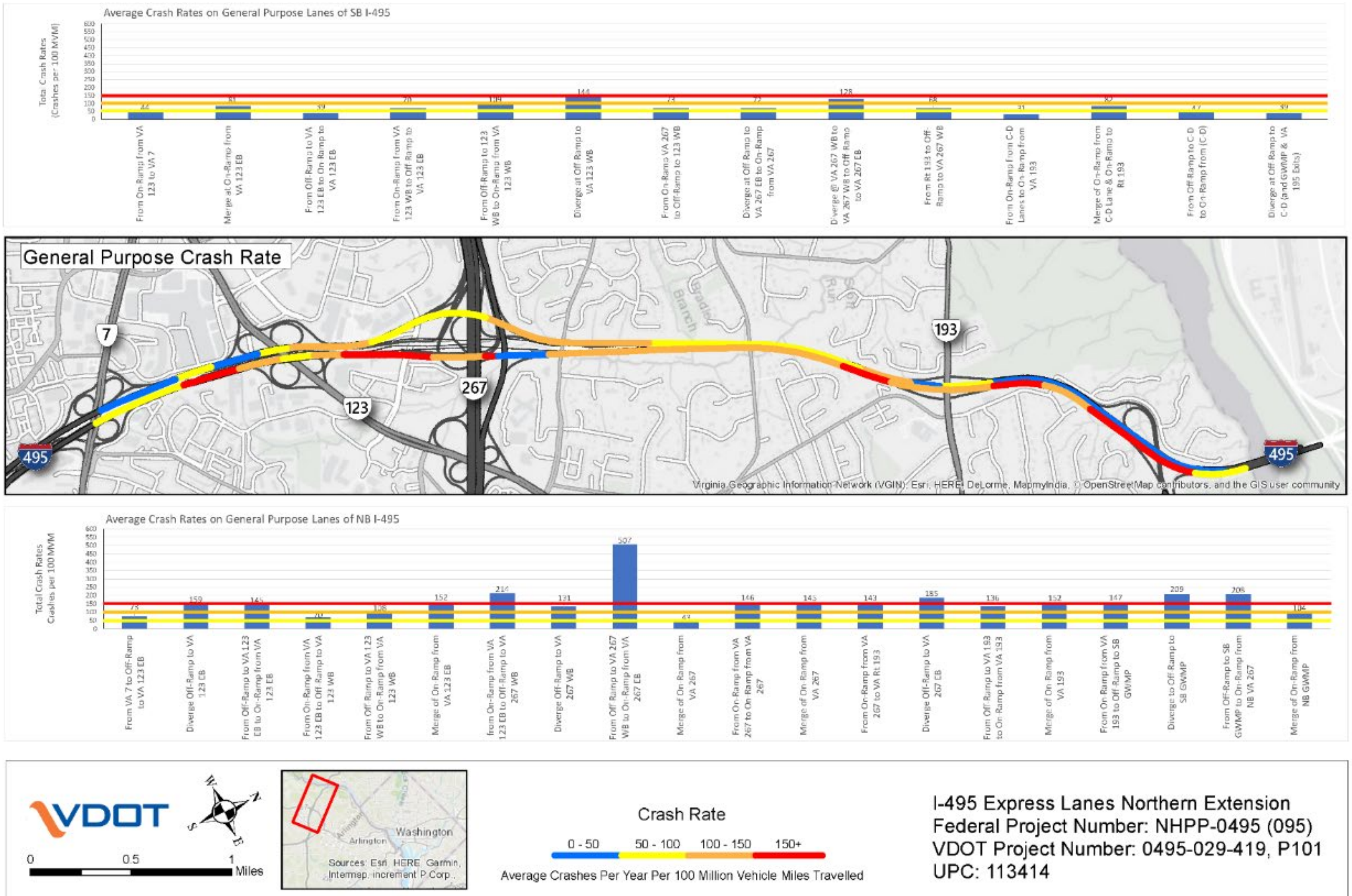


Figure 10-2. Crash Rates per Million VMT for I-495 Northbound and Southbound GP Lanes (2013-2017)

Summary of I-495 Crash History and Safety Issues

Northbound I-495 GP Lanes

The crash rate for northbound I-495 from Route 7 to the ALMB is worse than the southbound crash rate between the same termini. Moreover, the crash rate for this northbound section is approximately 100 percent higher than the statewide crash rate. The injury crash rate is 25 percent higher than the statewide injury crash rate. There were no fatalities reported. The northbound section includes the current northern terminus of the I-495 Express Lanes, 5 merges, 4 diverges, and a dynamic shoulder use lane. Over 70 percent of the crashes in all basic, diverge, and merge segments are PDO crashes in the northbound direction. The predominant type of crashes in all basic, diverge, and merge segments are Rear-End and Same-Direction Side-Swipe crashes. Traffic congestion in the study area influences the safety conditions. Rear-End and Side-Swipe crashes tend to typically be prominent in congested corridors.

The following three segments of I-495 experience the highest number of Rear-End crashes:

- Northbound I-495 from Route 267 to Route 193, with 145 crashes;
- Northbound I-495 from the off-ramp to Route 193 to the on-ramp from Route 193, with 67 crashes
- Northbound I-495 from the off-ramp to GWMP to the on-ramp from GWMP, with 60 crashes.

Each of these segments is located on northbound I-495 from the Route 267 interchange to near the GWMP where the northbound part-time shoulder lane currently terminates. A dynamic shoulder running lane was added in 2015, with a majority of the construction occurring from 2014 to 2015. This shoulder use lane drop contributes to increased turbulence in the traffic stream, creating the higher potential for Rear-End crashes to occur due to the stop-and-go nature of traffic operations in this area. This is further exacerbated by the long upgrade section north of the ALMB, which continues to the River Road interchange.

Northbound I-495 Express Lanes

Compared to the statewide average crash rates from 2013 through 2017 for interstate facilities within Virginia, the crash rate for the northbound Express Lanes section of I-495, exclusive of the existing northern terminus and the transition section to the GP lanes, was approximately 17 percent lower. The injury crash rate is 71 percent lower than the statewide injury crash rate. There were no fatalities reported. This can be attributed to the reduced congestion and improved LOS offered to commuters using the Express Lanes.

Southbound I-495 GP Lanes

Compared with the statewide average crash rates from 2013 through 2017 for interstate facilities within Virginia, the southbound section of I-495 between the ALMB and Route 7 exhibited an approximately 11 percent lower crash rate. The injury crash rate is 42 percent lower than the statewide injury crash rate. Over the five-year period, there were no fatal crashes reported. The southbound section includes the separated C-D roadway that provides access to the GWMP, which is operated and maintained by the NPS, and Route 193. The predominant type of crashes in all basic, diverge, and merge segments are Rear-End and Same-Direction Side-Swipe crashes. It is observed that diverge segments have an almost equal number of Rear-End and Side-Swipe crashes. This implies that in addition to the congestion, the merging and lane-changing maneuvers executed influence traffic safety in the study area.

Southbound I-495 Express Lanes

Compared with the statewide average crash rates from 2013 through 2017 for interstate facilities within Virginia, the southbound Express Lanes section of I-495 exhibited an approximately 27 percent lower crash rate. The injury crash rate is 55 percent lower than the statewide injury crash rate. There were no fatalities reported. This can be attributed to the reduced congestion and improved LOS offered to commuters using the Express Lanes.

10.4.2 Route 267 Crash History Summary

Further analysis was conducted on the section of the Dulles Toll Road/Dulles Connector Road (DTR/DCR) for the 2.5-mile mainline segment in the area of the I-495 Interchange (Exit 18). The analysis was broken up into the DTR/DCR mainline and Exit 18 off-ramps to I-495. The analysis included a six-year period from 2013-2018 which are the most complete years available at the time of analysis. During this period, there were 181 reported crashes on the DTR/DCR mainline, 61 crashes reported on the eastbound ramps to I-495, and 10 crashes reported on the westbound off-ramp to I-495 northbound.

From the analysis, five "Hot Spots", shown in **Figure 10-3**, were identified which in total account for 44 percent of all crashes along the DTR/DCR study area:

- Hot Spot 1 coincides with the westbound approach to the mainline toll plaza. Rear-End and Side-Swipe crashes combined comprise 85 percent of overall crashes at this location.
- Hot Spot 2 coincides with the westbound weave area between the I-495 and Spring Hill Road interchanges. Traffic is entering from the right from the heavy movement from I-495 southbound and is exiting to the right to access Spring Hill Road. Additionally, traffic is exiting to the left to access the Dulles Airport Access Road, and additional traffic is merging to the left to access the higher-speed EZ-Pass lanes at the downstream toll plaza. Notably, Rear-End and Side-Swipe crashes comprise 87 percent of overall crashes at this location.
- Hot Spot 3 coincides with the diverge area of the eastbound DTR and Exit 18 ramps to I-495, which represents a major decision point for drivers. Rear-End and Side-Swipe collisions are common, especially during congested periods. Approximately 91 percent of the collisions in this location are Rear-End and Side-Swipe type collisions.
- Hot Spot 4 coincides the eastbound weave area between the merge from southbound I-495 to eastbound DTR and the diverge to Exit 19 (Route 123). Exit 19 frequently sees significant congestion during peak periods due to spillback from the heavy loop ramp to Route 123 northbound. Rear-End and Side-Swipe type collisions comprise 79 percent of total crashes.
- Hot Spot 5 is just downstream from Hot Spot 3 and coincides with the diverge area of the Exit 18 ramps where drivers must properly lane position for the exit onto either northbound or southbound I-495. It has a similar pattern of Rear-End and Side-Swipe collisions; however, it does have additional presence of Fixed Object – Off Road collisions associated with the horizontal curvature of the segment. Overall, 68 percent of the total crash activity is Read-End and Side-Swipe type collisions, while 28 percent of the crashes are Fixed Object - Off Road.

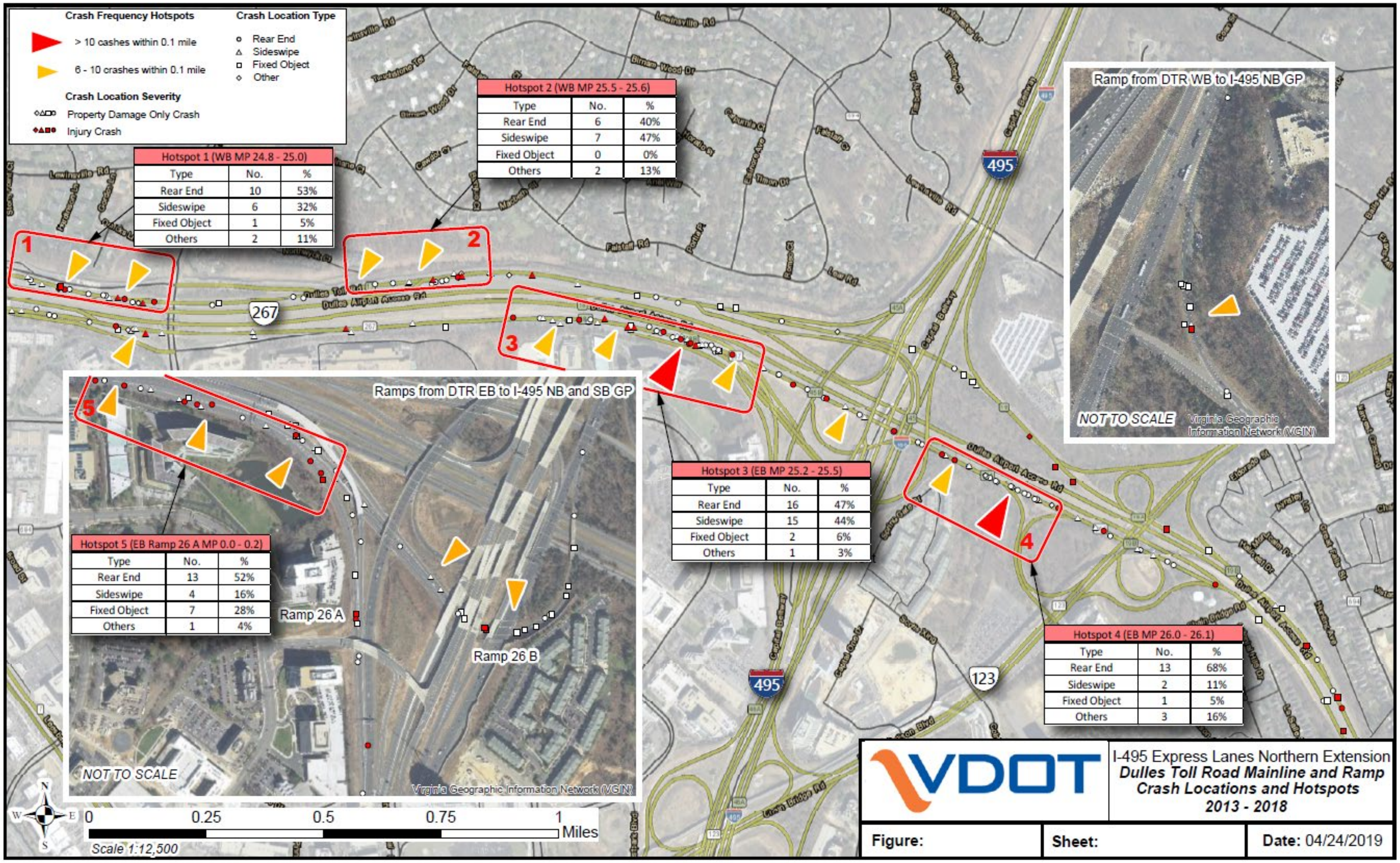


Figure 10-3. Detailed DTR/DCR Hot Spot Locations (2013-2018)

10.4.3 George Washington Memorial Parkway Crash History Summary

For thorough analysis of the entire project area, crash data was requested from the National Park Service (NPS) for the George Washington Memorial Parkway (GWMP) from the I-495 interchange to the Turkey Run Turnaround Ramps. Complete NPS data was provided for calendar years 2014-2017 which were the most recent full years available. NPS crash data include date/time, severity, and GPS locations of investigated incidents. Details, such as type of collision or diagrams of the crash, were not available from the data received. A summary of crashes by year and severity is shown in **Table 10-1**.

Table 10-1. Summary of NPS Crash Data for GWMP between I-495 and Turkey Run Interchange (2014-2017)

George Washington Mem Pkwy Crashes			
	PDO	Injury	Total
2014	76	5	81
2015	78	13	91
2016	70	5	75
2017	86	5	91

The data indicate the two primary areas of significant activity are the ramps to and from the Turkey Run turnaround and the gore area for westbound GWMP to the I-495 ramps. The crash frequency of the Turkey Run Ramps is likely due to limited geometrics and very short acceleration and deceleration lanes. The crash activity at the gore area may be due to late lane changes or unsafe diverging maneuvers by motorists.

Based on the number of crashes, calculations were performed to determine the segment crash rate. The rate was calculated on the segment from I-495 to the eastern most ramps for the Turkey Run Turnaround and utilized existing traffic volumes. The segment crash rate is 2.13 crashes per million VMT and 0.18 injuries per million VMT.

10.4.4 Arterial Intersections Crash History Summary

As traffic continues to encounter increasing levels of congestion, some drivers seek alternative routes to avoid the congestion. As a result, there are several intersections on the arterial streets within the vicinity of the interstate freeway that have experienced high annual crash frequencies and intersection crash rates. At several of these intersections, the intersection crash rate is significantly higher than the statewide intersection average crash rates for similar intersections. A total of 28 intersections were identified and assessed in terms of safety. A total of 1 fatal crash, 205 injury crashes, and 306 property damage only (PDO) crashes were reported over the five-year period at these 28 intersections. The average annual number of crashes per year per intersection varied from 1 to 16 intersection crashes per year. The associated intersection crash rates varied from 0.07 to 1.18 intersection crashes per million entering vehicles.

Additionally, the following existing conditions trends were observed along arterials:

- **Figure 10-4** and **Figure 10-5** show that the intersections of Route 123 (Chain Bridge Road) with Tysons Boulevard and Old Meadow Road have high crash rates and crash frequencies. Both intersections are adjacent to I-495 with several high traffic volume generators nearby. Both intersections experience heavy traffic congestion, leading to increased crashes.

- Across all intersections in the Traffic Operations Study area, approximately 40 percent of intersection crashes are injury crashes, which is notably high.
- Most of the crashes are either Rear-End crashes or angle crashes. Therefore, it can be inferred that heavy congestion primarily contributes to the intersection crashes in the study area.
- Based on the analysis of the reported crash data for this five-year period, environmental factors as lighting, weather, and pavement condition did not significantly affect the safety performance of the intersections.

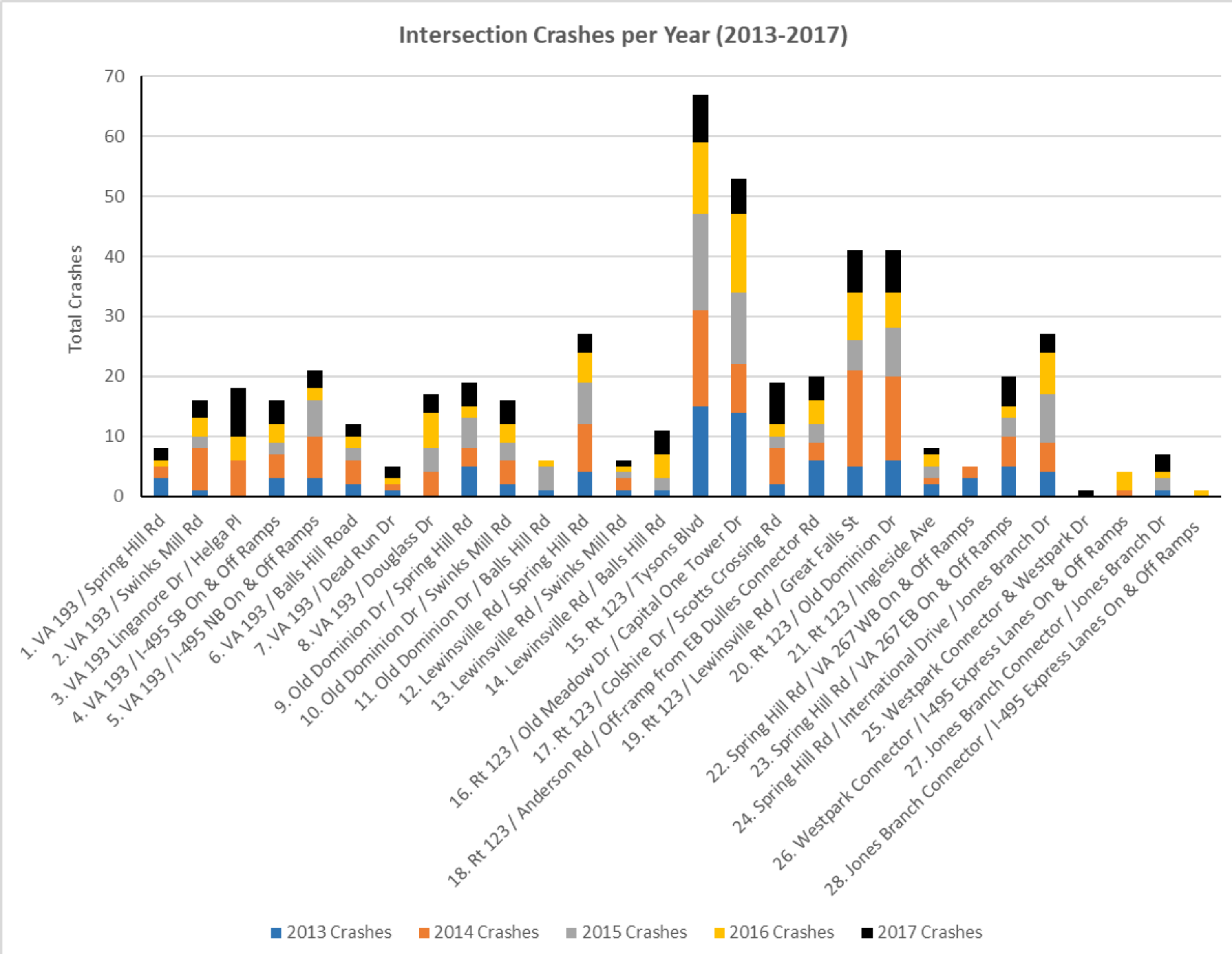


Figure 10-4. Arterial Intersection Crashes Reported by Year (2013-2017)

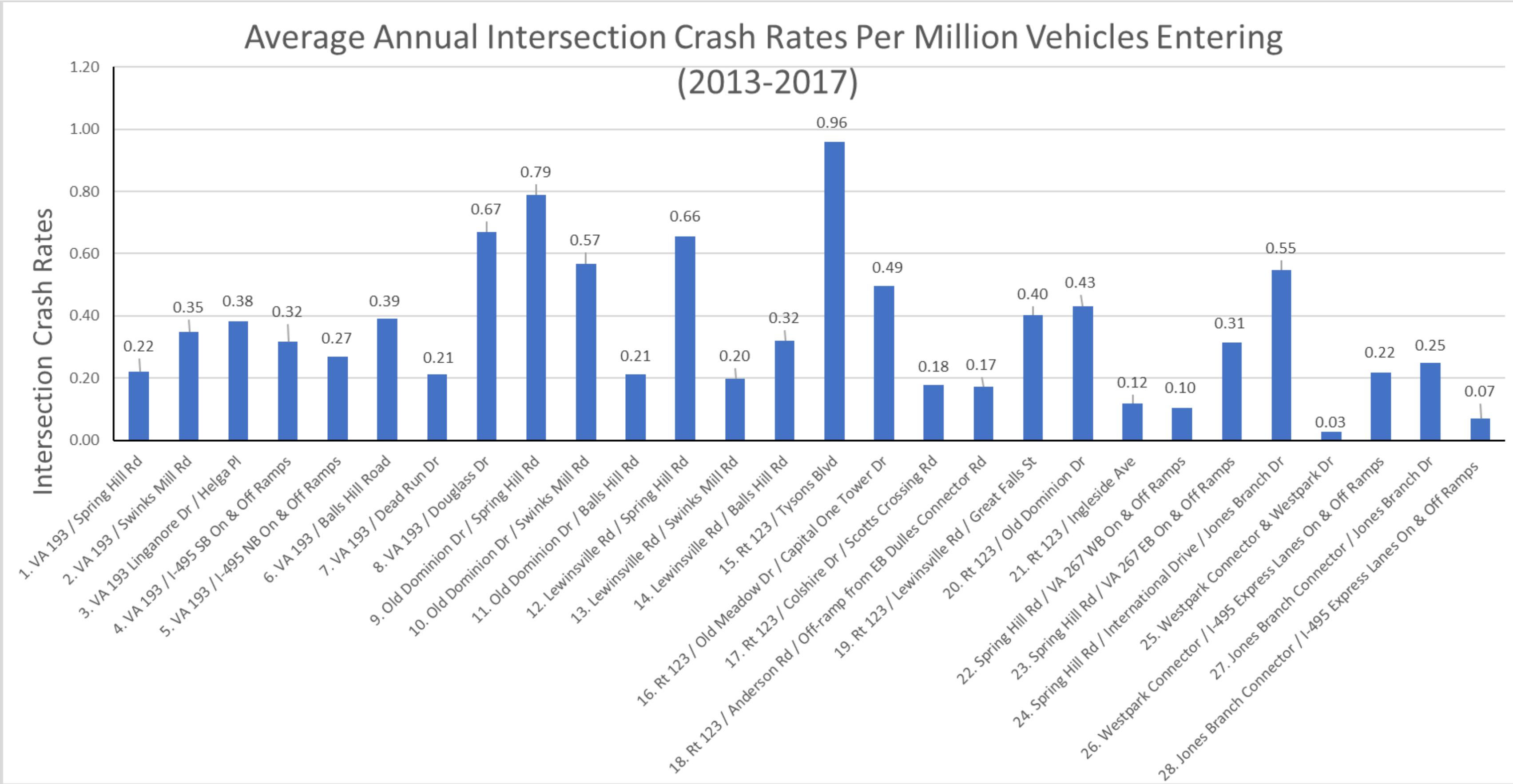


Figure 10-5. Arterial Intersection Crash Rates per Million Vehicles Entering (2013-2017)

10.5 FUTURE CONDITIONS SAFETY ANALYSIS

The operations and design elements of a proposed freeway system or interchange design project affect safety performance. Through the use of the principles and concepts in the HSM and safety analysis tools including ISATe, a project-specific SPF, and Extended HSM Spreadsheets, the project study team evaluated the safety impact of changes to the design. HSM methods and tools were used to predict the safety performance of the No Build and Build alternatives. This section describes the analysis of design year 2045 No Build and Build conditions.

10.5.1 Total Crash Prediction

In **Table 10-2**, the crash frequency results (predicted number of crashes per year) are provided for 2045 No Build and Build conditions. These numbers represent the total predicted crashes in the Traffic Operations Study Area, including GP lanes, Express Lanes, and arterials. As shown, the total number of predicted crashes, including the number of fatal and injury crashes (KABC) and PDO crashes are predicted to decrease under Build conditions. **Table 10-3** breaks out these totals into sub-totals for the I-495 GP lanes, Express Lanes, Route 267 segments, and arterial intersections. As shown, the predicted annual number of crashes decreases significantly for the I-495 GP Lanes. An increase in the predicted number of crashes along the I-495 Express Lanes, which are extended in the Build scenario and represent a much larger length of roadway, carrying significantly higher volumes than in the No Build scenario. A slight increase in the number of crashes is also predicted along the Route 267 segments due to additional ramp movements at the I-495 interchange. Finally, a slight decrease in the number of crashes is predicted along arterials. Overall, the total number of predicted crashes across the system are predicted to decrease under Build conditions.

Table 10-2. Total I-495 Traffic Operations Study Area Predicted Crash Frequency Summary

Year	Scenario	Total General Purpose, Express, and Arterial Intersection Predicted Crash Frequency (crashes/year)		
		KABC	PDO	Total
2045	No Build	257.8	565.6	823.4
	Build	223.9	424.5	648.4

Table 10-3. I-495 Traffic Operations Study Area Predicted Crash Frequency Summary Breakdown

Summary of Predicted Annual Crashes	KABC		PDO		Total	
	No Build	Build	No Build	Build	No Build	Build
I-495 GP Lanes and Interchange Ramps	153.1	106.0	376.8	214.5	529.9	320.5
I-495 Express Lanes	11.0	21.5	20.7	42.1	31.7	63.6
Route 267 (DTR and DAAR)	35.4	38.2	56.6	57.9	92.2	96.1
Arterial Intersections	58.3	58.2	111.6	110.0	169.9	168.2
Total Study Area Combined	**257.8**	**223.9**	**565.6**	**424.5**	**823.6**	**648.4**

10.5.2 Freeway Crash Prediction by Segment

Crash Analysis Zones Overview

Predicted crash frequencies and crash rates were calculated for individual freeway segments. For reporting purposes, these metrics were aggregated into interchange zones and/or segment zones within the Traffic Operations Study Area. Below is a description of limits for the various crash analysis zones.

- I-495 Interchanges
  - I-495/Route 123 and I-495/Route 267 interchanges were combined as one zone. These two interchanges were grouped together because of their close proximity and interconnectedness, especially in the 2045 scenarios in which C-D roads provide connectivity between the interchanges. See **Figure 10-6** for limits of I-495 Interchange Zone: Route 123 and Route 267 Combined.
  - I-495/Route 193 and I-495/GWMP interchanges were also combined as one zone for similar reasons. The interchanges currently share a C-D road in the southbound direction. See **Figure 10-7** for limits of Interchange Zone: Route 193 and GWMP Combined.
- Northbound I-495 GP Lane segments
  - From Route 7 to Route 123
  - From Route 267 to Route 193
- Southbound I-495 GP Lane segments
  - From Route 193 to Route 267
  - From Route 123 to Route 7
- Northbound I-495 Express Lanes segments
  - From Route 7 to I-495/Route 123/Route 267 interchanges
  - Within the I-495/Route 123/Route 267 interchanges[1]
  - From I-495/Route 123/Route 267 interchange to GWMP interchange
  - From GWMP interchange to the state line
- Southbound I-495 Express Lanes segments
  - From the state line to GWMP interchange
  - From to GWMP interchange to I-495/Route 123/Route 267 interchanges[1]
  - Within the I-495/Route 123/Route 267 interchanges
  - From I-495/Route 123/Route 267 interchanges to Route 7
- Route 267 (Dulles Toll Road) interchanges and segments
  - Spring Hill Road and Route 267 (Dulles Toll Road) interchange. See **Figure 10-8** for limits of the Route 267 Interchange Zone at Spring Hill Road and Dulles Toll Road.

---

[1] For the 2045 Build Alternative, it should be noted that because Ramp E1 from Route 267 (DTR & DAAR) eastbound is nearly 1 mile in length and serves both the northbound and southbound Express Lanes, and therefore accounts for a significant portion of the 2045 Build Express Lanes ramp crashes, the crash predictions for Ramp E1 were distributed to the northbound Express Lanes within the I-495/Route 123/Route 267 interchanges and to the southbound Express Lanes within the I-495/Route 123/Route 267 interchanges by percentage of ADT volume destined to each. See **Figure 8-11**.

- I-495 and Route 267 (Dulles Toll Road) interchange (mainline only; all ramps for the I-495/Route 267 interchange are included in the I-495/Route 267 interchange zone). See **Figure 10-9** for limits of the Route 267 Interchange Zone at I-495.
- Route 123 and Route 267 (Dulles Toll Road) interchange. See **Figure 10-10** for limits of the Route 267 Interchange Zone at Route 123.
- Route 267 eastbound from Route 123 interchange to 0.03 miles east of the bridge over Route 650
- Route 267 westbound from 0.03 miles east of the bridge over Route 650 to the Route 123 interchange

- Route 267 (Dulles Airport Access Road) segments
  - Eastbound Route 267 (DAAR) from Spring Hill Road to the eastern terminus
  - Westbound Route 267 (DAAR) from the eastern terminus to Spring Hill Road

Figure 10-6. I-495 Interchange Zone: Route 123 and Route 267 Combined

Figure 10-7. I-495 Interchange Zone: Route 193 and GWMP Combined

Figure 10-8. Route 267 Interchange Zone: Spring Hill Road and Dulles Toll Road

Figure 10-9. Route 267 Interchange Zone: I-495 (Dulles Toll Road Mainline Only)

Figure 10-10. Route 267 Interchange Zone: Route 123

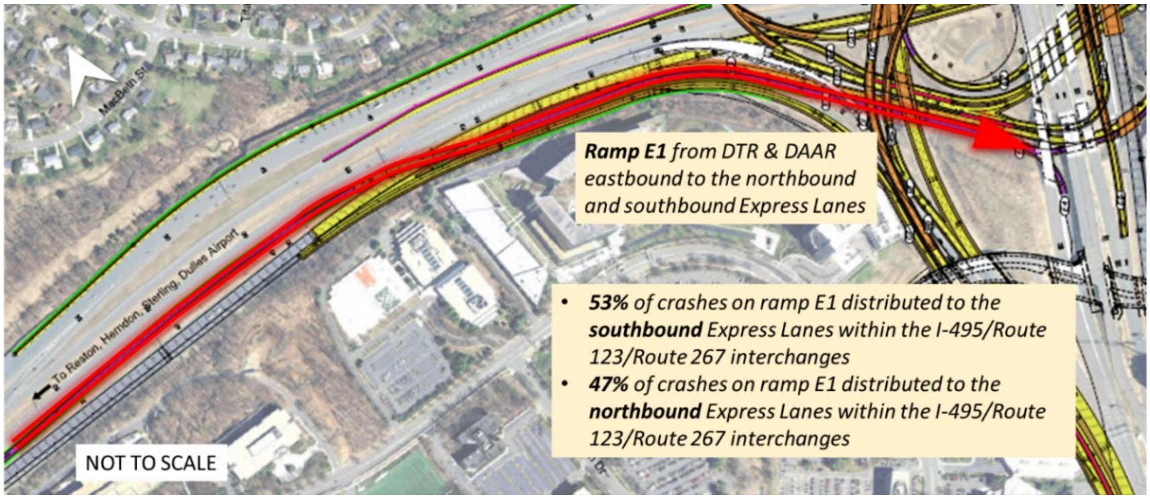


Figure 10-11. Ramp E1 from eastbound DTR and DAAR to northbound and southbound I-495 Express Lanes

2045 No Build and Build Crash Rate Predictions

I-495 Interchanges

Figure 10-12 shows the predicted crash rate per 100 MEV for the two major interchange areas of the I-495 GP Lanes between 2045 No Build and Build conditions. The following summarize the comparative crash rates for the I-495 interchanges under 2045 conditions**:**

- The predicted crash rate for the I-495 GP interchanges with Route 123 and Route 267 shows a negligible change from No Build to Build conditions.
- The predicted crash rate decreases significantly by 132 crashes per 100 MEV for the Route 193 and GWMP interchange analysis zone when comparing the No Build and Build conditions. There are multiple contributing factors:
  - (1) In the 2045 No Build condition, it is assumed that the Maryland managed lanes terminate within this zone. A merge from the southbound Maryland managed lanes and a diverge to the northbound Maryland managed lanes at this location will result in conflicts between vehicles continuing on the GP lanes and traffic merging from and diverging to the Maryland managed lanes.
  - (2) There is a decrease in approximately 35,000 ADT for vehicles entering this zone on the GP lanes in the 2045 Build conditions compared to the 2045 No Build conditions. This is due to vehicles choosing to either enter and exit the Express Lanes directly from the new GWMP access to and from the south and through trips traveling north and south on the Express Lanes bypassing the GP lanes all together.
  - (3) In the Build condition, the southbound ramp and C-D lane geometric re-configuration between GWMP and Route 193 removes weaving conflicts between vehicles destined for southbound I-495 and vehicles destined to Route 193. Additionally, the ability for “queue jumpers” to use the southbound C-D lanes and cause additional unnecessary weaving and merging conflicts is eliminated in the Build condition.

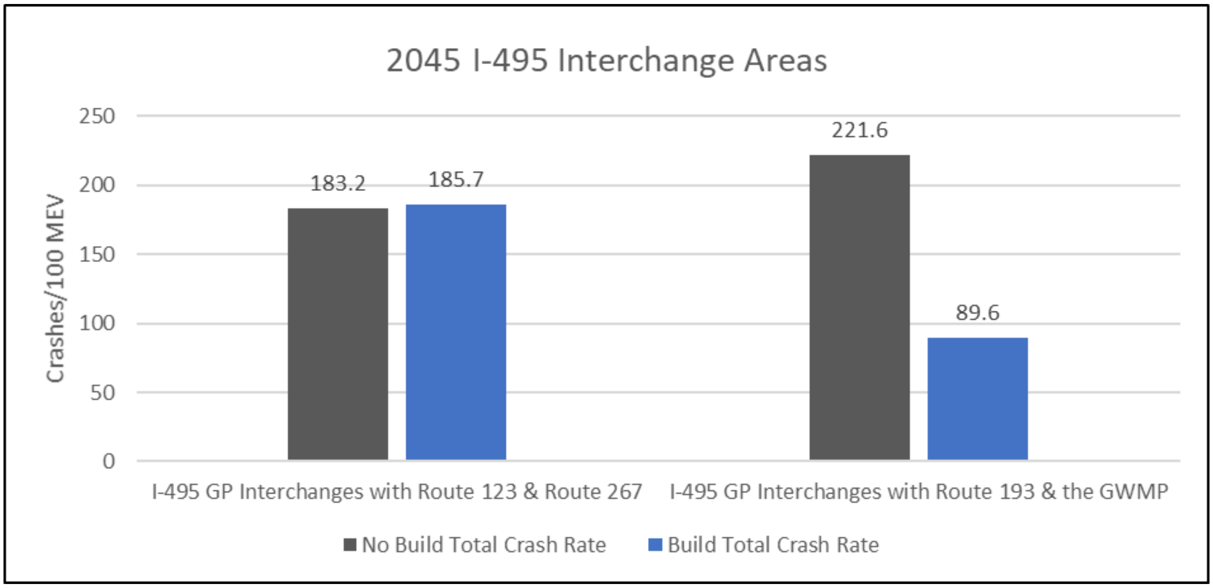


Figure 10-12. 2045 No Build and Build ISATe Predicted Crash Rate Summary for I-495 GP Interchange Areas

I-495 GP Lanes

Figure 10-13 shows the predicted crash rate per 100 MVMT for two segments of the northbound GP lanes between 2045 No Build and Build conditions. The following summarize the comparative crash rates for the northbound I-495 GP lanes under 2045 conditions**:**

- The predicted crash rate for the northbound GP lanes from the Route 7 bridge to the interchanges with Route 123 and Route 267 decreases by 21 crashes per 100 MVMT from No Build to Build conditions due to the C-D road system in both directions separating interchange traffic from through traffic and reducing weaving conflicts.
- The predicted crash rate for the northbound GP lanes from Route 267 to the interchanges with Route 193 and the GWMP decreases by nearly 10 crashes per 100 MVMT from No Build to Build conditions. The extension of the Express Lanes to the Maryland state line diverts volume from the GP Lanes to the Express Lanes through this segment, reducing congestion and there therefore lowering the potential for crashes to occur.

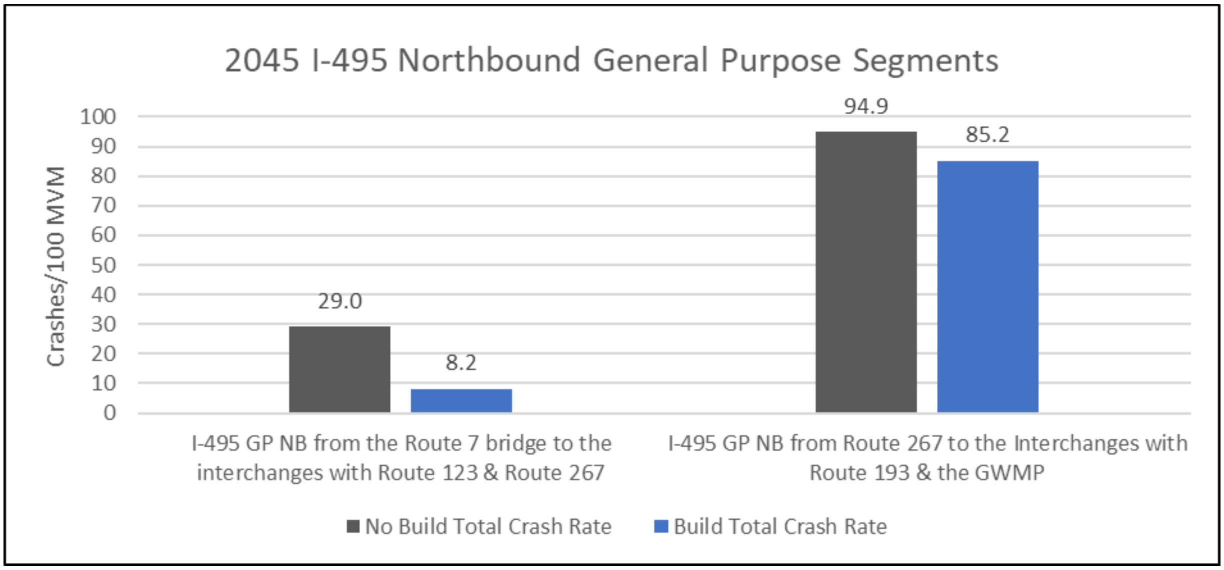


Figure 10-13. 2045 No Build and Build ISATe Predicted Crash Rate Summary for Northbound I-495 GP Lanes

Figure 10-14 shows the predicted crash rate for two segments of the southbound GP lanes between 2045 No Build and Build conditions. The following summarize the comparative crash rates for the southbound I-495 GP lanes under 2045 conditions**:**

- The predicted crash rate for the southbound I-495 GP lanes from Route 267 to the interchanges with Route 193 and the GWMP decrease from No Build to Build conditions. The extension of the Express Lanes from the northern terminus to the state line diverts volume from the GP Lanes to the Express Lanes through this segment; therefore, lowering projected crashes.
- The predicted crash rate for the southbound GP lanes from the Route 7 bridge to the interchanges with Route 123 and Route 267 show a nominal increase from No Build to Build conditions.

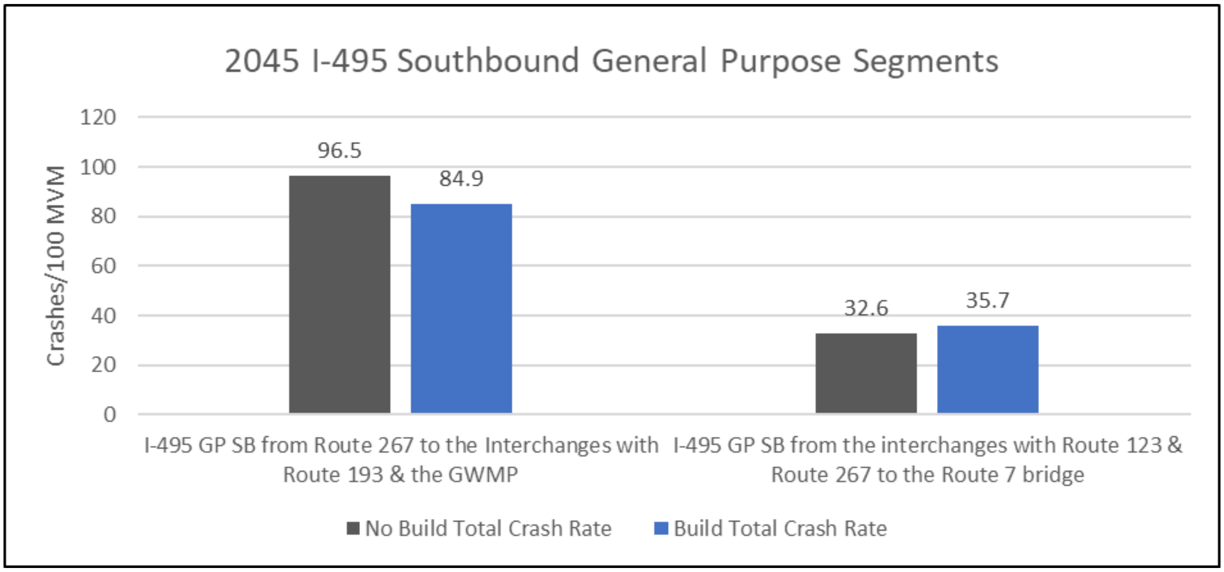


Figure 10-14. 2045 No Build and Build ISATe Predicted Crash Rate Summary for Southbound I-495 GP Lanes

<u>I-495 Express Lanes</u>

Figure 10-15 shows the predicted crash rate for four segments of the northbound Express Lanes between 2045 No Build and Build conditions. The following summarize the comparative crash rates for the northbound I-495 Express Lanes under 2045 conditions**:**

- The Express Lanes predicted crash rate from the existing northern terminus to the GWMP interchange is shown only for the Build condition. Express Lanes are not present in the No Build condition for this section.
- The predicted crash rate for the northbound Express Lanes from the Route 7 bridge to the interchanges with Route 123 and Route 267 decreases by nearly 14 crashes per 100 MVMT from No Build to Build conditions largely due to the increase in volume without introducing any new access for this segment.
- The predicted crash rate for the northbound Express Lanes within the Route 123 and Route 267 interchanges increases in the Build condition by 18 crashes per 100 MVMT due to the introduction of connecting ramps from Route 267 and an increase in volume on existing Express Lanes ramps. Note that in 2045 Build conditions, ramp-related crashes account for approximately 75 percent of all Express Lanes crashes in the I-495/Route 267/Route 123 interchange zone.
- The predicted crash rate for the northbound Express Lanes from the GWMP to the state line decreases by 7 crashes per MVMT from 2045 No Build conditions to 2045 Build conditions, as the Build condition provides a continuous Express Lanes system whereas the No Build condition assumes the southern terminus of the Maryland managed lanes system, featuring a southbound merge and northbound diverge.

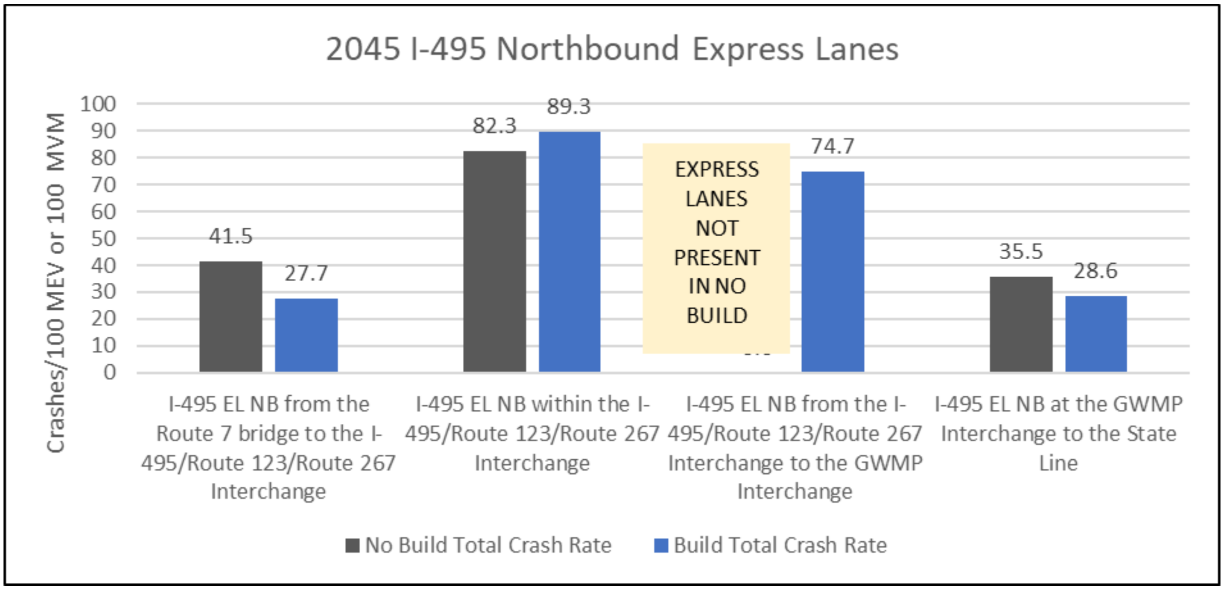


Figure 10-15. 2045 No Build and Build SPFs Developed for Express Lanes Predicted Crash Rate Summary for I-495 Northbound Express Lanes

Figure 10-16 shows the predicted crash rate for four segments of the southbound Express lanes between 2045 No Build and Build conditions. The following summarize the comparative crash rates for the southbound I-495 Express Lanes under 2045 conditions**:**

- The Express Lanes predicted crash rate from the GWMP interchange to the existing northern terminus is shown only for the Build condition. Express Lanes are not present in the No Build condition for this section.
- The predicted crash rate for the southbound Express Lanes from the GWMP to the state lines decrease by nearly 14 crashes per 100 MVMT from 2045 No Build conditions to 2045 Build conditions, as the Build condition provides a continuous Express Lanes system whereas the No Build condition assumes the southern terminus of the Maryland managed lanes system, featuring a southbound merge and northbound diverge.
- The predicted crash rate for the southbound Express Lanes within the Route 123 and Route 267 interchanges increases by nearly 22 crashes per 100 MVMT. Similar to the northbound Express Lanes, this is due to the introduction of connecting ramps from and to Route 267 and increases in volume on existing Express Lanes ramps. In 2045 Build conditions, ramp related crashes account for approximately 70 percent of all Express Lanes crashes in the I-495/Route 267/Route 123 interchange zone.
- The predicted crash rate for the southbound Express Lanes from the interchanges with Route 123 and Route 267 to the Route 7 bridge decreases from No Build to Build largely due to the increase in volume without introducing any new access for this segment.

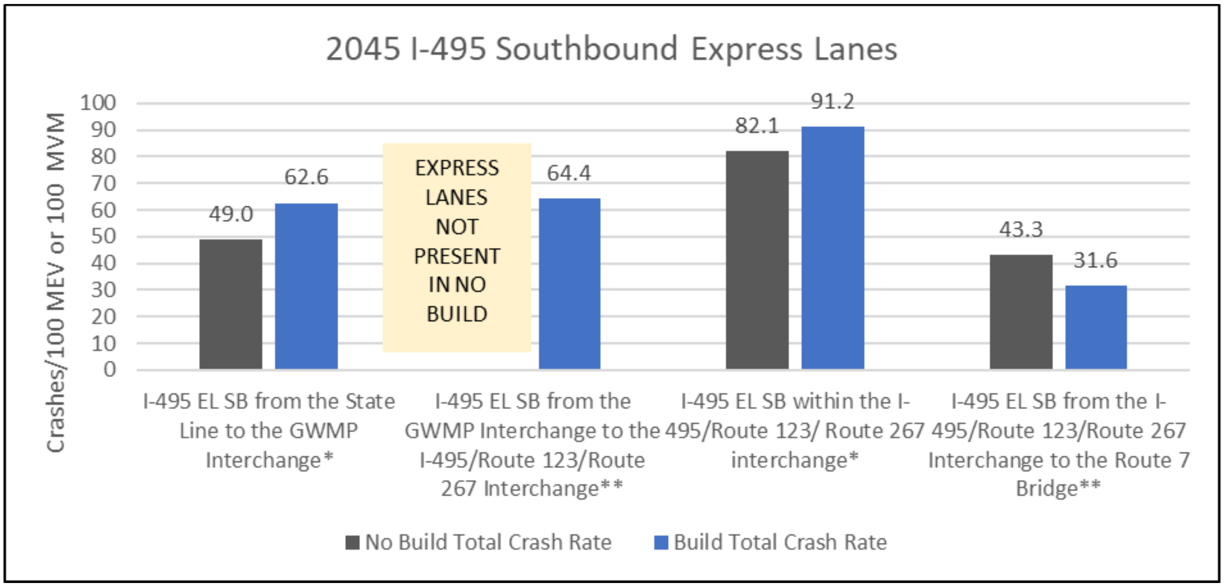


Figure 10-16. 2045 No Build and Build SPFs Developed for Express Lanes Predicted Crash Rate Summary for I-495 Southbound Express Lanes

Route 267

Figure 10-17 shows the predicted crash rate for five segments of Route 267 (DTR) between 2045 No Build and Build conditions. The following summarize the comparative crash rates for the DTR under 2045 conditions:

- The DTR crash rates decrease slightly in the Build condition as compared to the No Build condition at the interchange of Spring Hill Road and at the interchange with Route 123.
- The DTR crash rates increase slightly in the Build condition as compared to the No Build condition at the interchange with I-495; this is attributable to the increased demand from the Express Lanes extension and additional ramp connections to and from the Express Lanes.
- The DTR crash rates for the eastbound and westbound between the Route 123 interchange and the eastern terminus (0.03 miles past the Route 650 bridge) are significantly higher that segments to the west; however, these segments are quite short in length and overall annual crash frequencies are quite low. In both directions of the DTR along these segments, a decrease is predicted in Build conditions as compared to No Build conditions.

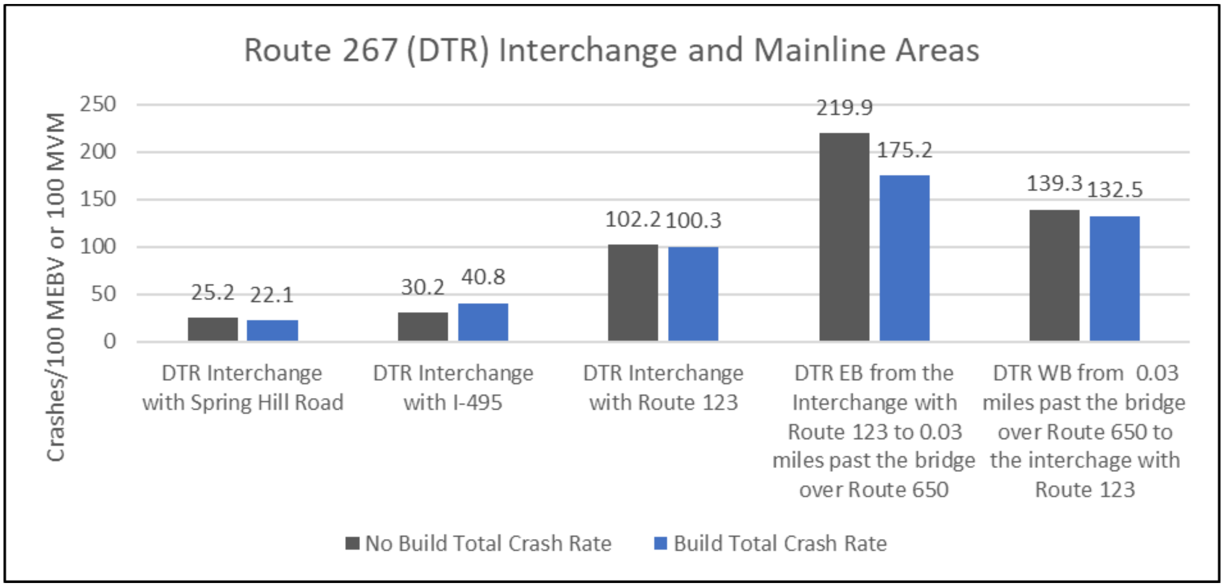


Figure 10-17. 2045 No Build and Build ISATe Predicted Crash Rate Summary for Route 267 (DTR)

Figure 10-18 shows the predicted crash crate for each direction of Route 267 (DAAR) between 2045 No Build and Build conditions. The following summarize the comparative crash rates for the DAAR under 2045 conditions:

- The predicted crash rate for eastbound DAAR decreases from No Build to Build conditions due to new direct access to the I-495 Express Lanes.
- The predicted crash rate for westbound DAAR shows a nominal decrease from No Build to Build conditions.

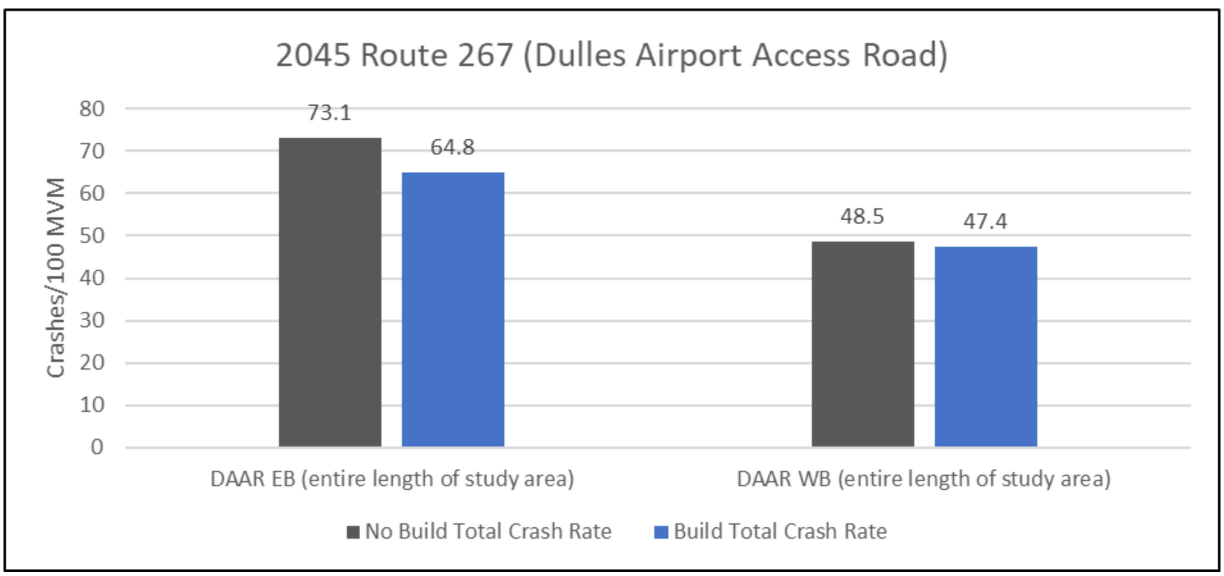


Figure 10-18. 2045 No Build and Build ISATe Predicted Crash Rate Summary for Route 267 (DAAR)

2045 No Build and Build Crash Frequency Predictions

I-495 Interchanges

Figure 10-19 shows the predicted crash frequency (crashes/year) for two segments of the I-495 interchanges between 2045 No Build and Build conditions. The following summarize the comparative crash frequencies for the I-495 interchanges under 2045 conditions:

- The predicted annual crash frequency decreases for the I-495 GP interchanges with Route 123 and Route 267 due to geometric improvements and a C-D system that separates interchange movements from mainline through movements.
- The predicted annual crash frequency decreases significantly by nearly 168 crashes per year for the Route 193 and GWMP interchange analysis zone when comparing the No Build and Build conditions. There are multiple contributing factors:
  - (1) In the 2045 No Build condition, it is assumed that the Maryland managed lanes terminate within this zone. A merge from the southbound Maryland managed lanes and a diverge to the northbound Maryland managed lanes at this location will result in conflicts between vehicles continuing on the GP lanes and traffic merging from and diverging to the Maryland managed lanes.
  - (2) There is a decrease in approximately 35,000 ADT for vehicles entering this zone on the GP lanes in the 2045 Build conditions compared to the 2045 No Build conditions. This is due to vehicles choosing to either enter and exit the Express Lanes directly from the new GWMP access to and from the south and through trips traveling north and south on the Express Lanes bypassing the GP lanes all together.
  - (3) In the Build condition, the southbound ramp and C-D lane geometric re-configuration between GWMP and Route 193 removes weaving conflicts between vehicles destined for southbound I-495 and vehicles destined to Route 193. Additionally, the ability for "queue jumpers" to use the southbound C-D lanes and cause additional unnecessary weaving and merging conflicts is eliminated in the Build condition.

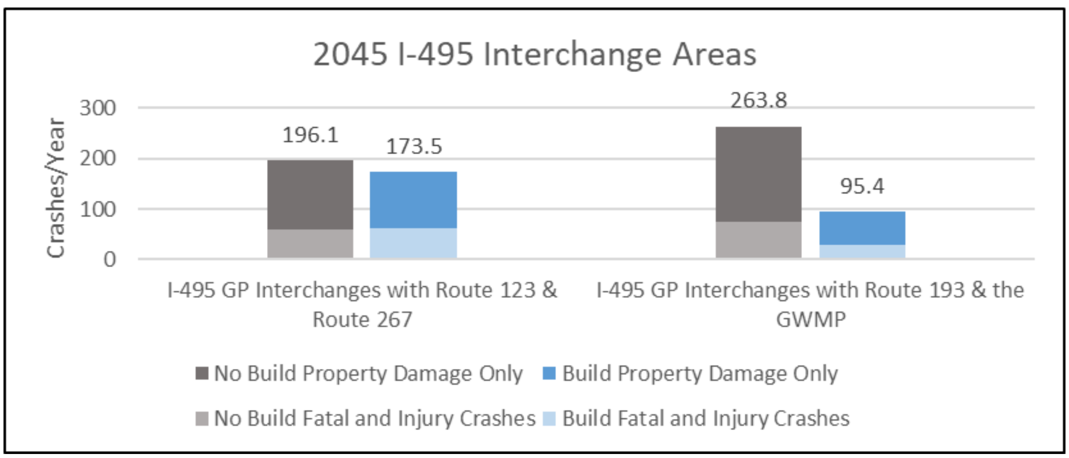


Figure 10-19. 2045 No Build and Build ISATe Predicted Crash Frequency Summary for I-495 GP Interchange Areas

I-495 GP Lanes

Figure 10-20 shows the predicted annual crash frequency for two segments of the northbound GP lanes between 2045 No Build and Build conditions. The following summarize the comparative annual crash frequencies for the northbound I-495 GP lanes under 2045 conditions**:**

- The predicted annual crash frequency for the northbound GP lanes from the Route 7 bridge to the interchanges with Route 123 and Route 267 decreases from No Build to Build conditions due to the C-D road system in both directions separating interchange traffic from through traffic and reducing weaving conflicts.
- The predicted annual crash frequency for the northbound GP lanes from Route 267 to the interchanges with Route 193 and the GWMP decreases from No Build to Build conditions. The extension of the Express Lanes to the Maryland state line diverts volume from the GP Lanes to the Express Lanes through this segment, reducing congestion and there therefore lowering the potential for crashes to occur.

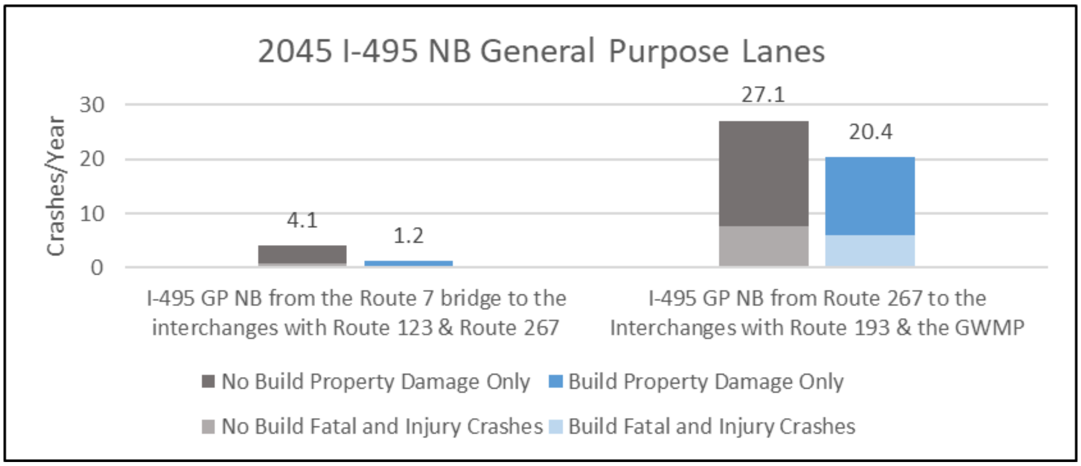


Figure 10-20. 2045 No Build and Build ISATe Predicted Crash Frequency Summary for I-495 Northbound GP Lanes

Figure 10-21 shows the predicted annual crash frequency for two segments of the southbound GP lanes between 2045 No Build and Build conditions. The following summarize the comparative annual crash frequencies for the southbound I-495 GP lanes under 2045 conditions**:**

- The predicted annual crash frequency for the I-495 southbound GP lanes from Route 267 to the interchanges with Route 193 and the GWMP decreases by 9 crashes per year from No Build to Build. The extension of the Express Lanes from the northern terminus to the state line diverts volume from the GP Lanes to the Express Lanes through this segment; therefore, lowering the projected number of crashes.
- The predicted annual crash frequency for the southbound GP lanes from the Route 7 bridge to the interchanges with Route 123 and Route 267 shows a nominal increase from No Build to Build conditions.

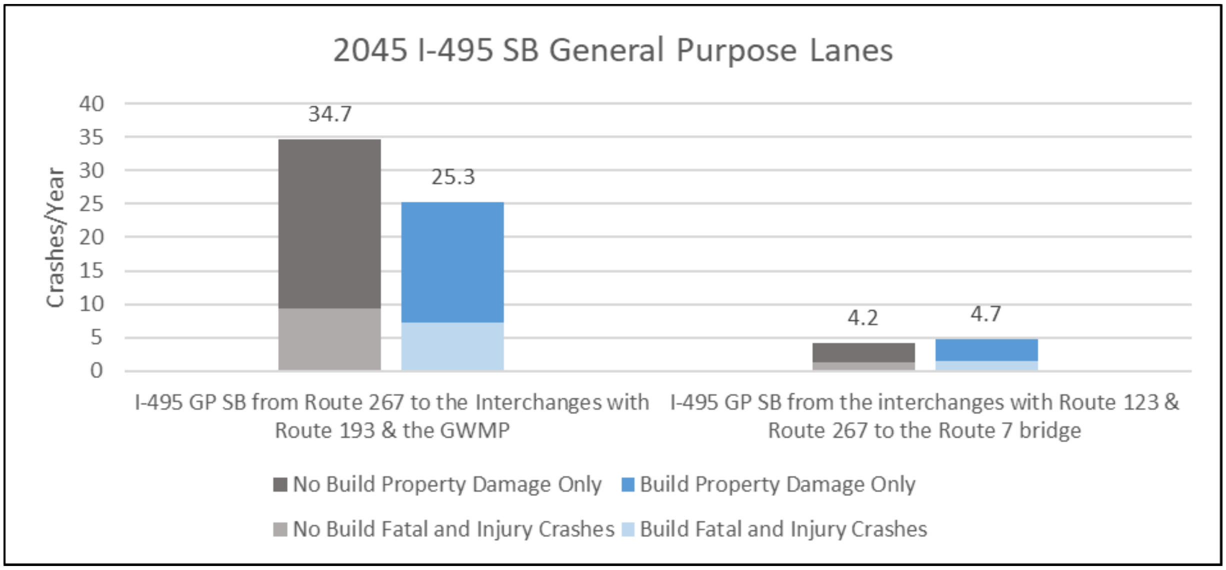


Figure 10-21. 2045 No Build and Build ISATe Predicted Crash Frequency Summary for I-495 Southbound GP Lanes

<u>I-495 Express Lanes</u>

Figure 10-22 shows the predicted annual crash frequency for four segments of the northbound Express Lanes between 2045 No Build and Build conditions. The following summarize the comparative annual crash frequencies for the northbound I-495 Express Lanes under 2045 conditions**:**

- The Express Lanes predicted crash frequency from the existing northern terminus to the GWMP interchange is shown only for the Build condition. Express Lanes are not present in the No Build condition for this section.
- The predicted crash frequency for the northbound Express Lanes from the Route 7 bridge to the interchanges with Route 123 and Route 267 decreases nominally from No Build to Build conditions.
- The predicted crash rate for the northbound Express Lanes within the Route 123 and Route 267 interchanges increases in the Build condition due to the introduction of connecting ramps from Route 267 and an increase in volume on existing Express Lanes ramps. Note that in 2045 Build conditions, ramp-related crashes account for approximately 75 percent of all Express Lanes crashes in the I-495/Route 267/Route 123 interchange zone.
- Given the increase in volume and connections to the south on I-495 and to the GWMP, the predicted annual crash frequency for the northbound Express Lanes from the GWMP interchange to the state line increase nominally from 2045 No Build to 2045 Build conditions.

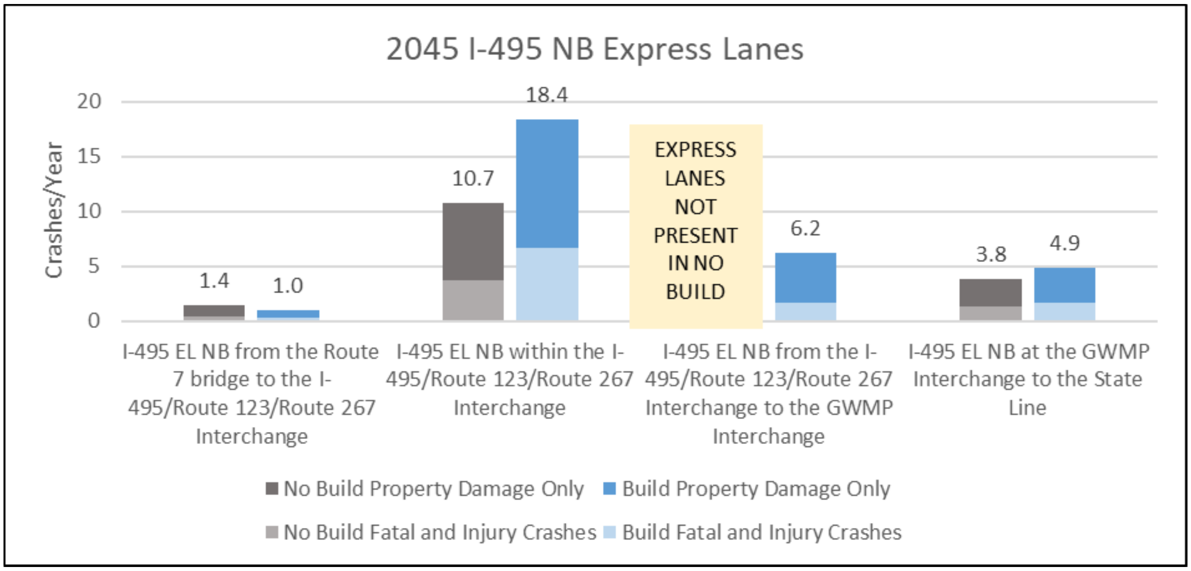


Figure 10-22. 2045 No Build and Build SPFs Developed for Express Lanes Predicted Crash Frequency Summary for I-495 Northbound Express Lanes

Figure 10-23 shows the predicted crash frequency (crashes/year) for four segments of the southbound Express lanes between 2045 No Build and Build conditions. The following summarize the comparative annual crash frequencies for the southbound I-495 Express Lanes under 2045 conditions**:**

- The Express Lanes predicted annual crash frequency from the existing northern terminus to the GWMP interchange is shown only for the Build condition. Express Lanes are not present in the No Build condition for this section.
- The predicted annual crash frequency for the southbound Express Lanes from the GWMP to the state line decreases from 2045 No Build to 2045 Build conditions, as the Build condition provides a continuous Express Lanes system whereas the No Build condition assumes the southern terminus of the Maryland managed lanes system, featuring a southbound merge and northbound diverge.
- The predicted annual crash frequency for the southbound Express Lanes within the Route 123 and Route 267 interchanges increases. Similar to the northbound Express Lanes, this is due to the introduction of connecting ramps from and to Route 267 and increases in volume on existing Express Lanes ramps. In 2045 Build conditions, ramp related crashes account for approximately 70 percent of all Express Lanes crashes in the I-495/Route 267/Route 123 interchange zone.
- The predicted annual crash frequency for the southbound Express Lanes from the interchanges with Route 123 and Route 267 to the Route 7 bridge decreases nominally.

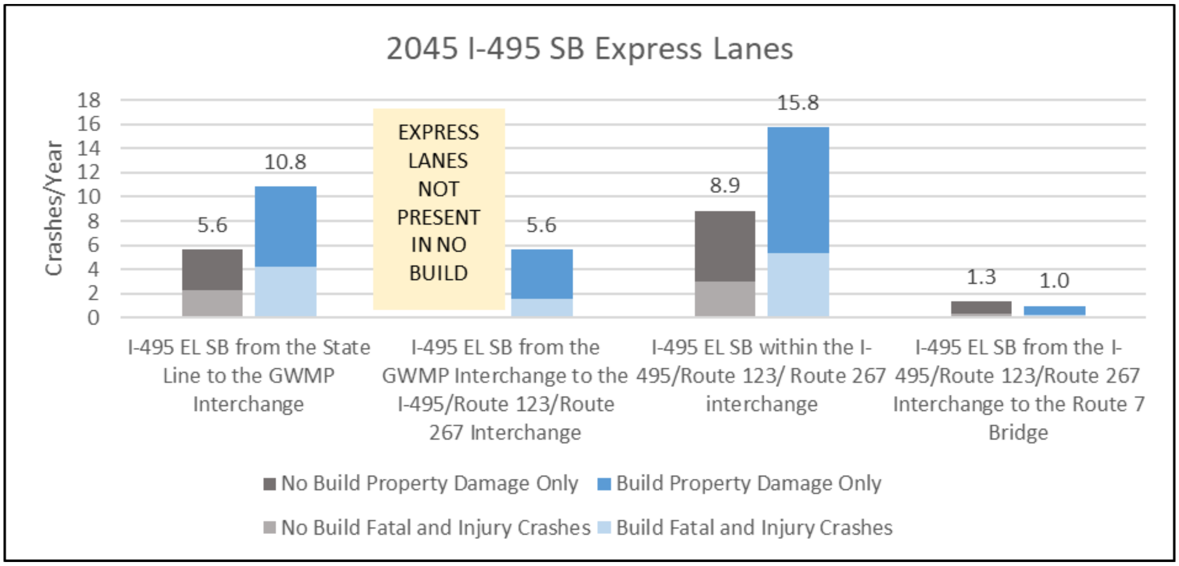


Figure 10-23. 2045 No Build and Build SPFs Developed for Express Lanes Predicted Crash Frequency Summary for I-495 Southbound Express Lanes

Route 267

Figure 10-24 shows the predicted crash frequency for five segments of Route 267 (DTR) between 2045 No Build and Build conditions. The following summarize the comparative annual crash frequencies for the DTR under 2045 conditions:

- The annual crash frequency along the DTR increases in the Build condition through the interchange with I-495 due to the increased demand from the Express Lanes extension and additional ramp connections to the Express Lanes.
- Annual crash frequencies at other locations along the DTR are predicted to decrease slightly or remain stable.

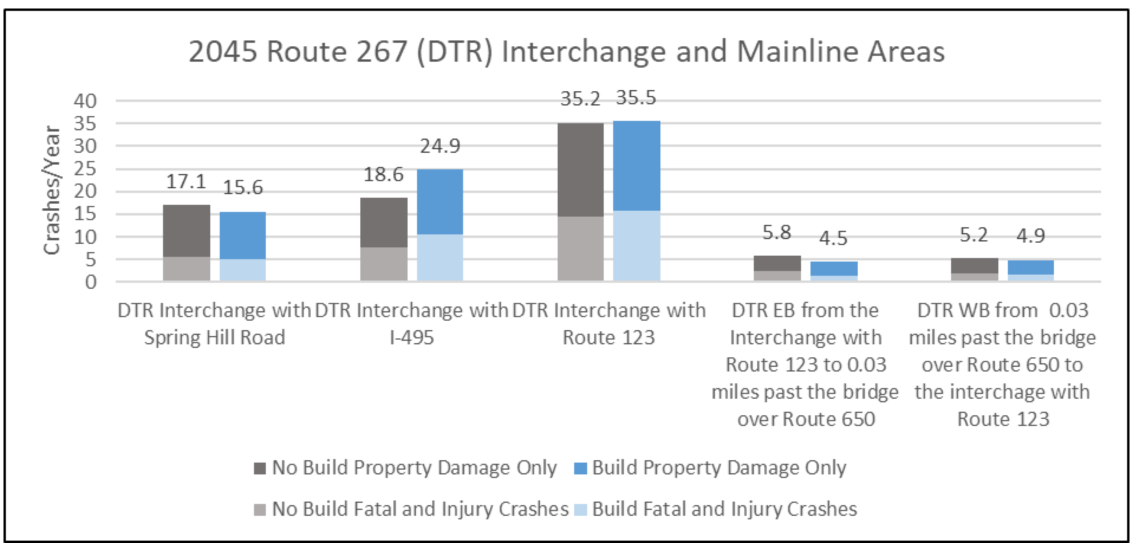


Figure 10-24. 2045 No Build and Build ISATe Predicted Crash Frequency Summary for Route 267 (DTR)

Figure 10-25 shows the predicted crash frequency for each direction of Route 267 (DAAR) between 2045 No Build and Build conditions. The following summarize the comparative annual crash frequencies for the DAAR under 2045 conditions:

- The predicted annual crash frequency for eastbound DAAR shows a nominal change from 2045 No Build to Build conditions.
- The predicted annual crash frequency for westbound DAAR shows a nominal change from 2045 No Build to 2045 Build conditions.

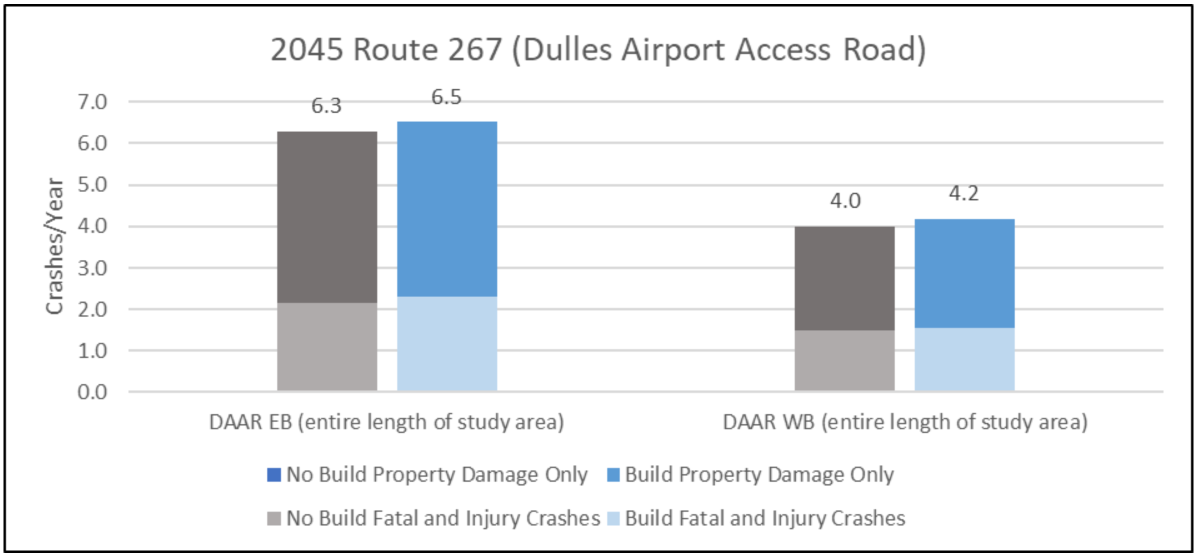


Figure 10-25. 2045 No Build and Build ISATe Predicted Crash Frequency Summary for Route 267 (DAAR)

Discussion of Freeway Locations with Crash Rate/Frequency Increases in 2045 Build Condition

As shown in **Figure 10-16** and **Figure 10-17**, as well as **Figure 10-23** and **Figure 10-24**, crash frequencies and rates are predicted to increase at some individual localized freeway locations in the 2045 Build condition, most notably along the I-495 Express Lanes and within the I-495/Route 267 interchange complex along the DTR freeway segments. These localized increases in predicted crashes are attributable to the new or modified access that is provided in the Build condition, as well as forecasted increases in volumes in the Express Lanes given this new access. **Table 10-4** provides a detailed breakdown of individual freeway mainline or ramp segments that see an increase in crashes in the 2045 Build condition. However, as shown previously, the overall number of crashes in the 2045 Build condition across the I-495 NEXT study area system-wide is forecasted to decrease significantly, most notably in the I-495 GP lanes.

The conceptual design for the I-495/Route 267/Route 123 interchange complex in the 2045 Build configuration provides new or improved access for several movements as compared to the conceptual No Build configuration at the Route 267 interchange:

- Eastbound DTR to northbound I-495 Express [New]
- Westbound DTR/DCR to northbound I-495 Express [New]
- Southbound I-495 Express to eastbound Route 267 [New]
- Southbound I-495 Express to Route 123 (via eastbound Route 267) [New]
- Southbound I-495 Express to southbound I-495 GP [New]

- Northbound I-495 GP to northbound I-495 Express [New]
- Southbound I-495 GP to eastbound Route 267 via right-side ramp instead of existing left-side ramp [Improved]
- Removal of existing weaves in both northbound and southbound GP lanes between Route 123 and Route 267 (movements accommodated via C-D system through interchange complex) [Improved]
- Removal of existing weave along eastbound DTR between I-495 and Route 123 (movements accommodated via C-D system through interchange complex) [Improved]
- Direct access from eastbound DAAR to northbound and southbound I-495 Express lanes [Improved]
- Direct access from eastbound DAAR to northbound I-495 GP lanes [Improved]

Figure 10-26 provides a comparison of access changes between the I-495 NEXT Ultimate Build and conceptual No Build configurations through this interchange complex. Some of these new access points and removed weaves help mitigate identified crash hotspots that exist today or would otherwise in the future, as shown in the Existing Conditions Crash History and Safety Analysis.

Additionally, through the Route 267 interchange, in the 2045 Build condition, the I-495 Express Lanes carry significantly higher projected daily volumes in each direction than the No Build condition due to the completion of the network into Maryland. The combination of increased volumes and new access connections results in higher projected amounts of crashes within the I-495/Route 267 interchange and along the Express Lanes, but as shown in **Table 10-5,** the overall *system* crashes through the IJR study area are decreased in the Build scenario. The most significant decreases in overall system crashes occur in the I-495 GP freeway segments and ramps near the Route 193 and GWMP interchanges, in which all crash types are forecasted to decrease by at least 60 percent. Beyond these two interchanges, crashes along the I-495 GP lanes are predicted to decrease through the majority of the study area due to a combination of shifts in volume to the Express Lanes, a reduction in congestion in the GP lanes, and improved geometric elements such as reduced weaving in the GP lanes.

Throughout the project development and conceptual design process, VDOT has coordinated design elements to mitigate safety concerns, most notably for the closely-spaced ramp connections and weave areas within the I-495/Route 267 interchange. Numerous iterations of this interchange have been refined through the course of the design process, in coordination with the Virginia division of FHWA. As noted in **Chapter 7**, some deviations from design standards were identified as necessary due to the constrained and built-out nature of the project study area and were incorporated into the design in order to minimize impacts to Section 4(f) / Section 6(f) resources, as well as to minimize impacts to private right-of-way, streams, and wetlands. A matrix of all design waivers and design exceptions, including remarks on rationale for seeking these, is provided as **Exhibit 7-2**. These are shown graphically in **Exhibit 7-3** (Phase 1) and **Exhibit 7-4** (2045 Design Year)**.**

- For interchange ramps E1 and E3, a design exception (DE-I) requests the use of a slightly lower minimum design speed for ramps (30 mph as opposed to the standard of 35 mph) providing a system to system connection between freeways with a 60 mph minimum design speed (DTR) and 70 mph minimum design speed (I-495 Express Lanes). This design exception is requested as the existing I-495 corridor is in an urban area with many constraining features at the interchanges.
- Furthermore, Ramp E1 is located in a constrained area, providing access from eastbound DTR to northbound I-495 Express underneath several existing bridges. These bridges were constructed as part of the original I-495 Express Lanes project and are in relatively new condition. Providing 35

mph minimum design speed would increase the superelevation needed to meet the respective design speed and increase the necessary shoulder widths for providing a safe stopping sight distance. The alternate method is to rebuild these structures and relocate their substructural supporting elements, disrupting the revenue service on the I-495 Express Lanes and significantly expanding the project scope.

As the project proceeds into more detailed design, including the Phase 2 and Ultimate configurations outlined in **Chapter 7** and **Appendix G** (Operational Independence and Non-Concurrent Construction [OINCC]), VDOT will continue to assess design refinements and mitigation measures, in coordination with FHWA, to improve safety throughout the system, especially at the I-495/Route 267/Route 123 interchange complex. This is further documented in the OINCC in **Appendix G**.

10.5.3 Arterial Crash Prediction

Predicted crash frequencies were calculated for each of the 33 arterial intersections in the Traffic Operations Study Area. Predicted annual number of fatal, injury, and property damage only crashes were identified by location for future No Build and Build conditions. **Table 10-6** provides a summary of predicted crash frequencies for 2045 No Build and Build conditions. In 2045, all intersections have a nominal decrease or no change in crash frequencies from No Build to Build conditions. The predicted annual number of crashes is estimated to reduce by approximately 1 percent (1 PDO crash per year) when comparing arterial intersections under 2045 No Build and Build conditions for the entire Traffic Operations Study Area.

Table 10-4. 2045 Build Freeway Locations with Notable Increases in Crash Frequencies

Facility	Location	Mainline / Ramp	Total Crashes Per Year			Fatal/Injury Crashes Per Year			Notes	Applicable DE/DW	Geometric Constraints	Proposed Mitigations
			No Build	Build	Δ	No Build	Build	Δ				
I-495 NB Express Lanes	Ramp E1 (from Ramp GX to Ramp E3	Ramp	-	0.9	0.9	-	0.4	0.4	New ramp providing access to NB EXP extension (combined movements from EB DTR/DAAR/NB GP). Movement not provided in No Build condition.	DE-I (DE - 2020-27) - reduced horizontal curve radius and shoulder widths (to meet reduced 30 mph ramp design speed)	At the DTR interchange, Ramp E1 is located in a constrained area, providing access from eastbound DTR to northbound I-495 Express Lanes underneath several existing bridges. These bridges were constructed as part of the original 495 Express Lanes project and are in relatively new condition. For Ramp E1, the Design Exception is proposed because at the minimum required design speed of 35 mph, it would not be possible to meet the superelevation requirements. Furthermore, at 35 mph minimum design speed, it would be necessary to increase the shoulder width to provide a safe stopping sign distance. The alternate method to avoid this design exception is to rebuild these structures and relocate their substructural supporting elements, disrupting the revenue service on the 495 Express Lanes and significantly expanding the project scope. The proposed ramp design is expected to function in a manner similar to adjacent existing ramps (from eastbound DTR to northbound I-495 GP) because driver expectations and conditions will be similar to the current condition. Drive entry speed onto the ramps and into the ramp curves is not expected to change significantly, as in all cases, drivers will still leave a 60 mph design facility and enter a long 30 mph design speed ramp. The change in speed is on the downstream sig; therefore, drivers will need to wait until nearer the end of the ramp to accelerate onto the new 70 mph design speed facility.	Several forms of mitigations are anticipated. Ramp speed signs and horizontal curve warning signs with advisory speed plaques will be provided to effectively warn drivers of reduced speed conditions. These ramps will have roadway lighting, 24/7 camera monitoring by the Express Lanes Operation Center for incidents, and Express Assist mobile breakdown service to provide help in the event of an incident. Retro reflective barrier markings are also being considered to further improve safety and driver awareness.
	Ramp E1 (from Ramp E3 to Express Lanes Merge)	Ramp	-	2.9	2.9	-	1.3	1.3	New ramp providing access to NB EXP extension (combined movements from EB DTR/DAAR/NB GP + WB DTR). Movement not provided in No Build condition.			
	Ramp E1 (from DTR/DAAR to Ramp E4)	Ramp	-	5.0	5.0	-	1.3	1.3	New C-D road carrying trips from EB DTR+DAAR combined to NB EXP (new) and SB EXP (modified). Eliminates required upstream weaving for trips from EB DAAR to access I-495 Express Lanes. Ramp provides acces to both NB and SB Express (not counted twice)			
	Express Lanes NB north of on-ramp from Jones Branch Connector to location of No Build Express Terminus	Mainline	1.8	3.1	1.3	0.5	0.8	0.4	NB EXP Extension in Build scenario (terminates in No Build condition)			
	Express Lanes NB between No Build Express Terminus and No Build start of MD managed lanes	Mainline	-	8.0	8.0	-	2.1	2.1	NB EXP Extension in Build scenario (facility does not exist in No Build condition)	DW-R - proposed 50% of Lr (superelevation runoff) into curve as opposed to the standard of 1/3 of Lr into curve	The short tangent section between curves under Georgetown Pike and Live Oak Drive bridges prevents the Lr placement per VDOT standards. This DW is needed in order to adequately fit the Express Lanes between the GP lanes without significant additional right-of-way acquisition and environmental impacts.	Horizontal S-curve warning signs are anticipated to be evaluated during the final design process to warn drivers of downstream reverse curvature.
I-495 SB Express Lanes	Express Lanes SB between end of MD managed lanes and No Build Express Terminus	Mainline	-	8.0	8.0	-	2.3	2.3	SB EXP Extension in Build scenario (facility does not exist in No Build condition)			
	Express Lanes SB between No Build Express Terminus and off-ramp to Route 267	Mainline	0.7	2.3	1.6	0.2	0.6	0.4	SB EXP Extension in Build scenario (terminates in No Build condition)			
	Ramp XG (SB EXP to SB GP)	Ramp	-	0.8	0.8	-	0.3	0.3	New ramp providing access from SB EXP to SB GP. Movement not provided in No Build condition.			
	Ramp from I-495 SB EXP to Route 267 (DTR) WB	Ramp	1.4	3.5	2.1	0.5	1.3	0.8	Same ramp geometry as No Build but significant increase in volume in Build (900 vpd to 18,000 vpd)			
Dulles Toll Road	DTR WB weave between on-ramp from Route 123 SB and off-ramp to I-495 NB GP	Mainline	9.3	12.7	3.4	4.3	6.6	2.3	Weave distance has been shortened in Ultimate (not Phase 1) Build condition to accommodate Ramps G3 (EB DTR/DAAR to NB I-495 GP, widened and relocated) and G9 (C-D road carrying trips from Route 123 to NB I-495 GP)	DE-W - reduced weaving distance (on-ramp gore to off-ramp gore)	A reduced weaving distance along westbound DTR between the on-ramp from southbound Route 123 and the off-ramp to northbound I-495 GP (Ramp G10) is needed to accommodate the placement of Ramps G2, G9, and D4 and their supporting structural elements.	Additional warning signage is anticipated to be evaluated during the final design process to alert drivers of this short weave area and encourage through traffic to keep left.

Figure 10-26. Comparison of Access Changes Between the I-495 NEXT Ultimate Build and Conceptual No Build Configurations

Conceptual No Build Configuration **Ultimate Build Configuration**

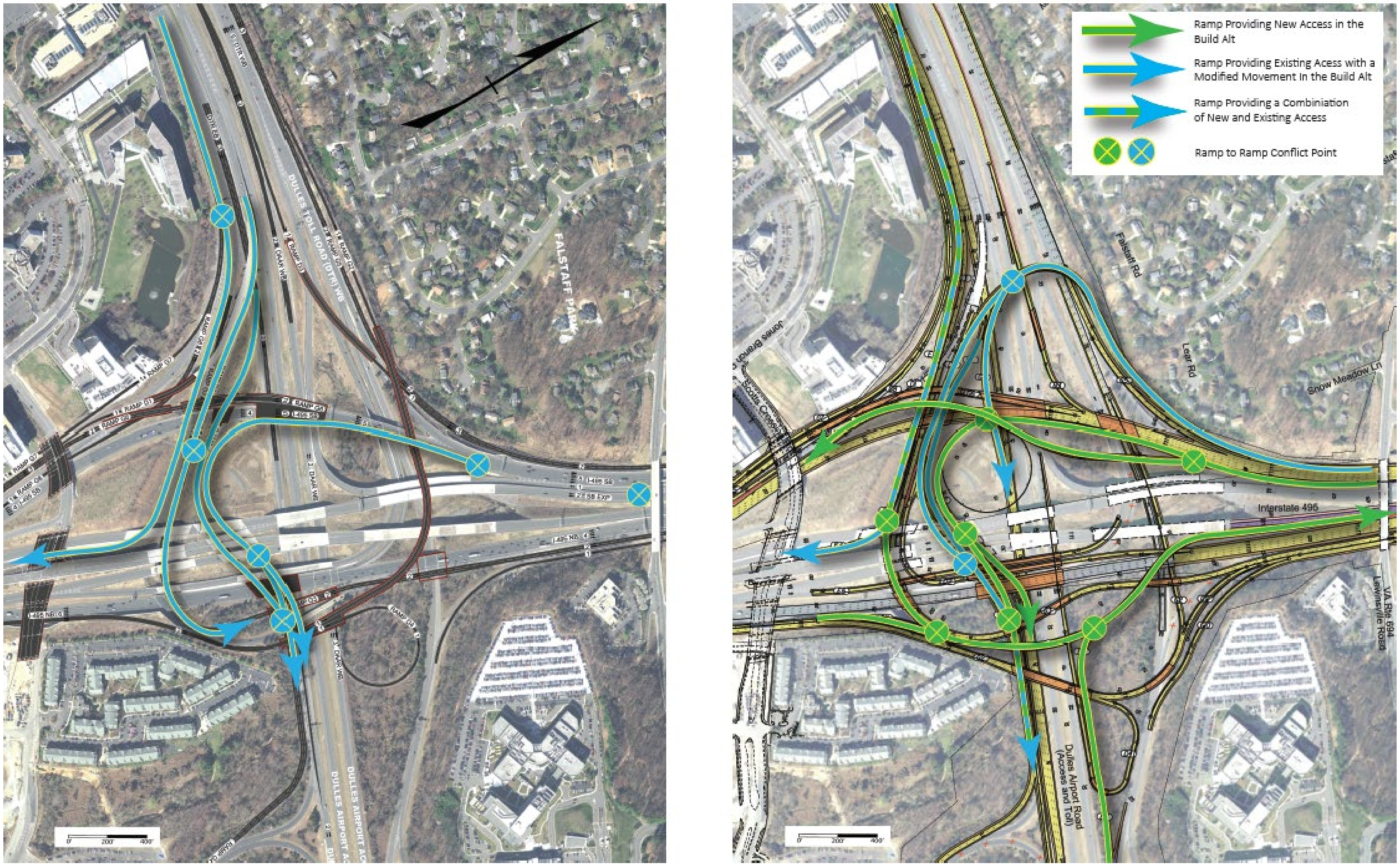


Table 10-5. 2045 Freeway Segment Predicted Crash Frequencies

Location	Predicted Annual Number of Fatal & Injury Crashes			Predicted Annual Number of Property Damage Only (PDO) Crashes			Predicted Annual Number of Total Crashes		
	2045 No Build	2045 Build	Difference	2045 No Build	2045 Build	Difference	2045 No Build	2045 Build	Difference
I-495 Interchange Areas (Includes GP Freeway Segments and All GP/Express Ramps)									
I-495 GP Interchanges with Route 123 and Route 267	58.7	62.1	3.4	137.4	111.4	-25.9	196.1	173.5	-22.5
I-495 GP Interchanges with Route 193 and GWMP	75.3	28.9	-46.4	188.4	66.5	-121.9	263.8	95.4	-168.4
I-495 NB General Purpose Lanes (GP Freeway Segments not within an Interchamge)									
I-495 GP NB from South of Route 123 to Route 267	0.9	0.4	-0.5	3.2	0.8	-2.4	4.1	1.2	-2.9
I-495 GP NB from Route 267 to the Interchanges with Route 193 and GWMP	7.7	6.0	-1.7	19.4	14.4	-5.0	27.1	20.4	-6.7
I-495 SB General Purpose Lanes (GP Freeway Segments not within an Interchange)									
I-495 GP SB from the Interchanges with Route 193 and GWMP to Route 267	9.3	7.2	-2.1	25.4	18.1	-7.3	34.7	25.3	-9.4
I-495 GP SB from Route 267 to South of Route 123	1.2	1.4	0.2	3.0	3.3	0.3	4.2	4.7	0.5
I-495 NB Express Lanes									
I-495 EL NB from South of Route 123 to the Route 267 Interchange	0.4	0.3	-0.1	1.0	0.7	-0.3	1.4	1.0	-0.4
I-495 EL NB within the Route 267 Interchange	3.7	6.6	2.9	7.0	11.7	4.8	10.7	18.4	7.7
I-495 EL NB from the Route 267 Interchange to the GWMP Interchange	0.0	1.7	1.7	0.0	4.5	4.5	0.0	6.2	6.2
I-495 EL NB through the GWMP Interchange to the VA/MD State Line (ALMB)	1.3	1.6	0.3	2.5	3.2	0.8	3.8	4.9	1.1
I-495 SB Express Lanes									
I-495 EL SB from the VA/MD State Line (ALMB) through the GWMP Interchange	2.2	4.2	2.0	3.4	6.7	3.3	5.6	10.8	5.2
I-495 EL SB from the GWMP Interchange to the Route 267 Interchange	0.0	1.6	1.6	0.0	4.1	4.1	0.0	5.6	5.6
I-495 EL SB within the Route 267 interchange	3.0	5.3	2.3	5.8	10.5	4.6	8.9	15.8	6.9
I-495 EL SB from the Route 267 Interchange to South of Route 123	0.4	0.3	-0.1	0.9	0.7	-0.2	1.3	1.0	-0.3
Route 267 (DTR) Interchange and Mainline Areas									
DTR Interchange with Spring Hill Road	5.5	5.0	-0.5	11.6	10.6	-1.0	17.1	15.6	-1.5
DTR Interchange with I-495 (*note: freeway mainline segments only)*	7.6	10.4	2.8	11.0	14.4	3.5	18.6	24.9	6.3
DTR Interchange with Route 123	14.3	15.8	1.5	20.8	19.7	-1.2	35.2	35.5	0.3
DTR EB/WB Segments East of Route 123	4.3	3.1	-1.2	6.7	6.3	-0.4	11.0	9.4	-1.6

Location	Predicted Annual Number of Fatal & Injury Crashes			Predicted Annual Number of Property Damage Only (PDO) Crashes			Predicted Annual Number of Total Crashes		
	2045 No Build	2045 Build	Difference	2045 No Build	2045 Build	Difference	2045 No Build	2045 Build	Difference
Route 267 (DAAR)									
DAAR EB (entire length of study area)	2.1	2.3	0.1	4.0	4.2	0.2	6.3	6.5	0.2
DAAR WB (entire length of study area)	1.5	1.6	0.1	2.5	2.6	0.1	4.0	4.2	0.2
Total Freeway and Ramp Segment Crashes	**199.5**	**165.7**	***-33.8***	**454.1**	**314.5**	***-139.6***	**653.7**	**480.2**	***-173.5***
% Difference			***-16.9%***			***-30.7%***			***-26.5%***
Total - I-495 GP Lanes and Interchange Ramps	153.1	106.0	-47.1	376.8	214.5	-162.2	529.9	320.5	-209.3
Total - I-495 Express Lanes	11.0	21.5	10.5	20.7	42.1	21.4	31.7	63.6	31.9
Total - Route 267 (DTR and DAAR)	35.4	38.2	2.8	56.6	57.9	1.2	92.2	96.1	3.9

Table 10-6. 2045 Arterial Intersection Predicted Crash Frequencies

Intersection	Predicted Annual Number of Fatal & Injury Crashes			Predicted Annual Number of Property Damage Only (PDO) Crashes			Predicted Annual Number of Total Crashes		
	2045 No Build	2045 Build	Difference	2045 No Build	2045 Build	Difference	2045 No Build	2045 Build	Difference
Intersection #1 - Anderson Rd/267 EB Off-ramp & Dolley Madison Blvd	5.8	5.9	0.1	9.9	10.0	0.1	15.7	15.9	0.2
Intersection #2 - Lewsinsville Rd & Balls Hill Rd	0.8	0.8	0.0	1.4	1.4	0.0	2.2	2.2	0.0
Intersection #3 - Dolley Madison Blvd & Lewinsville Rd/Great Falls St	4.0	4.0	0.0	6.7	6.8	0.1	10.7	10.8	0.1
Intersection #4 - Westpark Dr & 495 Exp. Lanes Connector	1.5	1.5	0.0	3.3	3.3	0.0	4.8	4.8	0.0
Intersection #5 - 495 Exp. Lanes Ramps & 495 Exp. Lanes Connector	0.9	1.0	0.1	1.8	1.9	0.1	2.7	2.9	0.2
Intersection #6 - Tysons Blvd & Chain Bridge Rd	3.4	3.5	0.1	6.0	6.1	0.1	9.4	9.6	0.2
Intersection #7 - Capital One Dr/Old Meadow Rd & Dolley Madison Blvd	3.1	3.1	0.0	5.5	5.4	-0.1	8.6	8.5	-0.1
Intersection #8 - Dolley Madison Blvd & Scotts Crossing Rd/Colshire Dr	3.4	3.4	0.0	6.0	6.0	0.0	9.4	9.4	0.0
Intersection #9 - Jones Branch Dr/Jones Branch Connector	1.1	1.1	0.0	2.1	2.1	0.0	3.2	3.2	0.0
Intersection #10 - 495 Exp. Lanes Ramps & Jones Branch Connector	0.4	0.4	0.0	0.8	0.8	0.0	1.2	1.2	0.0
Intersection #11 - Spring Hill Rd/International Dr & Jones Branch Dr	0.4	0.4	0.0	0.9	0.9	0.0	1.3	1.3	0.0
Intersection #12 - Spring Hill Rd & DTR EB Ramps	1.3	1.3	0.0	2.8	2.8	0.0	4.1	4.1	0.0
Intersection #13 - Spring Hill Rd & DTR WB Ramps	1.1	1.1	0.0	2.2	2.3	0.1	3.3	3.4	0.1
Intersection #14 - Spring Hill Rd & Lewinsville Rd	1.8	1.8	0.0	3.6	3.6	0.0	5.4	5.4	0.0
Intersection #15 - Spring Hill Rd & Old Dominion Dr	0.9	0.9	0.0	2.0	2.0	0.0	2.9	2.9	0.0
Intersection #16 - Old Dominion Dr & Swinks Mill Rd	0.9	0.9	0.0	1.9	1.8	-0.1	2.8	2.7	-0.1
Intersection #17 - Old Dominion Dr & Balls Hill Rd	0.8	0.9	0.1	1.8	1.9	0.1	2.6	2.8	0.2
Intersection #18 - Georgetown Pike & Balls Hill Rd	1.0	1.0	0.0	2.1	2.0	-0.1	3.1	3.0	-0.1
Intersection #19 - Georgetown Pike & 495 NB Ramp	1.2	1.0	-0.2	2.6	2.1	-0.5	3.8	3.1	-0.7
Intersection #20 - Georgetown Pike & 495 SB Ramp	3.1	2.8	-0.3	7.4	6.6	-0.8	10.5	9.4	-1.1
Intersection #21 - Dolley Madison Blvd & Old Dominion Dr	1.7	1.7	0.0	3.2	3.1	-0.1	4.9	4.8	-0.1
Intersection #22 - Georgetown Pike and Dead Run Dr	1.5	1.6	0.1	2.2	2.2	0.0	3.7	3.8	0.1
Intersection #23 - Georgetown Pike & Helga Place/Linganore Dr	0.8	0.8	0.0	1.3	1.2	-0.1	2.1	2.0	-0.1
Intersection #24 - Georgetown Pike & Swinks Mill Rd	1.0	0.9	-0.1	1.9	1.8	-0.1	2.9	2.7	-0.2
Intersection #25 - Georgetown Pike & Spring Hill Rd	0.6	0.6	0.0	0.8	0.7	-0.1	1.4	1.3	-0.1
Intersection #26 - Lewinsville Rd & Swinks Mill Rd	0.7	0.7	0.0	1.1	1.1	0.0	1.8	1.8	0.0
Intersection #27 - Dolley Madison Blvd & Ingleside Ave	2.8	2.8	0.0	3.6	3.6	0.0	6.4	6.4	0.0
Intersection #28 - Georgetown Pike & Douglass Dr	1.5	1.6	0.1	2.1	2.2	0.1	3.6	3.8	0.2
Intersection #29 - Jones Branch Connector & Capital One Dr (West)	1.5	1.5	0.0	2.9	2.9	0.0	4.4	4.4	0.0
Intersection #30 - Jones Branch Connector & Capital One Dr (East)	0.6	0.6	0.0	1.2	1.2	0.0	1.8	1.8	0.0
Intersection #31 - Chain Bridge Rd & 495 SB Off-Ramp	3.7	3.7	0.0	9.0	8.8	-0.2	12.7	12.5	-0.2
Intersection #32 - Dolley Madison Blvd & 495 NB Off-ramp	1.5	1.5	0.0	3.3	3.2	-0.1	4.8	4.7	-0.1
Intersection #33 - Dolley Madison Blvd & 267 EB On-Ramp	3.5	3.4	-0.1	8.2	8.2	0.0	11.7	11.6	-0.1
Total	***58.3***	***58.2***	***-0.1***	***111.6***	***110.0***	***-1.6***	***169.9***	***168.2***	***-1.7***

10.6 FUTURE SAFETY CONSIDERATIONS – NO BUILD AND BUILD

Based on the results of the No Build safety analyses conducted for this project, there are corridor-wide and interchange-specific geometric and safety deficiencies that warrant improvement in both the No Build and Build conditions. Since the Build Alternative will not be implemented in its entirety when the first phase of construction is completed, the considerations identified in the following sections should be taken into account when design concepts are prioritized for future phases of construction.

10.6.1 Signing and Pavement Markings

Signing and pavement markings are features that must clearly communicate important messages to drivers who may be unfamiliar, distracted, or slow to respond. Both the existing and proposed design alternatives include a mixture of left- and right-hand ramps, lane drops, and widely varying interchange types, which also contribute to potential driver confusion. No direct safety performance measure allows a calculation of expected reduced crashes associated with treatments that address these types of issues; however, there is a strong body of research that describes driver workload and relates undesirable driver behavior (unnecessary or abrupt lane changing, braking, etc.) to freeways with such features.

A project design that meets design standards must still provide crucial guidance elements where conditions defy driver expectation or present an overload of information to the driver. Positive guidance is based on the principle that the road environment is designed and operated to increase the likelihood of correct and timely responses from the user. An overall corridor signing and pavement marking plan will be an essential element of the preferred design concept and will have a significant influence on effectiveness of the design with regards to safety. An effective plan will provide sequential messages that provide appropriate prioritization clues to the driver including the spread of information into small and manageable chunks that are uniform and repetitive.

10.6.2 Design for Merging and Diverging Areas

In multiple existing locations, ramp merge and diverge areas were observed as being abrupt and shorter than current design policy or are not the most appropriate type of terminal for the given conditions, often due to constrained conditions or outdated designs. These locations represent potential safety-based project improvements that should be considered with any design alternative. Designing for acceleration and deceleration of vehicles on ramps is one feature for which there is a basis for calculating a crash-reduction benefit associated with lengthening either condition. Both the current HSM as well as the ISATe include models that allow for calculation of a benefit.

10.6.3 Interchange Geometry and Configuration

Design elements of interchange geometry and ramp configuration are recognized as features that influence safety performance of a freeway. Specifically, the following conditions were observed at numerous locations along I-495:

- Weaving sections both within and between interchanges not protected by C-D roads.
- Left exits defy driver expectation and require special attention to mitigate for potential safety implications of this condition.

Designing the environment in such a way that it conforms to the long-term expectancies of a driver (such as exits from a freeway always being to the right) reduces the chance of driver error and, subsequently, crashes. The HSM and the ISATe include methods for evaluating the crash-reduction benefits associated with ramp alignment, weaving segment length, ramp spacing, and ramp location (left vs. right). These tools can be used not only in this documentation to evaluate the No Build and Build alternatives but also as part of the design refinement and design exception review process.

10.6.4 Recurring Congestion

Spikes in rear-end and sideswipe same-direction crashes were observed at several locations where no readily apparent roadway alignment, cross section, ramp design, or signing issues were observed, especially in the northbound direction approaching the ALMB. Based on field reviews and traffic data, the study team concluded that such spikes were mainly attributable to recurring congestion – degradation in flow downstream due to a bottleneck.

The expected safety performance of freeway segments operating under recurring congestion, including number of hours of congestion, is an important metric that will be considered in the continued development of the I-495 corridor and future phase of construction.

10.6.5 Mainline Shoulders

A section of the northbound I-495 GP lanes in the Existing and No Build condition includes hard shoulder running in the northbound direction – allowing general traffic to use the shoulder during peak periods. This is considered an effective method of congestion mitigation, particularly where traffic peaking is limited to a well-defined period of the day and right-of-way is limited. While the concept itself may present benefit to operations and safety, hard shoulder running also presents challenges to safety by limiting the width to enable routine enforcement and maintenance activities. The safety benefits of full shoulders include their effect on accessing a crash scene and providing necessary medical assistance. Indirect safety benefits also can be estimated based on the ability to conduct regular traffic enforcement along I-495 for drivers under the influence of alcohol, restraint use, commercial vehicle inspection, distracted driving, and speeding.

Enforcement needs should be considered where hard shoulder running is implemented. This will mean assuring that shoulders will be free of traffic during off-peak periods (evenings, weekends) when enforcement actions will be most effective, and that provisions are in place for enforcement and emergency access during periods when hard shoulder running is permitted. VDOT, the Concessionaire, and the selected design-build contractor will coordinate and plan traffic operations during continued hard shoulder running such that the State Police's enforcement activities can be conducted safely.

10.7 FUTURE SAFETY ANALYSIS CONCLUSIONS

Planning-level crash prediction analysis was performed using industry-standard practices and highway safety analysis tools. This analysis evaluated the safety performance of the existing condition and assessed the differences the 2045 No Build and Build alternatives. This evaluation considered all locations within the I-495 NEXT Traffic Operations Study Area affected by changes in geometry or forecasted volumes: interchanges, freeway segments, ramp segments, and key arterial intersections. Both qualitative and quantitative analyses were conducted to evaluate No Build and Build conditions in the I-495 NEXT corridor between Route 7 and the ALMB. The safety analyses focused on the network as a system, including mainline segments, ramps, collector-distributor roads, intersections, and arterials.

The results of the safety analysis showed that the crash rate for the northbound GP lanes is much worse than the corresponding southbound GP lanes, with a crash rate approximately 100 percent higher than the statewide crash rate and injury crash rate 25 percent higher than the statewide injury crash rate. The predominant types of crashes are Rear-End and Same-Direction Side-Swipe crashes, which are influenced by the severe recurring traffic congestion. These types of crashes are prominent in congested corridors. At the same time, the crash rates in the existing Express Lanes south of Old Dominion Drive (in both directions) are much lower than statewide crash rate, which can be attributed to the reduced congestion and improved LOS offered to commuters using the Express Lanes.

For 2045 conditions, the Build alternative is projected to reduce the overall number of crashes along the corridor. In particular, a significant reduction in crashes is expected in the GP lanes in the areas near the Route 193 and GWMP interchanges. The Build condition produces significant overall safety benefits as compared to No Build conditions by efficiently moving a greater volume of traffic with significantly reduced congestion in both directions of the I-495 corridor. With the full Express Lanes network extended into Maryland, it is anticipated that the corridor will operate at a much-improved level of safety as compared to No Build conditions. Comprehensively, the project is a significant improvement in overall safety.

11. ADDITIONAL SUPPORTING INFORMATION

11.1 PROCUREMENT METHOD AND FUNDING SOURCE

The delivery method selected for Phase 1 of the project (implemented by 2025 per Section 13.3 below) is Design/Build-Finance-Operate-Maintain (DBFOM). As part of the Public-Private Partnership (P3) between the Department and Capital Beltway Express (The Concessionaire), funding will be in accordance with the terms of the Comprehensive Agreement amendment for the I-495 NEXT project between the Department and the Concessionaire.

The Department is developing a financial plan for the I-495 NEXT project. According to Federal Code 23 U.S.C. 106(h)(3)(C), a financial plan "may include a phasing plan that identifies fundable incremental improvements or phases that will address the purpose and the need of the project in the short term, in the event there are insufficient financial resources to complete the entire project. If a phasing plan is adopted for a project pursuant to this section, the project shall be deemed to satisfy the fiscal constraint requirements in the statewide and metropolitan planning requirements in sections 134 and 135." The I-495 NEXT elements are being delivered as a P3 project and are included in the MPO's Constrained Long-Range Plan as phased in over time between 2025 and 2045.

A combination of improvements to the Express Lanes, the general purpose lanes, and future ramp connections will be necessary, some of which can be implemented in the near term, while others can be realized over a longer term. Because all of these improvements cannot be implemented simultaneously, a tiered project development process provides for phased implementation of a set of improvements as independent elements of an overall long-term program of project phases. Accordingly, VDOT has used the NEPA and IJR planning efforts and findings to frame the elements of the I-495 NEXT project, which represents a combination of conceptual improvements over the 3-mile long corridor. These improvements account for the impacts to and from the proposed Maryland 495 Managed Lanes system, as part of MDOT's Traffic Relief Plan for the Capital Beltway and I-270, which, if approved, is anticipated to open a few years following I-495 NEXT Phase 1. Some southbound ramp movements at the DTR interchange and mainline southbound capacity enhancements are proposed as phased accordingly, and account for subsequent changes in traffic coming from Maryland via the ALB once the bridge is widened and interstate capacity is increased on the Capital Beltway north of GWMP.

The traffic analysis included in the I-495 NEXT IJR for the design year 2045 was based on the Preferred Alternative that was identified in the EA and will be considered for approval by FHWA in a FONSI. For the interim year 2025, the traffic analysis was based on the RFP Conceptual Plans for Phase 1. Based on the results of both horizon year analyses, average speeds in the general purpose lanes of I-495 were equal to or above the existing speeds for the AM and PM peak periods between the Dulles Toll Road and the northern limits of the study area.

Results from the operational analysis indicate that future vehicular demand can be served by the overall corridor capacity for the 2025 interim year, and that additional capacity associated with future auxiliary lanes and ramps will not be required immediately, but will be needed by the 2045 design horizon. The first phase of the I-495 NEXT project satisfies criteria for phasing in FHWA's Major Project Financial Plan Guidance, in that it "*can be opened to the public and effectively operated without the completion of subsequent segments or other additional transportation investments*." The decision to adopt a phasing plan for the I-495 NEXT project was coordinated with FHWA. The Phase 1 project extents shown in the RFP Conceptual Plans can serve as an operationally sufficient stand-alone project, independent of the ultimate Preferred Alternative.

The Developer will be required to complete an updated traffic study and corresponding IJR Reevaluation based on their negotiated project scope, if project elements in their design-build contract scope differ from the approved IJR and NEPA decision. If necessary, the IJR Reevaluation will include projected 2025 and 2045 traffic volumes and operational and safety analyses associated with the proposed configuration, as defined in the final executed Comprehensive Agreement, or as modified through the Alternative Technical Concepts process defined in the Agreement. This analysis may identify locations where improvements may be necessary prior to 2045. Following the completion of the IJR Reevaluation for the negotiated project scope (if required), VDOT will review these potential locations, and perform analyses, if necessary, to determine an appropriate course of action for future mitigation measures.

For funding of Phase 2 and improvements beyond Phase 2 – the 2045 Ultimate Configuration (or Ultimate Phase), the Department anticipates an array of potential funding sources, to include conventional federal-aid and local sources, potentially utilizing non-traditional federal funding programs such as TIFIA, as well as tolling, private sector debt, and equity.

Once negotiations with the Concessionaire are complete and the funding sources are defined to fully fund the project, the Department will work with the National Capital Region Transportation Planning Board to amend the Transportation Improvement Program (TIP) to include full funding for the next (i.e., post-NEPA) phase of the project based on the financial terms agreed between the Department and the private sector. Once the TIP is amended, the Department will coordinate with FHWA to confirm that funding for the next phase of the project is also included in the Statewide Transportation Improvement Program.

11.2 PROJECTED CONSTRUCTION SCHEDULE

Construction of Phase 1 of the I-495 NEXT project is anticipated to begin in 2021. Following a construction duration of approximately 36 months, revenue (tolling) operations are projected to being in late 2024, with final project completion occurring 4 - 6 months later.

The bar chart below indicates the potential phasing for the project. Based on the FHWA guidance under Operationally Independent and Non-concurrent Construction (OINCC) projects, VDOT believes that the I-495 NEXT project phasing satisfies all three criteria to be considered an OINCC Project:

1. The initial portion of the I-495 NEXT project does not require the remainder of the overall project for the Preferred Alternative to be completed in order to operate reasonably in the future, as indicated by the operational analysis results.
2. The time period between completion of the operationally independent and non-concurrent construction project (Phase 1 completed by 2024) and the start of construction for a subsequent phase will be at least 5 years (i.e. no earlier than 2030 for any interim phases of the ultimate Preferred Alternative). An example of an interim phase project would be the proposed southbound 495 Express Lanes ramp to Dulles Connector Road (Route 267) inside the Capital Beltway and the southbound auxiliary lane between Georgetown Pike and the Dulles Toll Road interchanges.

3. The time period between commencement of construction for the initial operationally independent and non-concurrent construction project (Phase 1 initiated by late 2021) and commencement of construction for the final portion of the overall project exceeds 20 years (i.e. no earlier than 2041 for construction of the final remaining element(s) of the ultimate Preferred Alternative). An example of a final phase project would be the flyover ramps from the right side of the general purpose lanes to the Dulles Toll Road and Dulles Connector Road.

Table 11.1 Potential Project Phasing Timeline for I-495 NEXT

Activity / Phase	2021-2024	2024-2029	2029-2034	2034-2041	2041-2045
Phase 1 (Project NEXT RFP Plans)					
Phase 2 (to begin no earlier than 5 years after Phase 1)					
Final Phase (to begin no earlier than 20 years after 2021)					

Additional details for project phasing and non-concurrent construction are included in the OINCC determination and phasing letter in **Appendix G**.

11.3 RAMP IMPROVEMENTS PHASING

As outlined in **Chapter 6** of this document, the Build Alternative would provide direct access to and from the Express Lanes at the two system interchanges within the project limits. Due to the size, complexity, and cost of the Build Alternative, the Department has elected to phase the project for certain interchange access ramps. The phasing was determined based on a high-level needs assessment and prioritization evaluation, taking into consideration the influence of, and impacts on, other projects overlapping with or adjacent to the 495 NEXT project (including I-495 manage lanes system improvements being built by Maryland and improvements by others at the Dulles Toll Road). In summary, the following direct connection ramps to / from the 495 Express Lanes are accommodated in Phase 1, to be constructed and open to traffic by 2025:

- New Express Lanes access to and from Route 267:
  - Eastbound Route 267 (Dulles Toll Road (DTR)) to northbound I-495 Express
  - Westbound Route 267 (Dulles Connector Road (DCR)) to northbound I-495 Express
  - Note that the southbound I-495 Express to westbound Route 267 (DTR) movement is already provided today; additionally, the northbound I-495 Express to westbound Route 267 (DTR) and eastbound Route 267 (DTR) to southbound I-495 Express movements are also provided today.
- New Express Lanes access to and from GWMP:
  - Northbound I-495 Express to GWMP

- GWMP to southbound I-495 Express

Note that the proposed Maryland managed lanes system (assumed to be in place under the Build or No Build conditions) would provide access to the movements from GWMP to northbound I-495 Express and from southbound I-495 Express to GWMP. Justification for these ramps will be provided under a separate NEPA and IJR process being advanced by MDOT-SHA and the Maryland Division Office of FHWA.

Later phases of the project would entail construction of additional Express Lanes connections:

- Phase 2: Southbound I-495 Express to eastbound Route 267 (DCR). This movement would tie into an eastbound C-D road along Route 267 at the Route 267/Route 123 interchange, allowing access to both the eastbound DCR and Route 123.
- Ultimate Phase: Flyover exchange ramps to provide access from the northbound I-495 GP lanes to the northbound I-495 Express Lanes, and from the southbound I-495 Express Lanes to the southbound I-495 GP lanes. These exchange ramps would be located at the Route 267 interchange.

Figure 11-1 provides an overview of the proposed phasing for the project, consistent with displays presented at previous I-495 NEXT project public information meetings, and as presented at the Location and Design Public Hearing for the project.

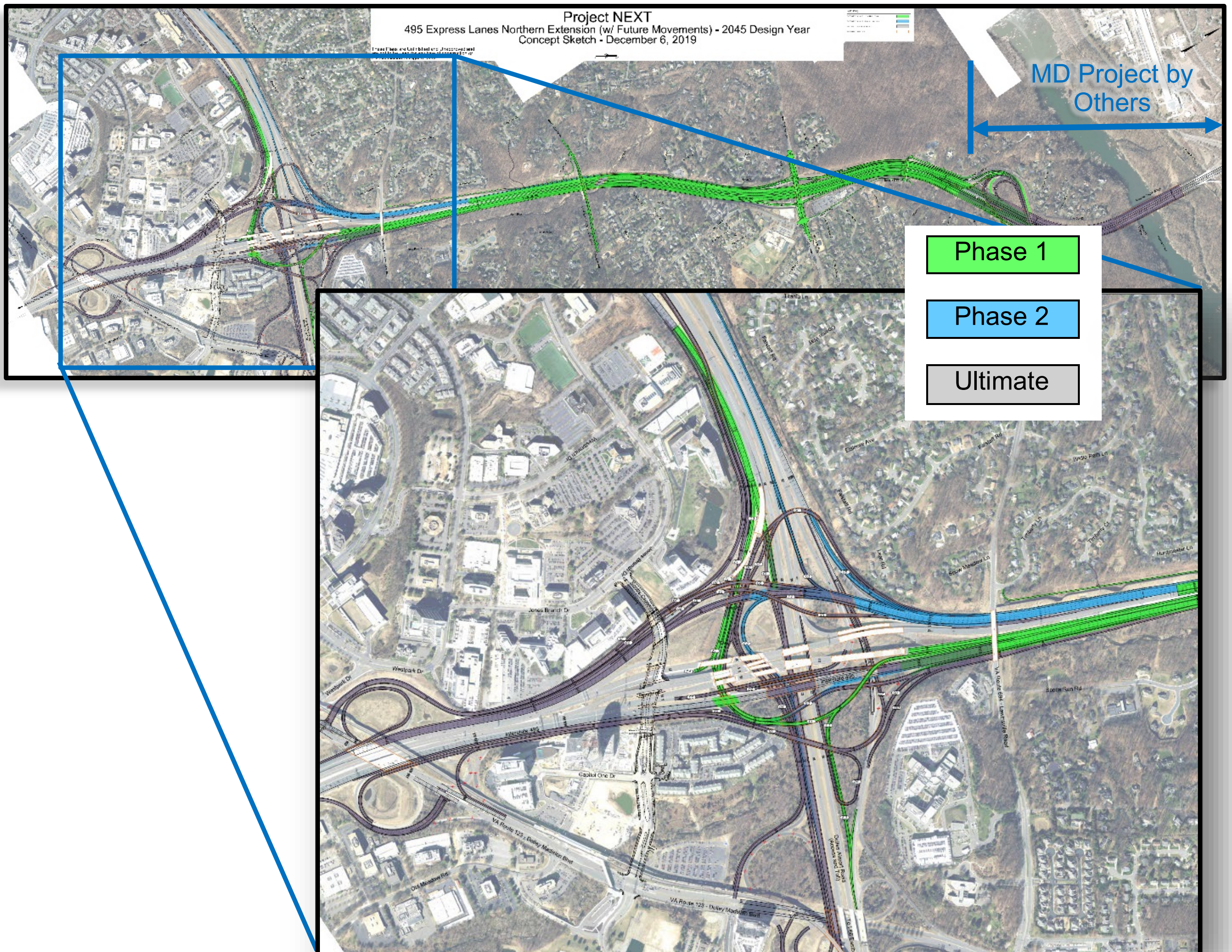


Figure 11-1. I-495 NEXT Phase 1, Phase 2, and Ultimate Phase of the Build Alternative

11.3.1 Route 267 Interchange

In addition to changes in access for the 495 Express Lanes movements, the Build Alternative includes modifications to several of the general purpose (GP) ramp connections. Individual Ramp movements to be phased are described are color-coded by phase below and can be seen in detail in **Exhibit 11-1**. Phase 1 is coded green, Phase 2 is coded in blue, and the Ultimate Phase is coded in grey. "Modified Access" refers to movements which are provided under the existing interchange configuration, while "Additional Access" refers to movements which are not provided under the existing interchange configuration. All access provided in the existing interchange configuration is maintained in some form through all phases of the Build Alternative. Proposed changes in access include modified and additional access for the following ramps:

General Purpose Lanes Ramps

- **G1**—Ramp G1 is a one-lane ramp which provides Modified Access from southbound I-495 GP lanes to eastbound DTR. Ramp G1 also provides access to Route 123 at the Route 267/Route 123 interchange via a connection to ramp D2 and subsequent connection to ramp G4.
- **G2**—Ramp G2 provides Modified Access from northbound I-495 to westbound DTR with one-lane of capacity. Ramp G2 also provides access from Route 123 at the I-495/Route 123 interchange via the proposed C-D road system at that interchange.
- **G3**—Ramp G3 is a two-lane ramp which provides Modified Access from eastbound DTR to northbound I-495 GP lanes. Ramp G3 would be extended to combine with ramps G10 and G9 about before tying into northbound I-495 GP lanes about 0.6 miles downstream of the existing tie in point.
- **G4**—Ramp G4 provides Modified Access from eastbound DTR to the Route 123 C-D road at the Route 267/Route 123 interchange. Ramp G4 also provides access to the Route 123 C-D from eastbound DAAR via a connection from ramp D2.
- **G5**—Ramp G5 is a two-lane ramp which provides Modified Access from southbound I-495 GP lanes to westbound DTR.
- **G6**—Ramp G6 provides Modified Access from southbound I-495 GP lanes to the proposed Route 123 C-D road at the I-495/Route 123 interchange with one-lane of capacity.
- **G7**—Ramp G7 is a one-lane ramp which provides Modified Access from eastbound DTR to the propose Route 123 C-D road at the I-495/Route 123 interchange.
- **G8**—Ramp G8 is a one-lane ramp which provides Modified Access from eastbound DTR to southbound I-495 GP lanes.
- **G9**—Ramp G9 is a one-lane ramp which provides Modified Access from the Route 123 C-D road at the I-495/Route 123 interchange to northbound I-495 GP lanes (provided access to the northbound GP lanes from Route 123). Ramp G9 is provided via a connection from ramp G2 to combined ramps G3 and G10.
- **G10**—Ramp G10 is a one-lane ramp which provides Modified Access from westbound DTR to northbound I-495. The Ramp G10 tie-in to I-495 general purpose lanes is provided via a connection from the westbound DTR mainline to ramp G3.

Dulles Airport Access Road Ramps

- **D1**—Ramp D1 provides Modified Access from eastbound DAAR (indirectly via eastbound DTR) to southbound I-495 GP lanes with one-lane of capacity.
- **D2**—Ramp D2 provides Modified Access from eastbound DAAR to northbound I-495 GP lanes with one-lane of capacity.
- **D3**—Ramp D3 is a one-lane ramp which provides Additional Access from southbound I-495 GP lanes to westbound DAAR.

- **D4**—Ramp D4 is a one-lane ramp which provides Additional Access from northbound I-495 GP lanes to westbound DAAR.

General Purpose Lanes – Express Lanes Exchange Ramps

- **GX**—Ramp GX is a one-lane ramp which provides Additional Access from northbound I-495 GP lanes, from and Route 123 at the I-495/Route 123 interchange, to northbound I-495 Express Lanes. Ramp GX would be provided via a connection from ramp G2 to ramp E1.
- **XG**—Ramp XG is a one-lane ramp which provides Additional Access from southbound I-495 Express Lanes to southbound I-495 GP lanes. Ramp XG would be provided via flyover ramp connecting ramp E2 to ramp D1.

Express Lanes Access Ramps

- **E1**—Ramp E1 provides Modified Access from eastbound DTR and eastbound DAAR to northbound and southbound I-495 Express Lanes, with one lane of capacity to each Express Lane facility. Modified Access from eastbound DTR and eastbound DAAR would be provided via a C-D road which collects traffic from the DTR and DAAR upstream of the Route 267 interchange and then flies over eastbound DTR.
- **E2**—Ramp E2 is a one-lane ramp which provides Additional Access from southbound I-495 Express Lanes to eastbound DCR and Route 123 inside the Beltway.
- **E3**—Ramp E3 is a one-lane ramp which provides Additional Access from westbound DCR to northbound I-495 Express Lanes. Ramp E3 merges with ramp E1 before tying into northbound I-495 Express Lanes.
- **E5**—Ramp E5 is a one-lane ramp which exists today, but which provided Modified Access from northbound I-495 Express Lanes to westbound DTR and DAAR. This ramp would be slightly shifted and slightly reconfigured to accommodate Ramp D2.

11.4 CONCEPTUAL SEQUENCE OF CONSTRUCTION AS DESIGN-BUILD PROJECT

Due to the nature of the project as a design-build and a privately funded project, the ultimate sequence of construction will be developed by the Concessionaire's Design-Build Contractor. In order to maintain four lanes of traffic capacity on I-495, the Department and the Concessionaire anticipate that the project will be accomplished by widening the corridor to the outside between Lewinsville Road and George Washington Memorial Parkway, shifting all of the existing General Purpose lanes outward, and then constructing the Express Lanes to the inside. New ramp construction at the Dulles Toll Road interchange at the George Washington Memorial Parkway will likely occur simultaneously with widening of the I-495 mainline, or shortly thereafter. The following bridges must be replaced or widened in order to provide adequate width for the mainline cross section, prior to completion of the I-495 widening and shifting of the General Purpose lanes to the outside:

- Old Dominion Drive overpass (replacement)
- Georgetown Pike overpass (replacement)
- Live Oak Drive overpass (replacement)

- I-495 General Purpose lanes over eastbound Dulles Toll Road on-ramps (replacement)
- I-495 General Purpose lanes over Scott's Run (widening)

11.5 PRELIMINARY SIGNING PLAN

A preliminary signing plan for the General Purpose lanes and the Express Lanes was created for Phase 1 of the project. Where feasible, the type and location of signs were developed according to the MUTCD and the VDOT supplement to the MUTCD. Design development and constraints were coordinated with FHWA, VDOT Central Office, as well as with the Metropolitan Washington Airports Authority (for signing along the Dulles Toll Road and Dulles International Airport Access Highway), and with the National Park Service (for signing along or approaching the George Washington Memorial Parkway (GWMP)). Special focus was given to balancing the requirements of the MUCTD while retaining the visual setting and features of the GWMP.

Due to the historic designation of the GWMP, and the contributing views along the corridor, the location and frequency of dynamic message signs for advance toll pricing signs on the GWMP was iteratively refined and optimized as part of the Section 106 consultation process with Virginia Department of Historic Resources – State Historic Preservation Office (DHR--SHPO), the National Capital Region Office of the National Park Service, and the GWMP Superintendent's Office. DMS signing for the south-facing ramps at the GWMP to and from Virginia were located outside of the park boundaries, in order to allow for a determination of No Adverse Effect by DHR-SHPO, and to be consistent with a Section 4(f) *de minimis* determination by FHWA. The preliminary signing plan is shown in roll plot format in **Appendix C**. More details on proposed signing are included as part of the RFP Conceptual Plans in **Appendix F** (included as a separate volume attached by reference).

11.6 INFORMATION ON COMPREHENSIVE AGREEMENT, PERFORMANCE MEASURES, TECHNICAL REQUIREMENTS, AND CONCEPT OF OPERATIONS

The current Comprehensive Agreement between the Department and the Concessionaire for the existing I-495 Express Lanes (executed December 2007) is located here: http://www.p3virginia.org/projects/i-495-express-lanes/. It will be amended and restated to incorporate the I-495 NEXT project based on pending commercial negotiations between the Department and the Concessionaire.

More information on the project procurement and agreement process for the I-495 NEXT project can be found at the Virginia Public-Private Partnerships (VAP3) website:
https://www.p3virginia.org/projects/495-next/.

The Concessionaire is currently completing a competitive solicitation process to select a design-build contractor for the I-495 NEXT project. Additional details and current status of this procurement process can are available on the Concession's website:
https://expresslanes.com/NEXT-procurement.

Upon contract award, this contractor will be responsible for the design and construction of the project in accordance with the technical requirements established by the Department and the Concessionaire.

Performance measures and technical requirements for the existing I-495 Express Lanes are addressed in the original Comprehensive Agreement Technical Requirements (Exhibit N) found here: https://www.p3virginia.org/wp-content/uploads/2015/12/1.-ARCA-Exhibit-N.pdf. Performance measures for the I-495 NEXT project are anticipated to be consistent with those of the existing system, unless modified by the parties in the pending Comprehensive Agreement amendment. Updated technical requirements specific to the I-495 NEXT project are currently being finalized and will be incorporated into the pending Comprehensive Agreement amendment.

The operating requirements for the existing I-495 Express Lanes are addressed in Sections 4.1 through 4.6 of the Technical Requirements (Exhibit N) of the Comprehensive Agreement, and the current Concept of Operations includes the documents listed below:

- Concept of Operations - Tolling and Enforcement
- Concept of Operations - Operations and Traffic Management
- Concept of Operations - Maintenance

The Concept of Operations for the existing I-495 Express Lanes will be updated by the Concessionaire, in partnership with the Department, to address and incorporate the I-495 NEXT project. The revised Concept of Operations will address any new project-specific elements and outline how the complete 495 Express Lanes will be operated as a single, integrated facility. With regard to tolling, this includes:

- Tolling for non-HOV-3 vehicles is 24 hours per day, seven days per week
- Tolling concept uses dynamic pricing based on variable traffic conditions in the Express Lanes, as determined by the Concessionaire
- HOV-3 vehicles are exempt from tolling when using an EZPass-FLEX Transponder switched to HOV mode
- Tolling collection is exclusively via overhead toll gantries with automated enforcement, augmented by manned Virginia State Police vehicles

No substantive changes to existing operating policies and maintenance procedures are anticipated with the implementation of the I-495 NEXT project. Additional details on the structure and contents of the pending updates to the Concept of Operations are provided in **Appendix J**.

APPENDICES AND ATTACHMENTS

Attachment 1 – Traffic and Transportation Technical Report (Under Separate Cover)

Appendix A – Environmental Assessment, Chapter 1

Appendix B – Letters of Support

Appendix C – Preliminary Signing Plans

Appendix D – MWCOG Congestion Survey Results and Aerials (Provided Electronically)

Appendix E – Alternatives/Interchange Options Development Memorandum

Appendix F – Conceptual Plans (October 2020 Design Public Hearing Plans – Under Separate Cover)

Appendix G - Operationally Independent and Non-Concurrent Construction (OINCC) & Proposed Phasing Letter

Appendix H – Traffic Models (Provided Electronically)

Appendix I – Detailed Queueing Results

Appendix J – Concept of Operations

Appendix K – Covid-19 Sensitivity Analysis

VDOT

I-495 Express Lanes Northern Extension (NEXT)

Interchange Justification Report Exhibits

495 ExpressLanes
NORTHERN EXTENSION

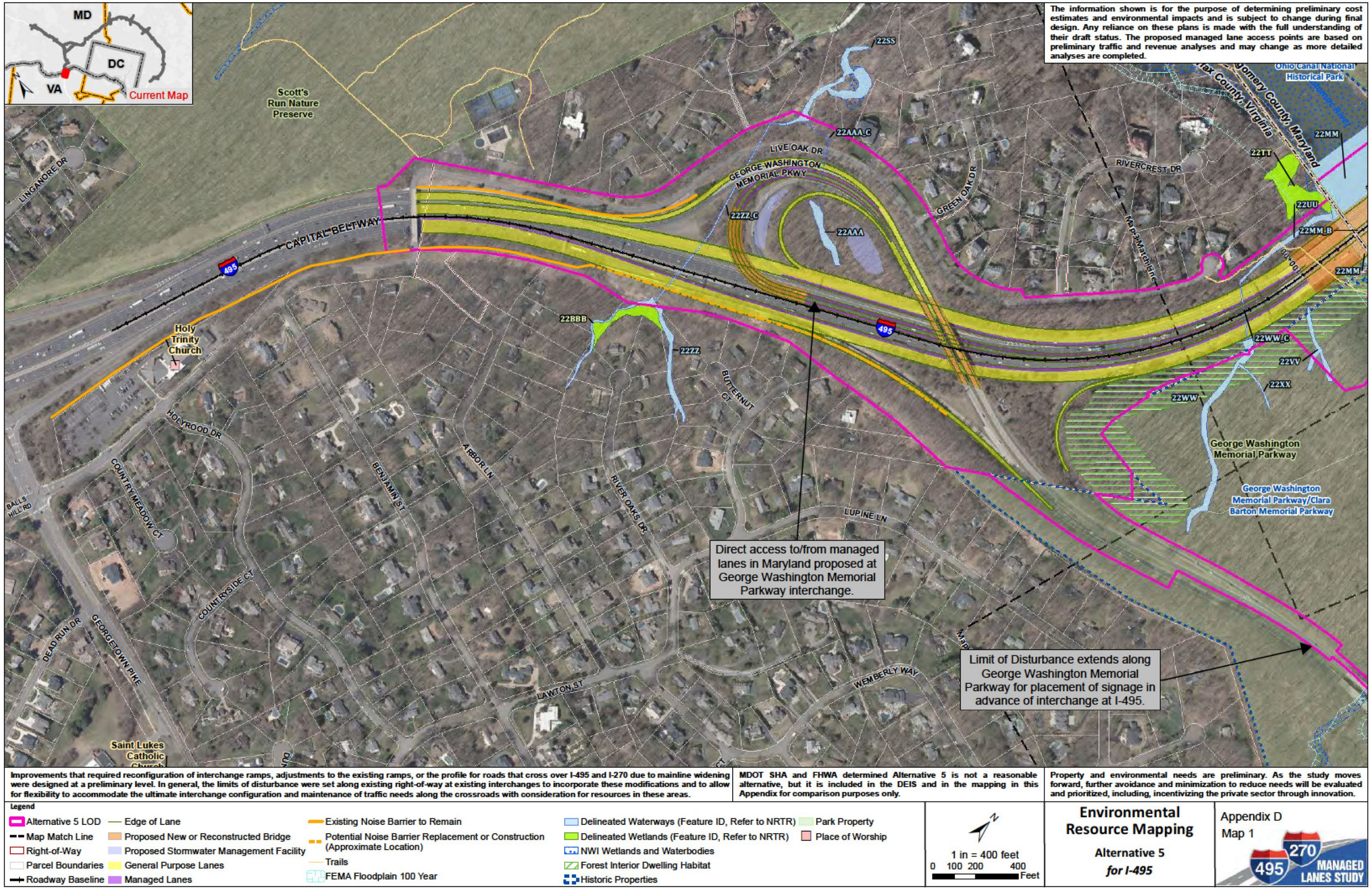


Exhibit 6-1. Project NEXT No Build Geometry at GWMP Interchange and Maryland Managed Lanes Project in Place

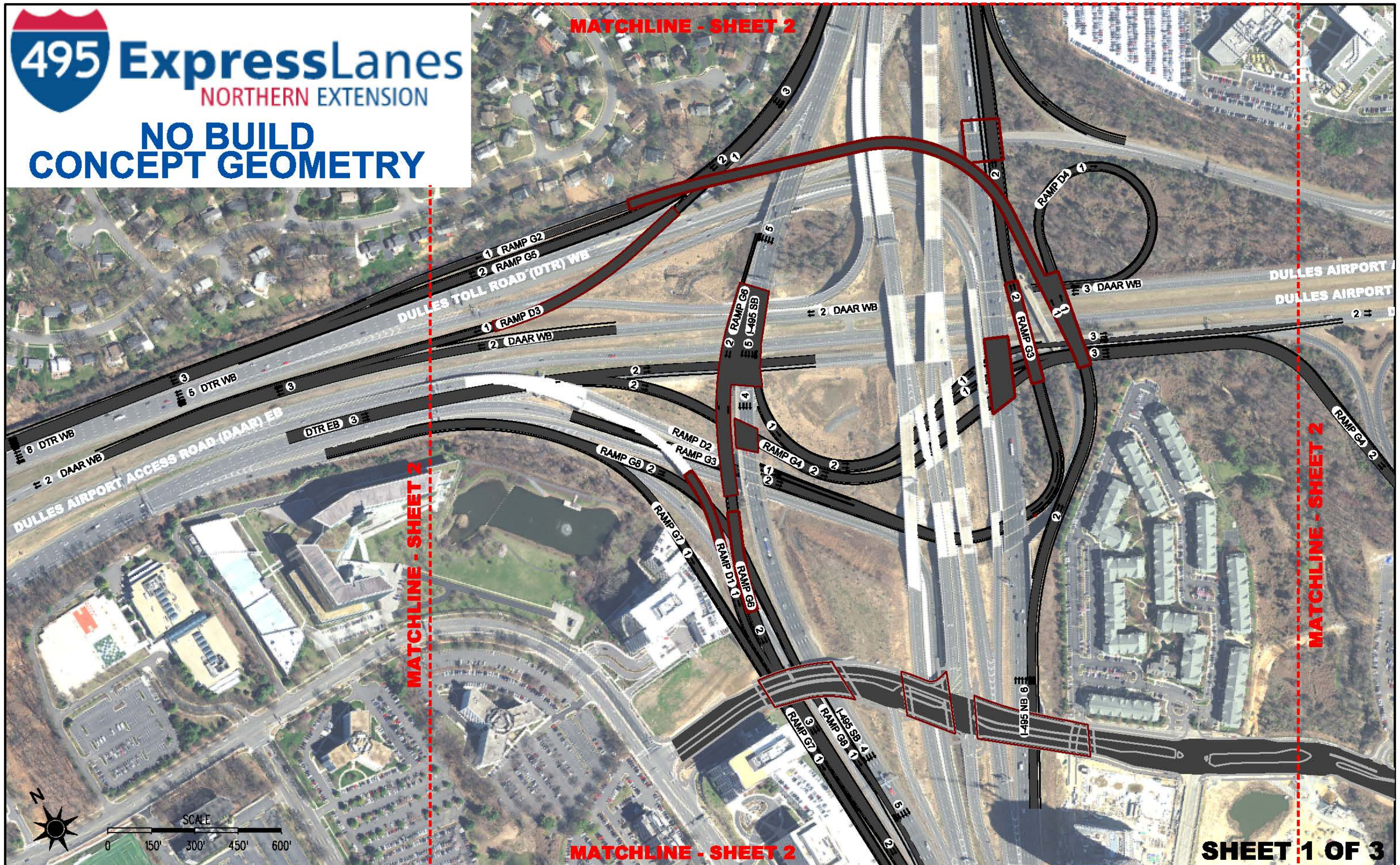


Exhibit 6-2a. Project NEXT No Build Geometry at Route 267 Interchange (Sheet 1 of 3)

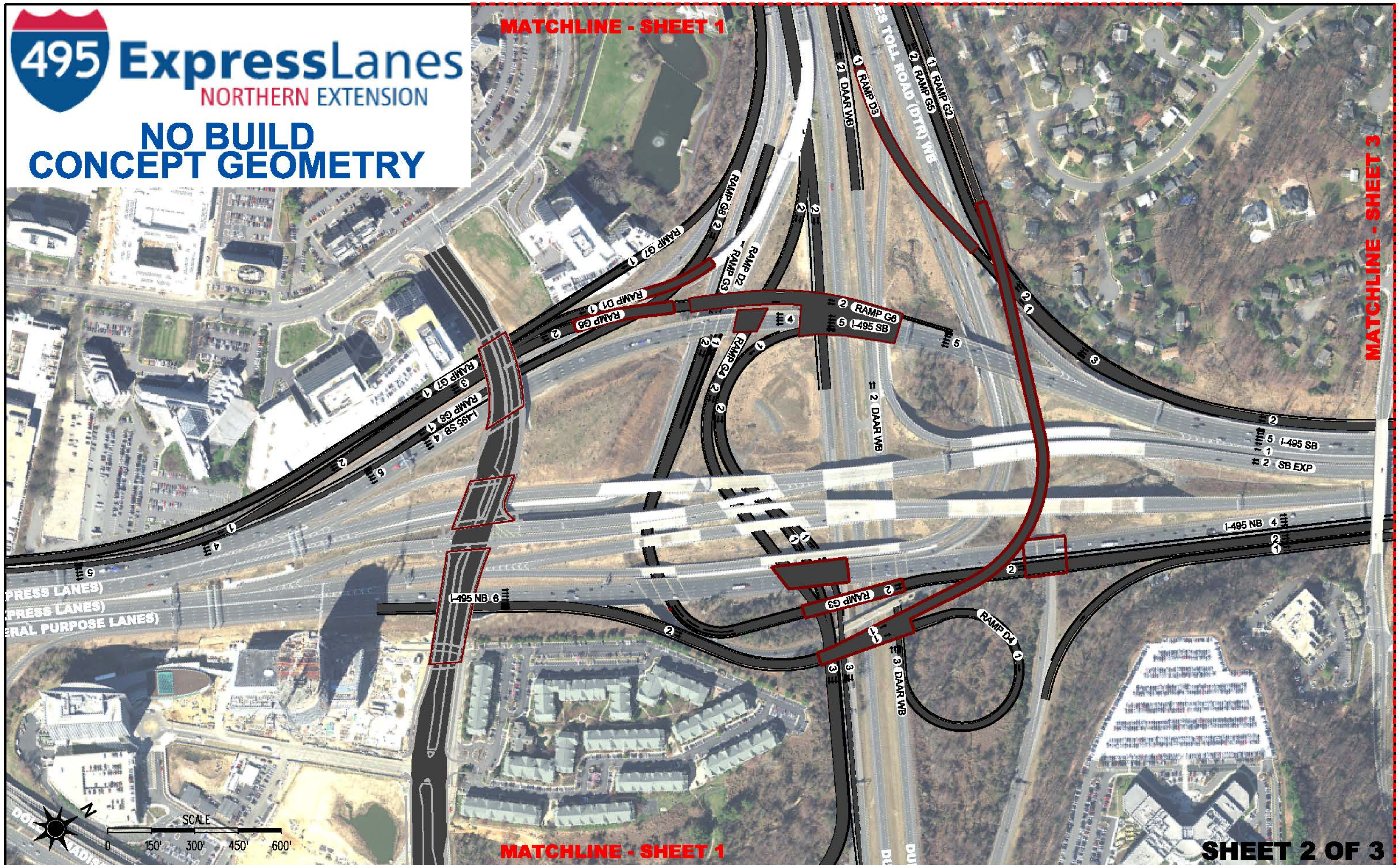


Exhibit 6-2b. Project NEXT No Build Geometry at Route 267 Interchange (Sheet 2 of 3)

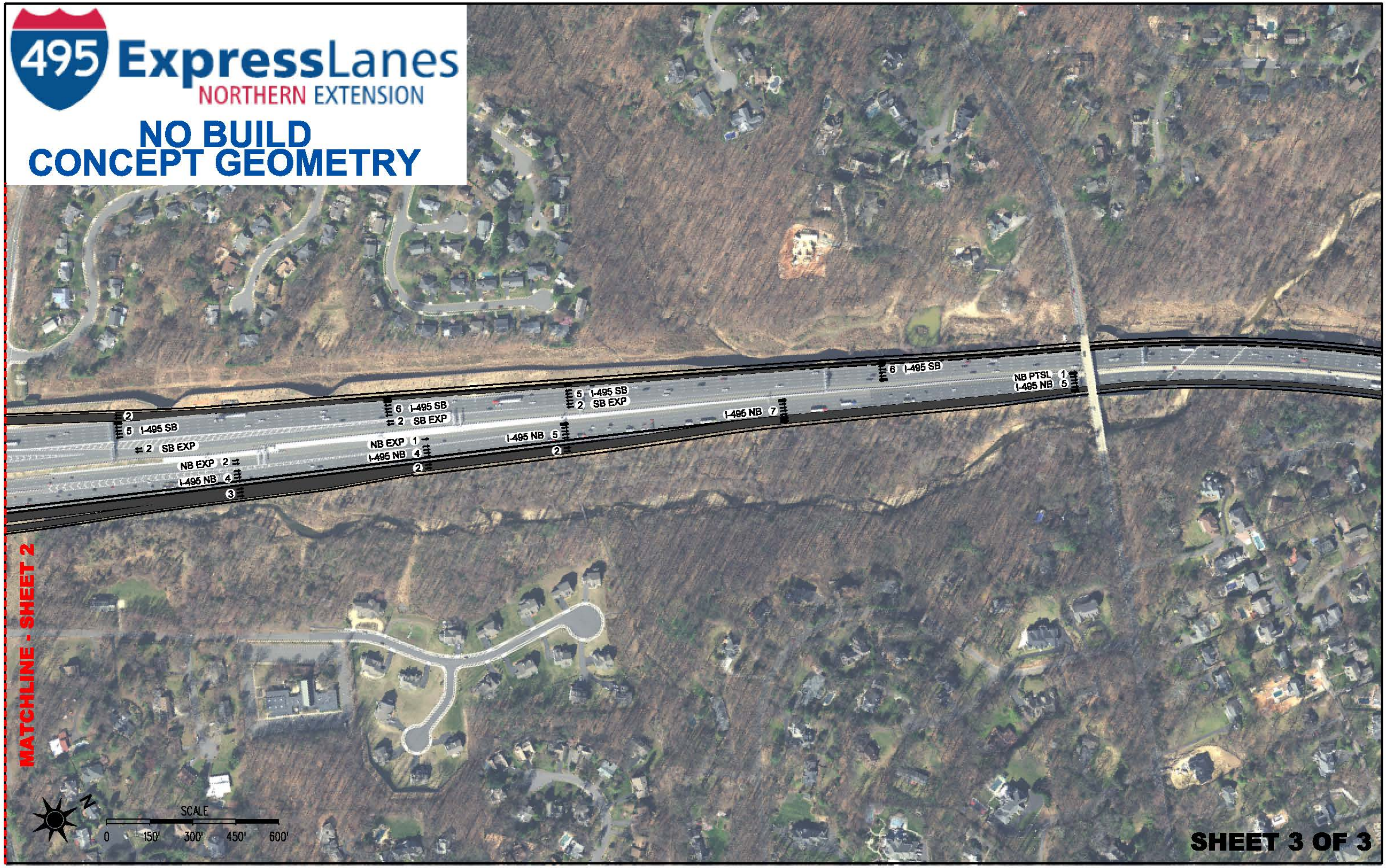


Exhibit 6-2c. Project NEXT No Build Geometry at Route 267 Interchange (Sheet 3 of 3)

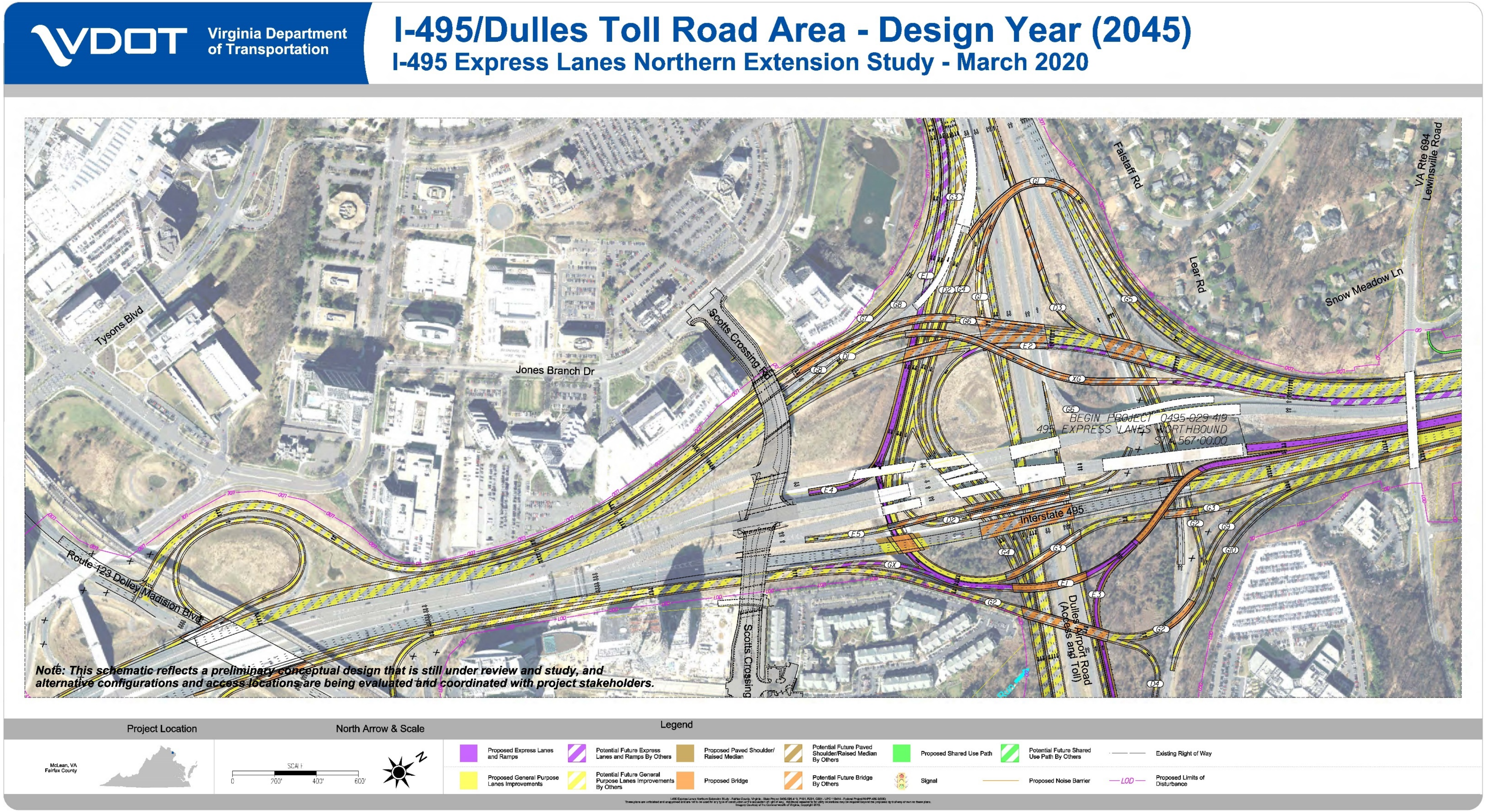


Exhibit 6-3a. Project NEXT 2045 Design Year Build Geometry (Sheet 1 of 5)

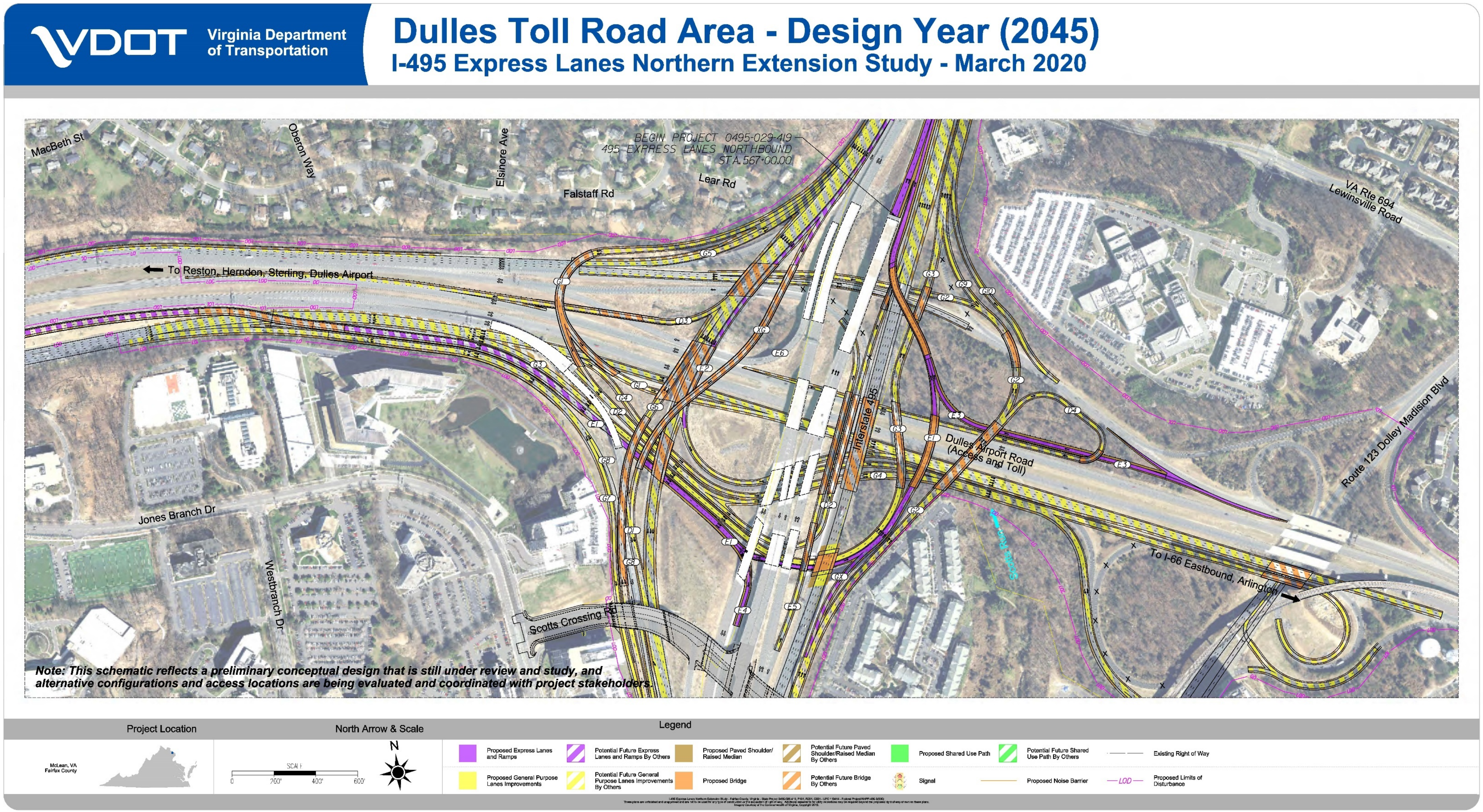


Exhibit 6-3b. Project NEXT 2045 Design Year Build Geometry (Sheet 2 of 5)

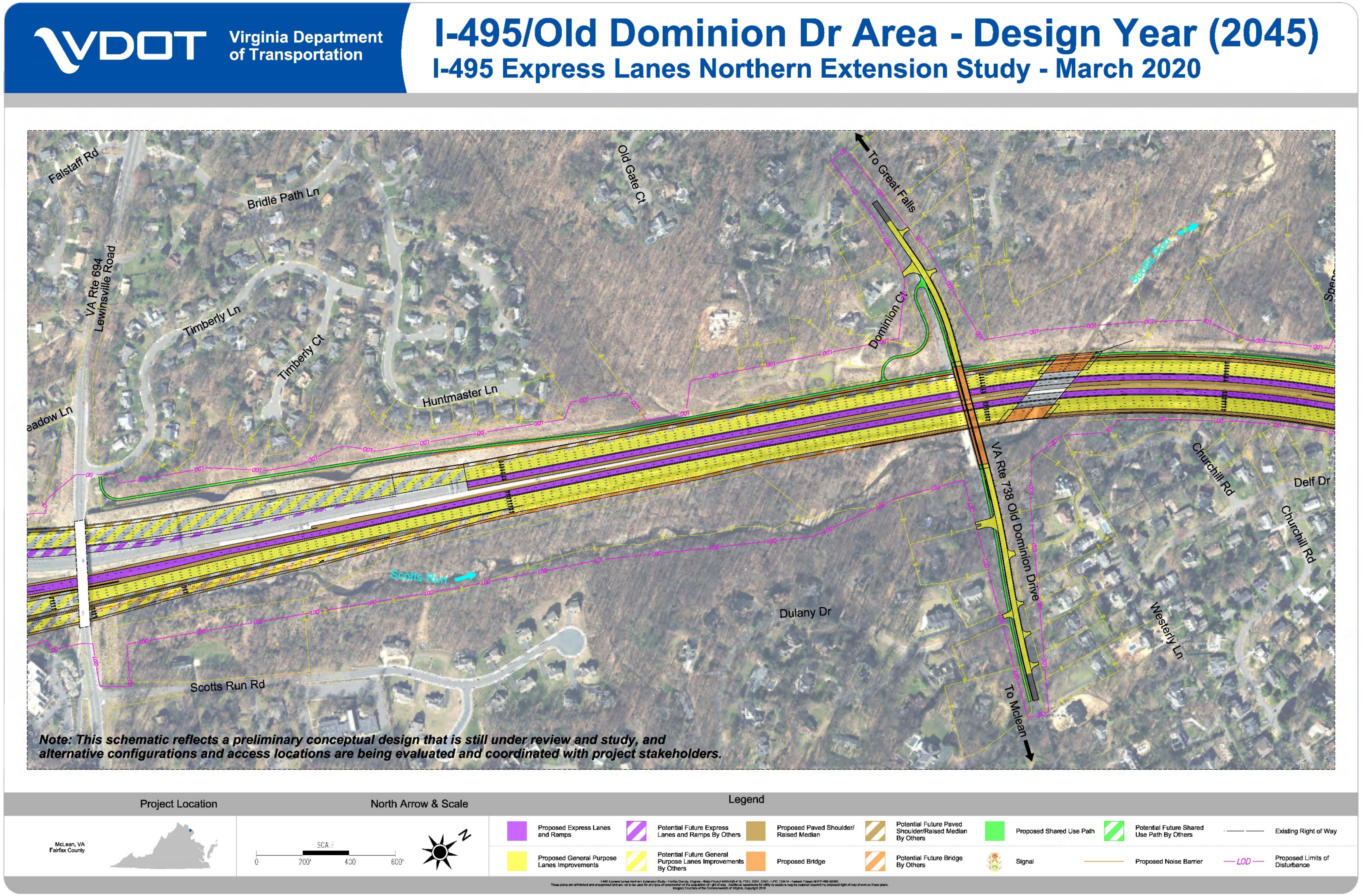


Exhibit 6-3c. Project NEXT 2045 Design Year Build Geometry (Sheet 3 of 5)

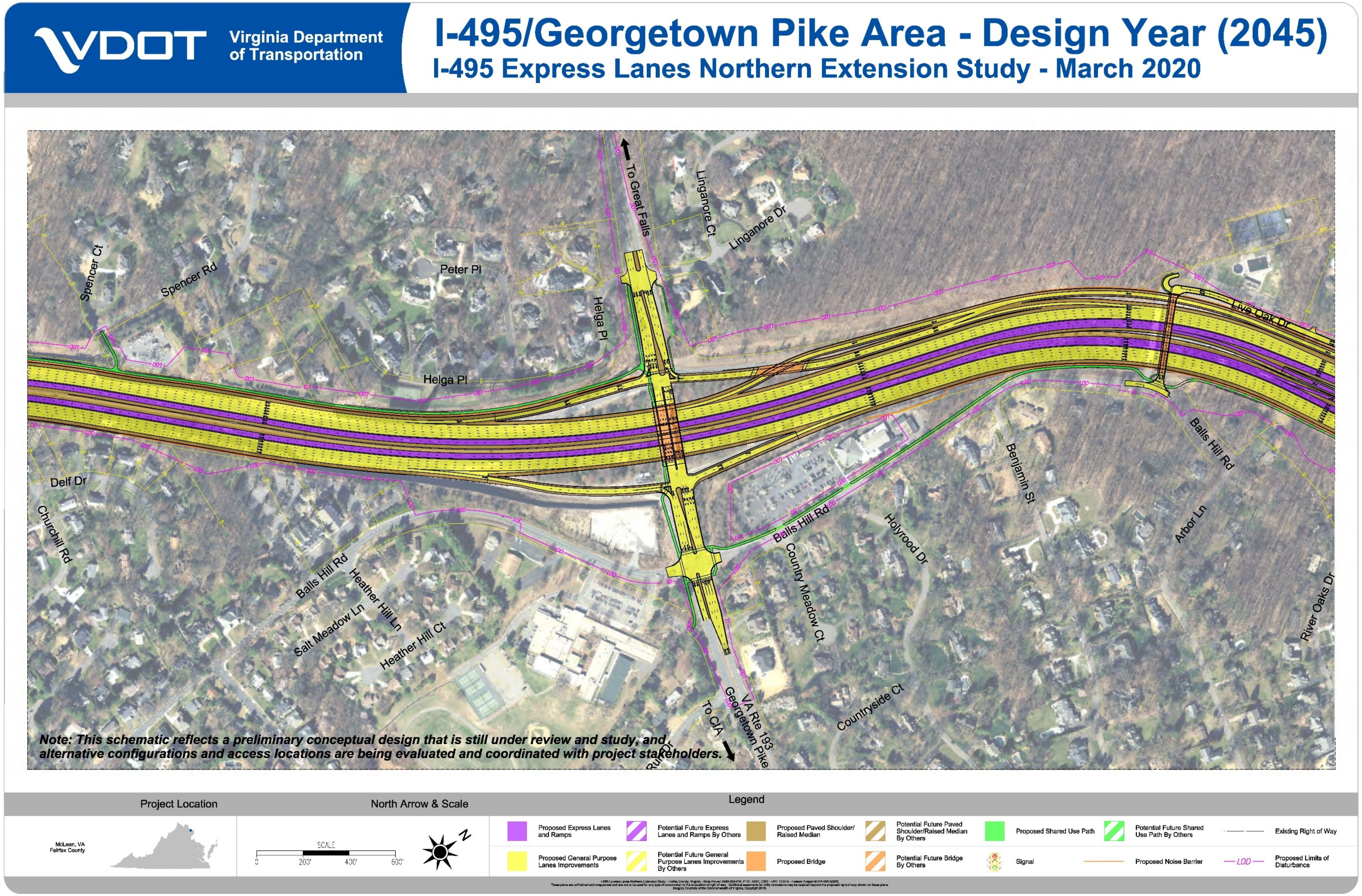


Exhibit 6-3d. Project NEXT 2045 Design Year Build Geometry (Sheet 4 of 5)

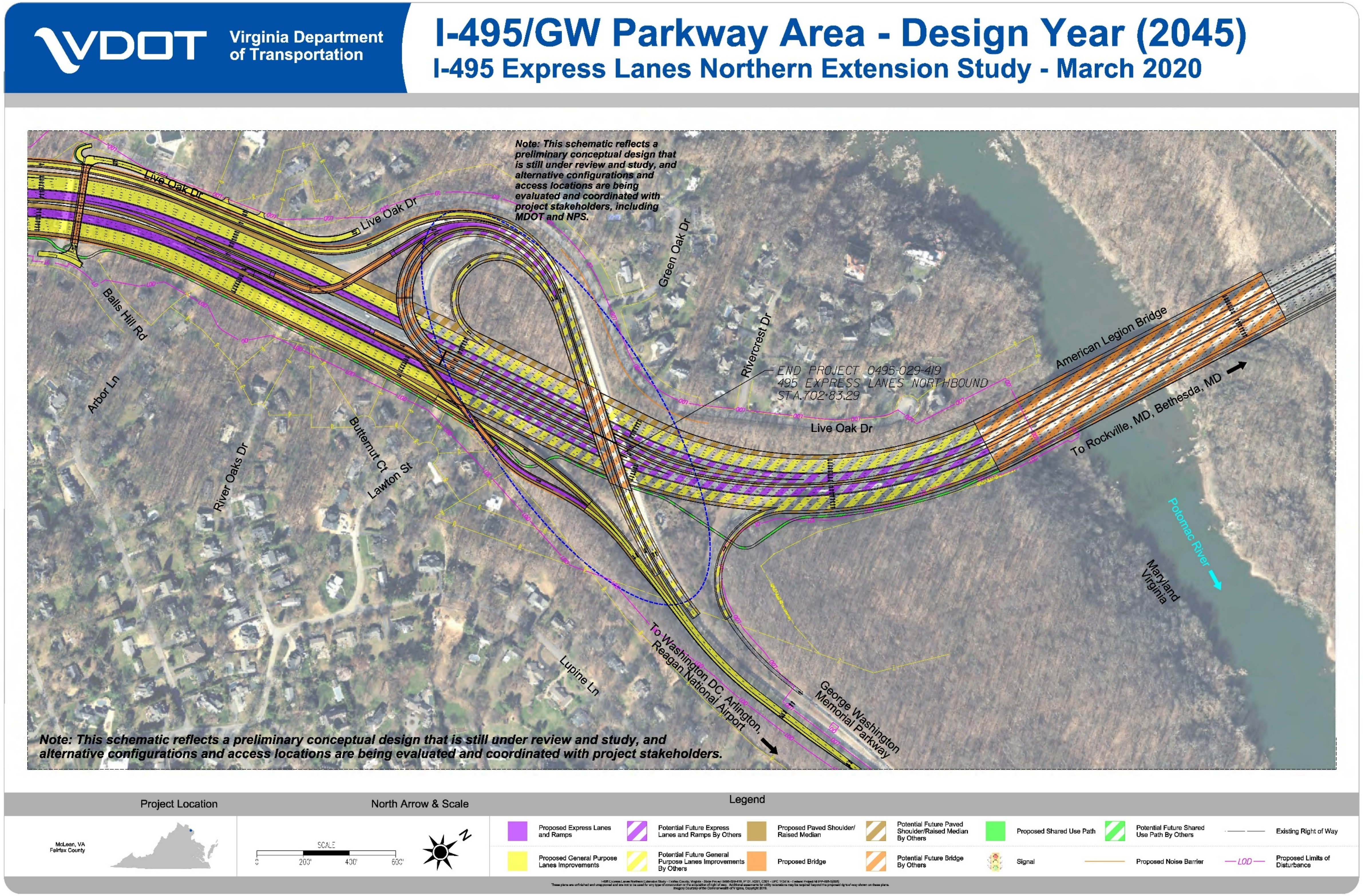


Exhibit 6-3e. Project NEXT 2045 Design Year Build Geometry (Sheet 5 of 5)

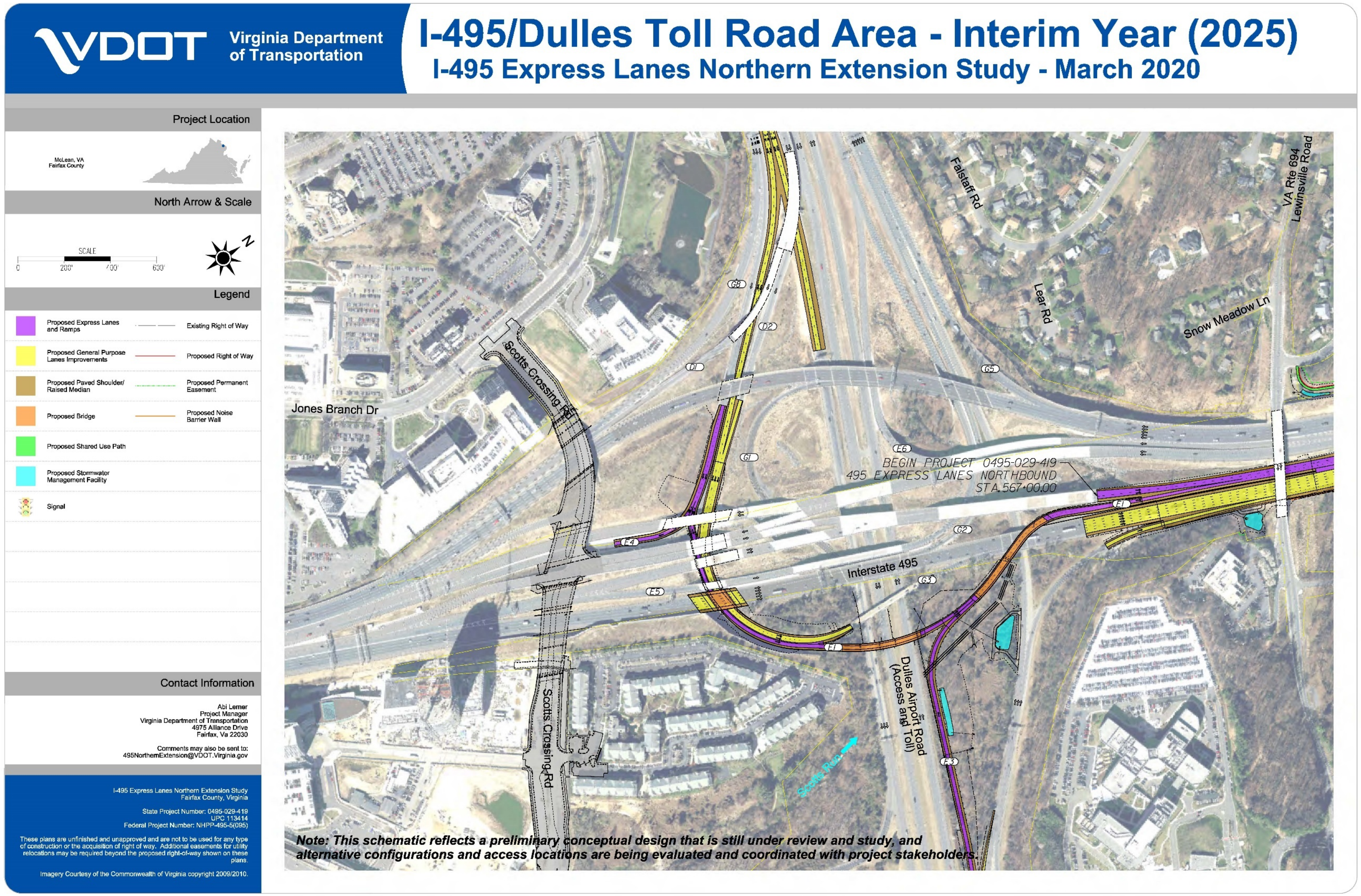


Exhibit 7-1a. Project NEXT Phase 1 2025 Phase 1 Build Geometry (Sheet 1 of 5)

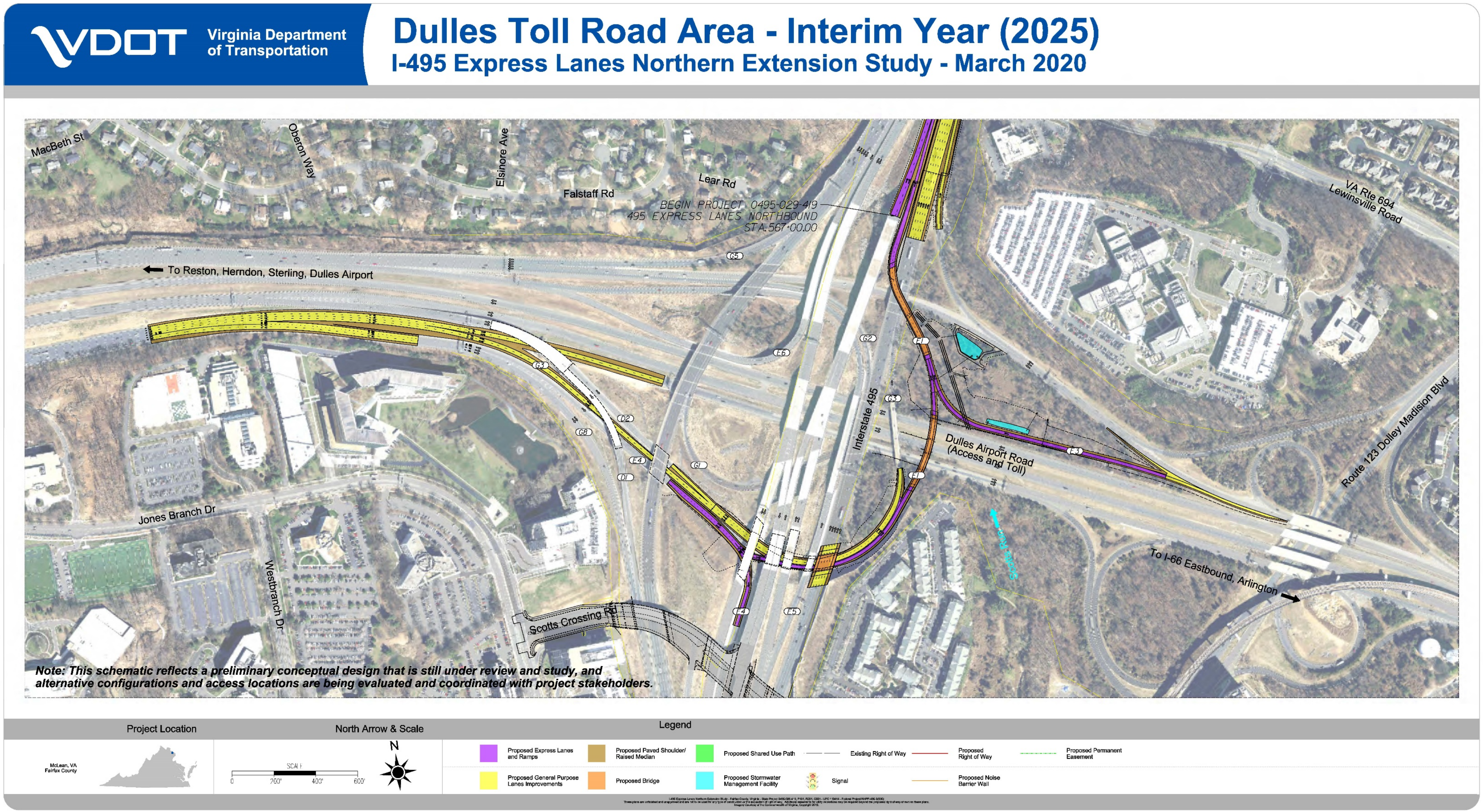


Exhibit 7-1b. Project NEXT Phase 1 2025 Phase 1 Build Geometry (Sheet 2 of 5)

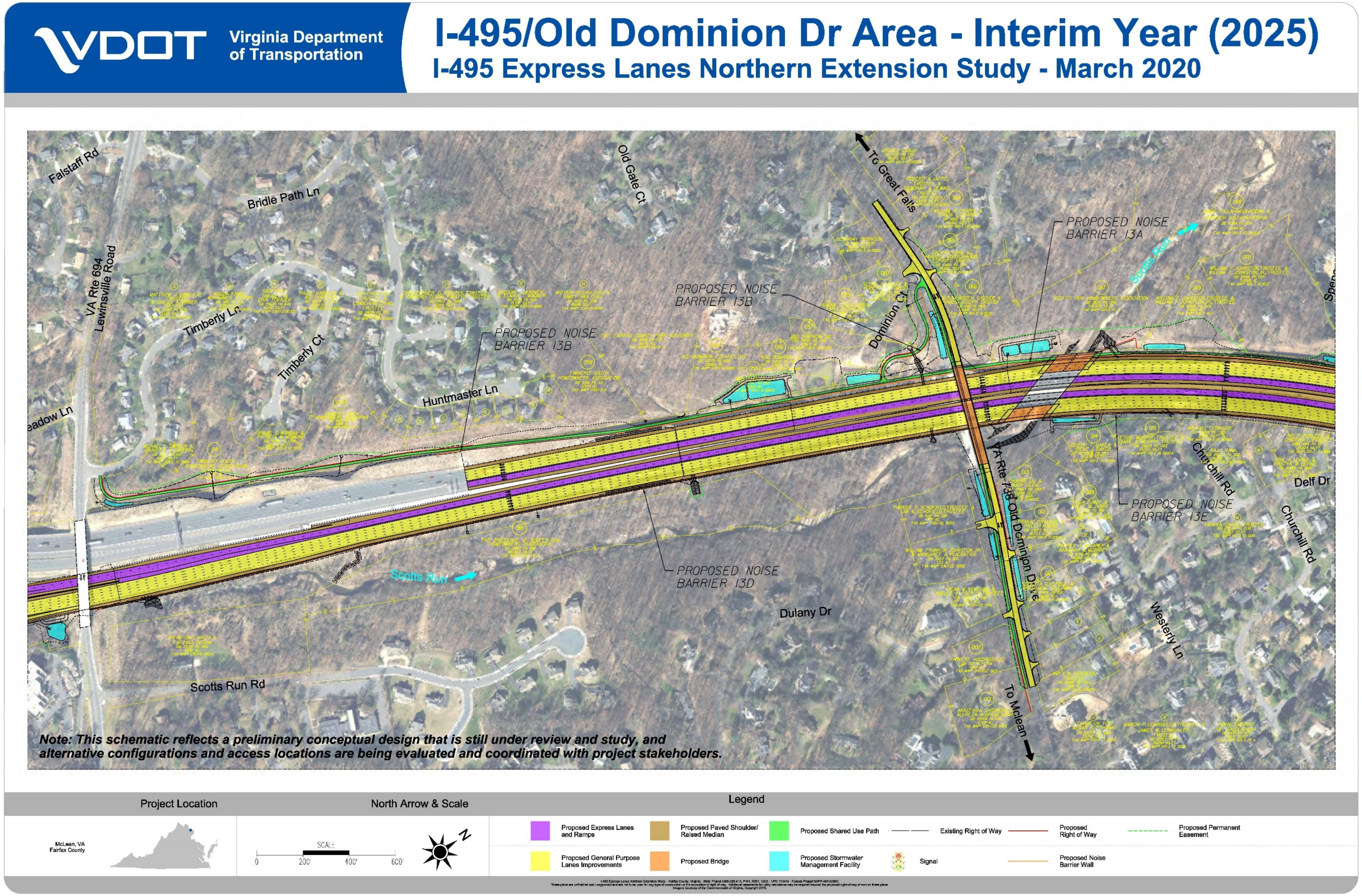


Exhibit 7-1c. Project NEXT Phase 1 2025 Phase 1 Build Geometry (Sheet 3 of 5)

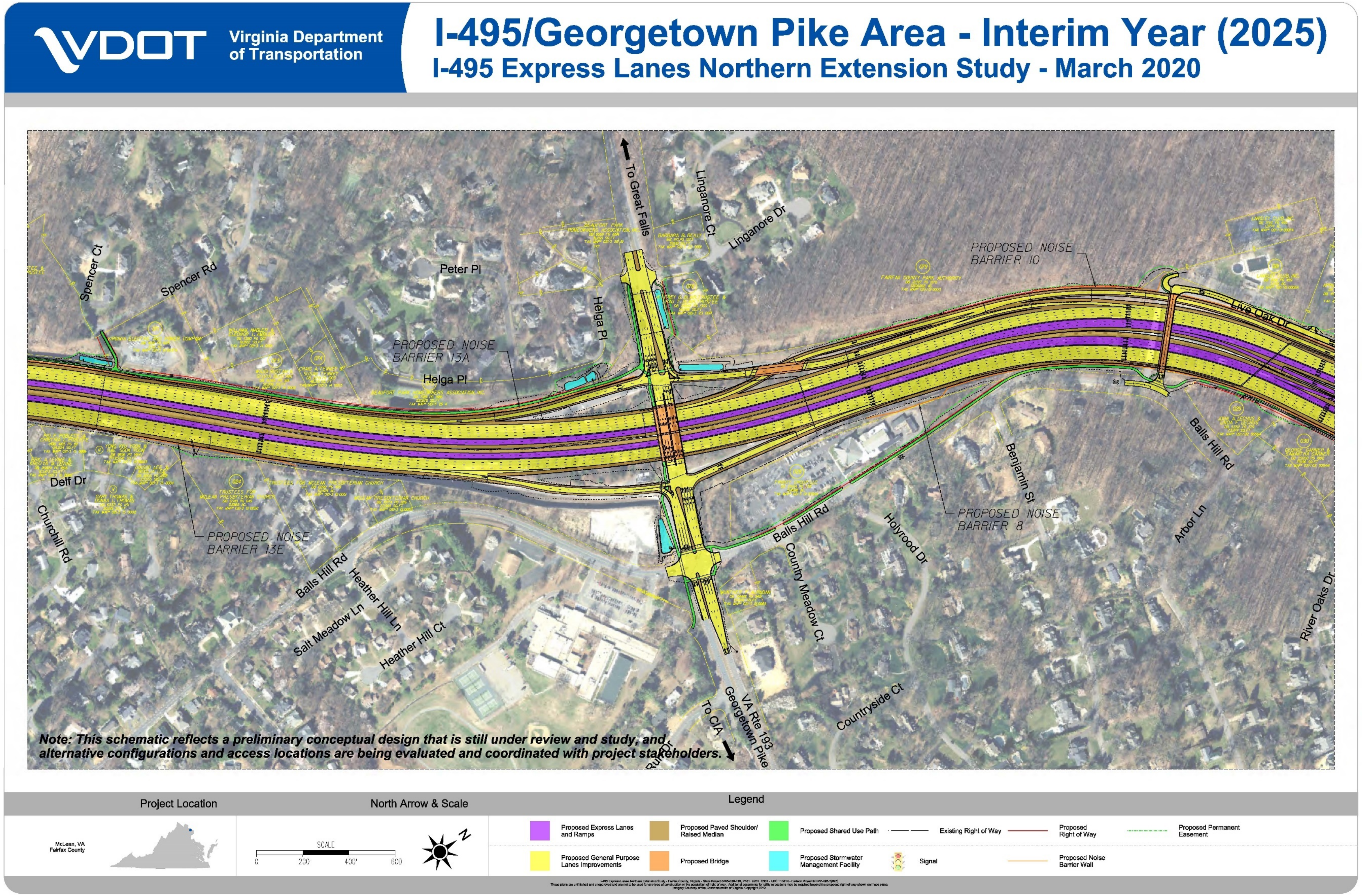


Exhibit 7-1d. Project NEXT Phase 1 2025 Phase 1 Build Geometry (Sheet 4 of 5)

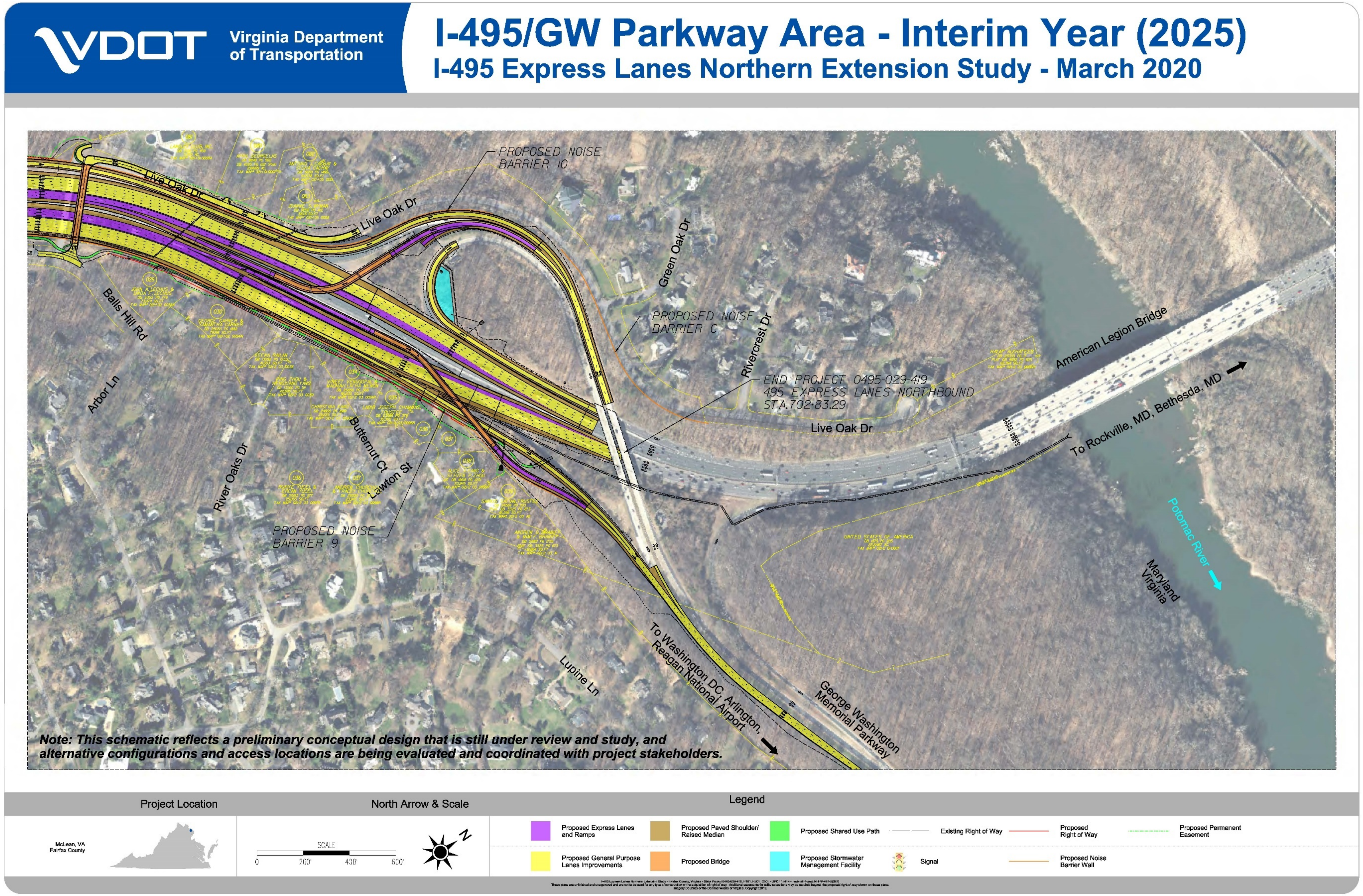


Exhibit 7-1e. Project NEXT Phase 1 2025 Phase 1 Build Geometry (Sheet 5 of 5)

Project: 495 Express Lanes - Project NEXT
Subject: List of Requested DE/DWs

2020-12-18

Project DE/DW No.	VDOT NOVA DE/DW No.	Roadway Name	From	To	Side	Design Feature	Proposed Design	Standard Required	Remarks	Approval Path Forward
Ex495 DE-2		No longer used								
Ex495 DW-14		I-495	Corridor-wide		N/A	Gore Area Geometry	No shoulder at recovery areas in gores	Provide full shoulder at recovery areas in gores	Application of Existing DE for removing shoulders at recovery area at gore areas (full recovery area geometry provided)	List in RFP, DB to Acquire
Ex495 DW-29	DW-2020-23	I-495	*See Appendix A		N/A	Horizontal Geometry	Mainline Compound Curves with radius ratio more than 1.5:1	Mainline Compound Curves with radius ratio shall be less than 1.5:1	Application of Existing DE for allowing tighter compound curvature	Obtain Approval at RFP Stage
Ex495 DW-30	DW-2020-51	I-495	*See Appendix B		N/A	Horizontal Geometry	Ramp Compound Curves with radius ratio more than 2:1	Ramp Compound Curves with radius ratio shall be less than 2:1	Application of Existing DE for allowing tighter compound curvature	Obtain Approval at RFP Stage
Ex495 DE-52		I-495	Eastbound DTR/ DTR Ramp E4		N/A	Gore Area Geometry	No Widening Transition at multi-lane exit terminals	500ft length Widening Transition shall be provided at multi-lane exit terminals	Application of Existing DE for tightening exit ramp geometry	List in RFP, DB to Acquire
DW-A		No longer used								
DE - B1	DE-2020-25	I-495	Bridge over DTR Ramps E1/G3		N/A	Superelevation	Match Existing Normal Crown	NB 3.4% (DTR)	Match superelevation of existing bridges over DTR Ramp E1/G3	Obtain Approval at RFP Stage
DE - B2	DE-2020-24	I-495	Bridge over Scotts Run		N/A	Superelevation	Match Existing 2% Reverse Crown	NB min. 4.4%/ SB min. 4.3% (SR)	Match superelevation of existing bridges over Scotts Run	Obtain Approval at RFP Stage
DW - C through DE - H		No longer used								
DE-I	DE-2020-27	DTR Ramp E1, DTR Ramp E3, GWMP Ramp E21	Corridor-wide		Both	Ramp Minimum Design Speed	30 mph	35 mph min. for 70 mph mainline	Reduced ramp design speed due to geometrics/right of way	Obtain Approval at RFP Stage
DE - J		No longer used								
DW-K		GWMP Ramp E21, GWMP Ramp E22	Bridges over I-495 at GWMP Interchange		N/A	Bridge Span Length	280ft - GWMP Ramp E21, 284ft - GWMP Ramp E22	240ft	Bridge span lengths in excess of 240ft	List in RFP, DB to Acquire
DW-L		DTR Ramp E3	Deceleration Lane from Westbound DTR		Both	Lane Taper, Gore Width and Deceleration Length	100ft	25:1, 300ft	Reduced space available between entrance from Route 123 and bridge over Route 123	List in RFP, DB to Acquire
DW-M	DW-2020-16	Balls Hill Road/ Balls Hill SUP	Corridor-wide		Both	Buffer Strip Width (Between SUP and Roadway)	2.5ft	8ft	Reduced impacts to church property. Maintains existing buffer width	Obtain Approval at RFP Stage
DW-N	DW-2020-17	Georgetown Pike	Linganore Drive	Balls Hill Road	Both	Access Management			Maintain existing roadway intersections near interchange	Obtain Approval at RFP Stage
DE-O		No longer used								
DW-P		I-495	Maryland		Median	Shoulder Width	Reduced Shoulder	10' Minimum Median Shoulder	Spot locations for Advance signage to support new Express Lanes entrance	List in RFP, DB to Acquire
DE-Q		Slip Ramp from Ramp G21 to Ramp NW/Exit onto DTR Ramp E1	Corridor-wide		Both	Lane Width	12'	16'	Reduced space available to due Power Transmission Lines, Scotts Run Nature Preserve and existing 495SB XL Bridge.	List in RFP, DB to Acquire
DW-R		I-495	Georgetown Pike	Live Oak Drive	Both	LR placement	Up to 50% of Lr into Curve	1/3 Lr into Curve	Short tangent section between curves under Georgetown Pike and Live Oak Drive bridges prevents the Lr placement per VDOT standards	List in RFP, DB to Acquire
DW-S		DTR Ramp E3	Superelevation Transition along DTR Ramp E3 Curve No.2		Both	LR placement	Up to 100% of Lr into Curve	1/3 Lr into Curve	LR is placed further back into the curve DTR_RMP_E3-2 avoid rollover concens through the gor of DTR_RMP_E1 and DTR_RMPE3.	List in RFP, DB to Acquire

Exhibit 7-2a. Table of Design Exceptions and Design Waivers (Page 1 of 2)

Project: 495 Express Lanes - Project NEXT

Subject: List of Requested DE/DWs

2020-12-18

Project DE/DW No.	VDOT NOVA DE/DW No.	Roadway Name	From	To	Side	Design Feature	Proposed Design	Standard Required	Remarks	Approval Path Forward
DE/DWs for 2045 Concept (By Others)										
DE/DW - W		Dulles Toll Road WB	Route 123	Ramp G10		Interchange Ramp Spacing	Reduced Weaving Distance (On-ramp Gore to Off-ramp Gore)	2000ft (System to Service - Freeway) 1600ft (System to Service - CD Road) 1600ft (Service to Service - Freeway) 1000ft (Service to Service - CD Road)		Future DE or DW (to be obtained by Others)
		CD Road (Ramp D2/G1A/G4)	Ramp D2/G1A	Ramp D2/G4						
		CD Road (Ramp G4)	Ramp E2/G4	Ramp G4A						
		CD Road (I-495 NB)	Rte 123/G2	Ramp G2/GX						
DE/DW - X		No longer used								
DE/DW - Y		GWMP Interchange	Ramp G21/E21	Ramp E21/E24		Interchange Ramp Spacing	Reduced Gore-to-Gore Spacing (between consecutive on- or off-ramps [EN-EN or EX-EX], between off- then on- ramps [EX-EN], or on Turning Roadways [ramps merging or diverging])	1000ft (EN-EN or EX-EX Freeway) 800ft (EN-EN or EX-EX CD Road) 500ft (EX-EN Freeway) 400ft (EX-EN CD Road) 800ft (Turning Roadway System) 600ft (Turning Roadway Service)		Future DE or DW (to be obtained by Others)
		I-495 GP Lanes SB	Ramp G1	Ramp G5						
		I-495 GP Lanes SB	Ramp G5	Ramp D3						
		I-495 GP Lanes SB	Ramp D3	Ramp G6						
		CD Road (Ramp G3)	Ramp G9	Ramp G10						
		CD Road (Ramp G2)	Ramp D4	Ramp G9						
		Ramp E2	I-495 GP SB	Ramp G4						
		CD Road (Ramp G4)	Ramp D2/G1A	Ramp E2						
		CD Road (Ramp D1)	Ramp GX	I-495 GP SB						
DE/DW - Z		No longer used								

Exhibit 7-2b. Table of Design Exceptions and Design Waivers (Page 2 of 2)

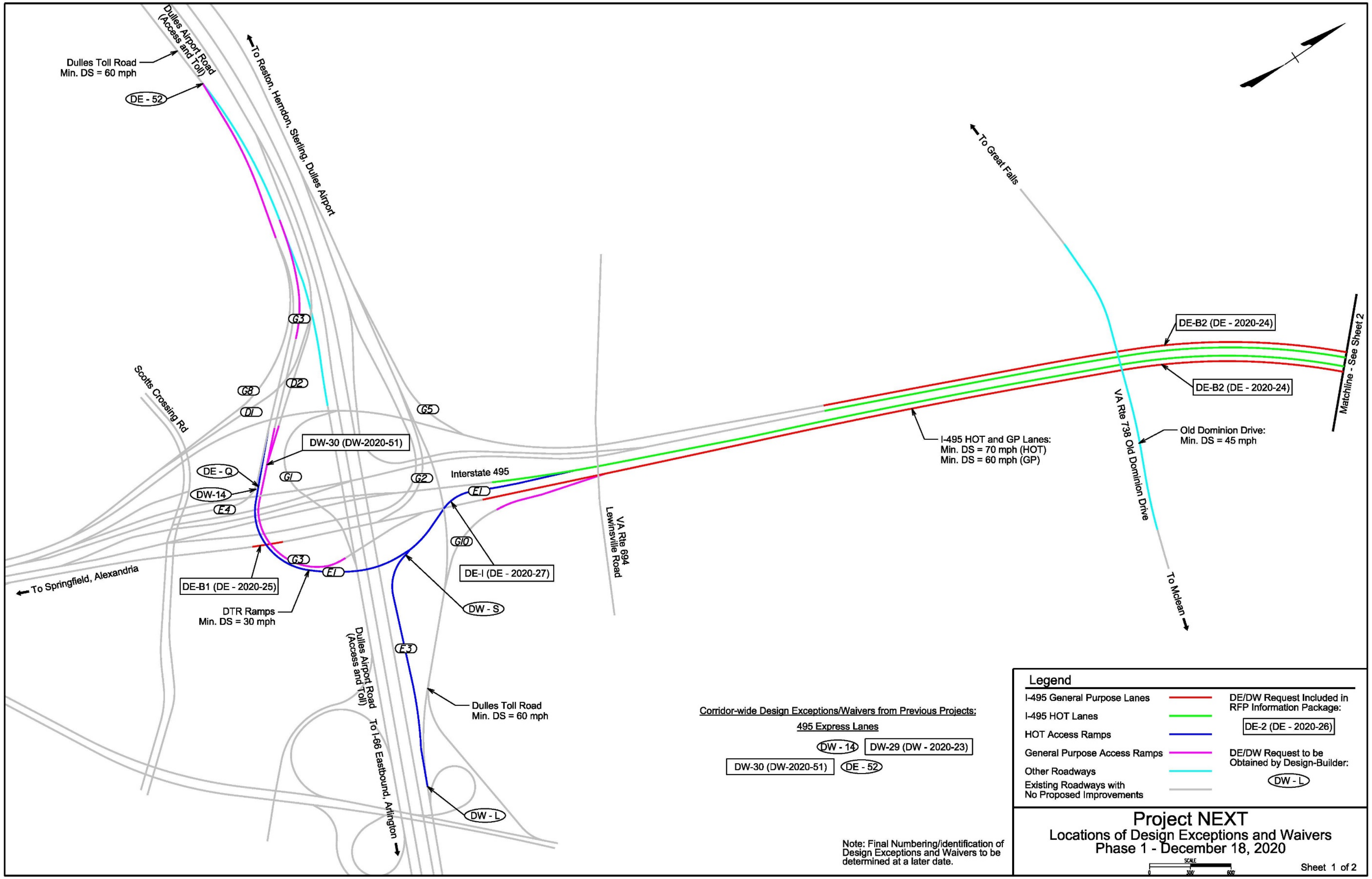


Exhibit 7-3a. Map of Design Exceptions and Design Waivers – Phase 1 (Sheet 1 of 2)

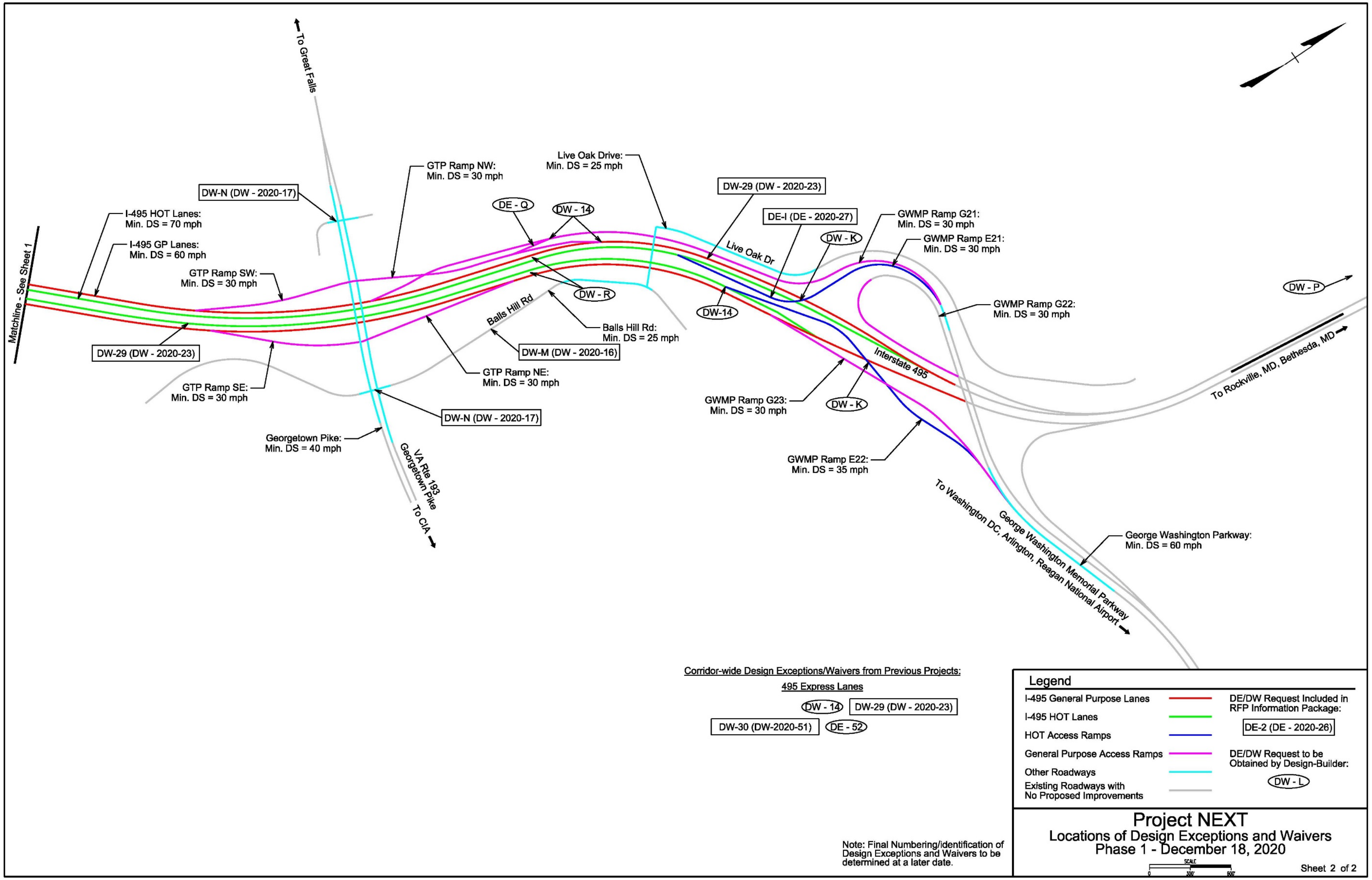


Exhibit 7-3b. Map of Design Exceptions and Design Waivers – Phase 1 (Sheet 2 of 2)

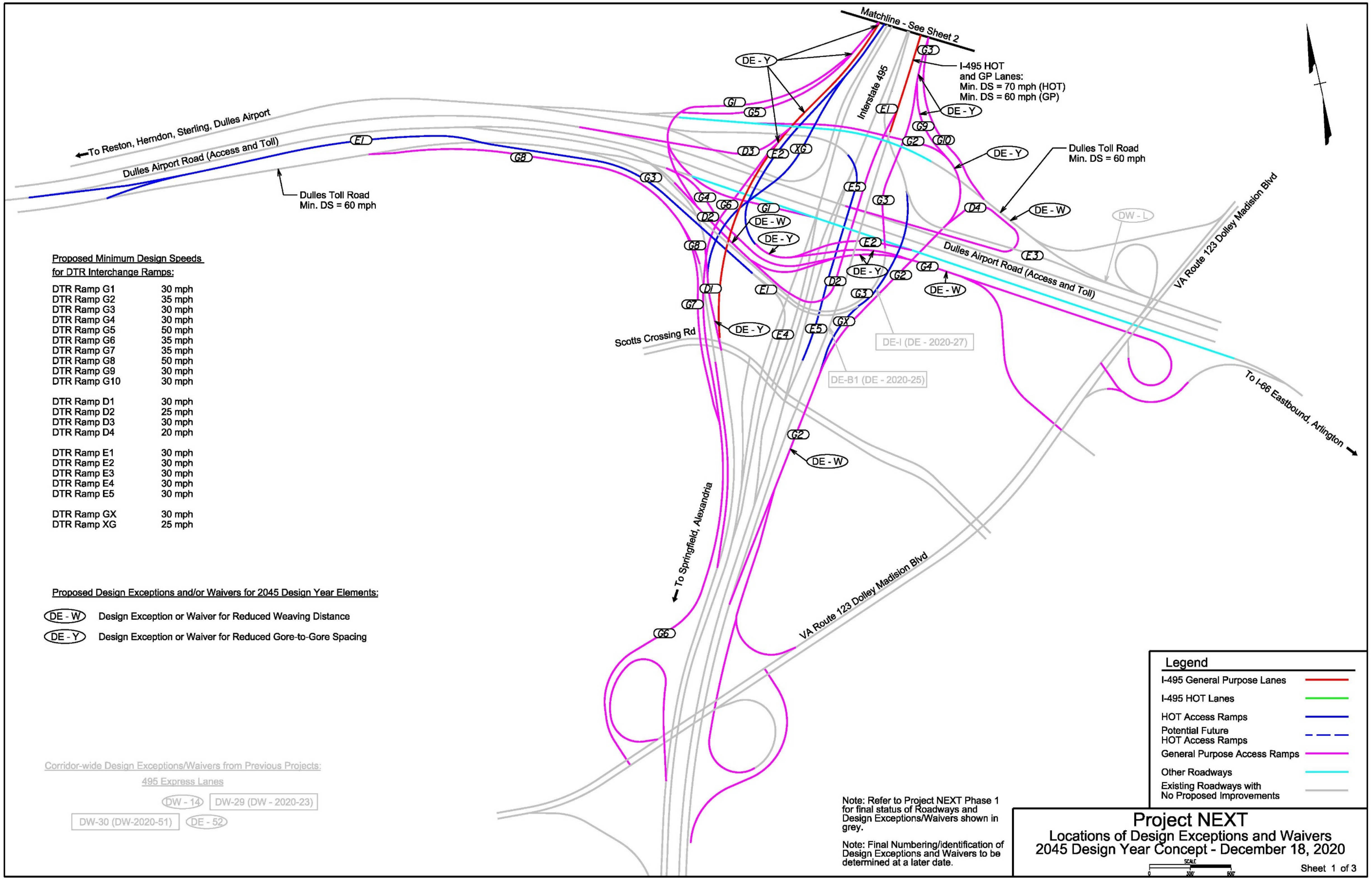


Exhibit 7-4a. Map of Design Exceptions and Design Waivers – 2045 Design Year (Sheet 1 of 3)

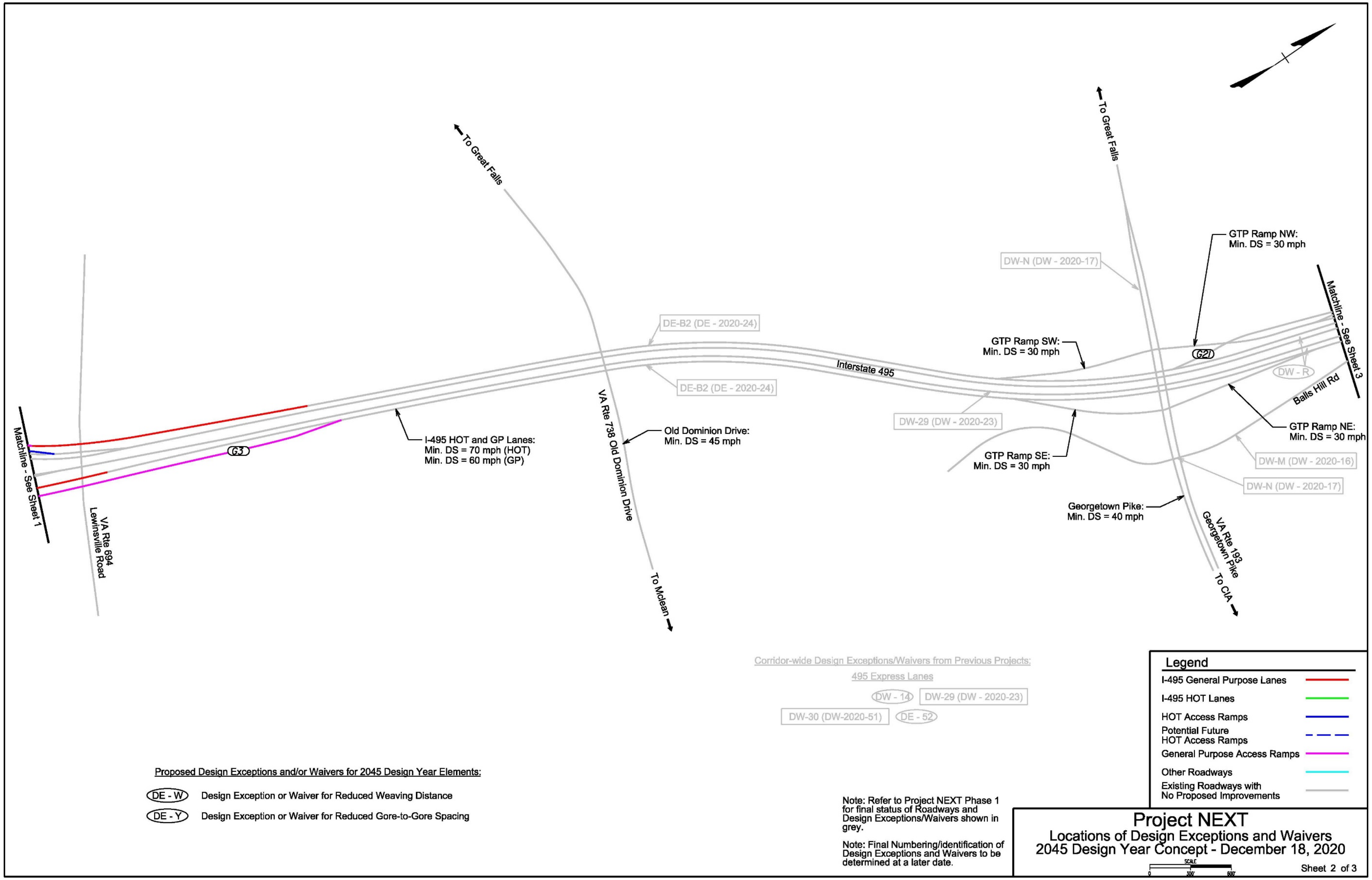


Exhibit 7-4b. Map of Design Exceptions and Design Waivers – 2045 Design Year (Sheet 2 of 3)

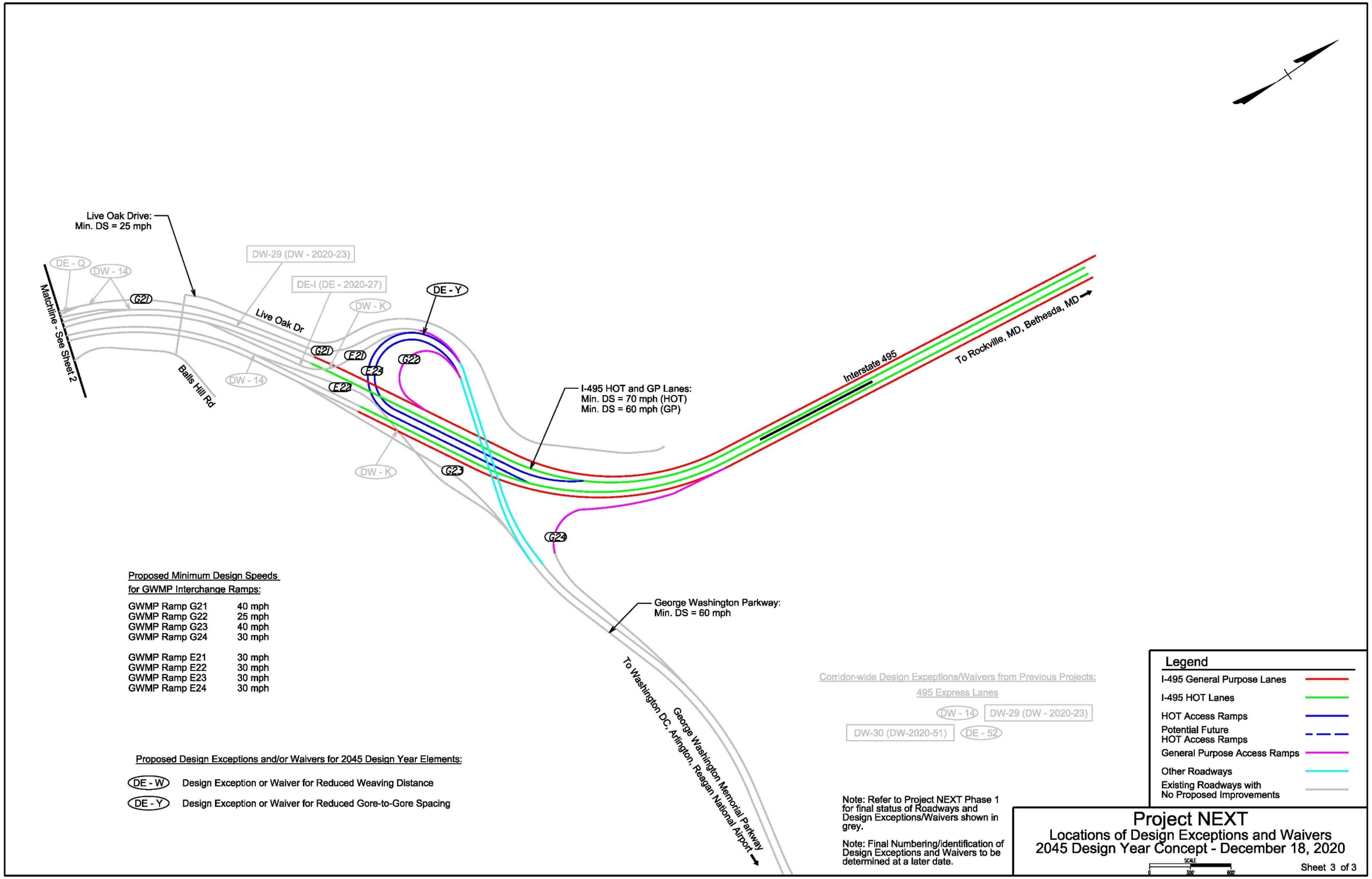


Exhibit 7-4c. Map of Design Exceptions and Design Waivers – 2045 Design Year (Sheet 3 of 3)

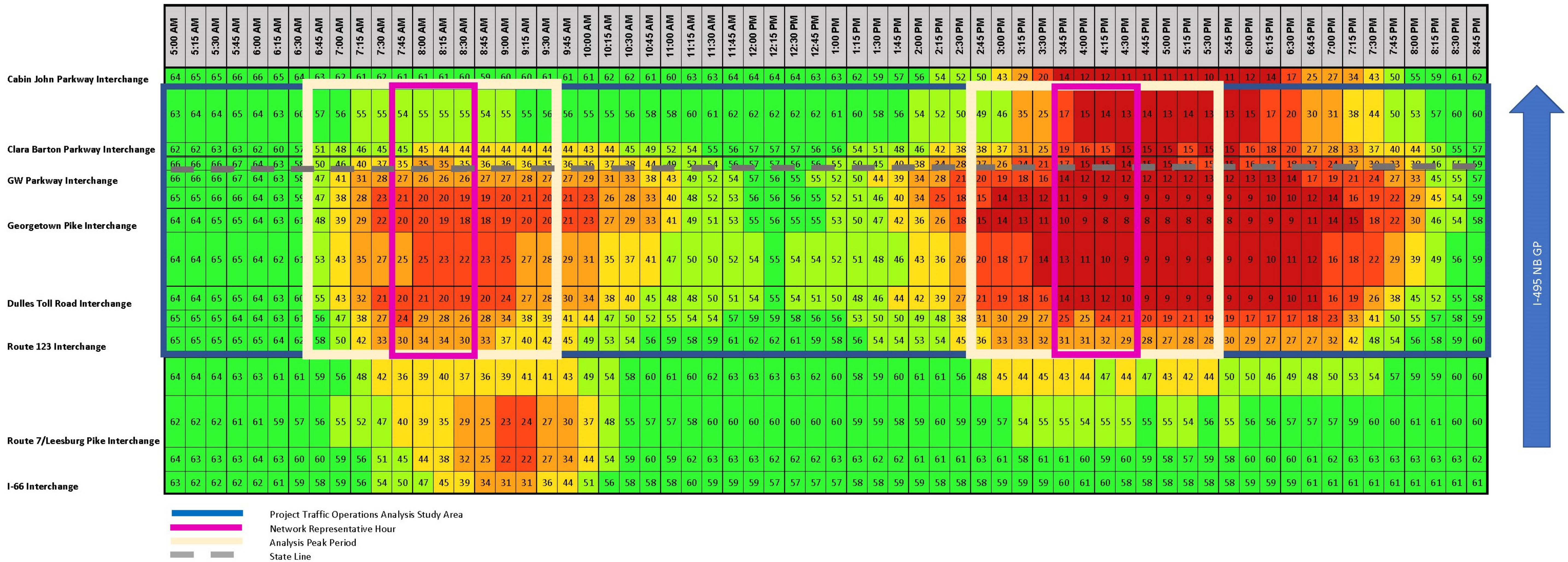


Exhibit 9-1. Definition of Peak Periods and Representative Hours – Northbound I-495

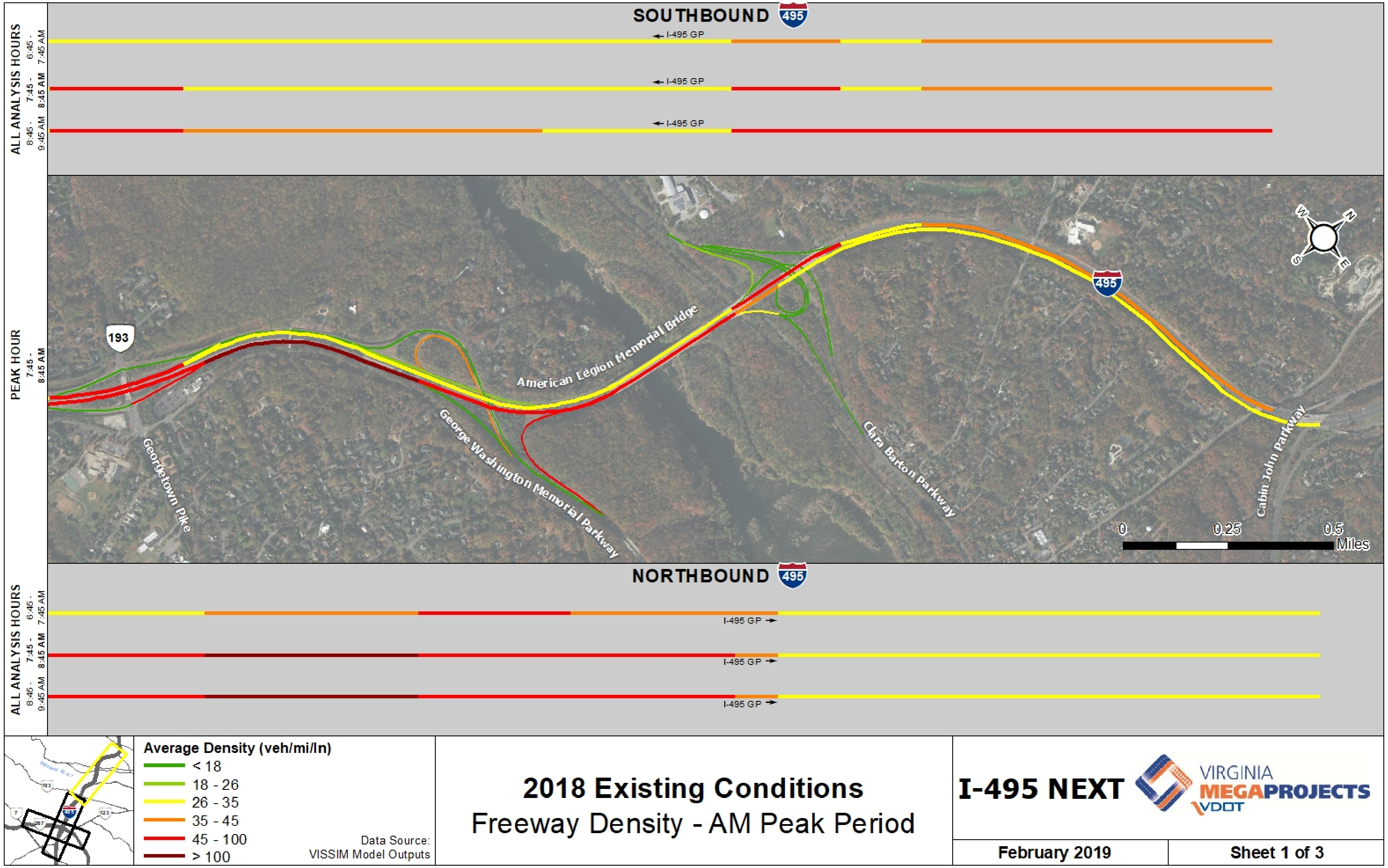


Exhibit 9-2a. Existing (2018) I-495 AM Peak Period Average Densities – Georgetown Pike to Northern Terminus

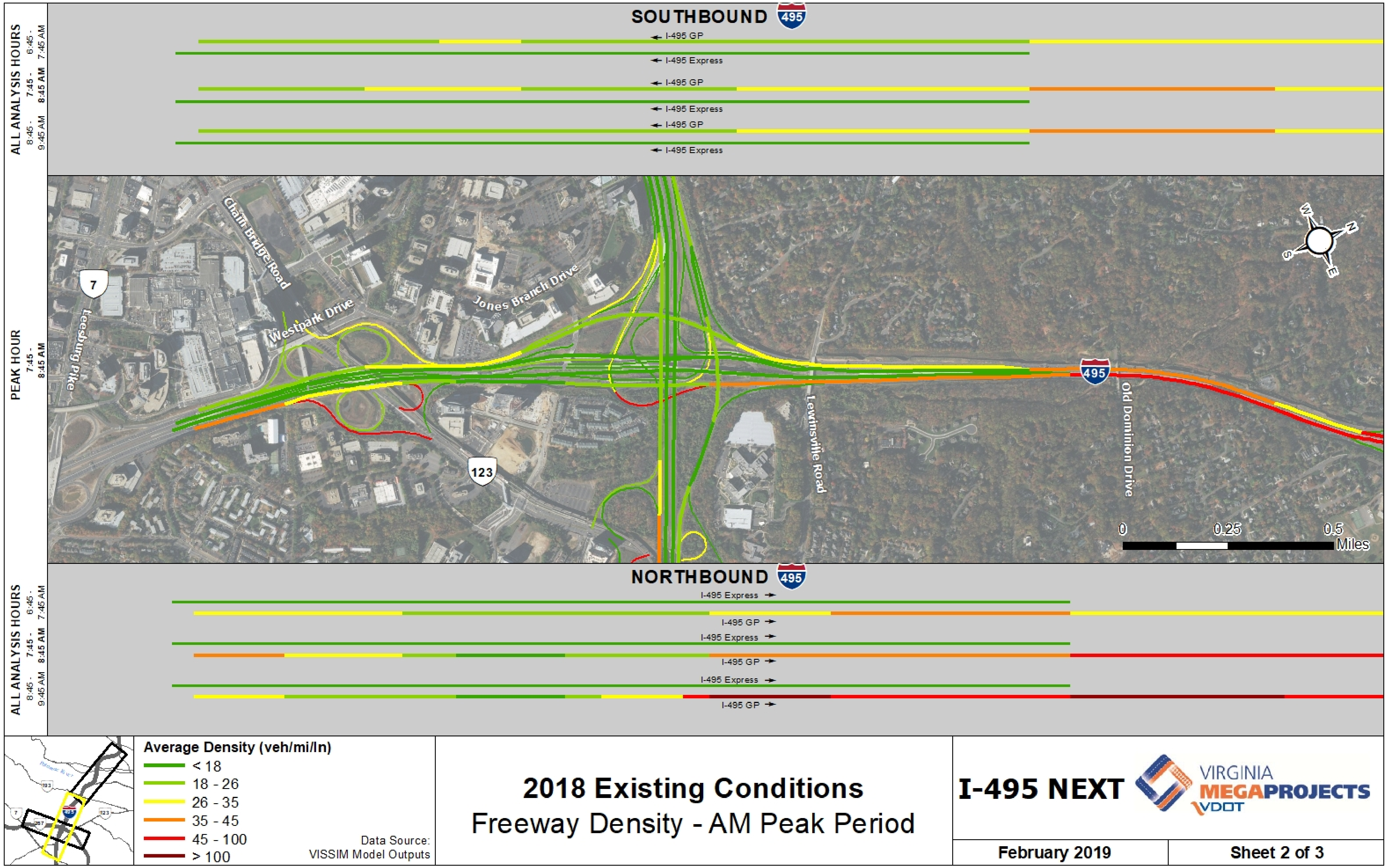


Exhibit 9-2b. Existing (2018) I-495 AM Peak Period Average Densities – Southern Terminus through Old Dominion Drive

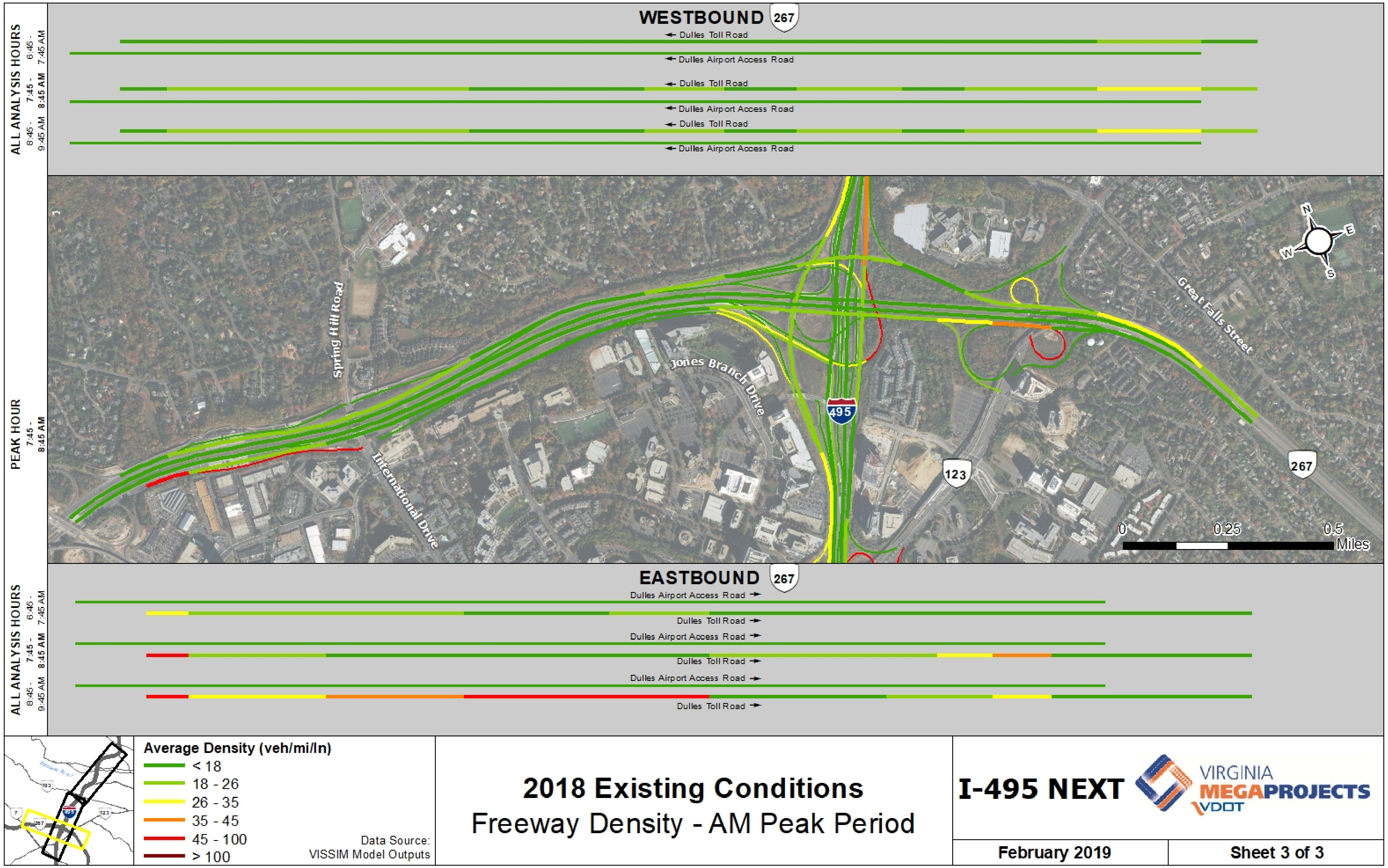


Exhibit 9-2c. Existing (2018) Route 267 AM Peak Period Average Densities

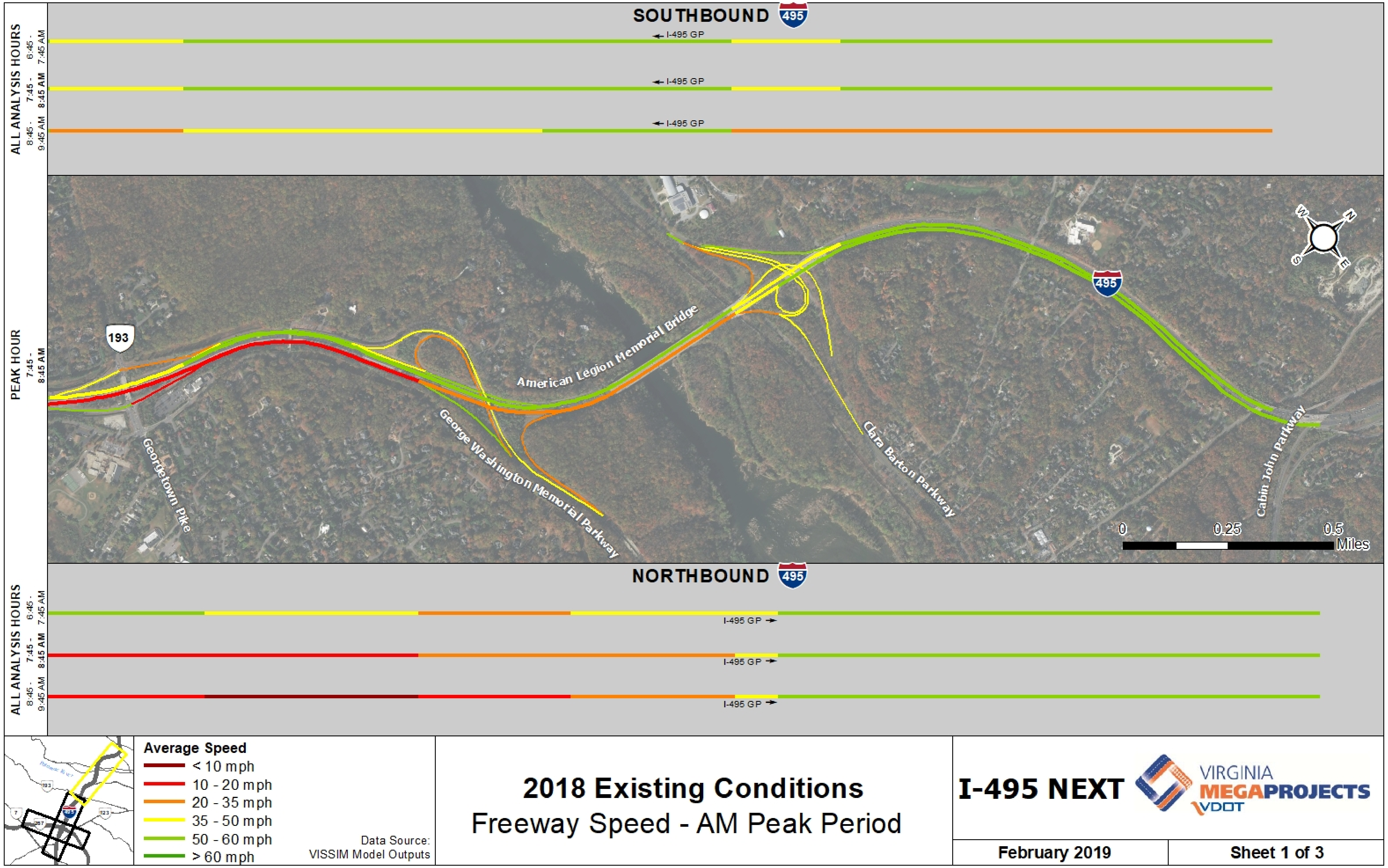


Exhibit 9-3a. Existing (2018) I-495 AM Peak Period Average Speeds – Georgetown Pike to Northern Terminus

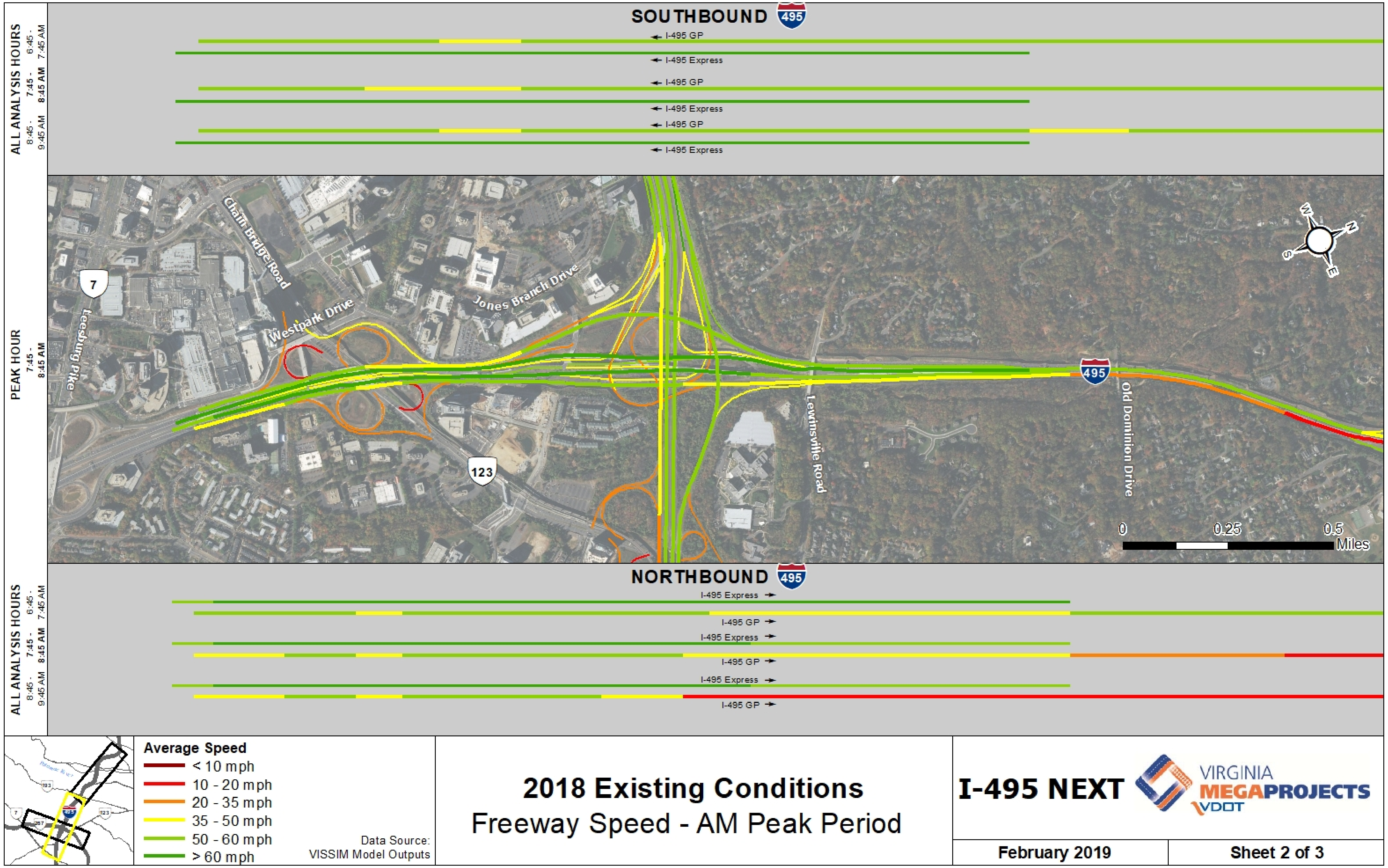


Exhibit 9-3b. Existing (2018) I-495 AM Peak Period Average Speeds – Southern Terminus through Old Dominion Drive

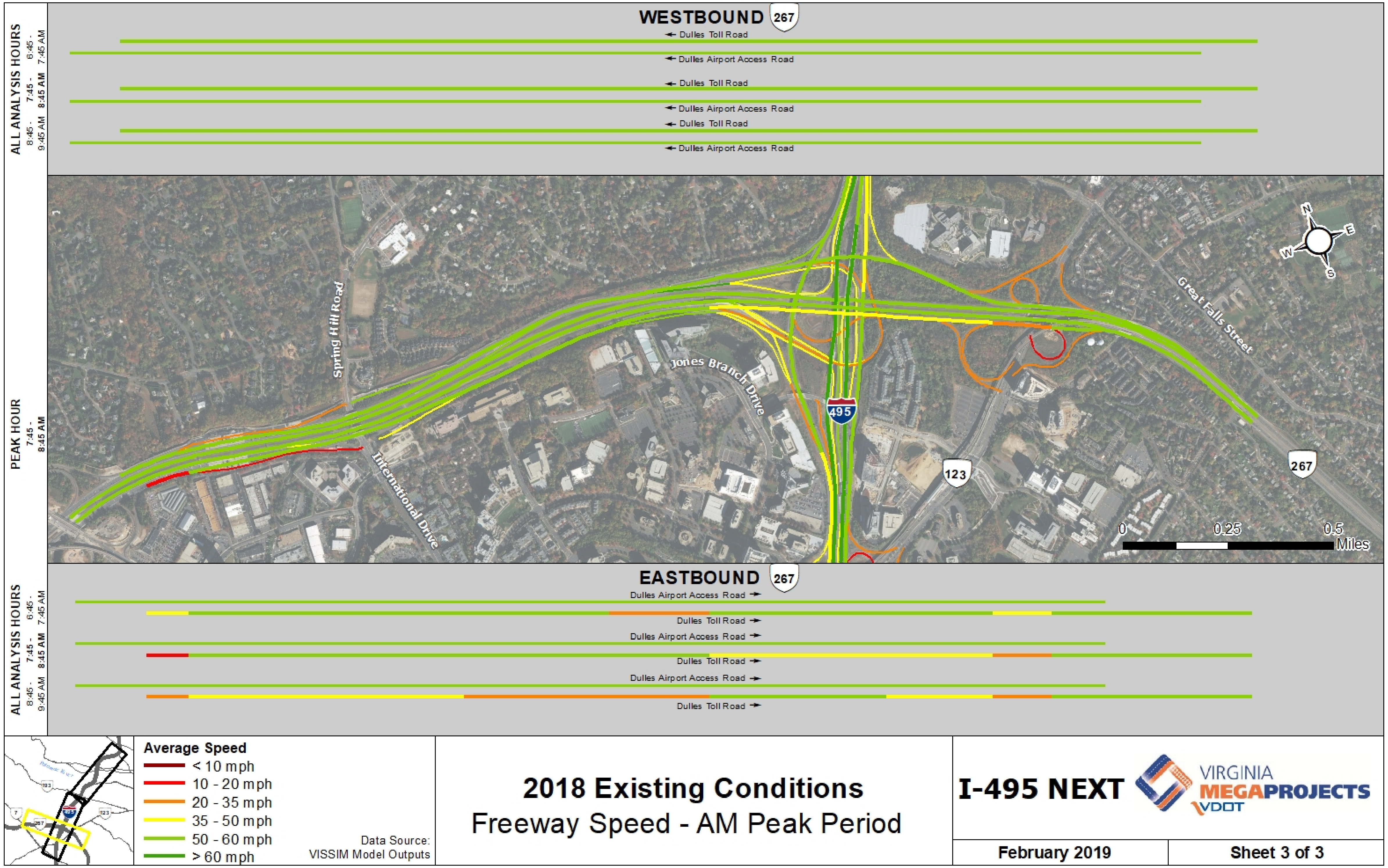


Exhibit 9-3c. Existing (2018) Route 267 AM Peak Period Average Speeds

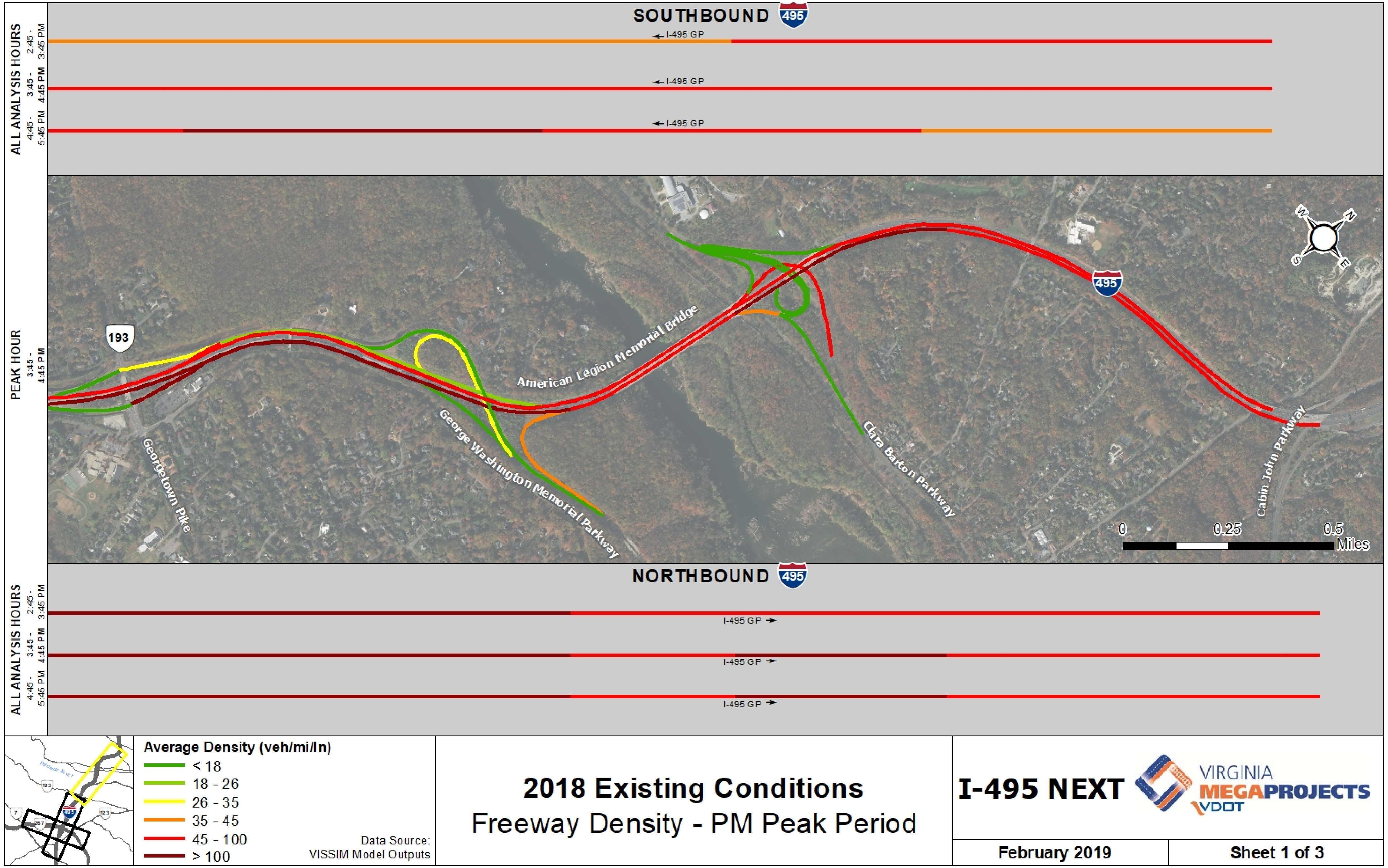


Exhibit 9-4a. Existing (2018) I-495 PM Peak Period Average Densities – Georgetown Pike to Northern Terminus

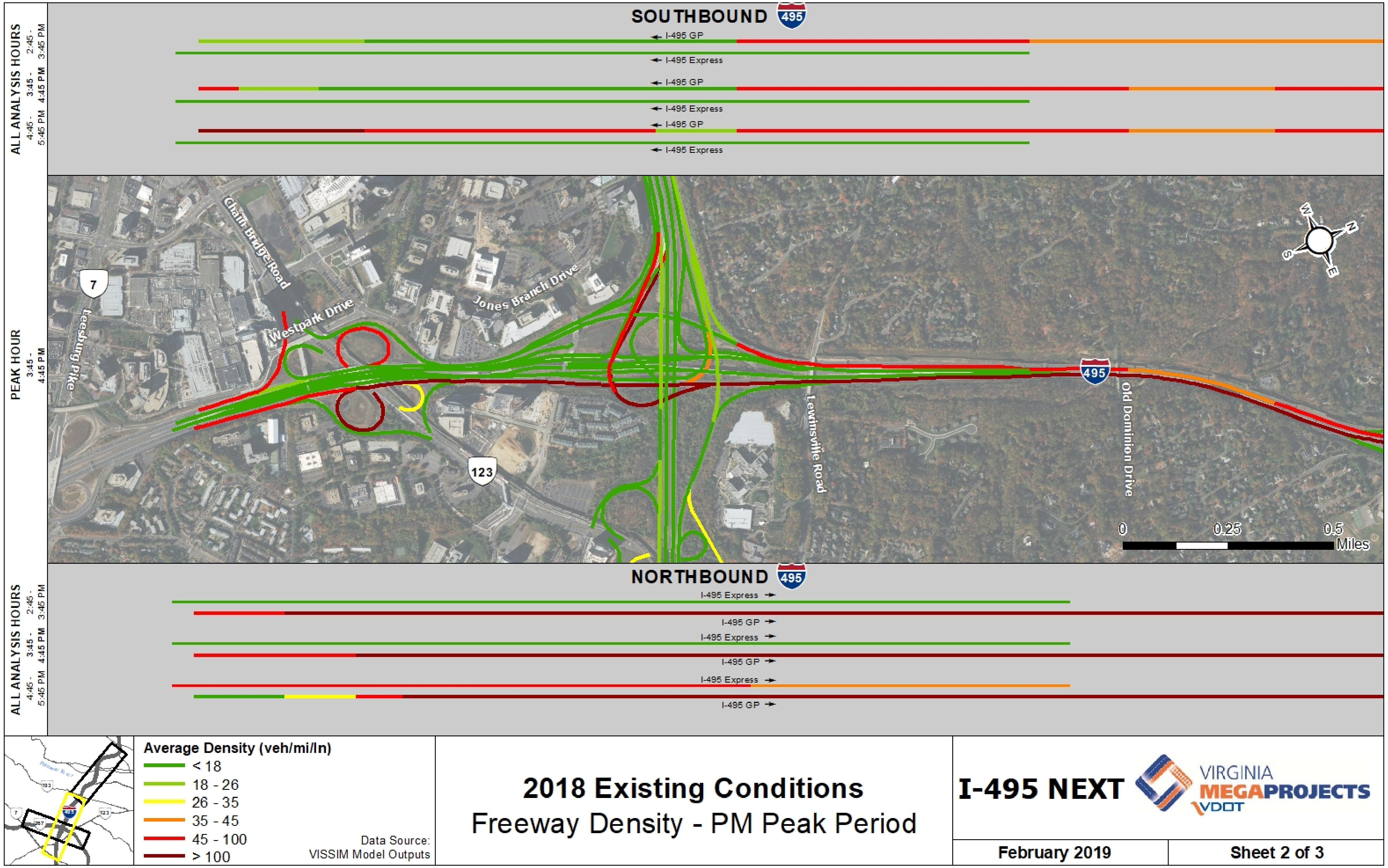


Exhibit 9-4b. Existing (2018) I-495 PM Peak Period Average Densities – Southern Terminus through Old Dominion Drive

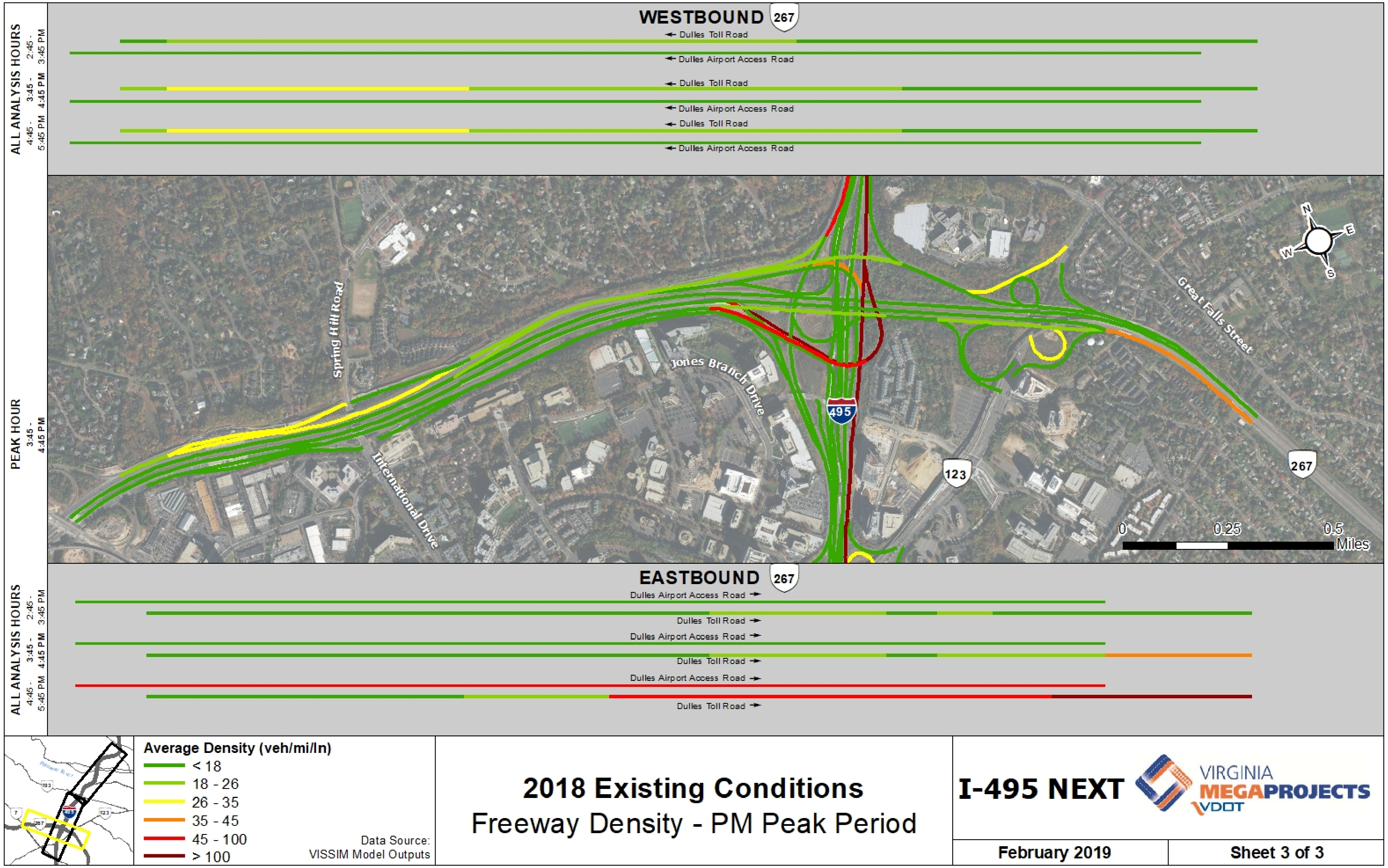


Exhibit 9-4c. Existing (2018) Route 267 PM Peak Period Average Densities

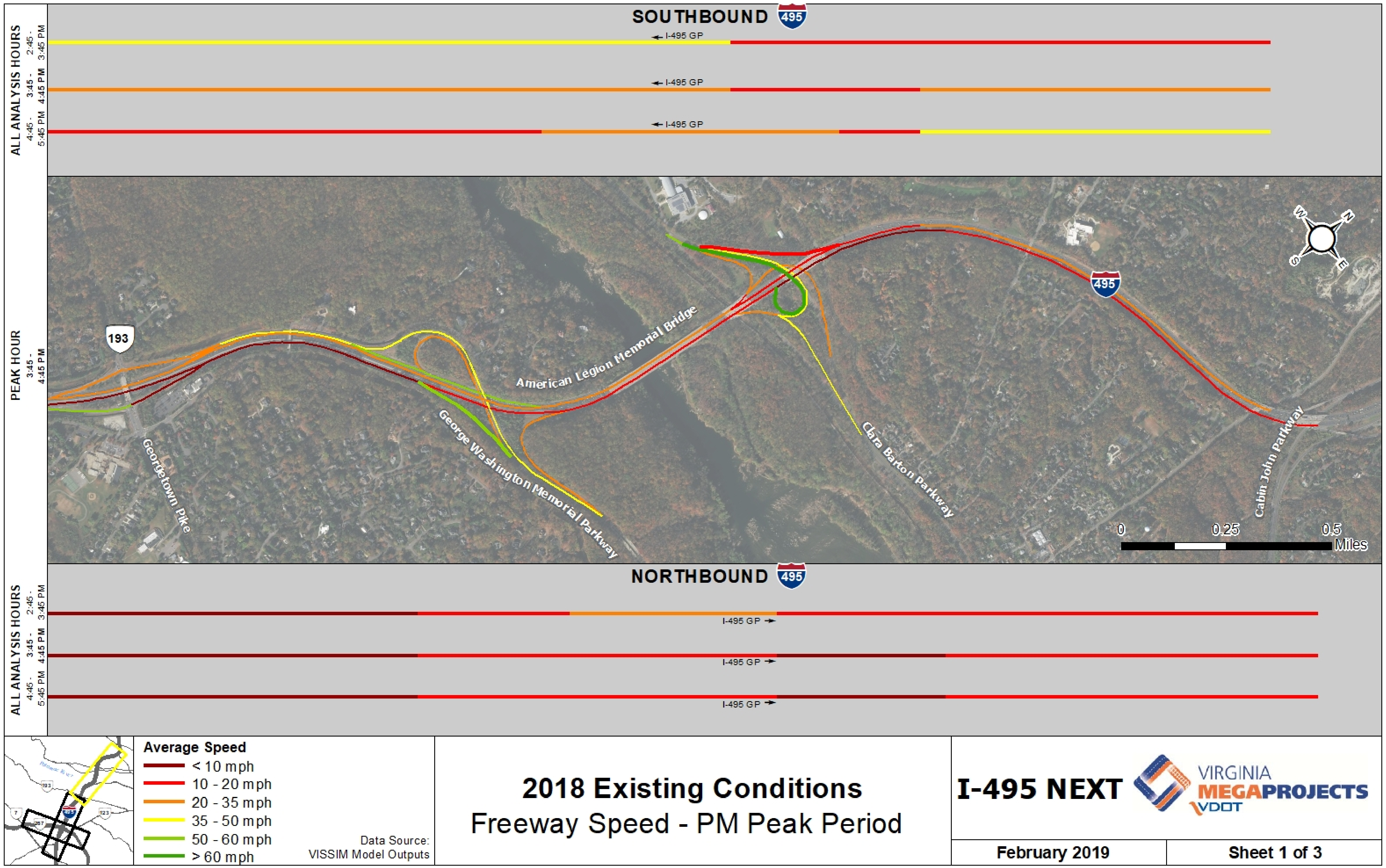


Exhibit 9-5a. Existing (2018) I-495 PM Peak Period Average Speeds – Georgetown Pike to Northern Terminus

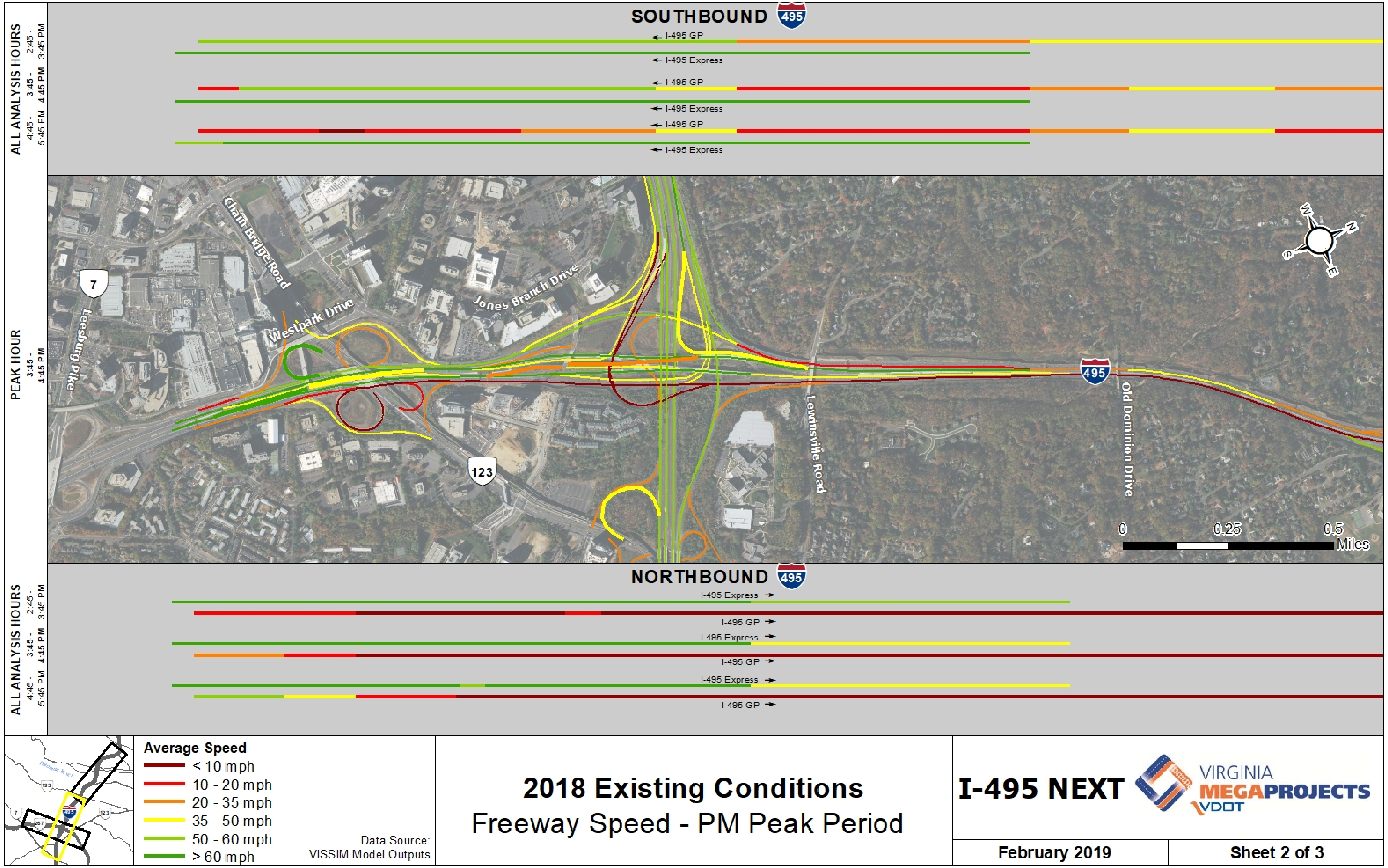


Exhibit 9-5b. Existing (2018) I-495 PM Peak Period Average Speeds – Southern Terminus through Old Dominion Drive

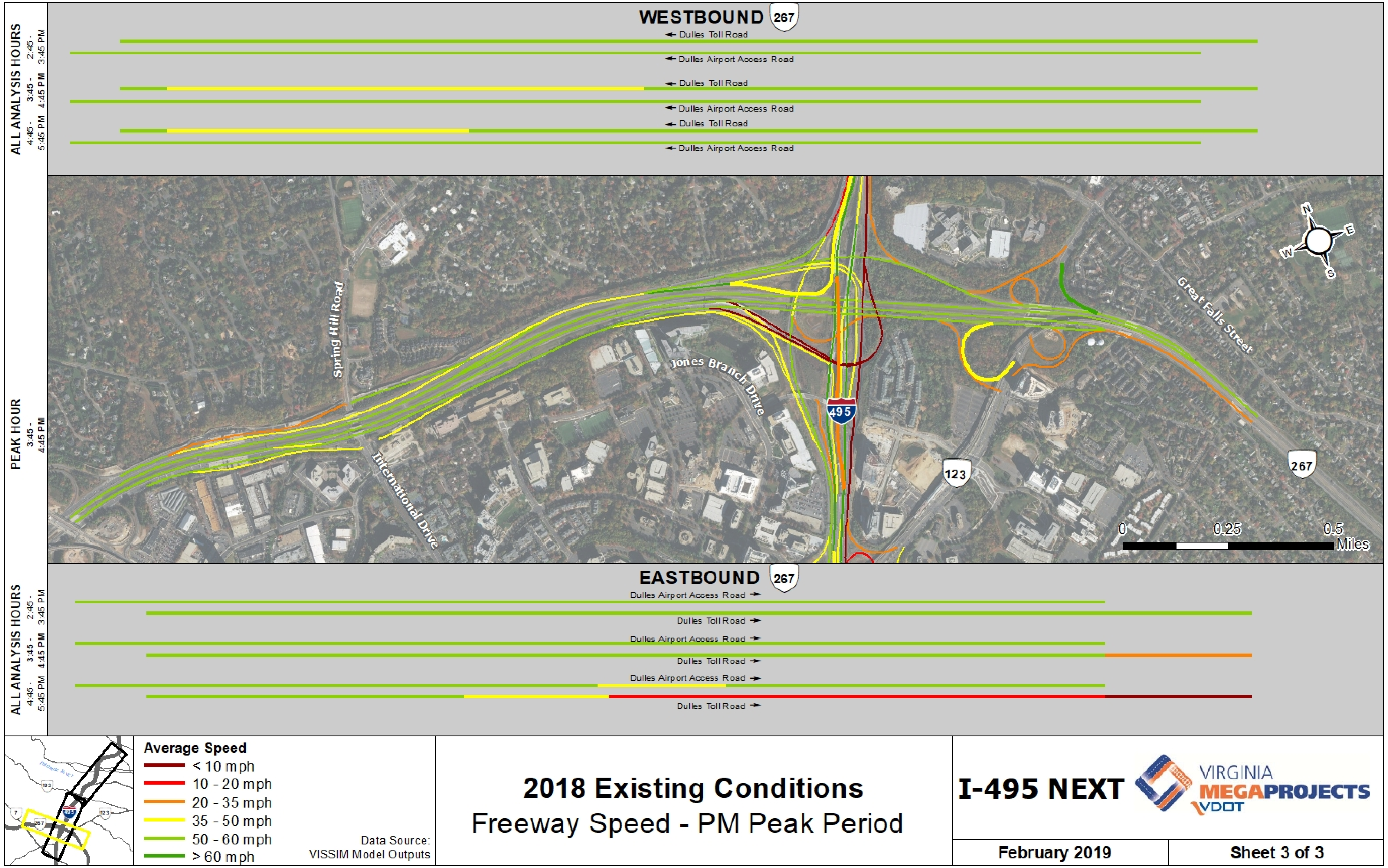


Exhibit 9-5c. Existing (2018) Route 267 PM Peak Period Average Speeds

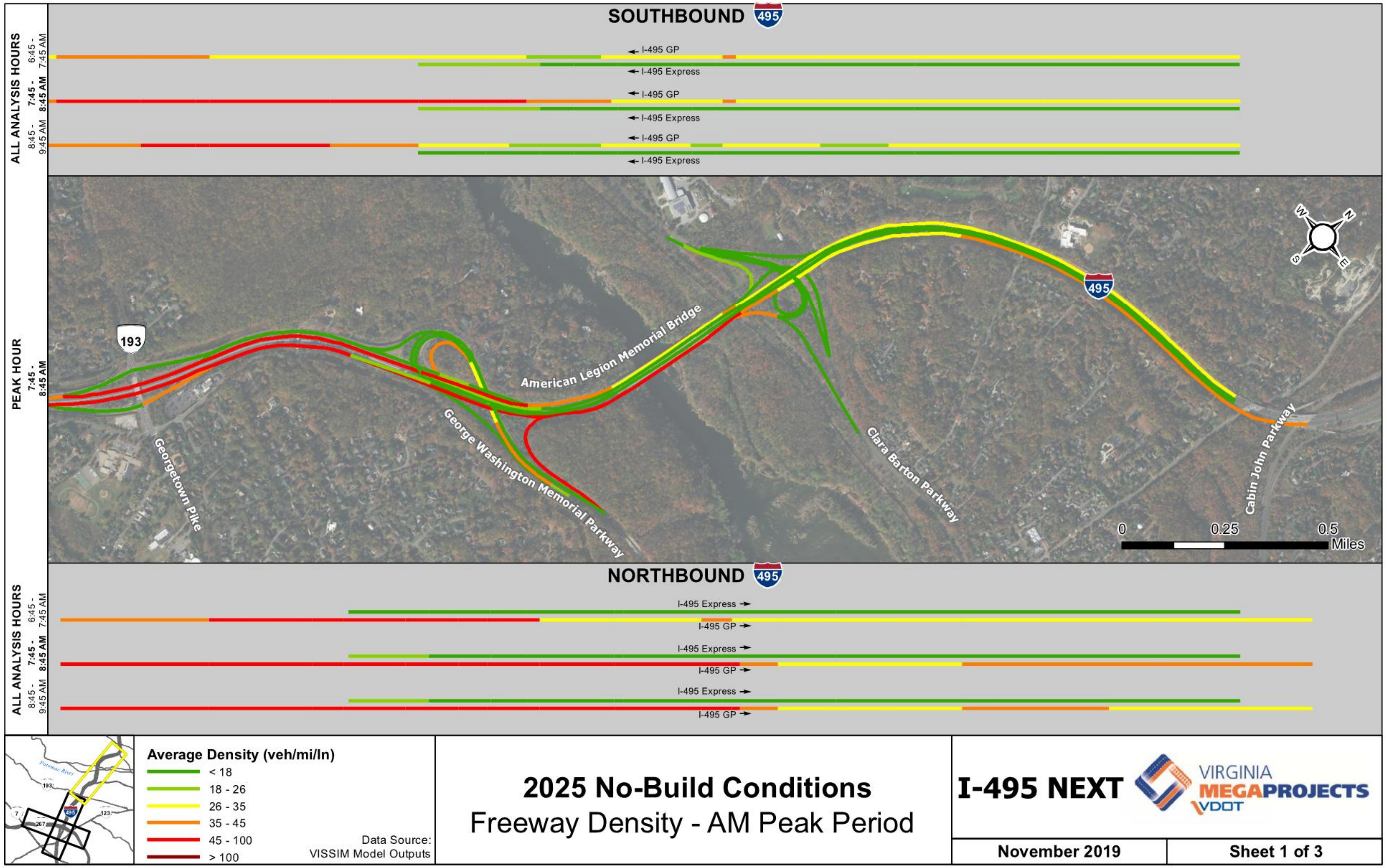


Exhibit 9-6a. 2025 No Build I-495 AM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

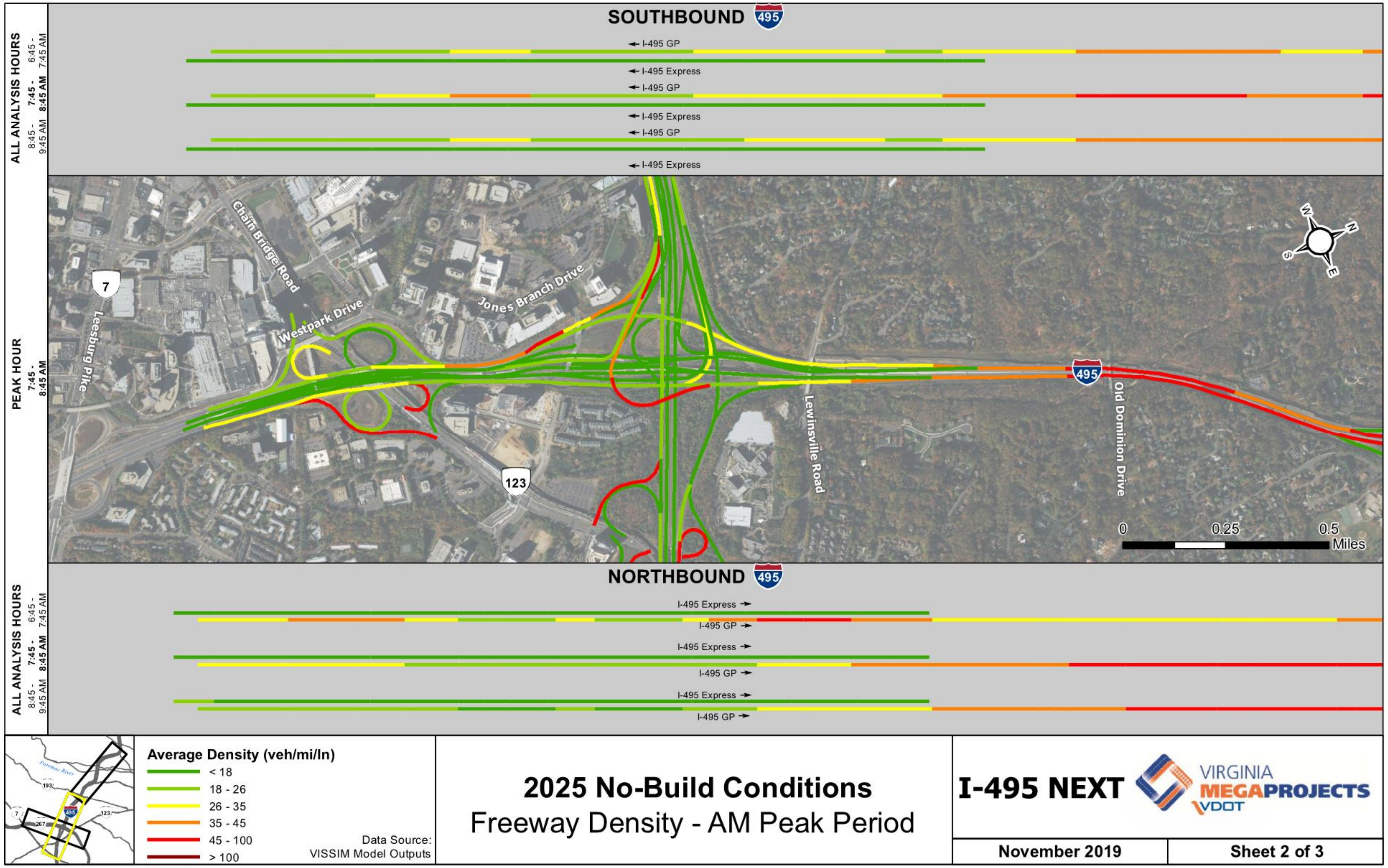


Exhibit 9-6b. 2025 No Build I-495 AM Peak Period Average Densities – Route 123 through Old Dominion Drive

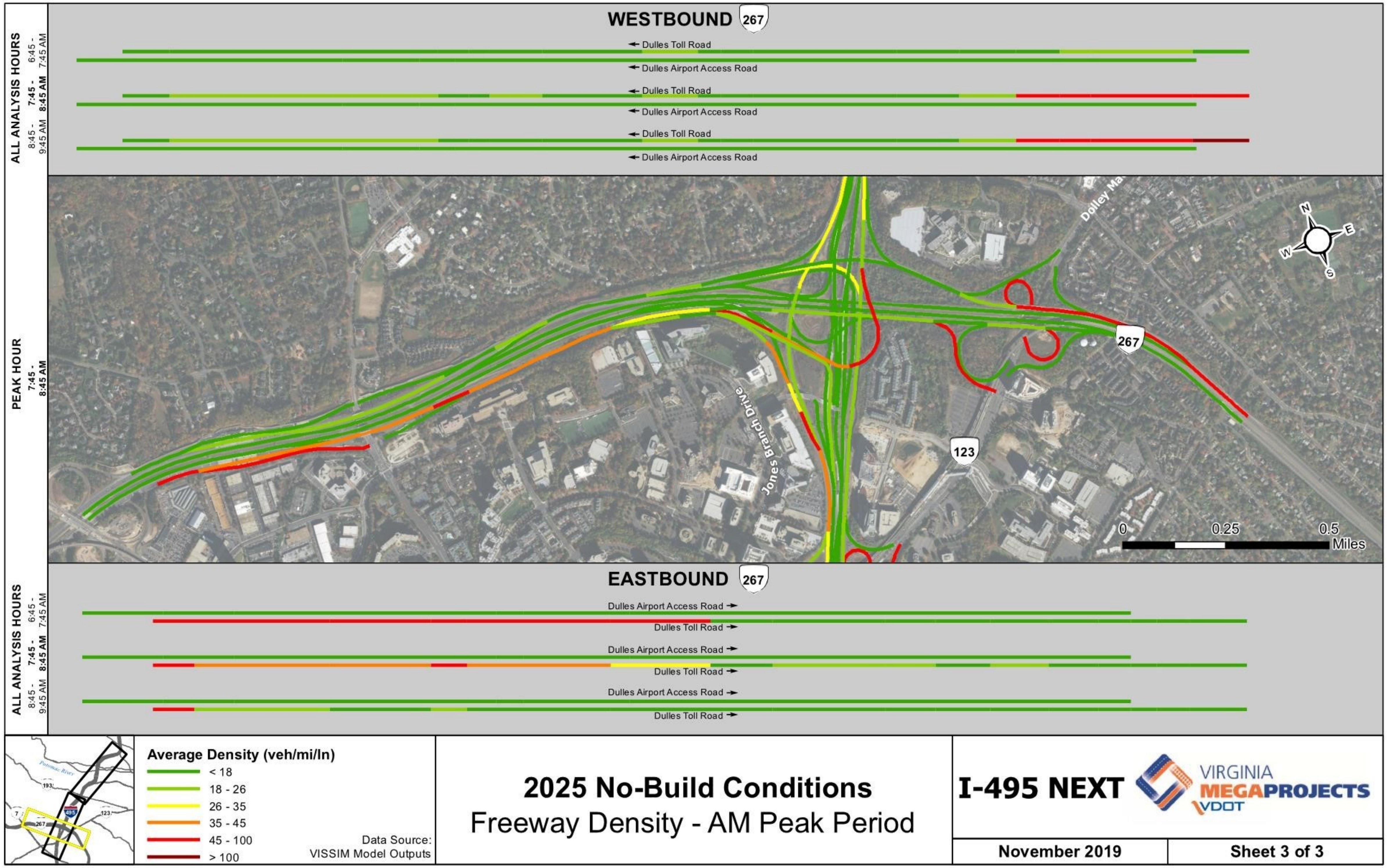


Exhibit 9-6c. 2025 No Build Route 267 AM Peak Period Average Densities

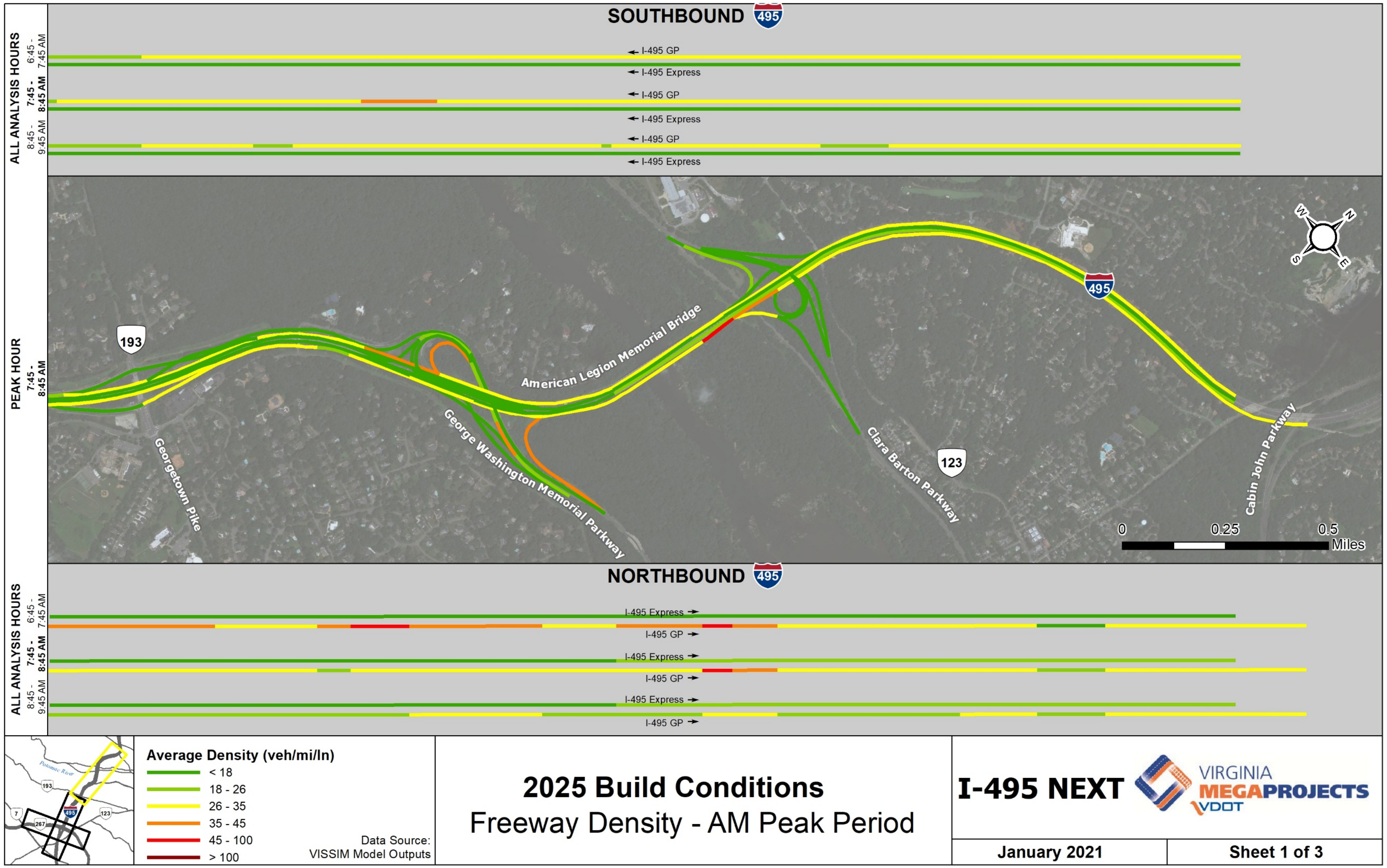


Exhibit 9-7a. 2025 Build I-495 AM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

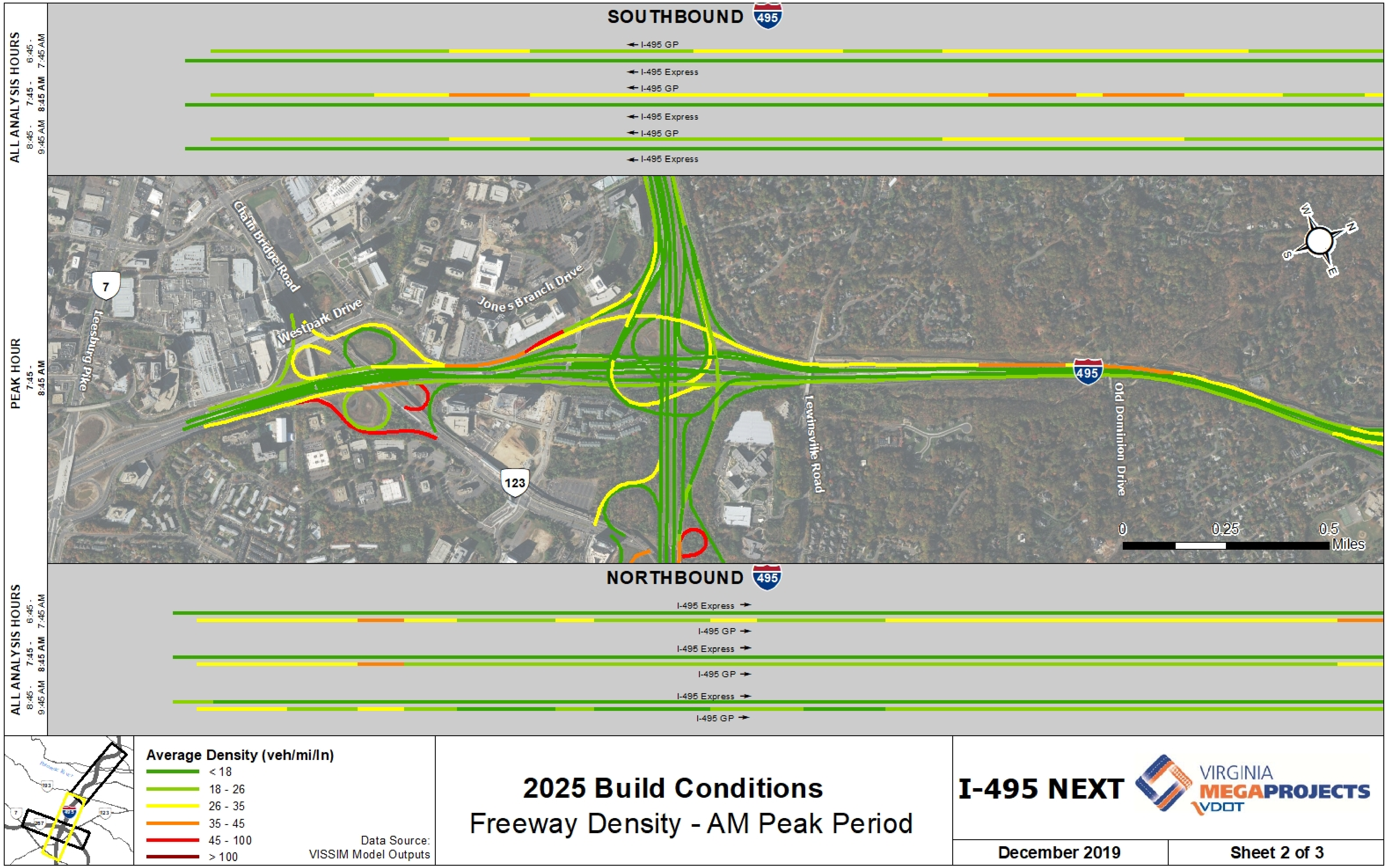


Exhibit 9-7b. 2025 Build I-495 AM Peak Period Average Densities – Route 123 through Old Dominion Drive

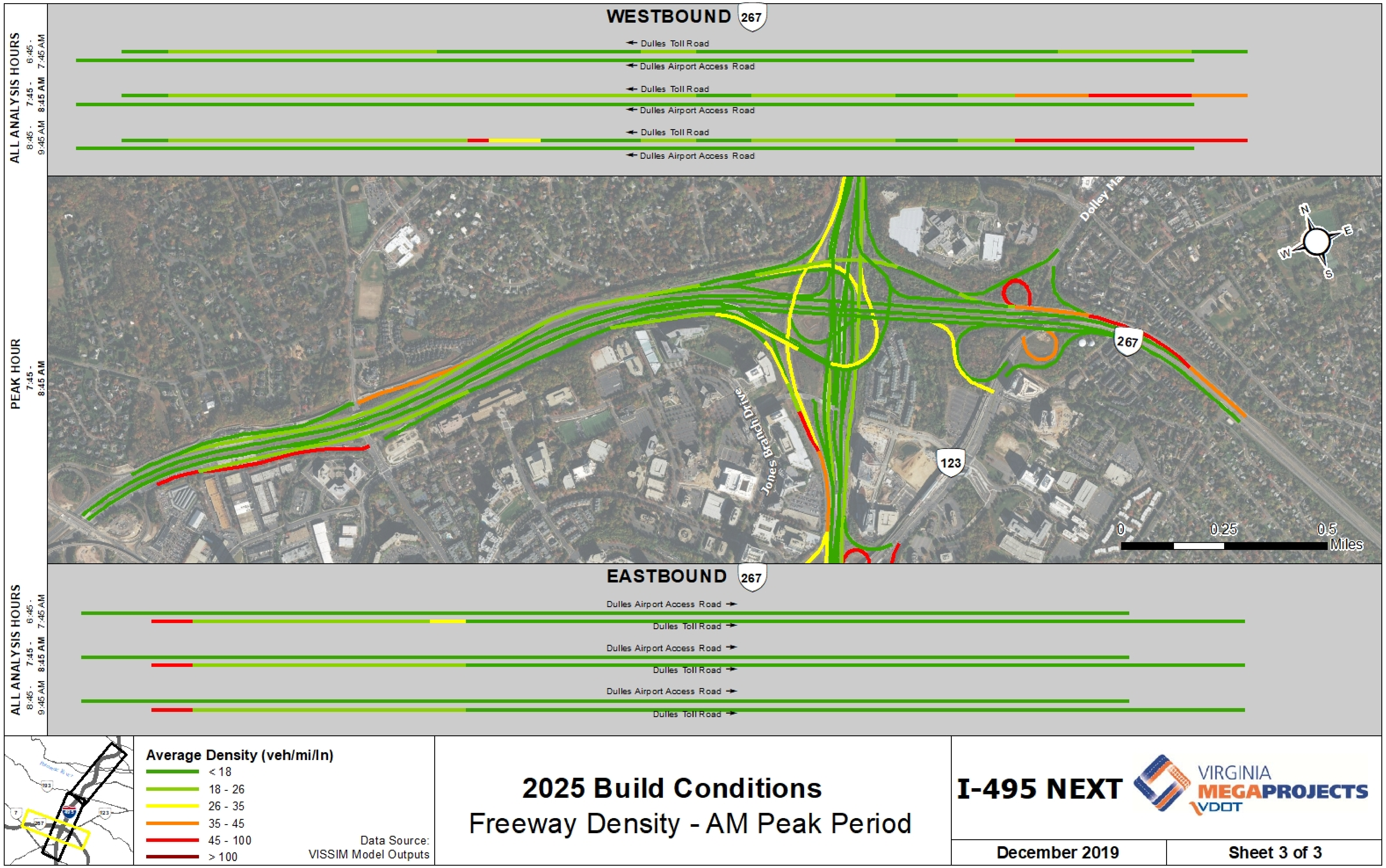


Exhibit 9-7c. 2025 Build Route 267 AM Peak Period Average Densities

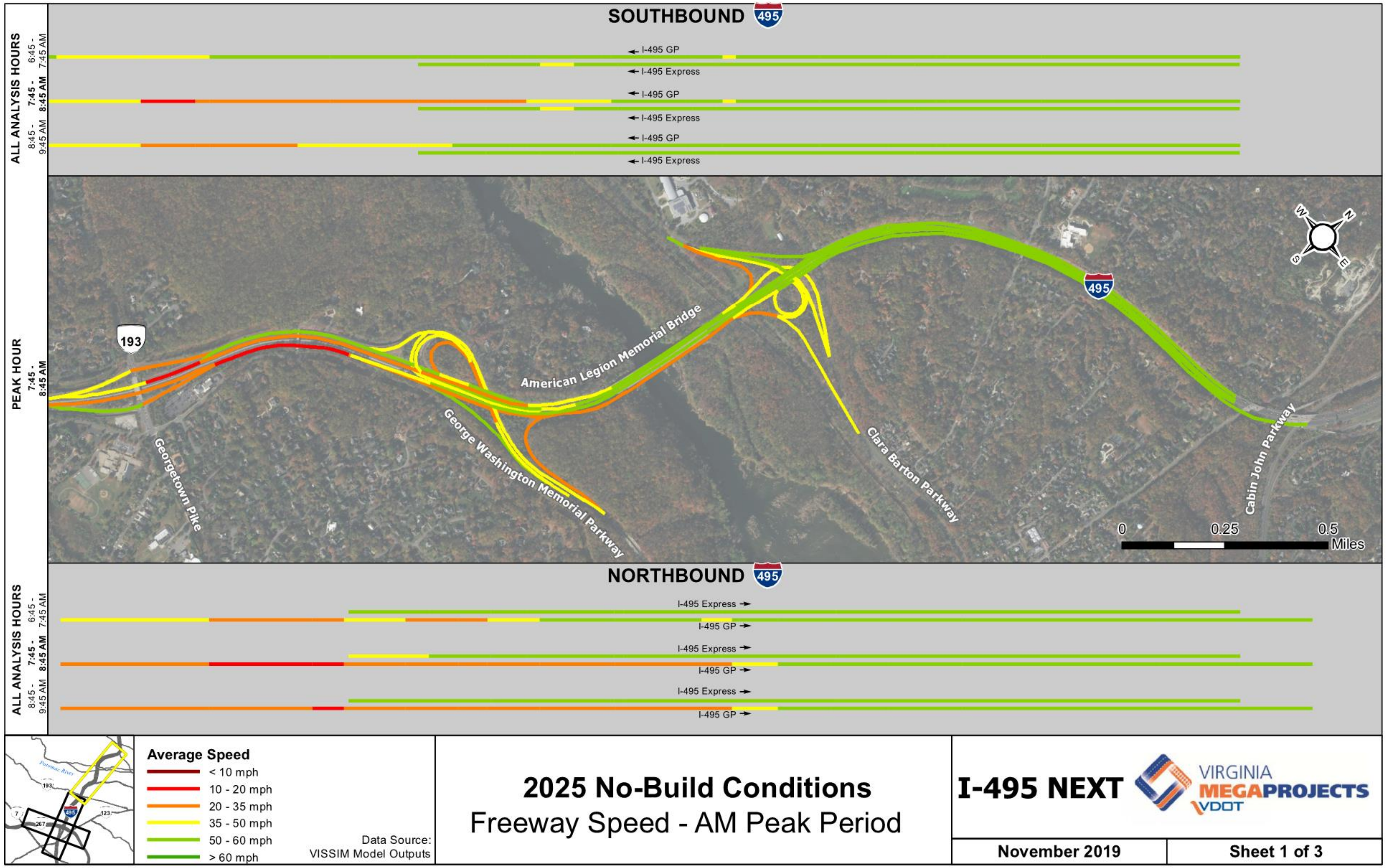


Exhibit 9-8a. 2025 No Build I-495 AM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

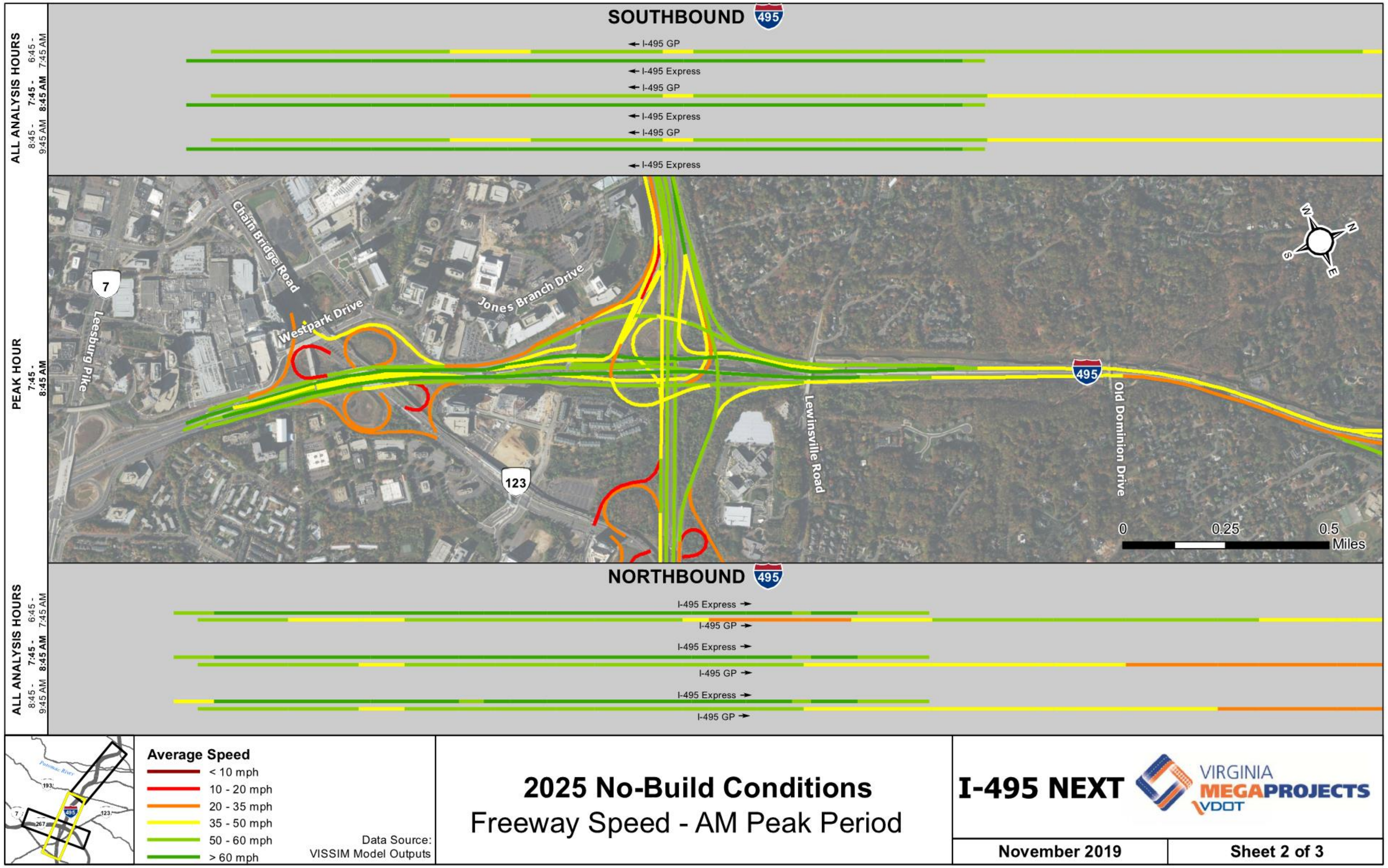


Exhibit 9-8b. 2025 No Build I-495 AM Peak Period Average Speeds – Route 123 through Old Dominion Drive

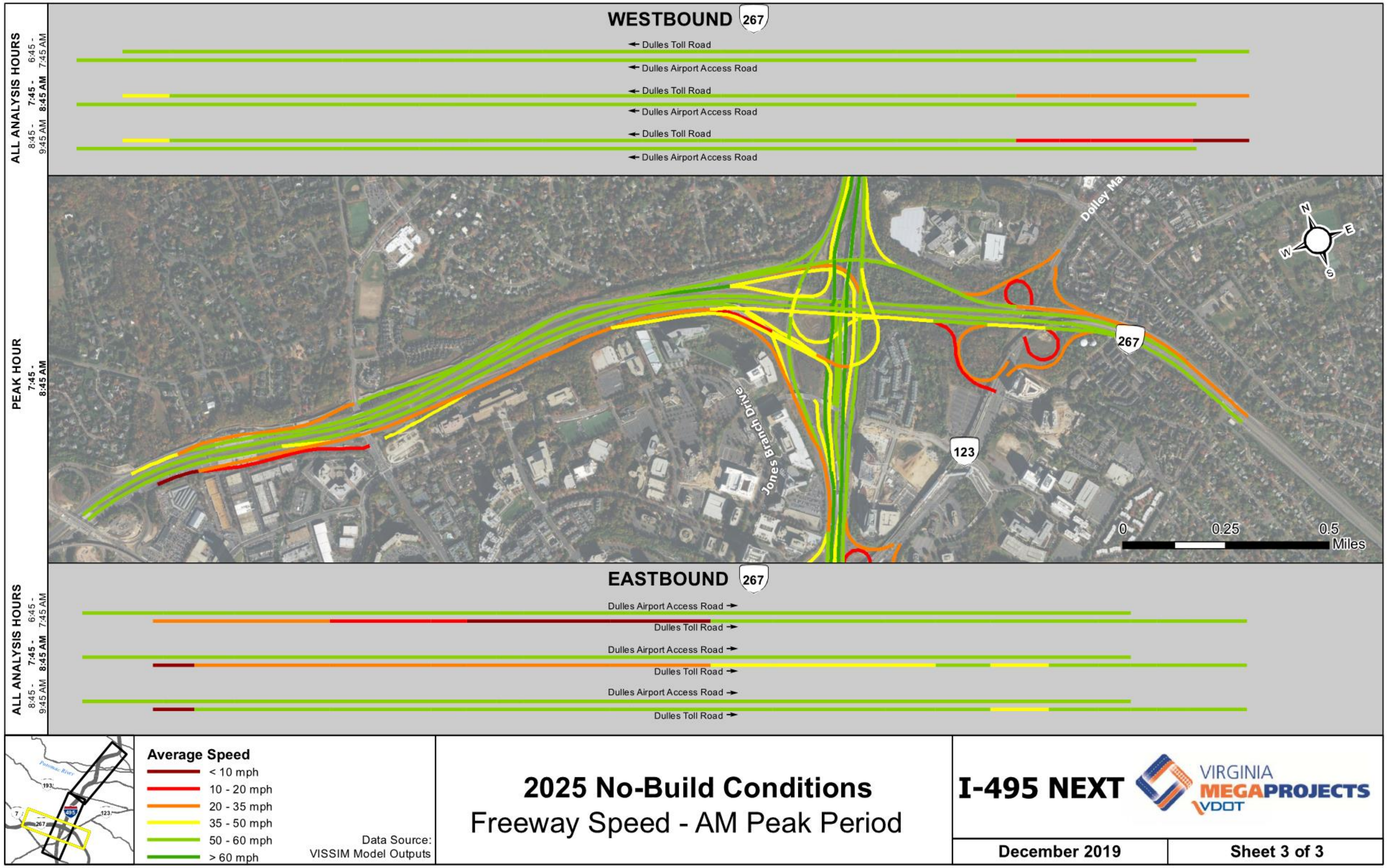


Exhibit 9-8c. 2025 No Build Route 267 AM Peak Period Average Speeds

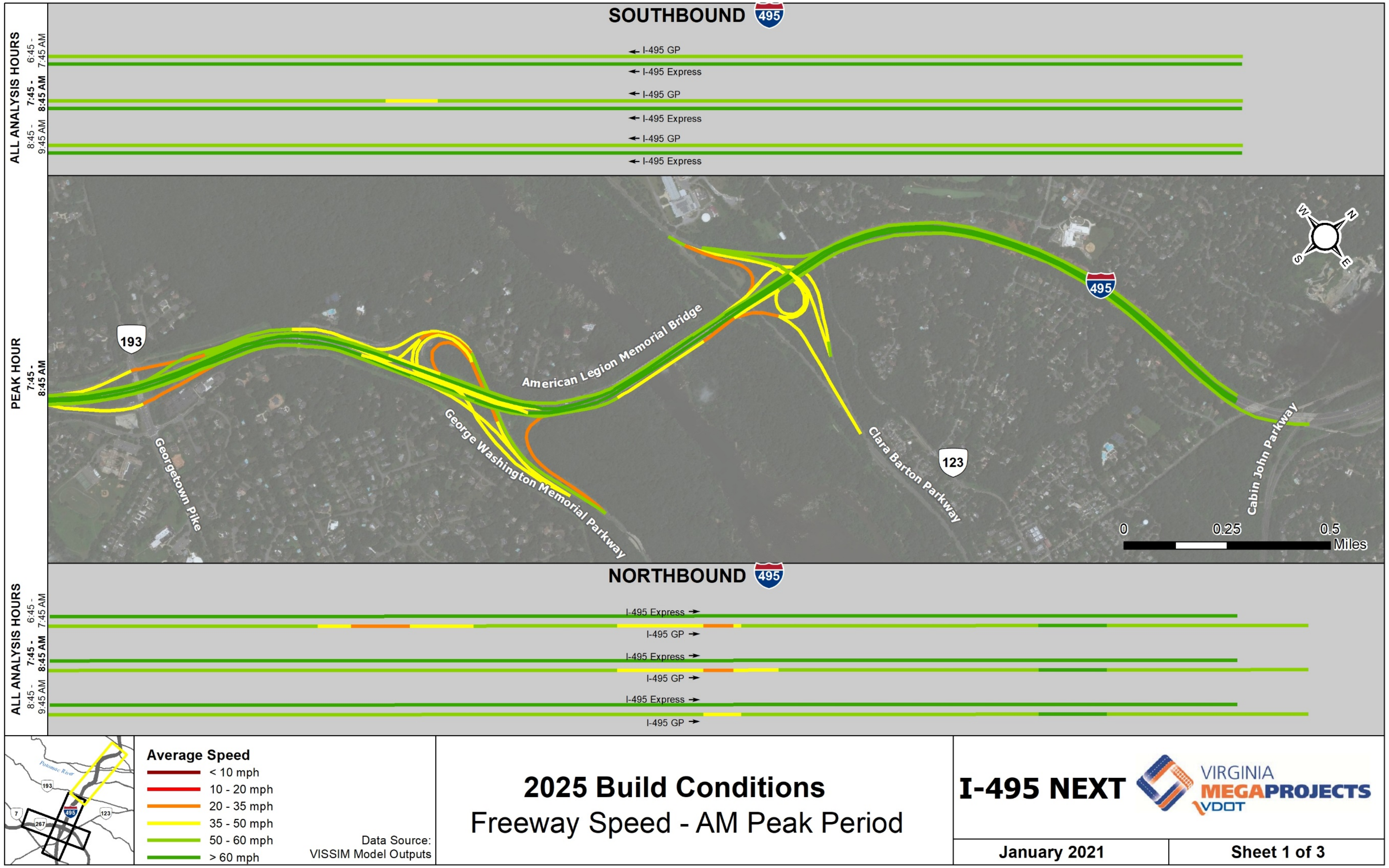


Exhibit 9-9a. 2025 Build I-495 AM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

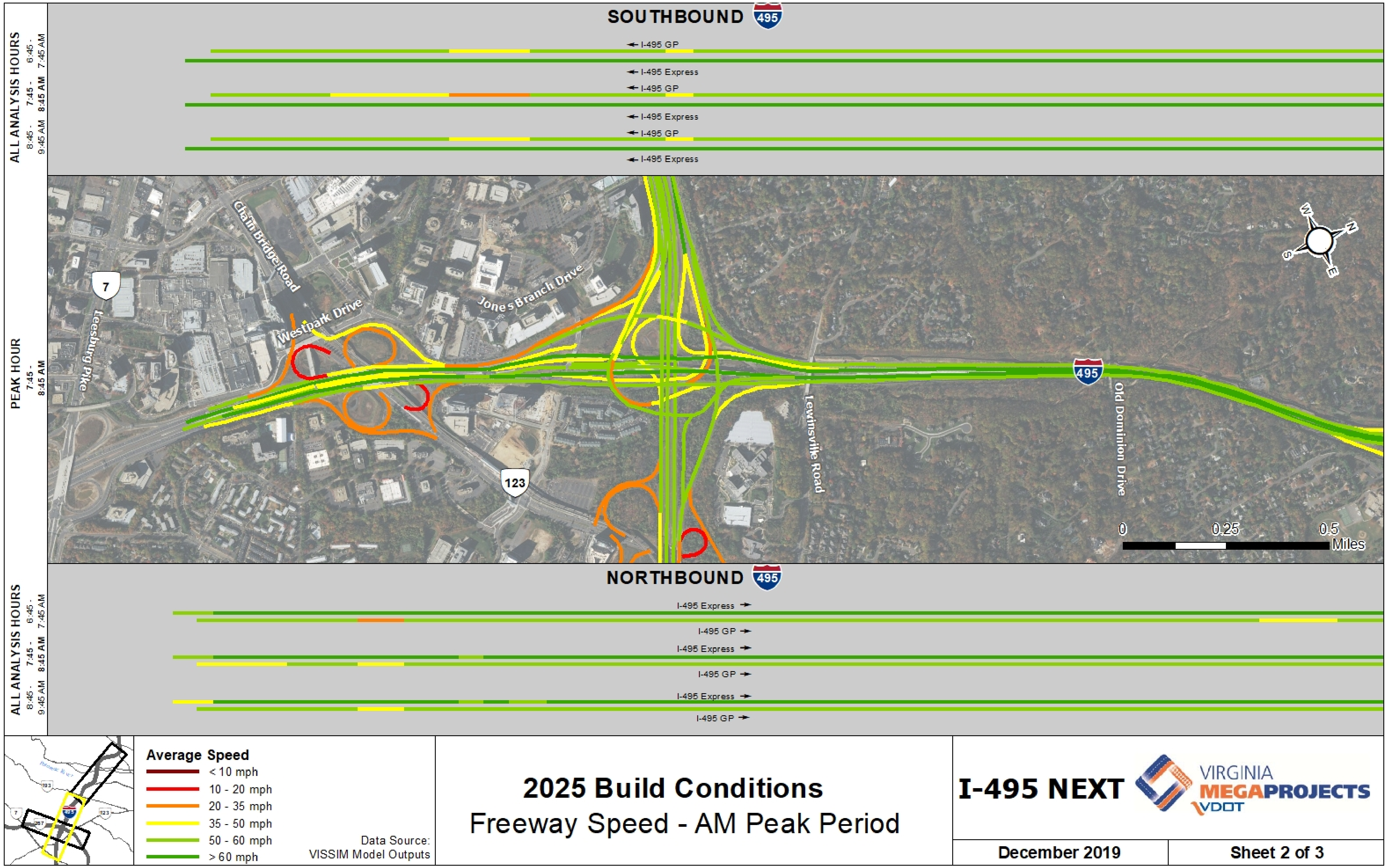


Exhibit 9-9b. 2025 Build I-495 AM Peak Period Average Speeds – Route 123 through Old Dominion Drive

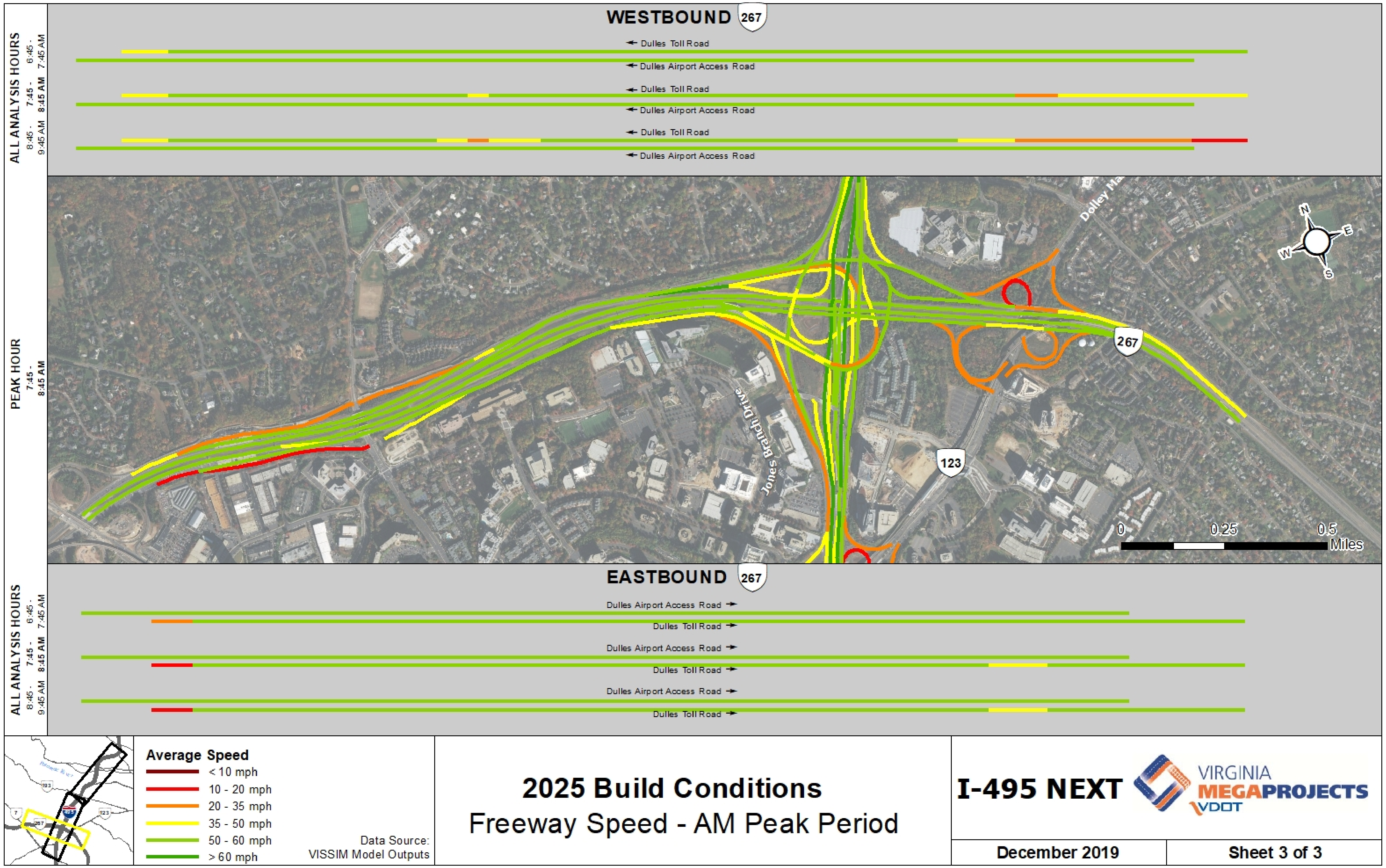


Exhibit 9-9c. 2025 Build Route 267 AM Peak Period Average Speeds

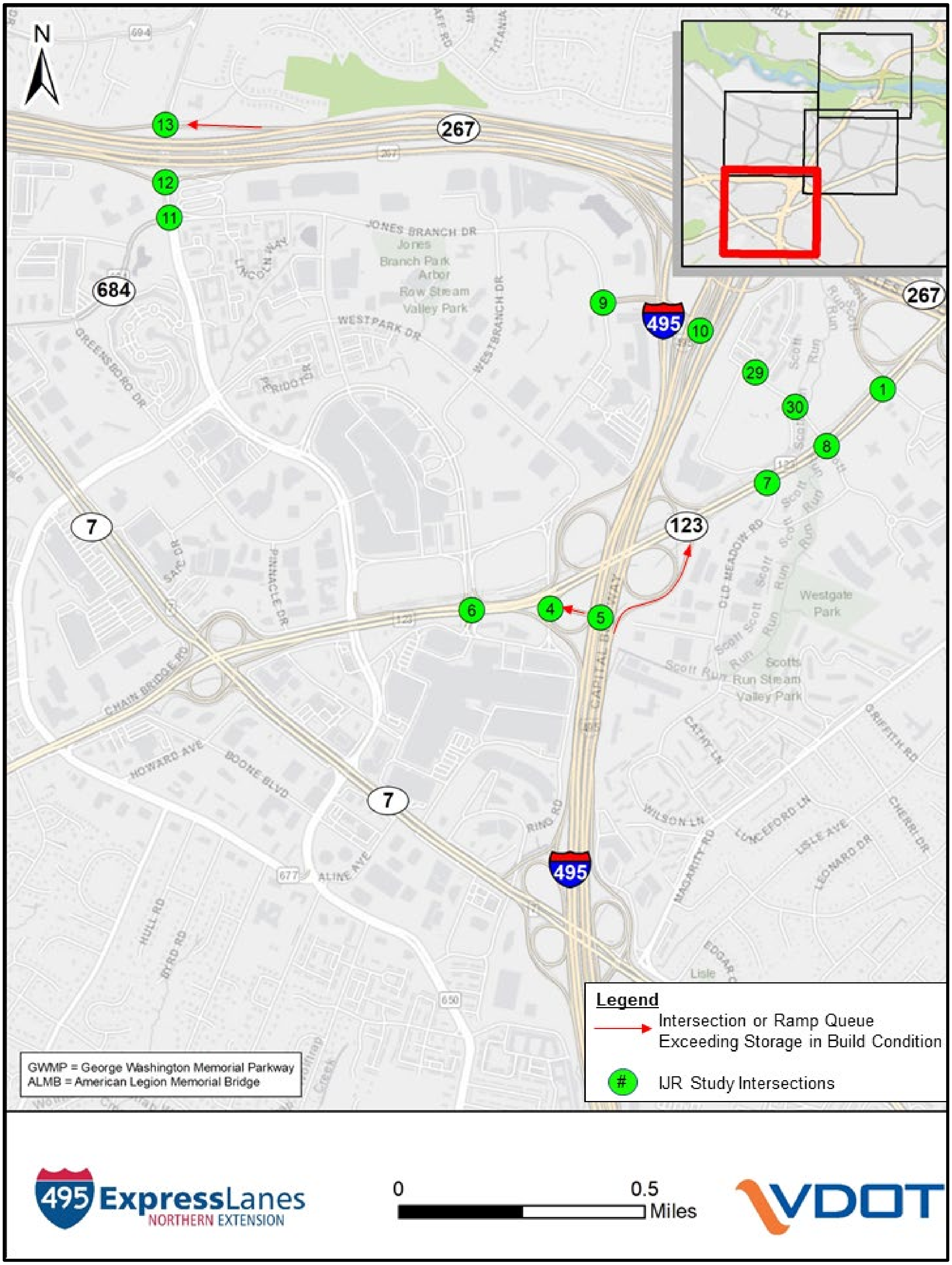


Exhibit 9-10a. Queues Exceeding Storage in 2025 Build AM Condition (Page 1 of 4)

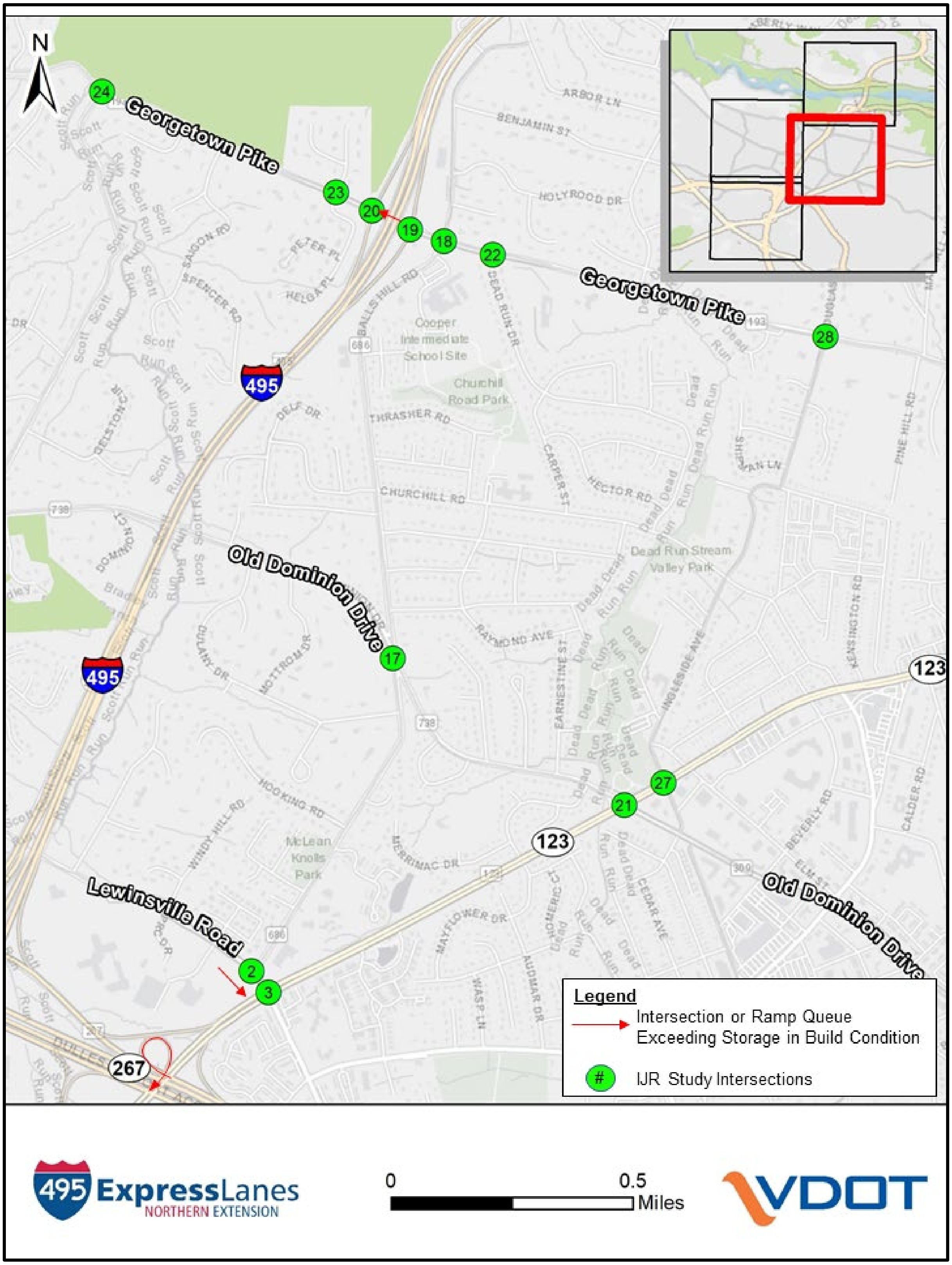


Exhibit 9-10b. Queues Exceeding Storage in 2025 Build AM Condition (Page 2 of 4)

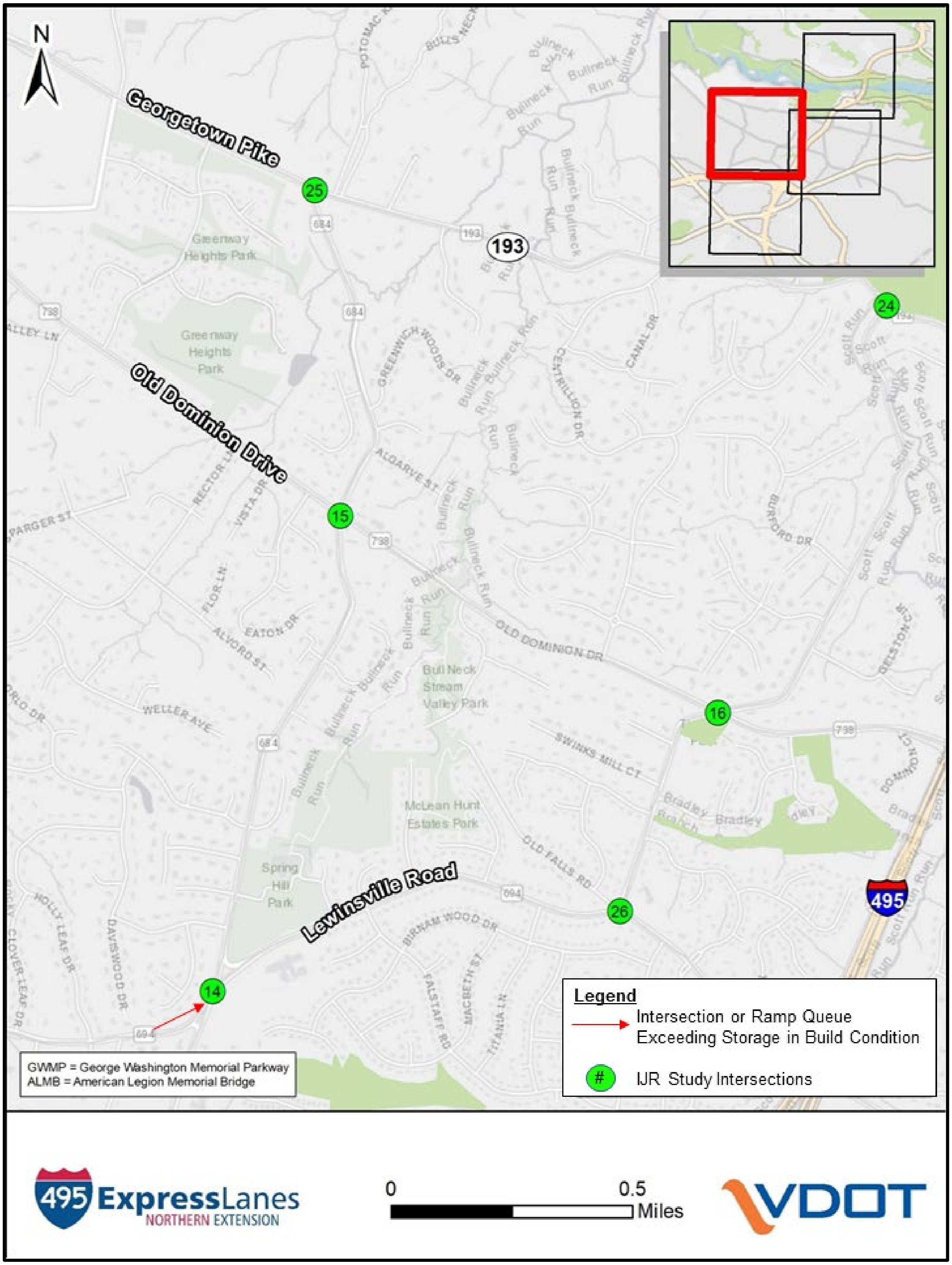


Exhibit 9-10c. Queues Exceeding Storage in 2025 Build AM Condition (Page 3 of 4)

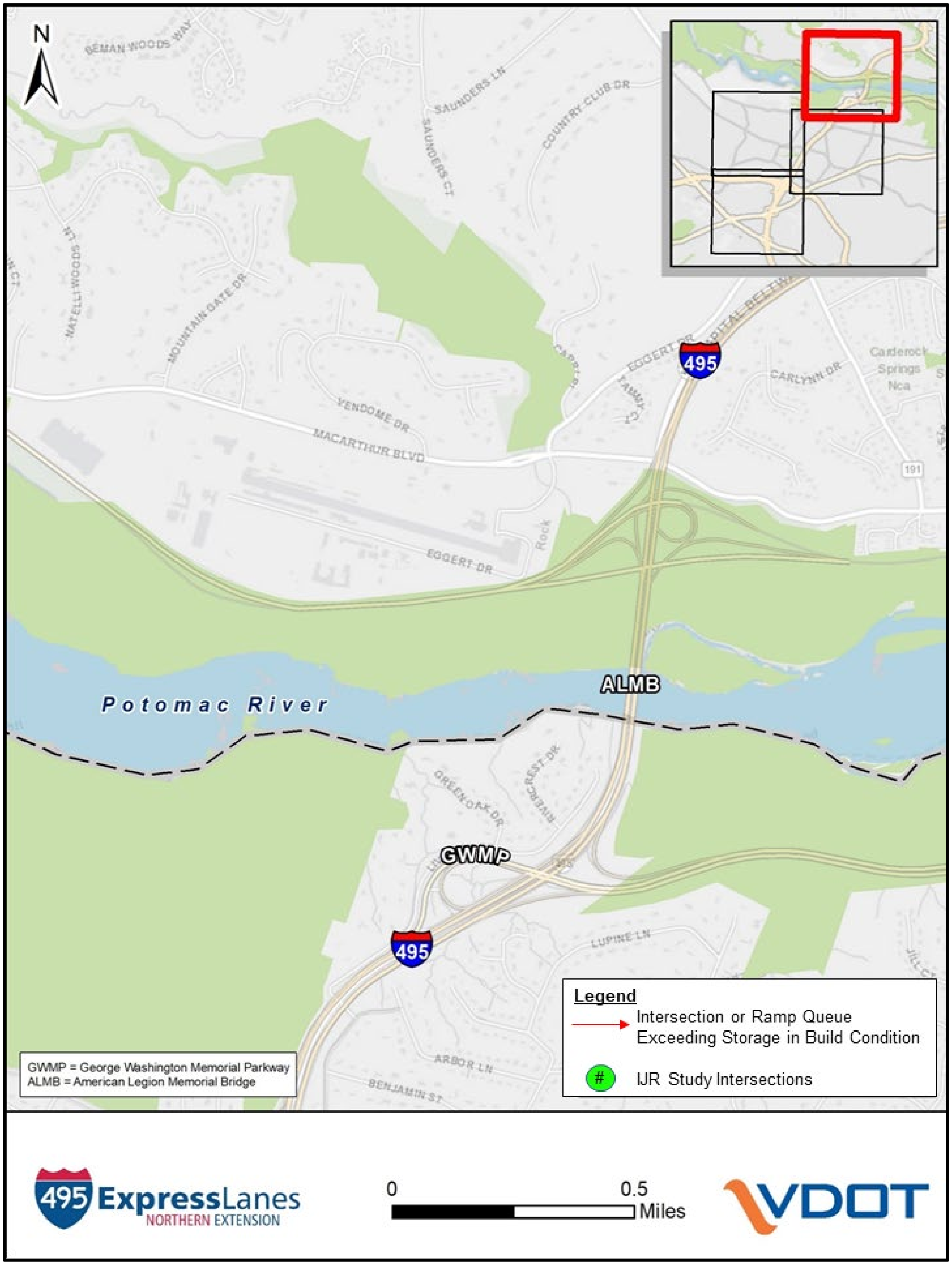


Exhibit 9-10d. Queues Exceeding Storage in 2025 Build AM Condition (Page 4 of 4)

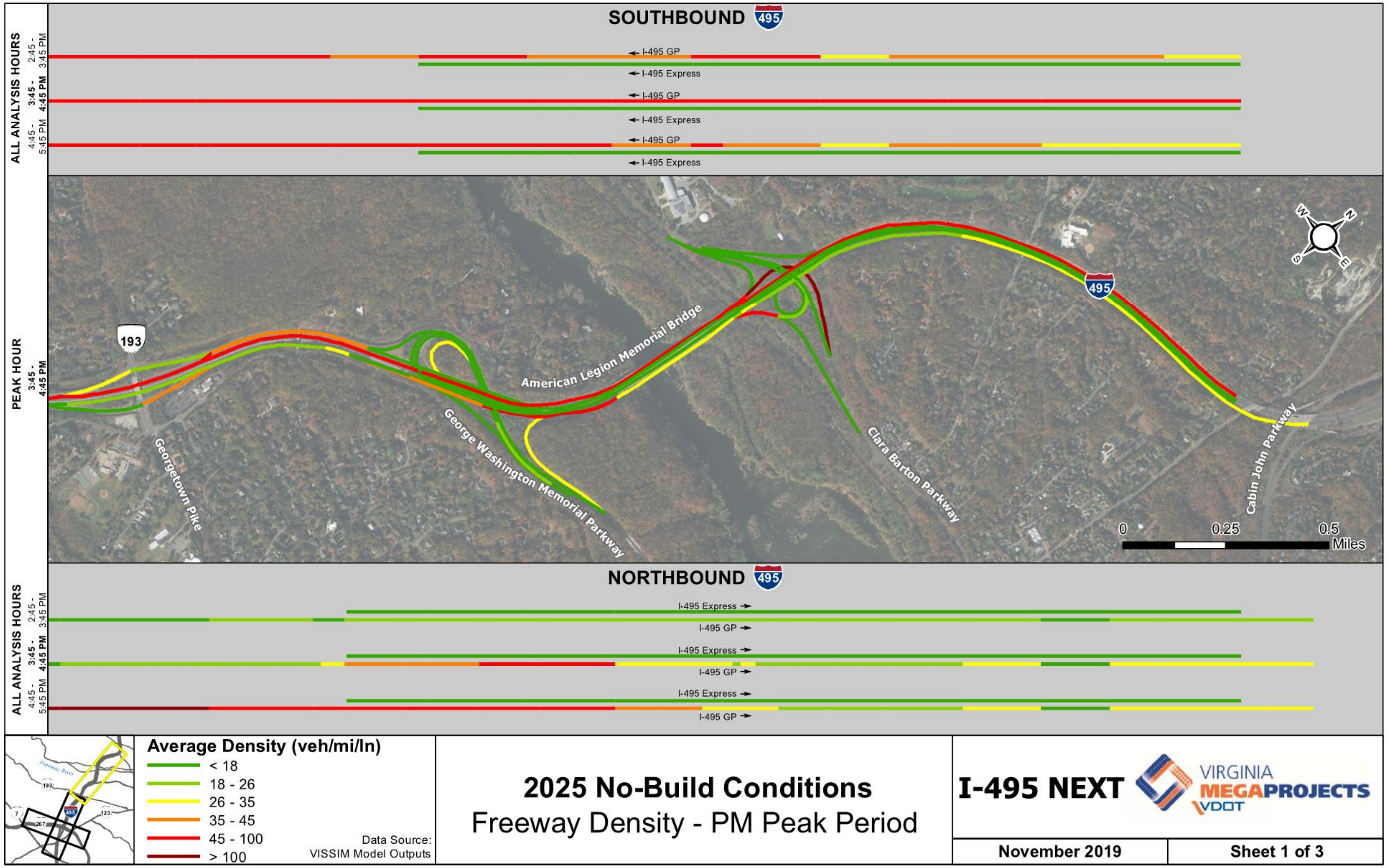


Exhibit 9-11a. 2025 No Build I-495 PM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

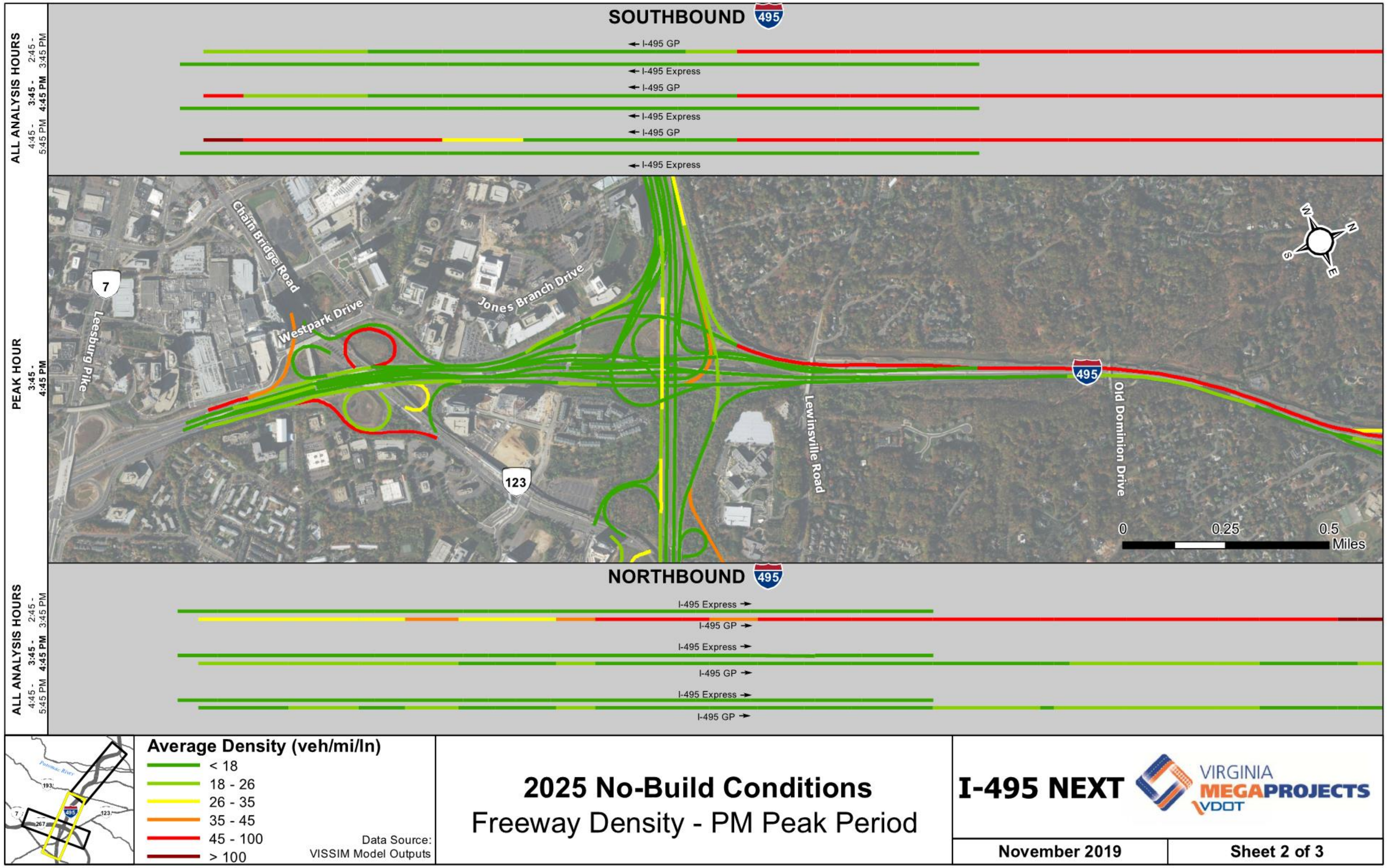


Exhibit 9-11b. 2025 No Build I-495 PM Peak Period Average Densities – Route 123 through Old Dominion Drive

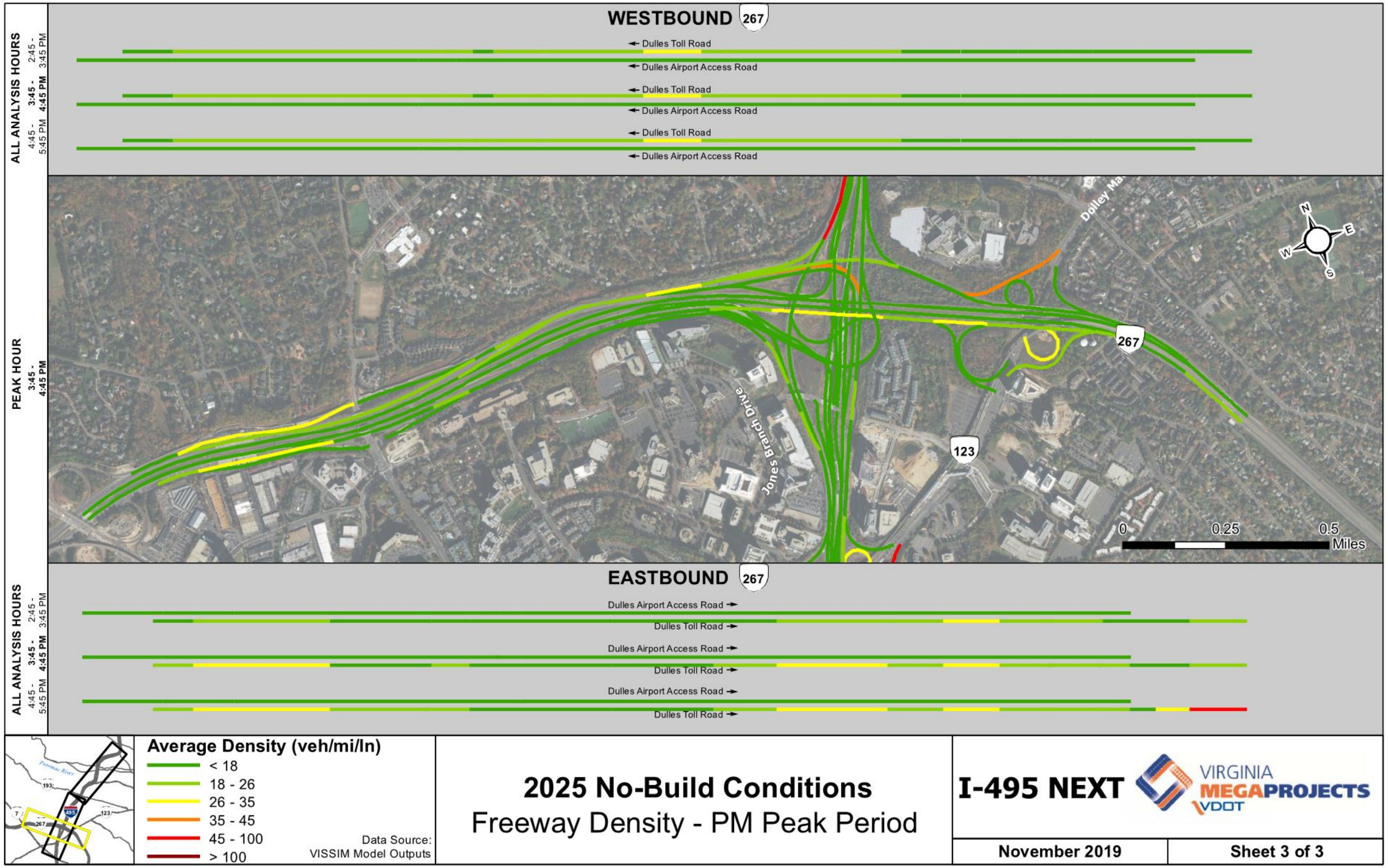


Exhibit 9-11c. 2025 No Build Route 267 PM Peak Period Average Densities

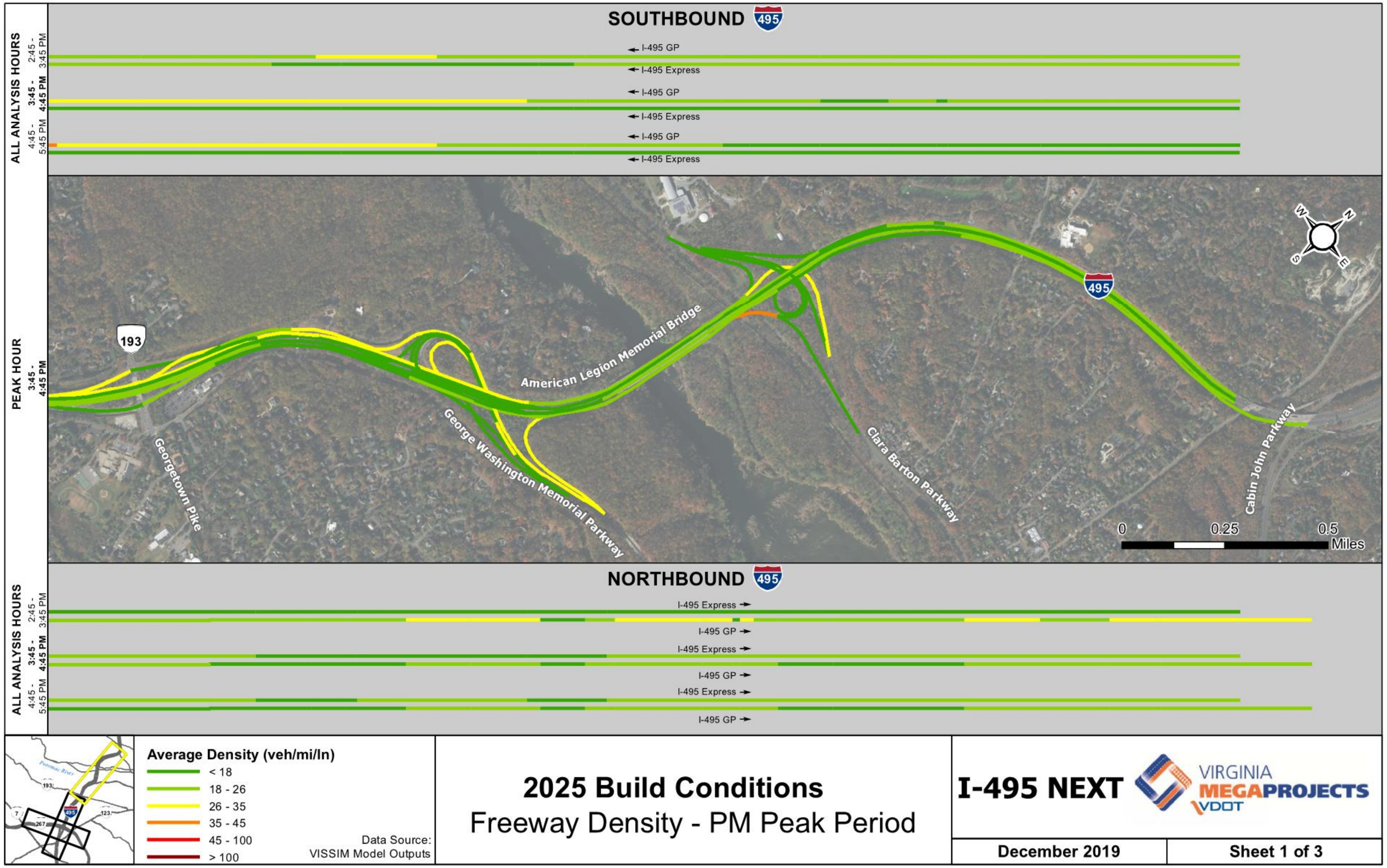


Exhibit 9-12a. 2025 Build I-495 PM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

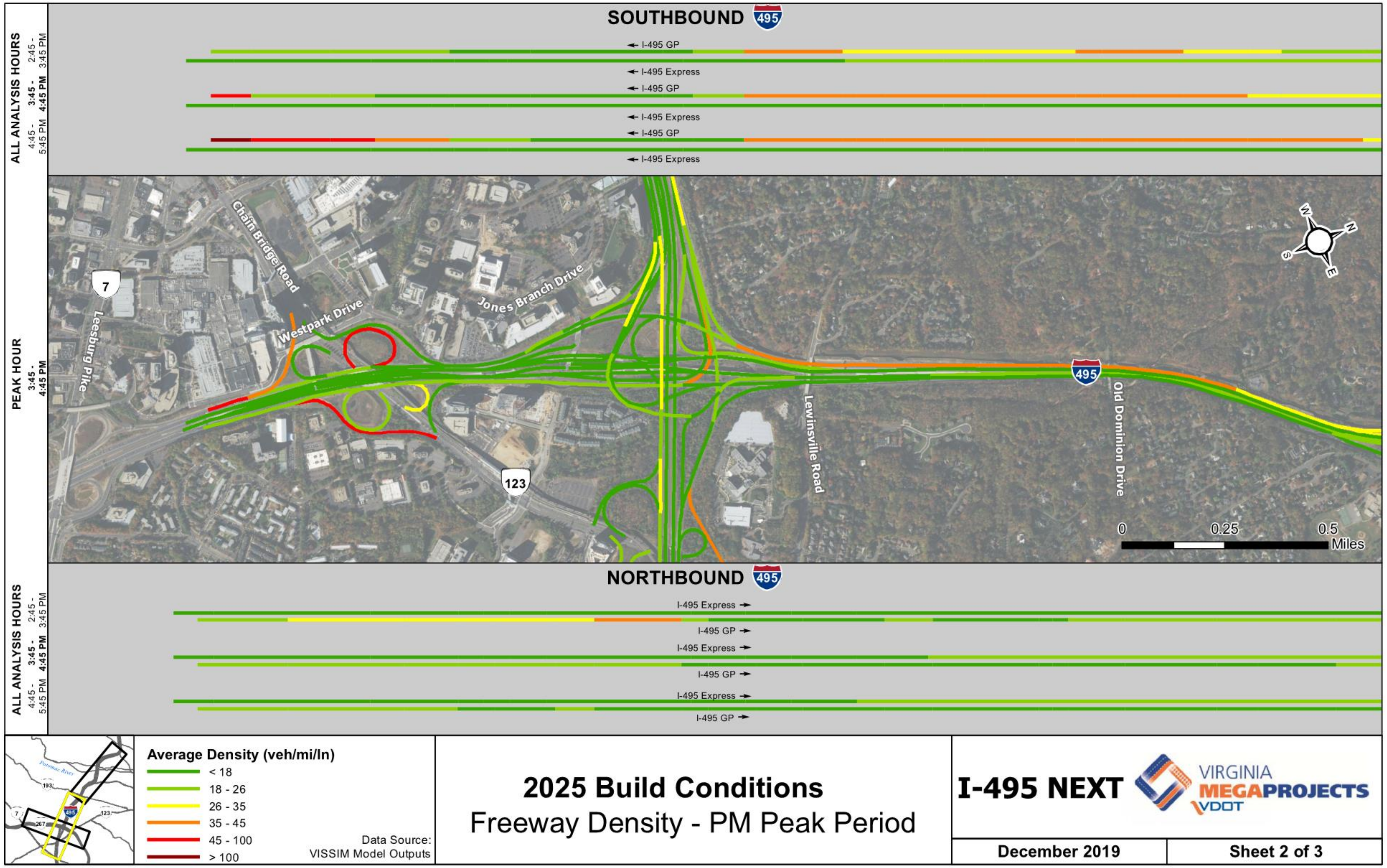


Exhibit 9-12b. 2025 Build I-495 PM Peak Period Average Densities – Route 123 through Old Dominion Drive

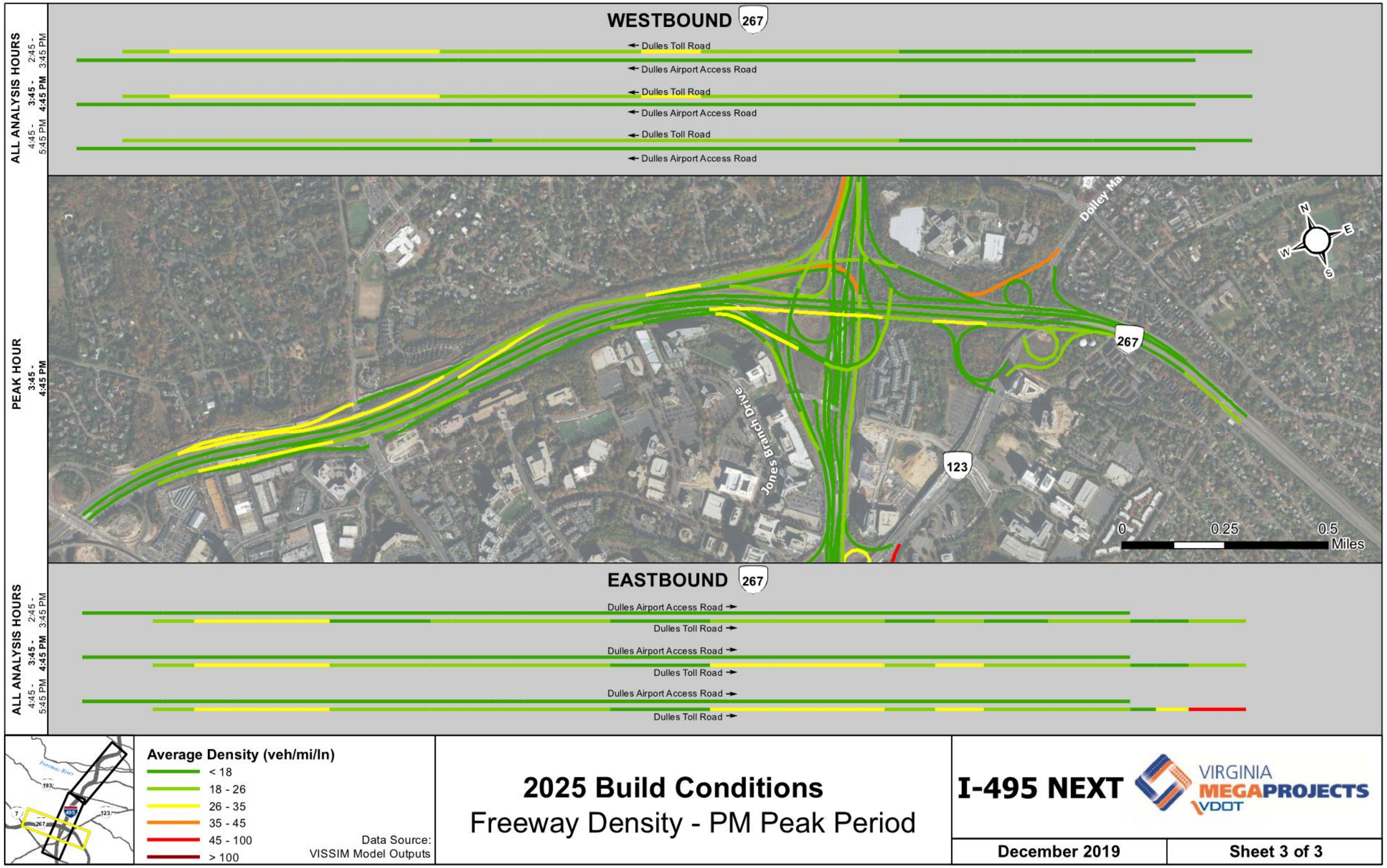


Exhibit 9-12c. 2025 Build Route 267 PM Peak Period Average Densities

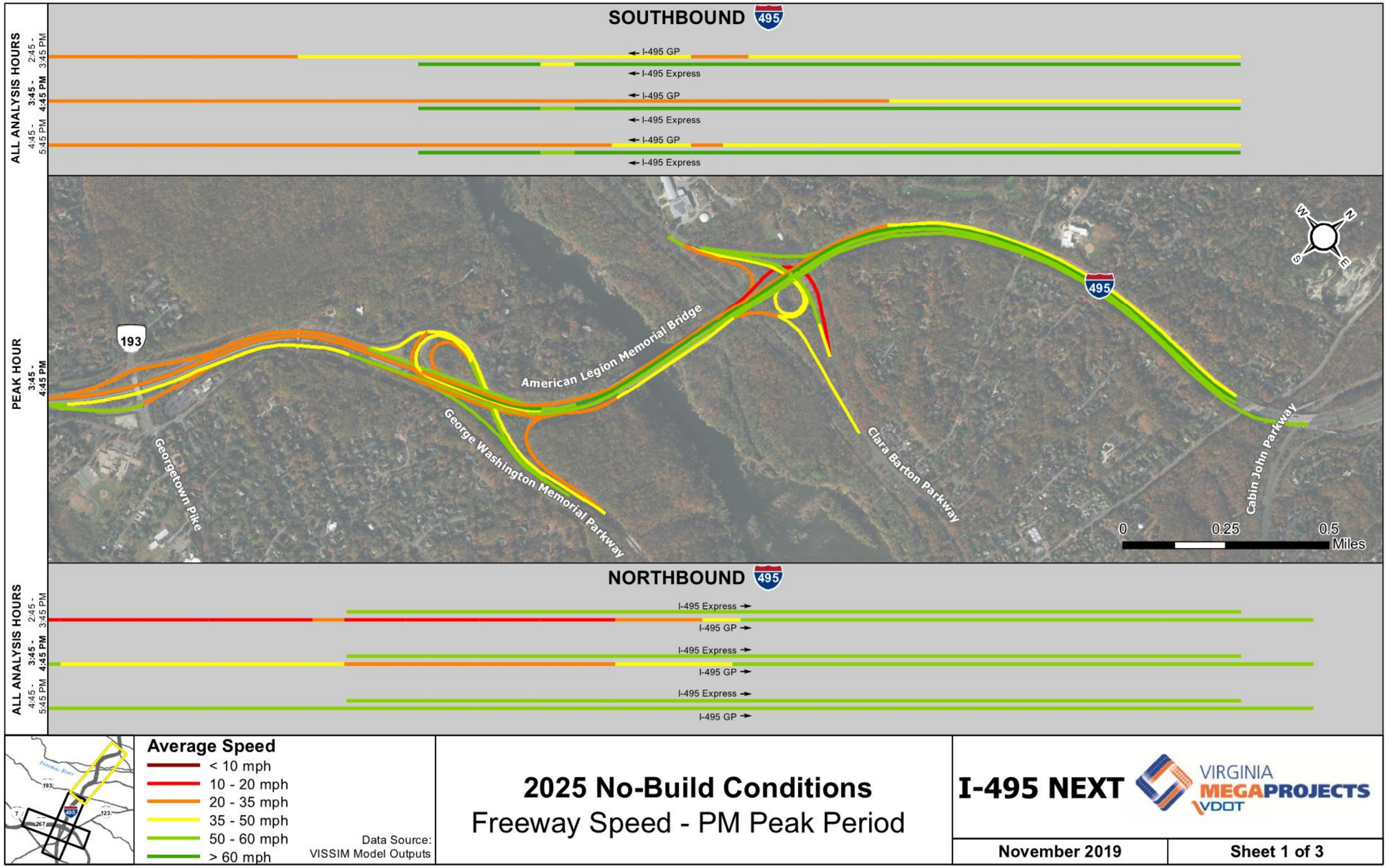


Exhibit 9-13a. 2025 No Build I-495 PM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

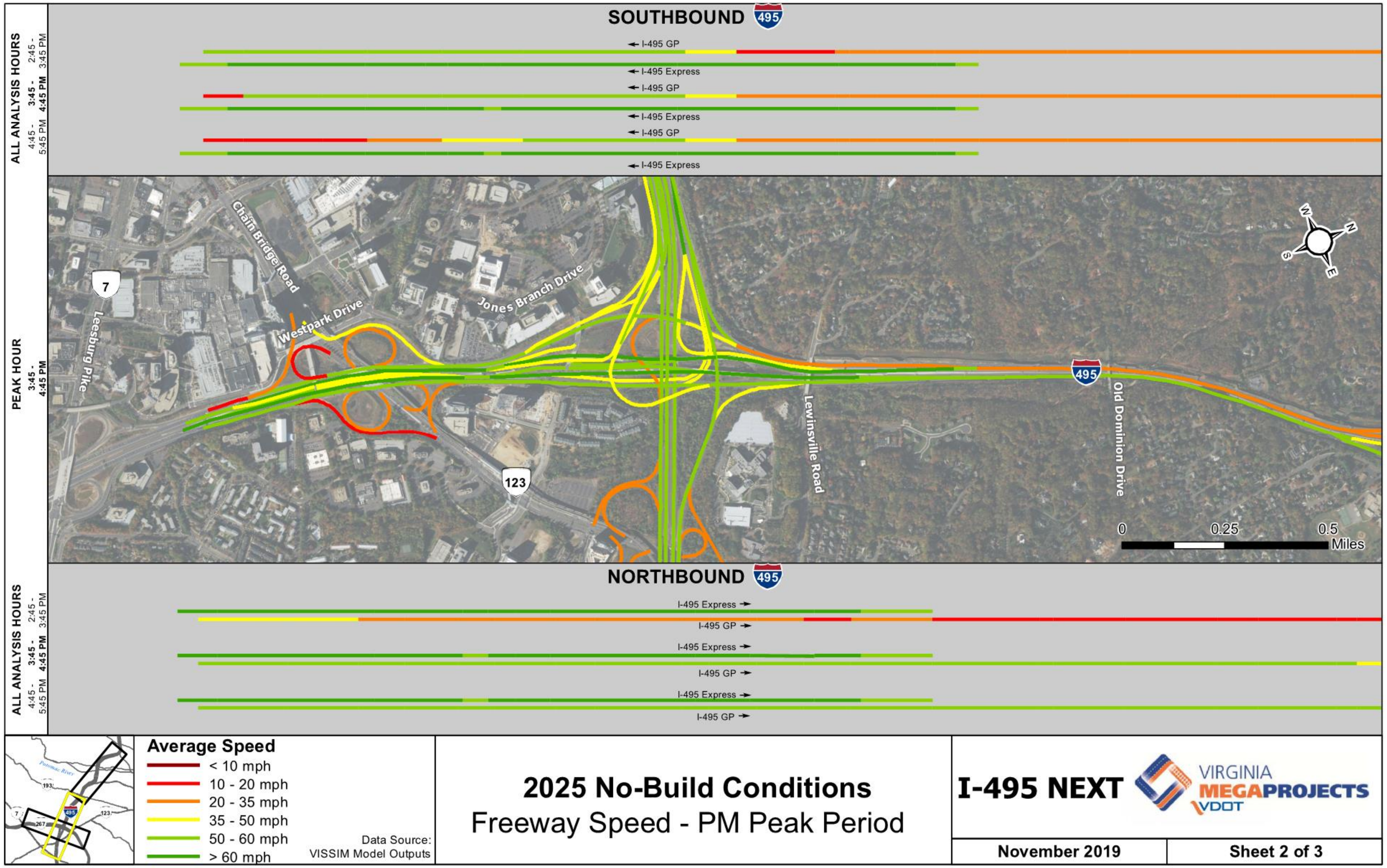


Exhibit 9-13b. 2025 No Build I-495 PM Peak Period Average Speeds – Route 123 through Old Dominion Drive

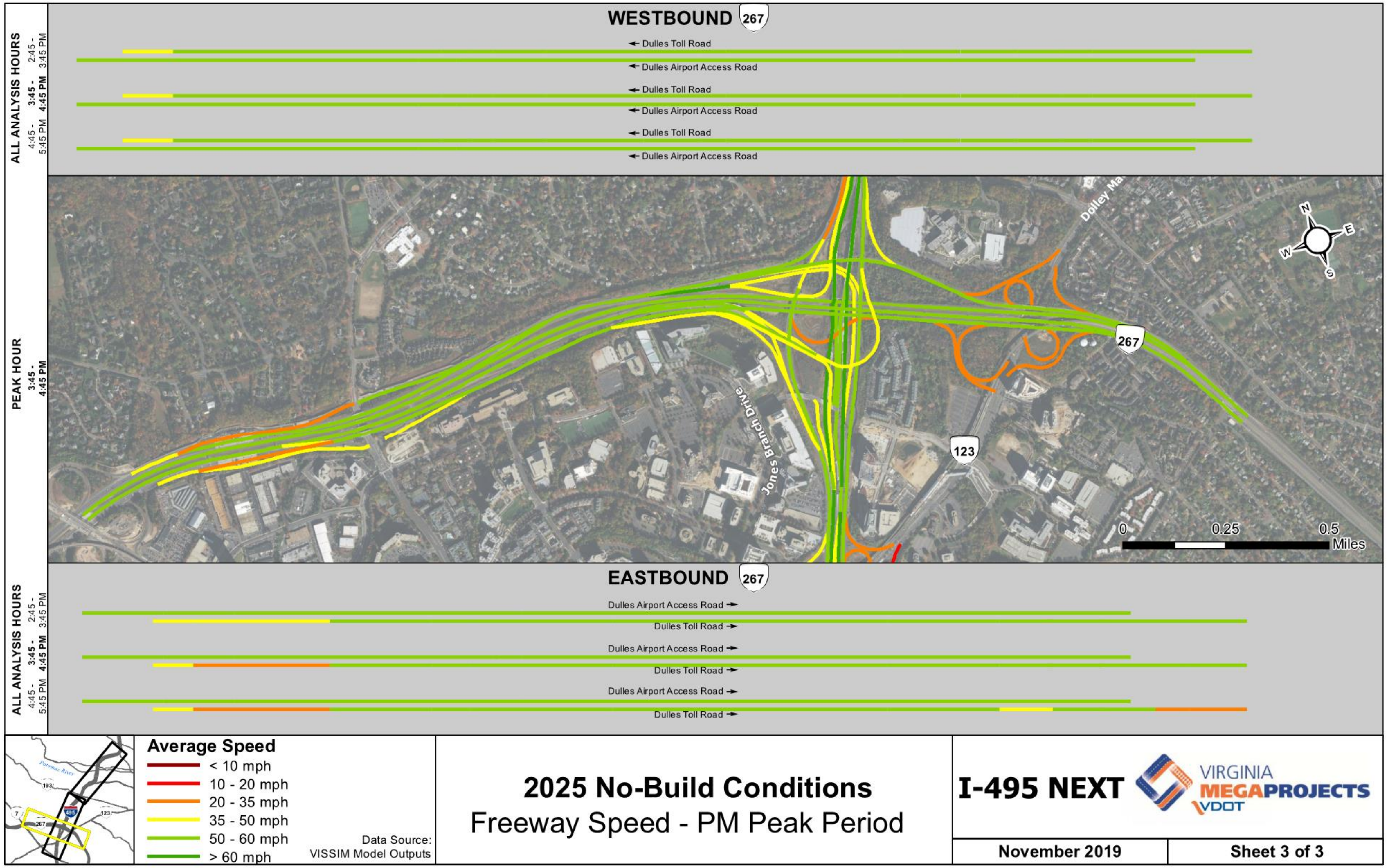


Exhibit 9-13c. 2025 No Build Route 267 PM Peak Period Average Speeds

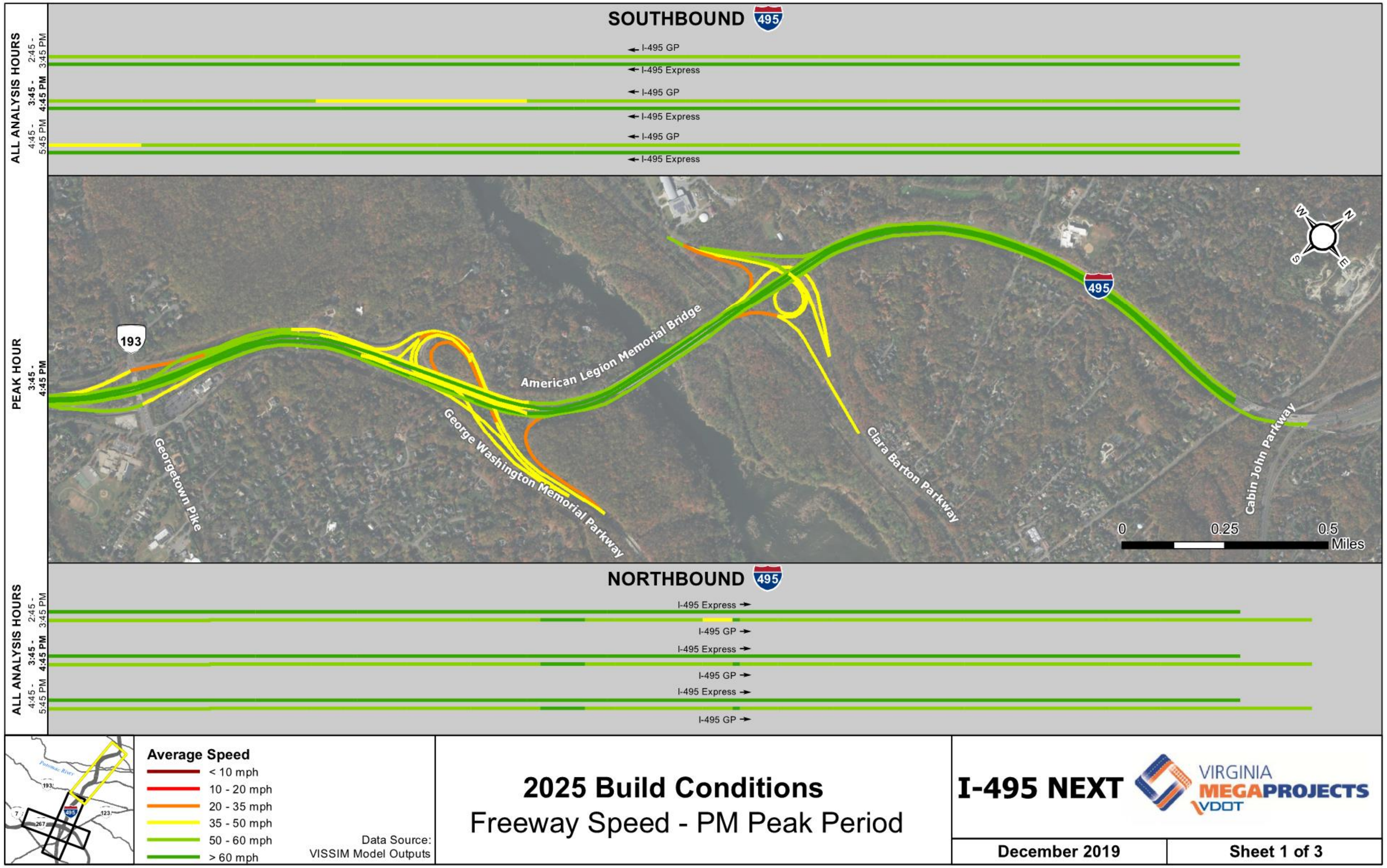


Exhibit 9-14a. 2025 Build I-495 PM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

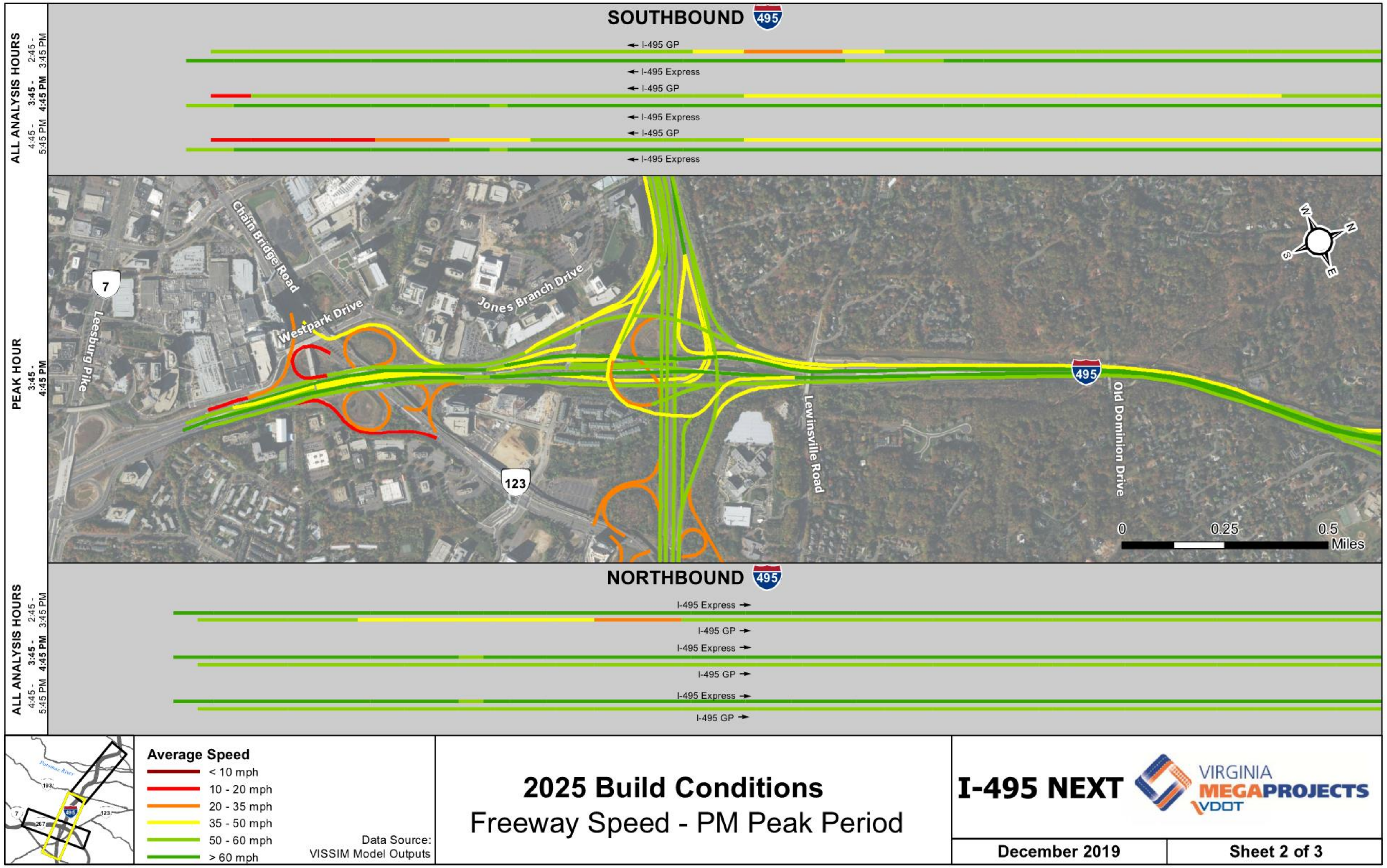


Exhibit 9-14b. 2025 Build I-495 PM Peak Period Average Speeds – Route 123 through Old Dominion Drive

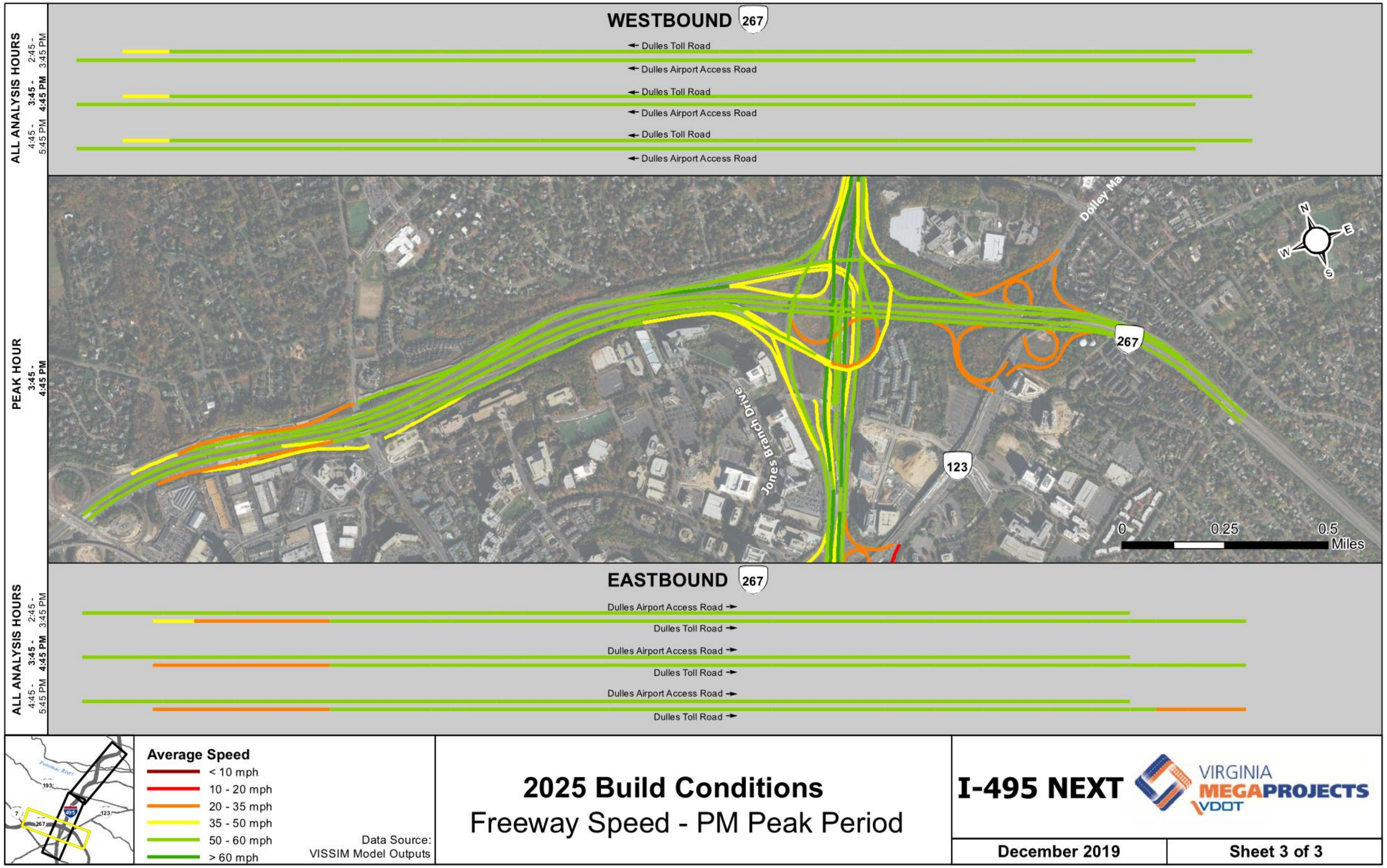


Exhibit 9-14c. 2025 Build Route 267 PM Peak Period Average Speeds

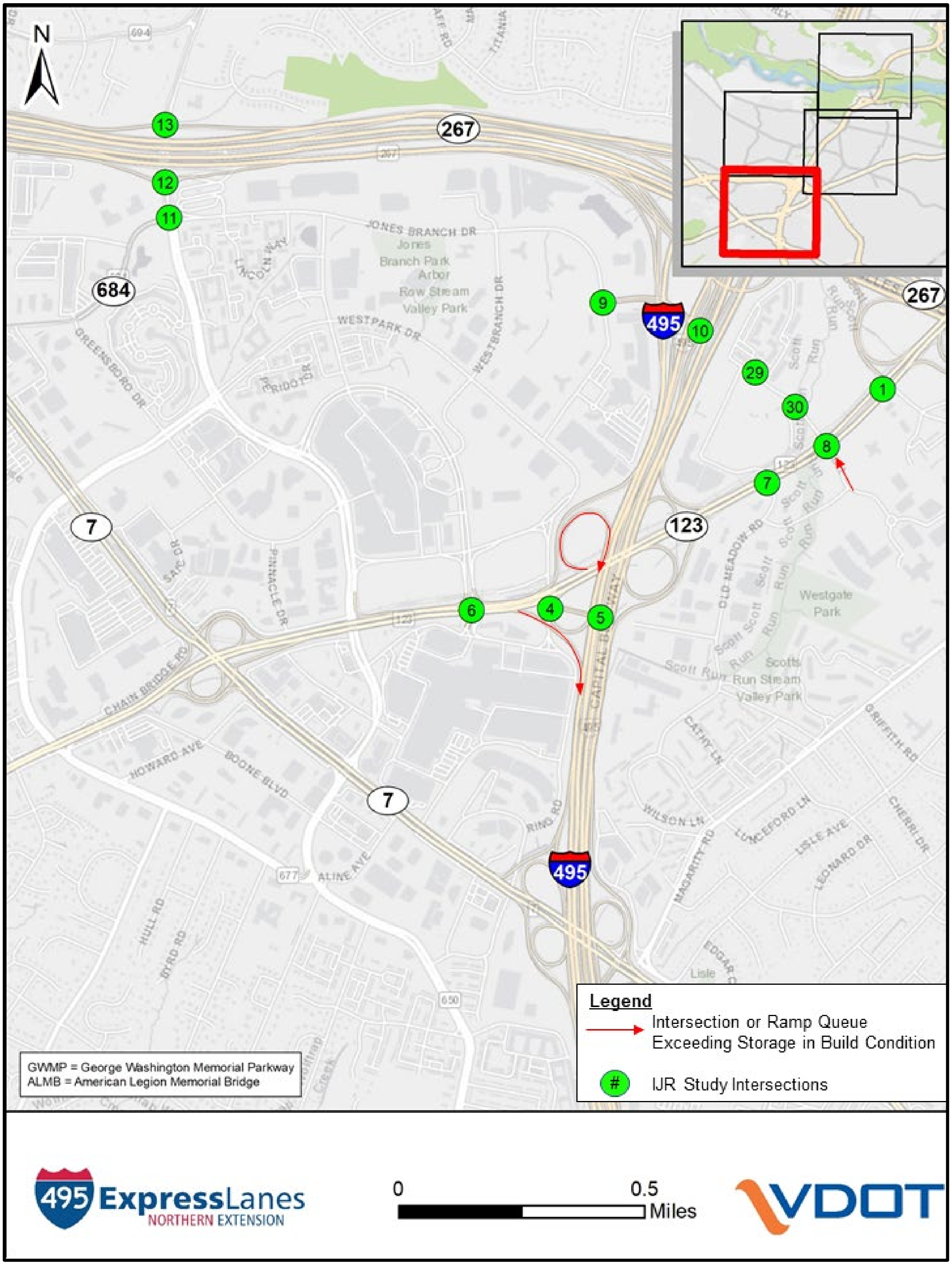


Exhibit 9-15a. Queues Exceeding Storage in 2025 Build PM Condition (Page 1 of 4)

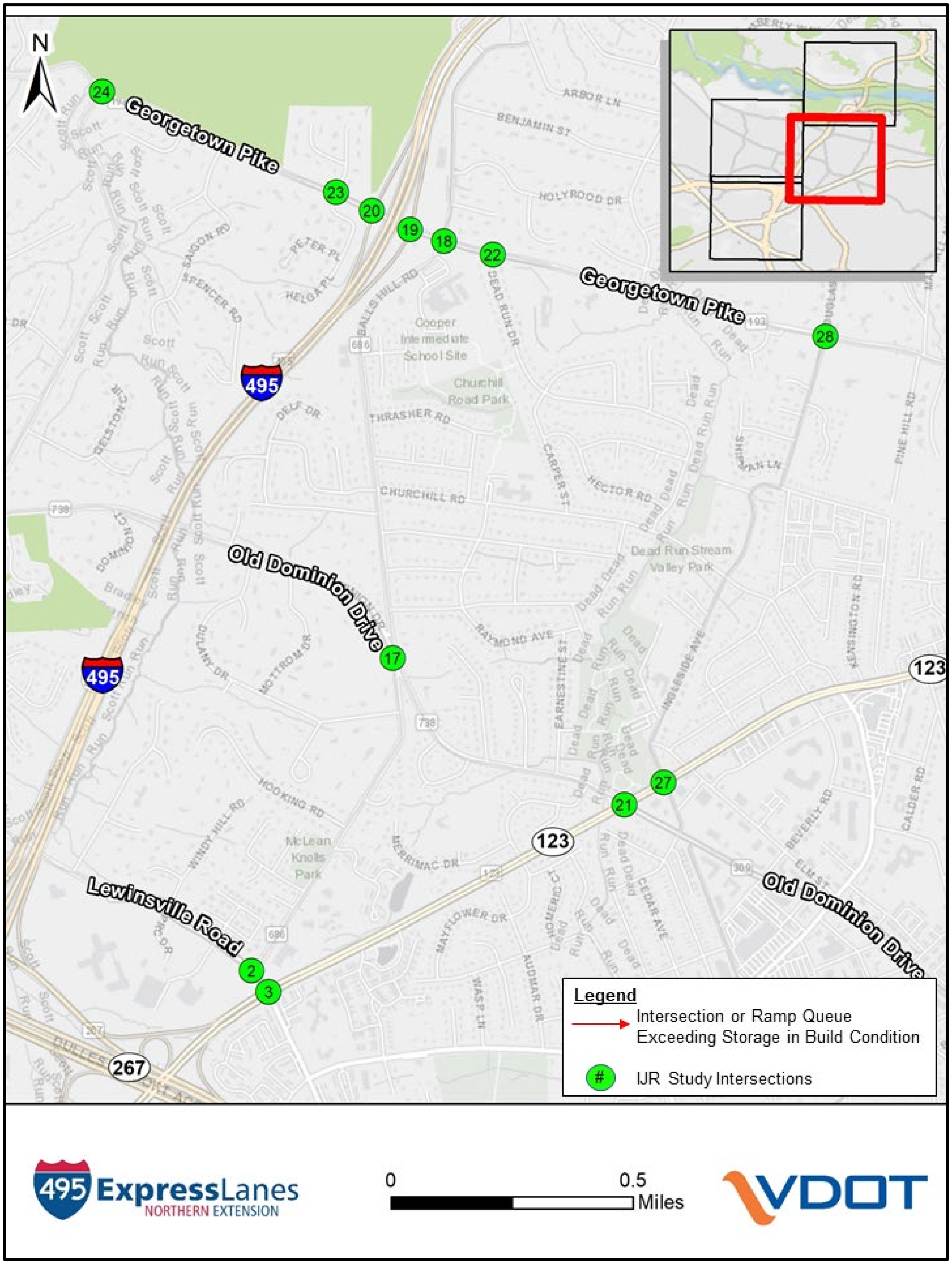


Exhibit 9-15b. Queues Exceeding Storage in 2025 Build PM Condition (Page 2 of 4)

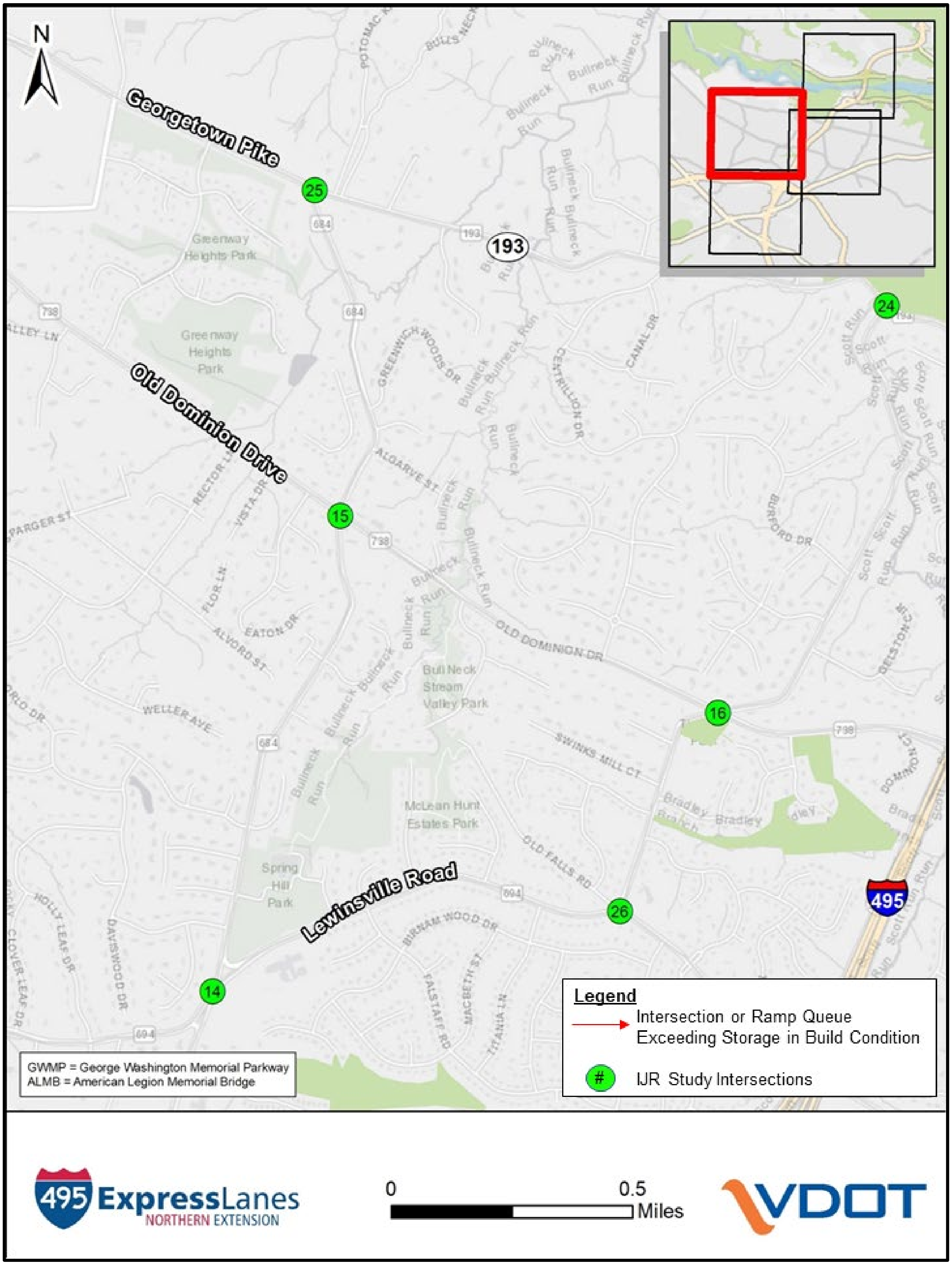


Exhibit 9-15c. Queues Exceeding Storage in 2025 Build PM Condition (Page 3 of 4)

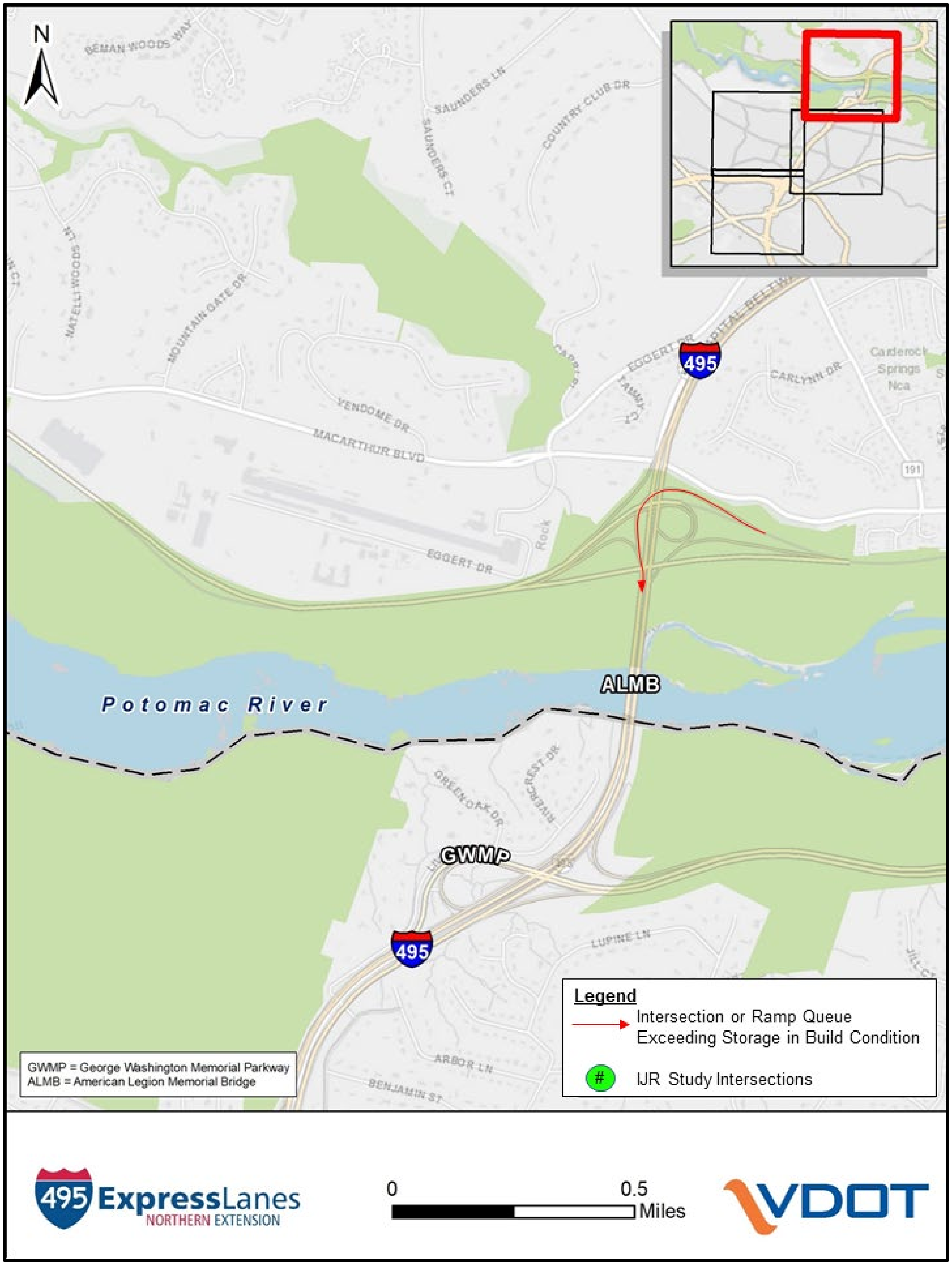


Exhibit 9-15d. Queues Exceeding Storage in 2025 Build PM Condition (Page 4 of 4)

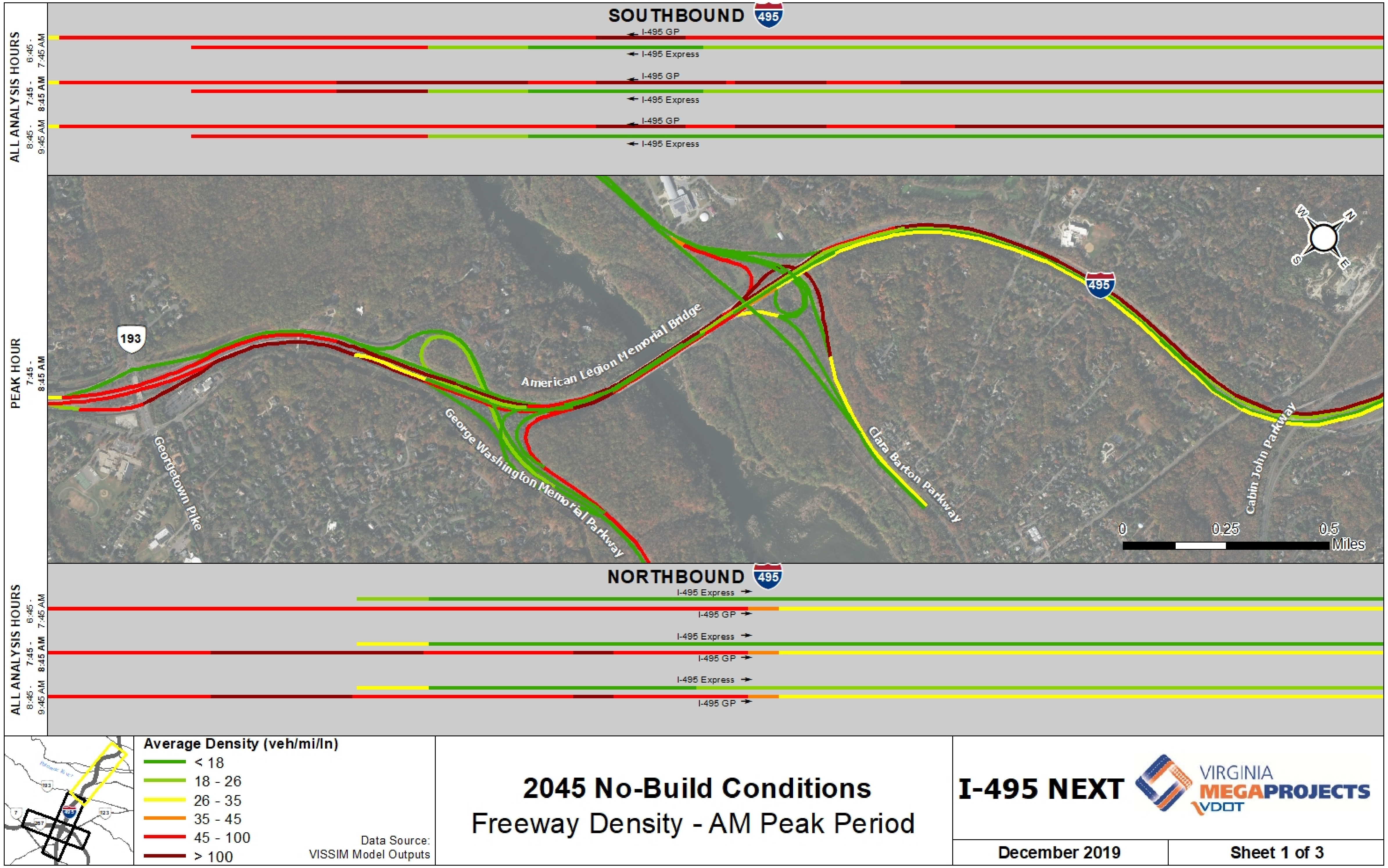


Exhibit 9-16a. 2045 No Build I-495 AM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

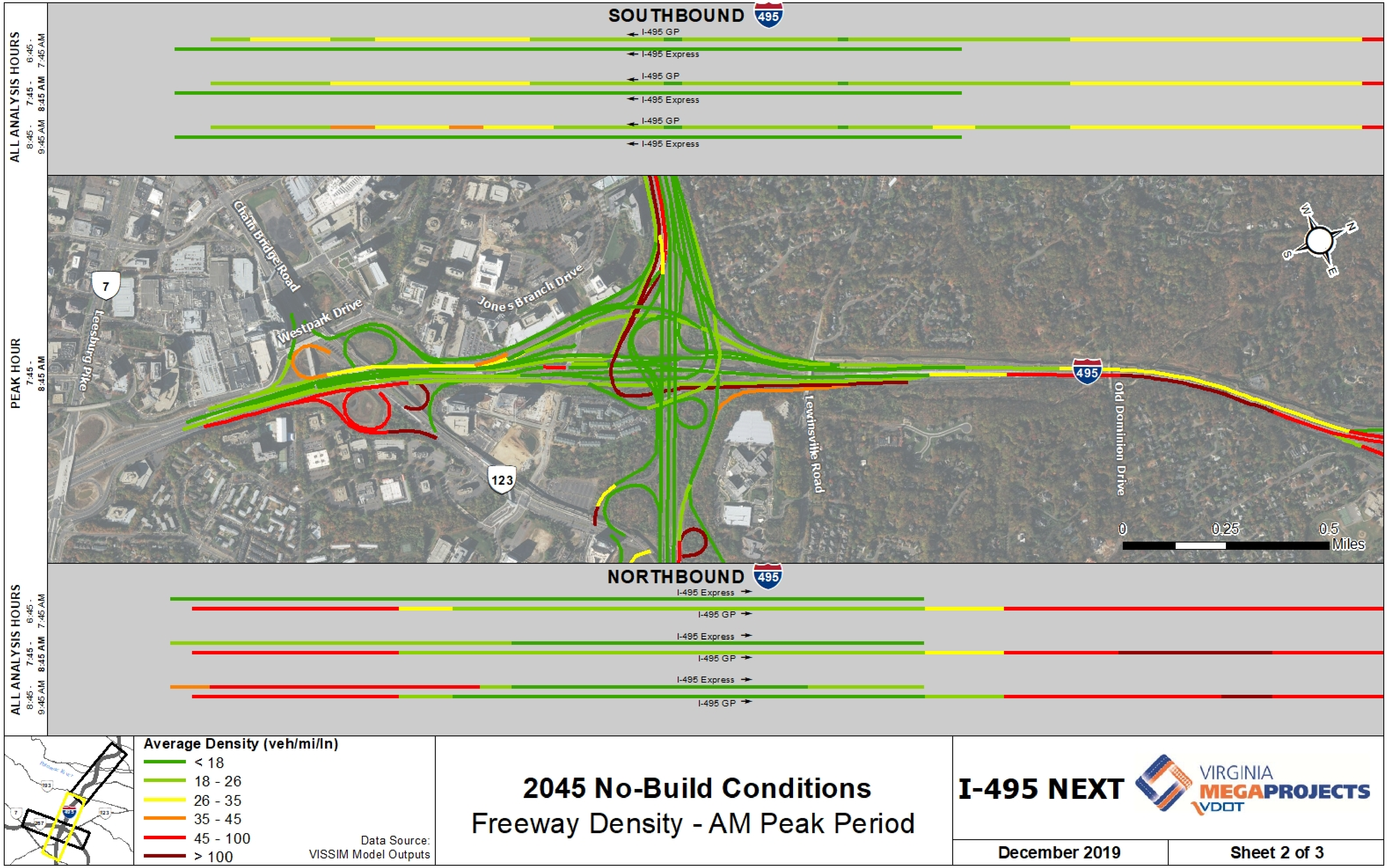


Exhibit 9-16b. 2045 No Build I-495 AM Peak Period Average Densities – Route 123 through Old Dominion Drive

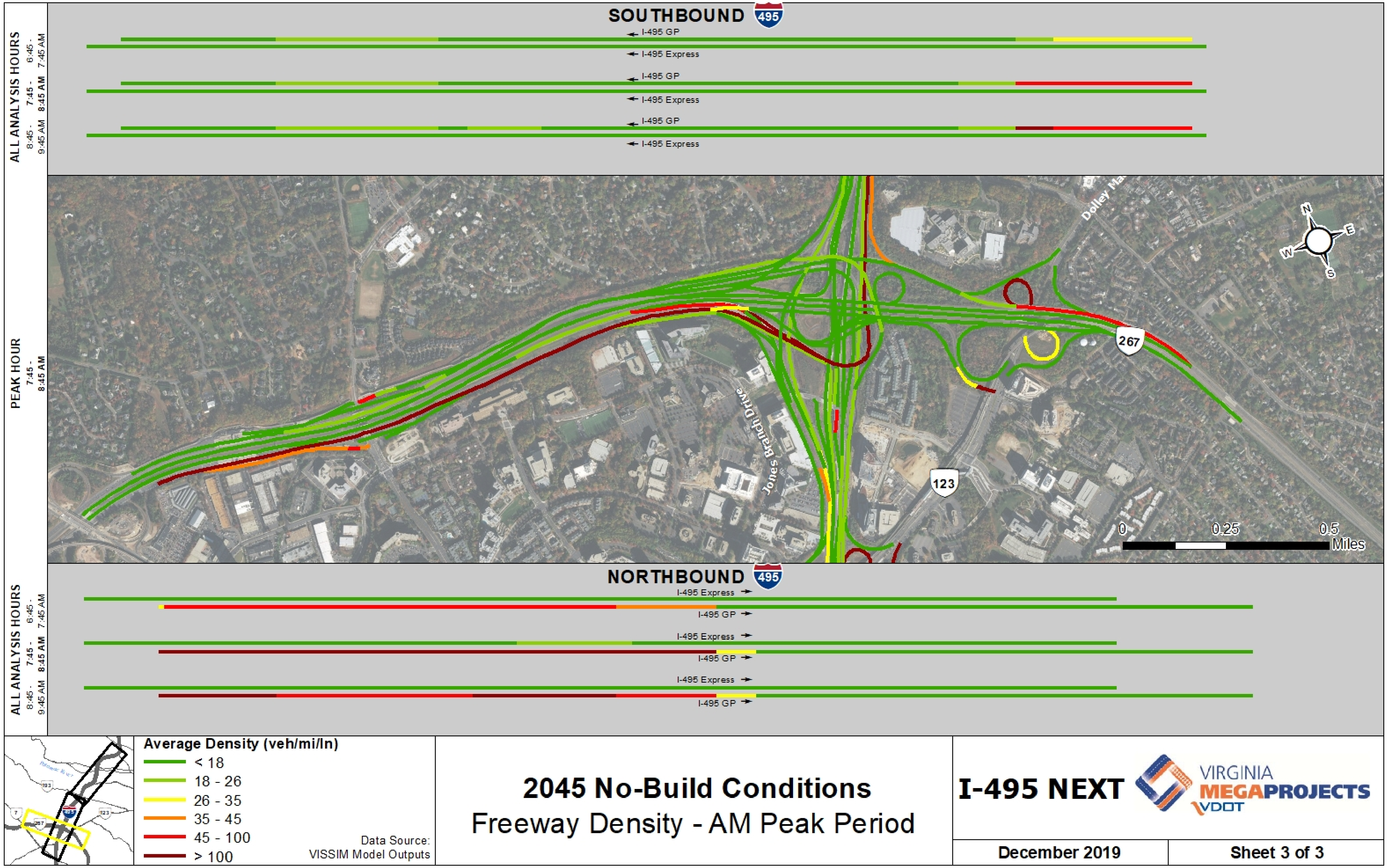


Exhibit 9-16c. 2045 No Build Route 267 AM Peak Period Average Densities

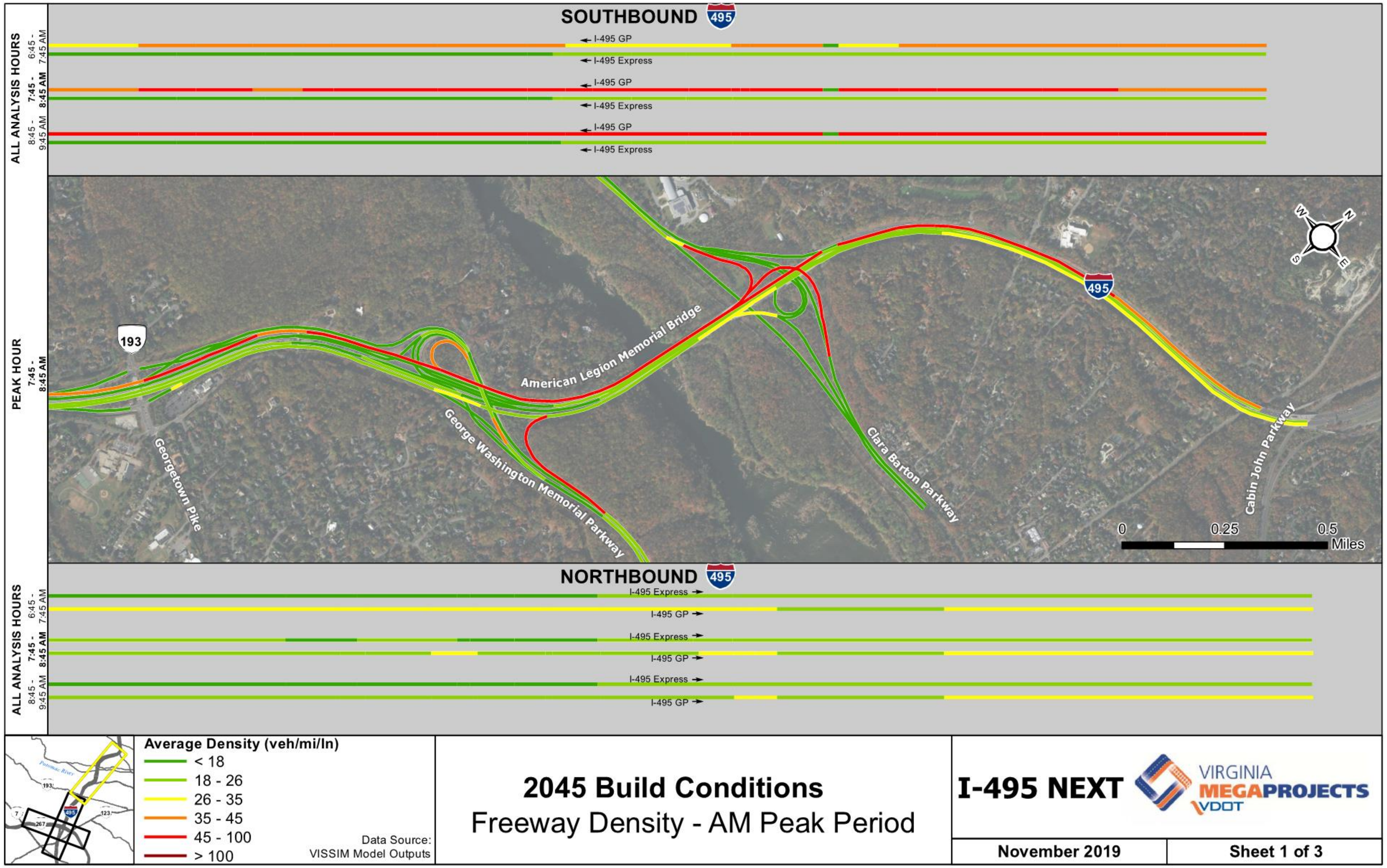


Exhibit 9-17a. 2045 Build I-495 AM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

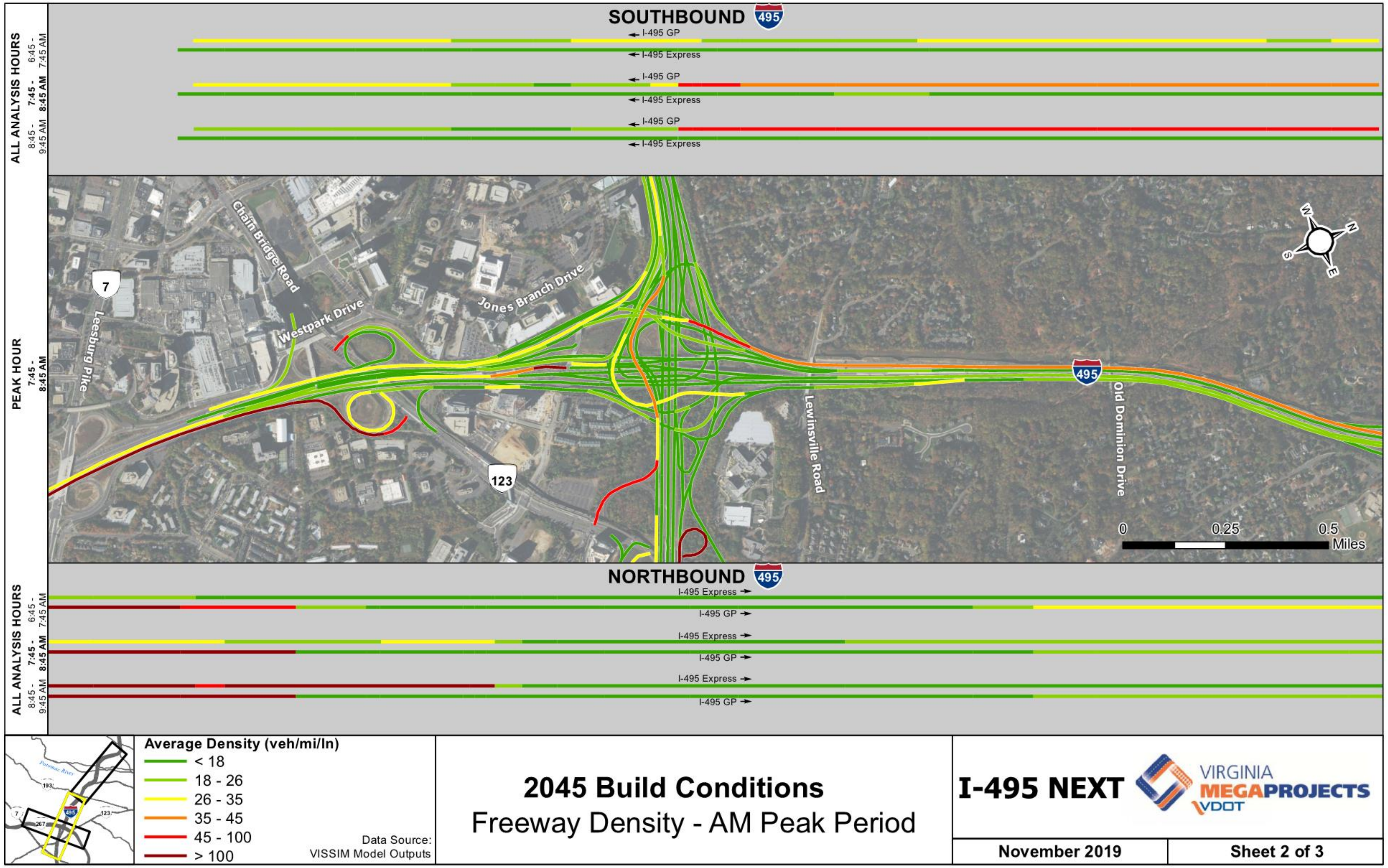


Exhibit 9-17b. 2045 Build I-495 AM Peak Period Average Densities – Route 123 through Old Dominion Drive

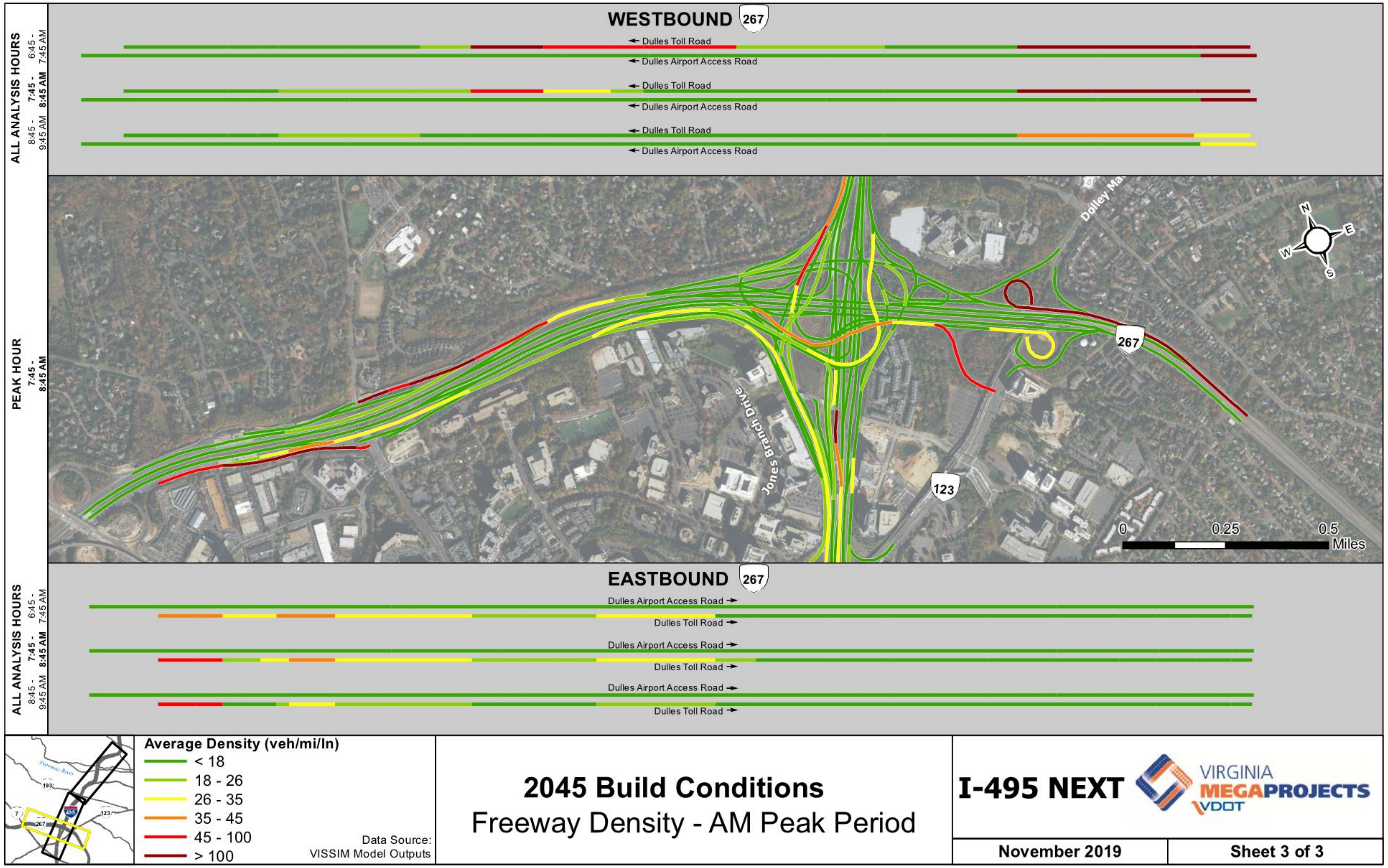


Exhibit 9-17c. 2045 Build Route 267 AM Peak Period Average Densities

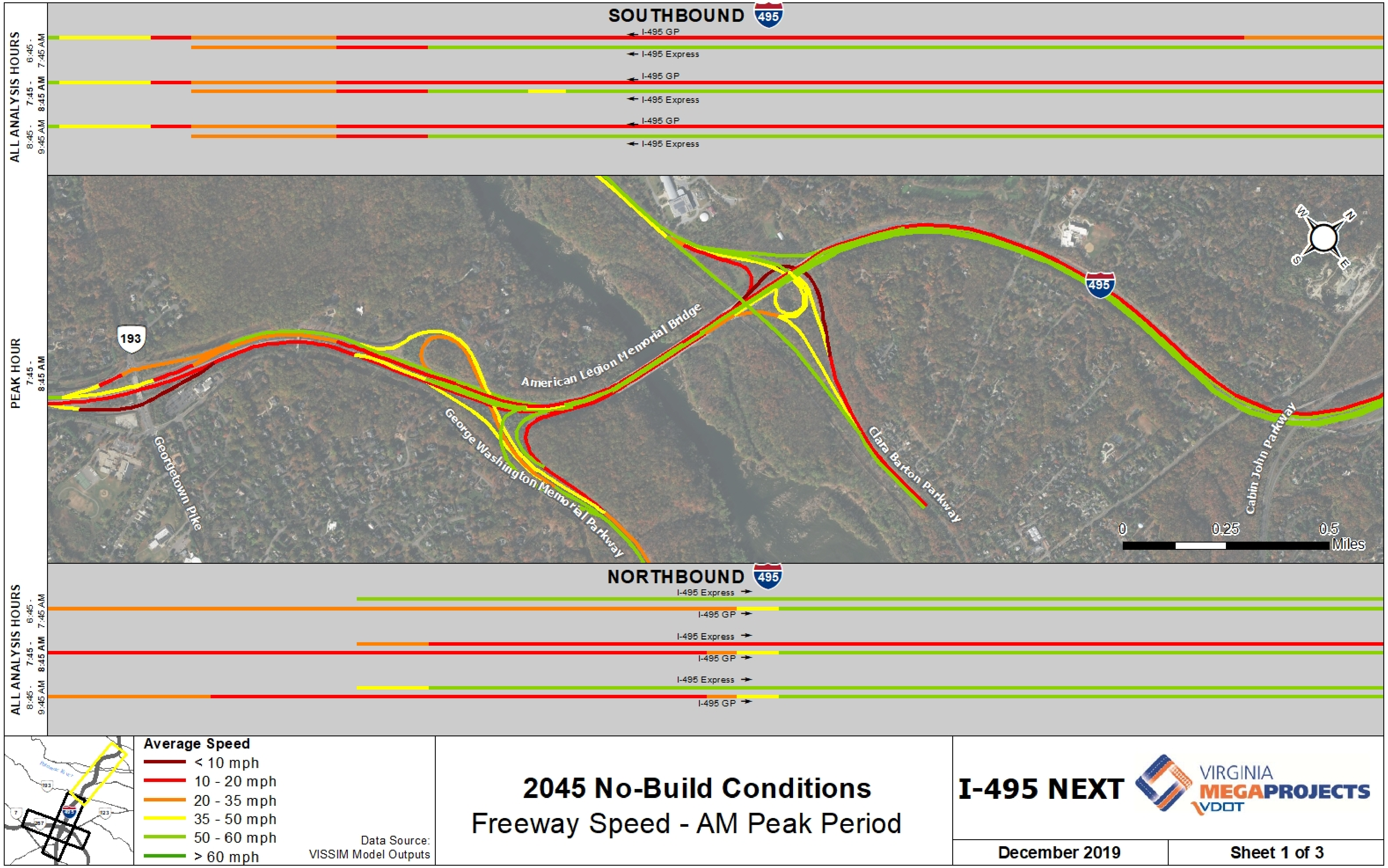


Exhibit 9-18a. 2045 No Build I-495 AM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

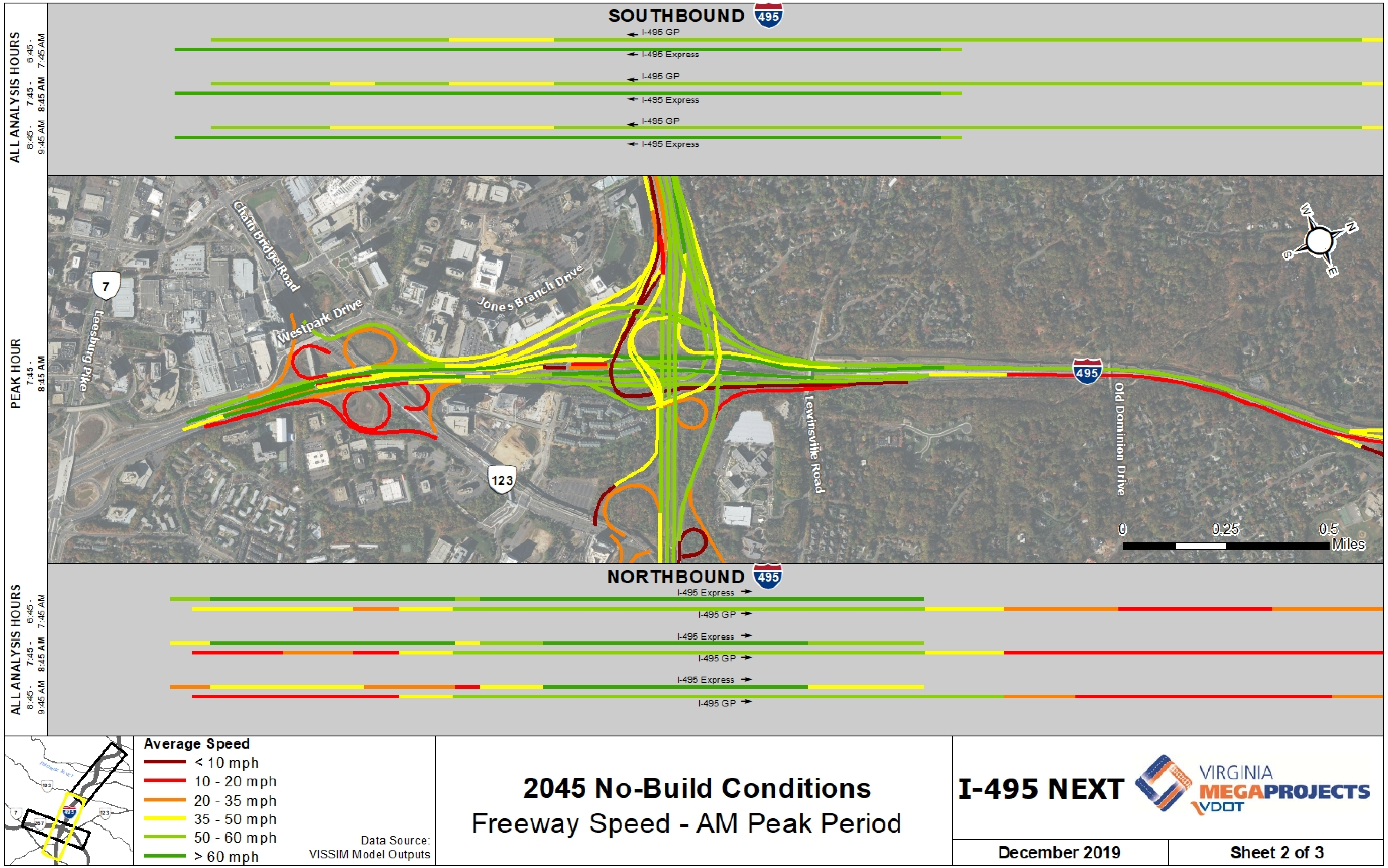


Exhibit 9-18b. 2045 No Build I-495 AM Peak Period Average Speeds – Route 123 through Old Dominion Drive

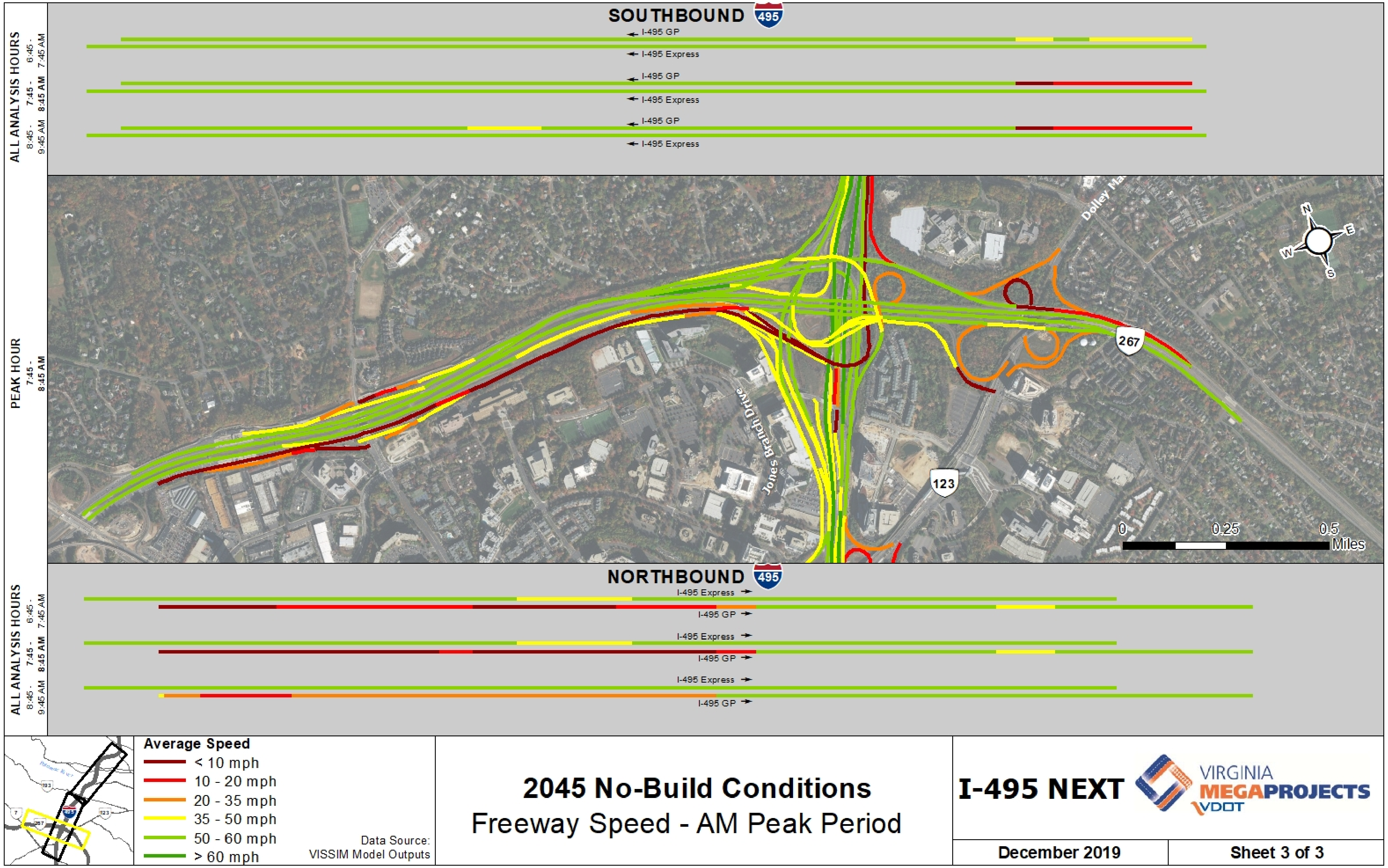


Exhibit 9-18c. 2045 No Build Route 267 AM Peak Period Average Speeds

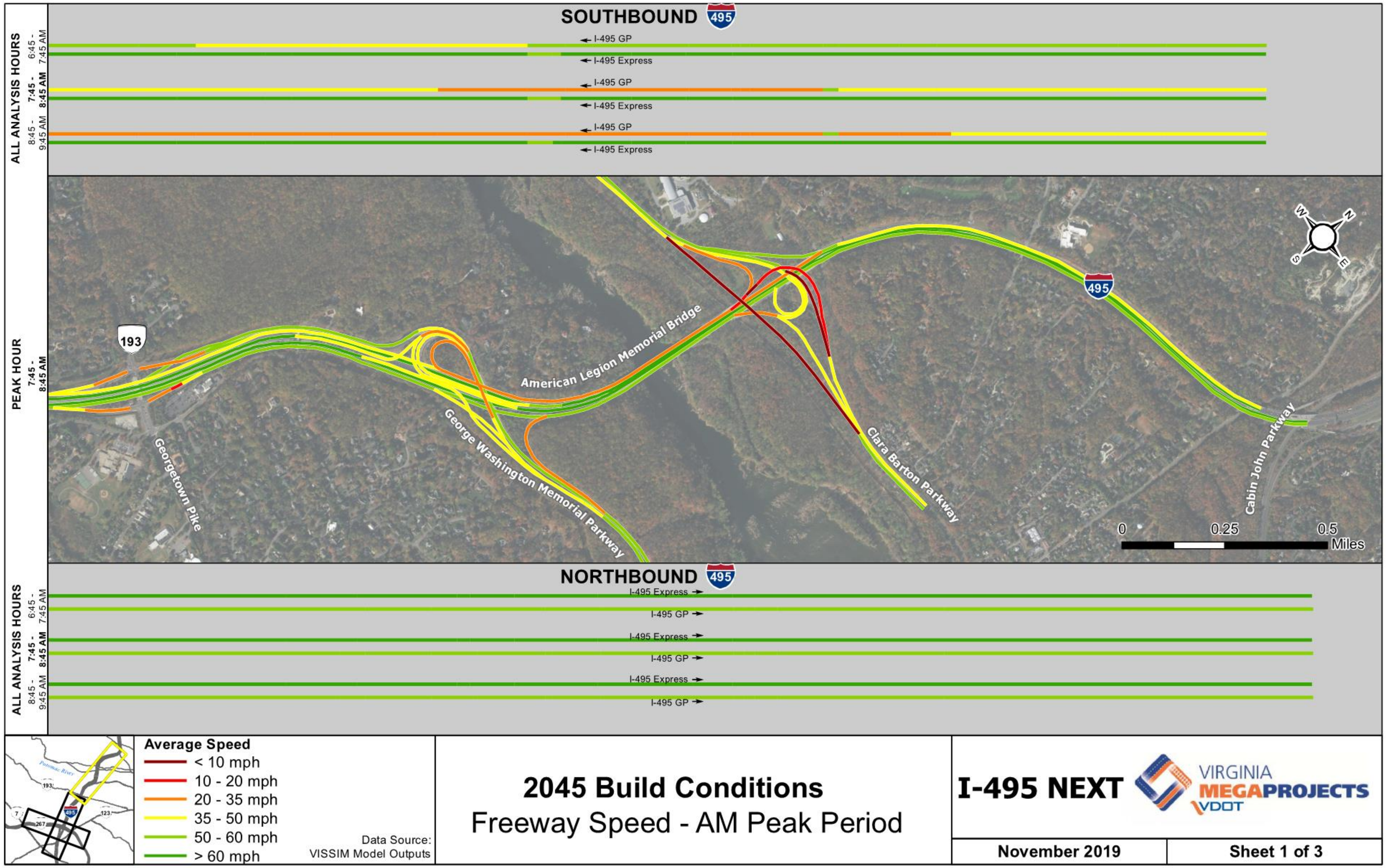


Exhibit 9-19a. 2045 Build I-495 AM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

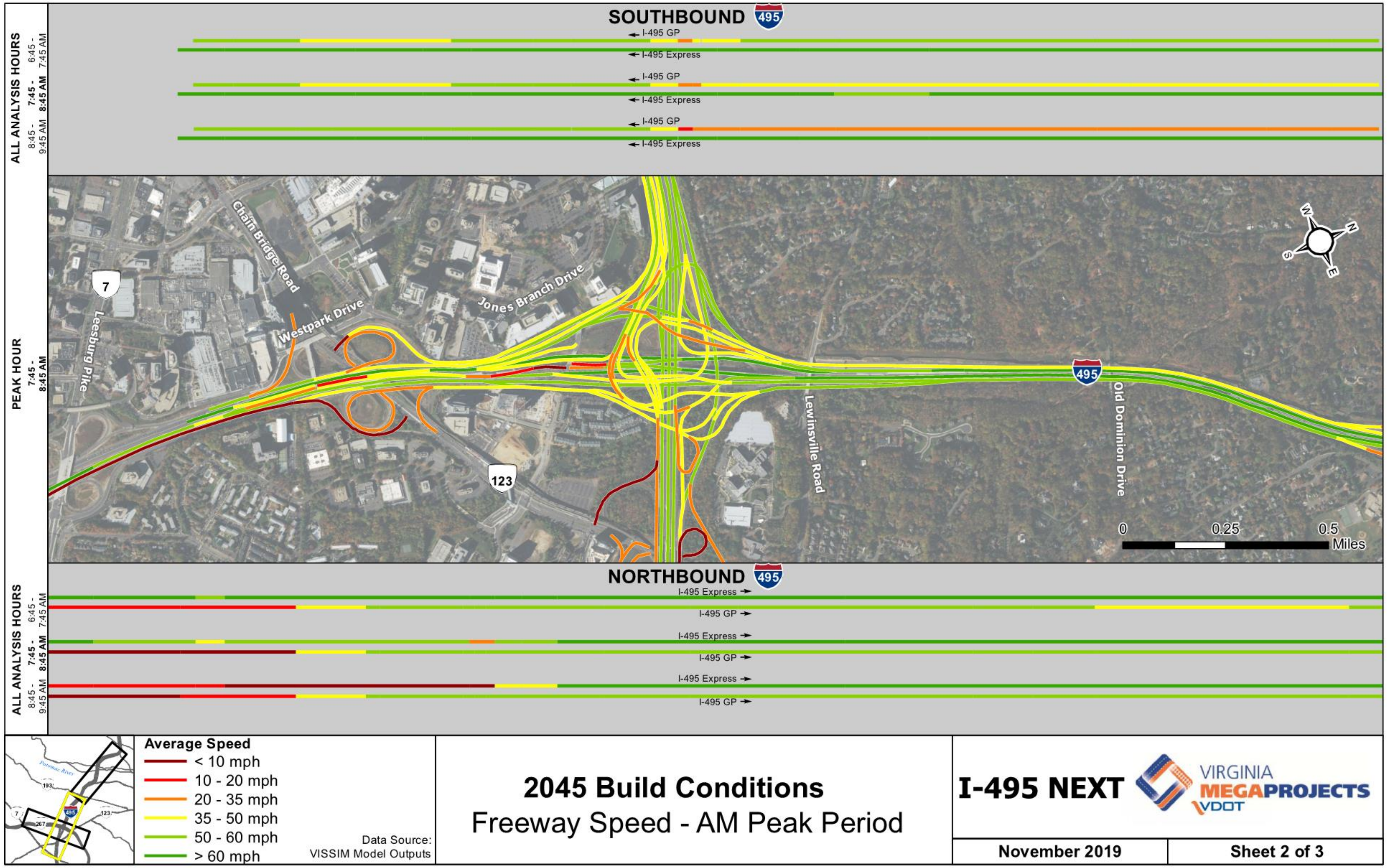


Exhibit 9-19b. 2045 Build I-495 AM Peak Period Average Speeds – Route 123 through Old Dominion Drive

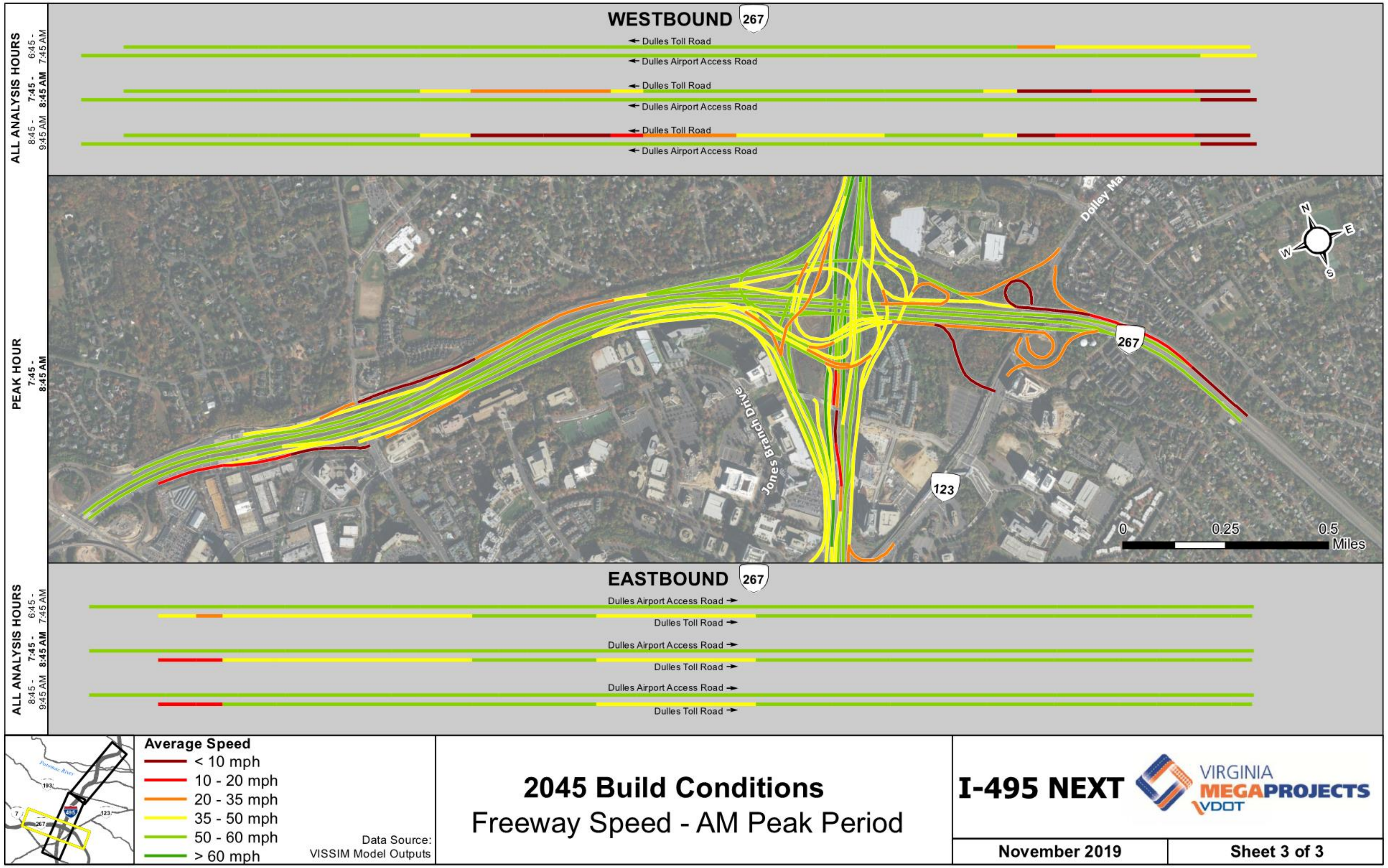


Exhibit 9-19c. 2045 Build Route 267 AM Peak Period Average Speeds

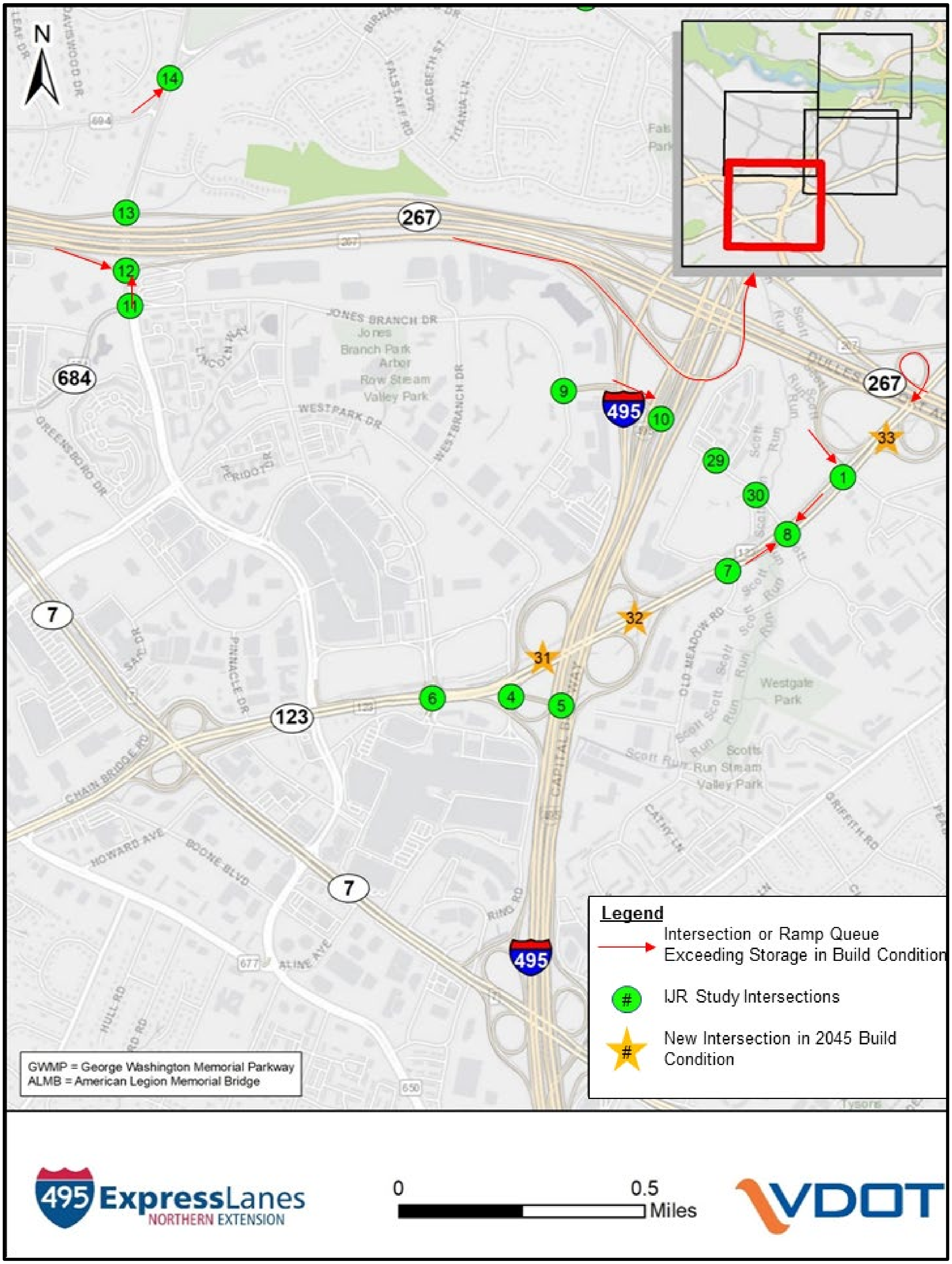


Exhibit 9-20a. Queues Exceeding Storage in 2045 Build AM Condition (Page 1 of 4)

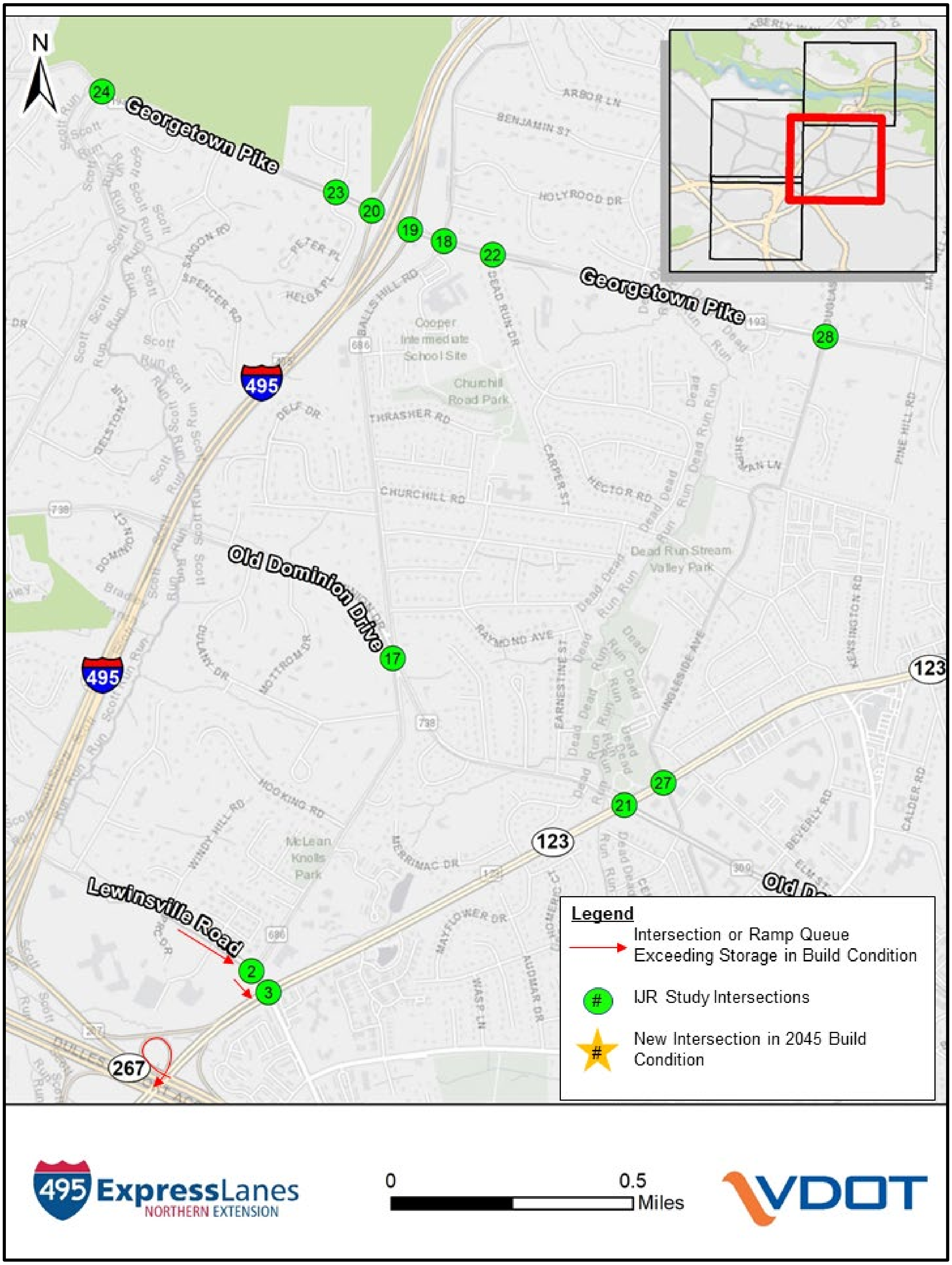


Exhibit 9-20b. Queues Exceeding Storage in 2045 Build AM Condition (Page 2 of 4)

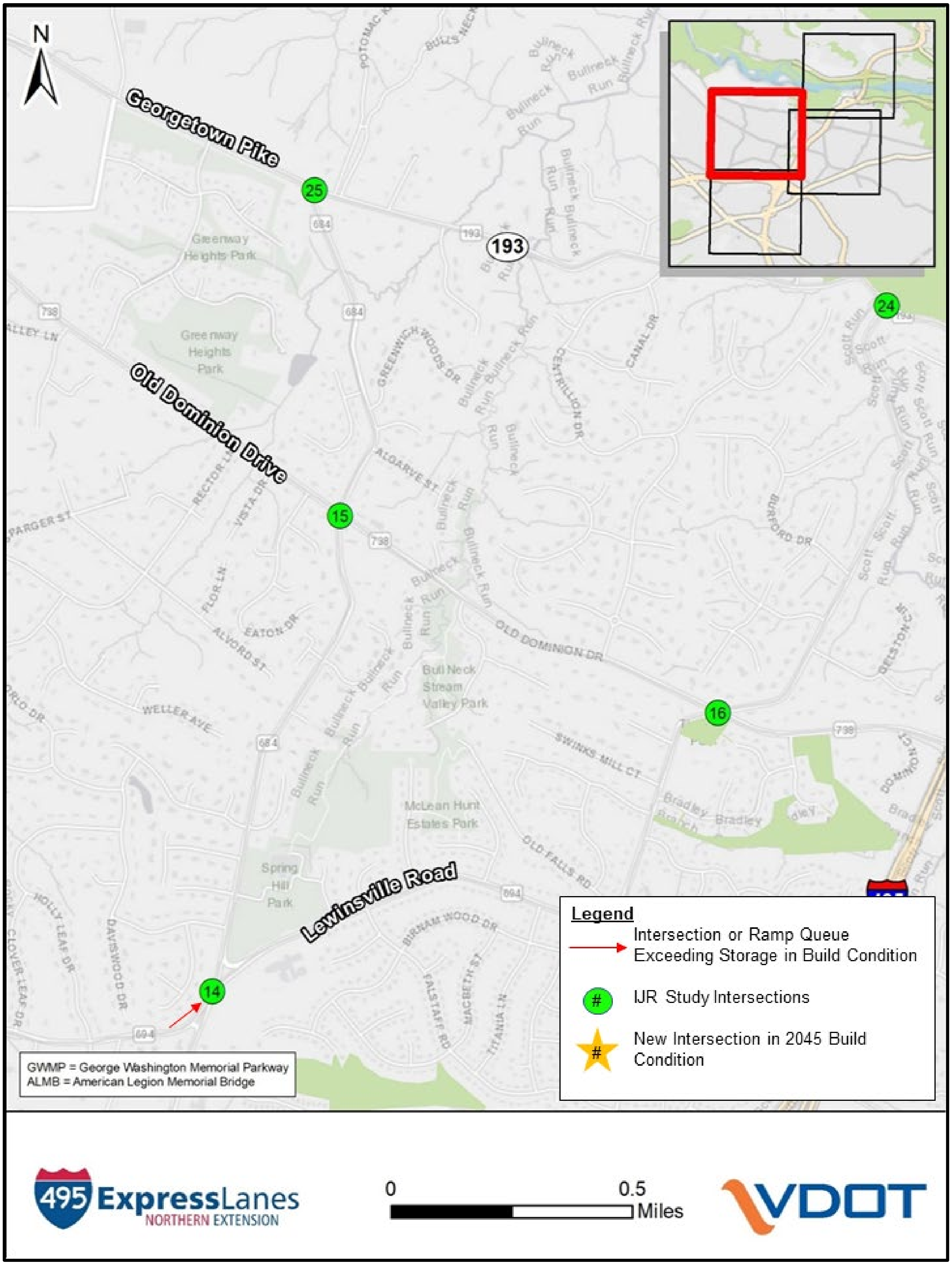


Exhibit 9-20c. Queues Exceeding Storage in 2045 Build AM Condition (Page 3 of 4)

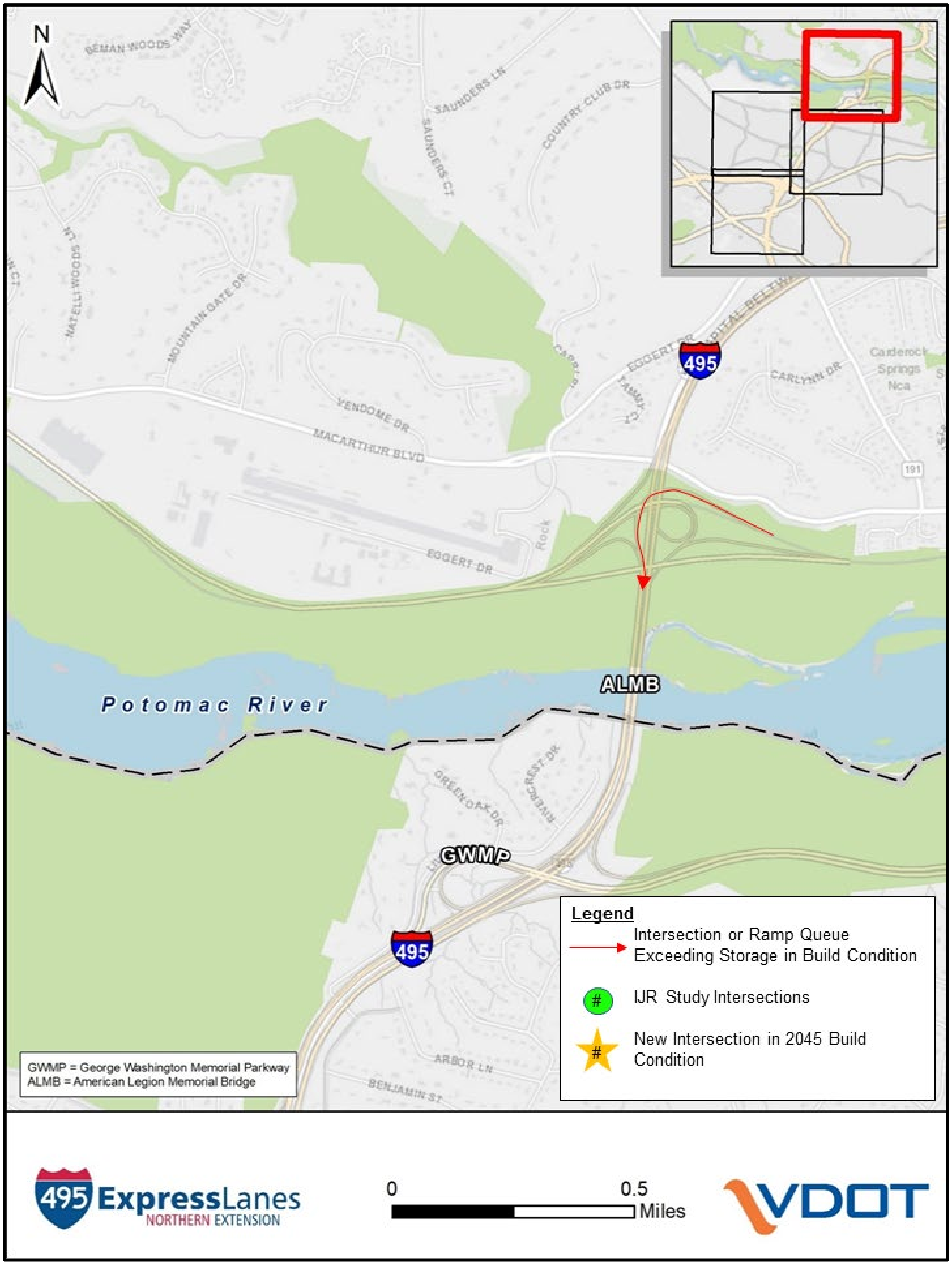


Exhibit 9-20d. Queues Exceeding Storage in 2045 Build AM Condition (Page 4 of 4)

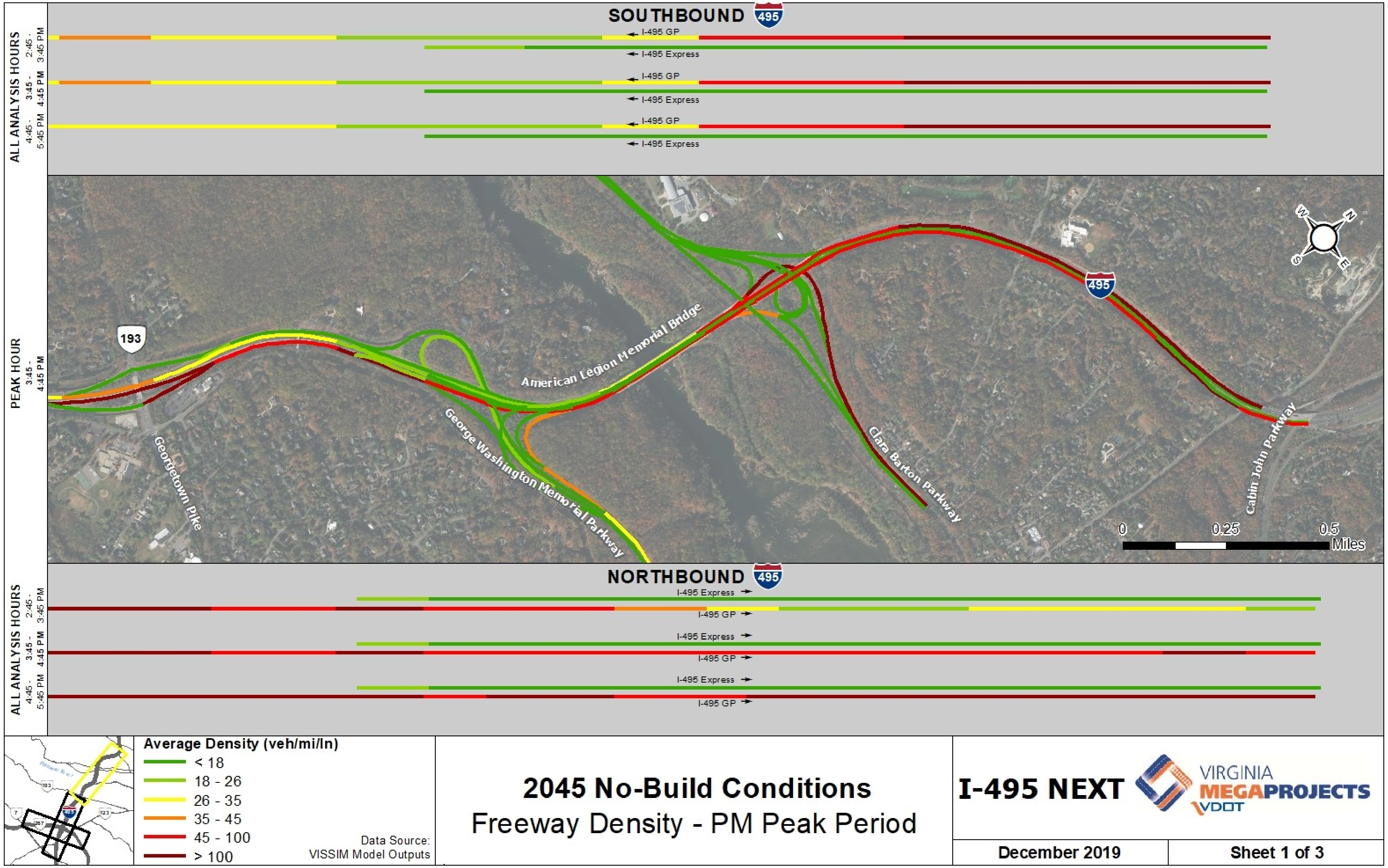


Exhibit 9-21a. 2045 No Build I-495 PM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

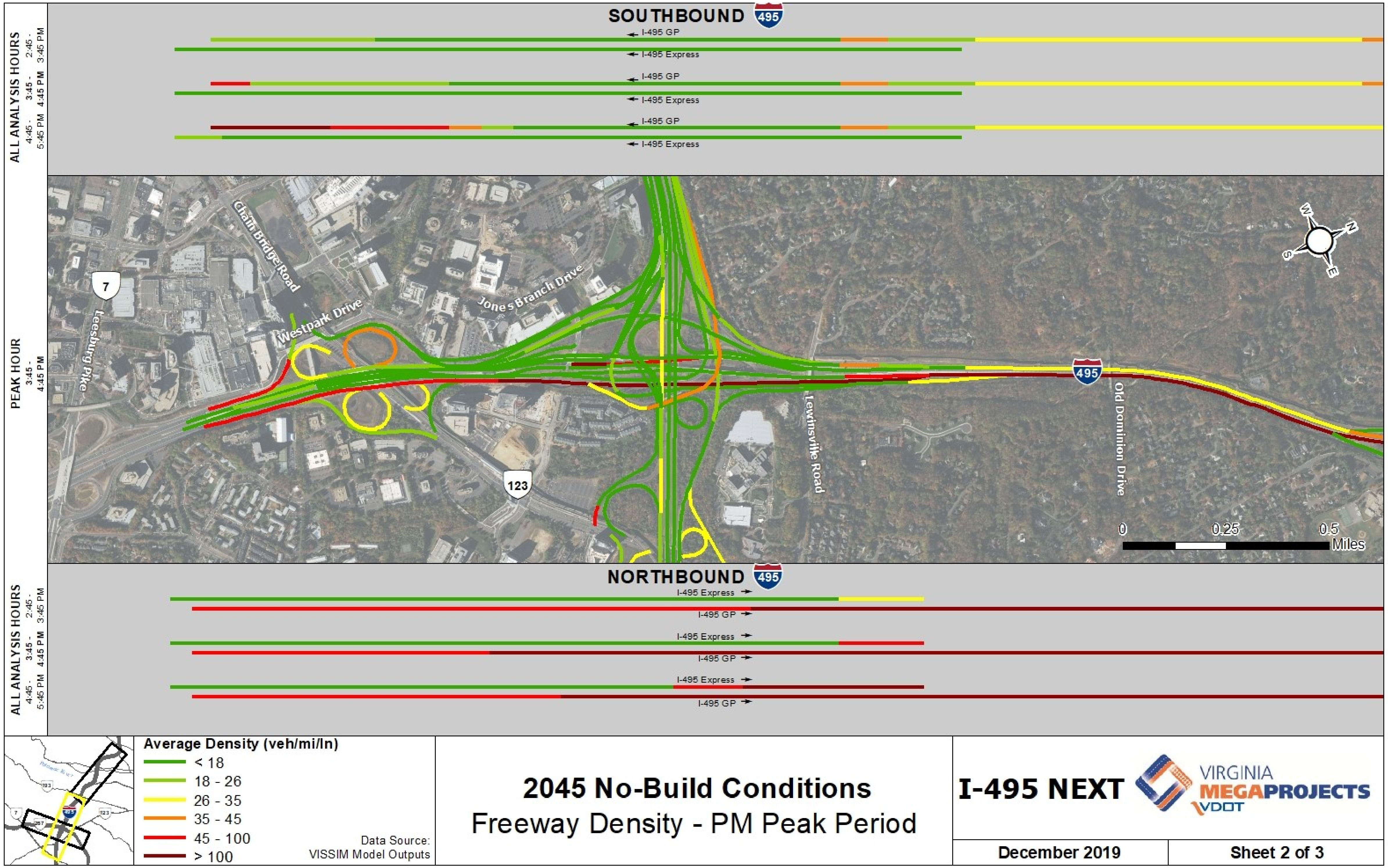


Exhibit 9-21b. 2045 No Build I-495 PM Peak Period Average Densities – Route 123 through Old Dominion Drive

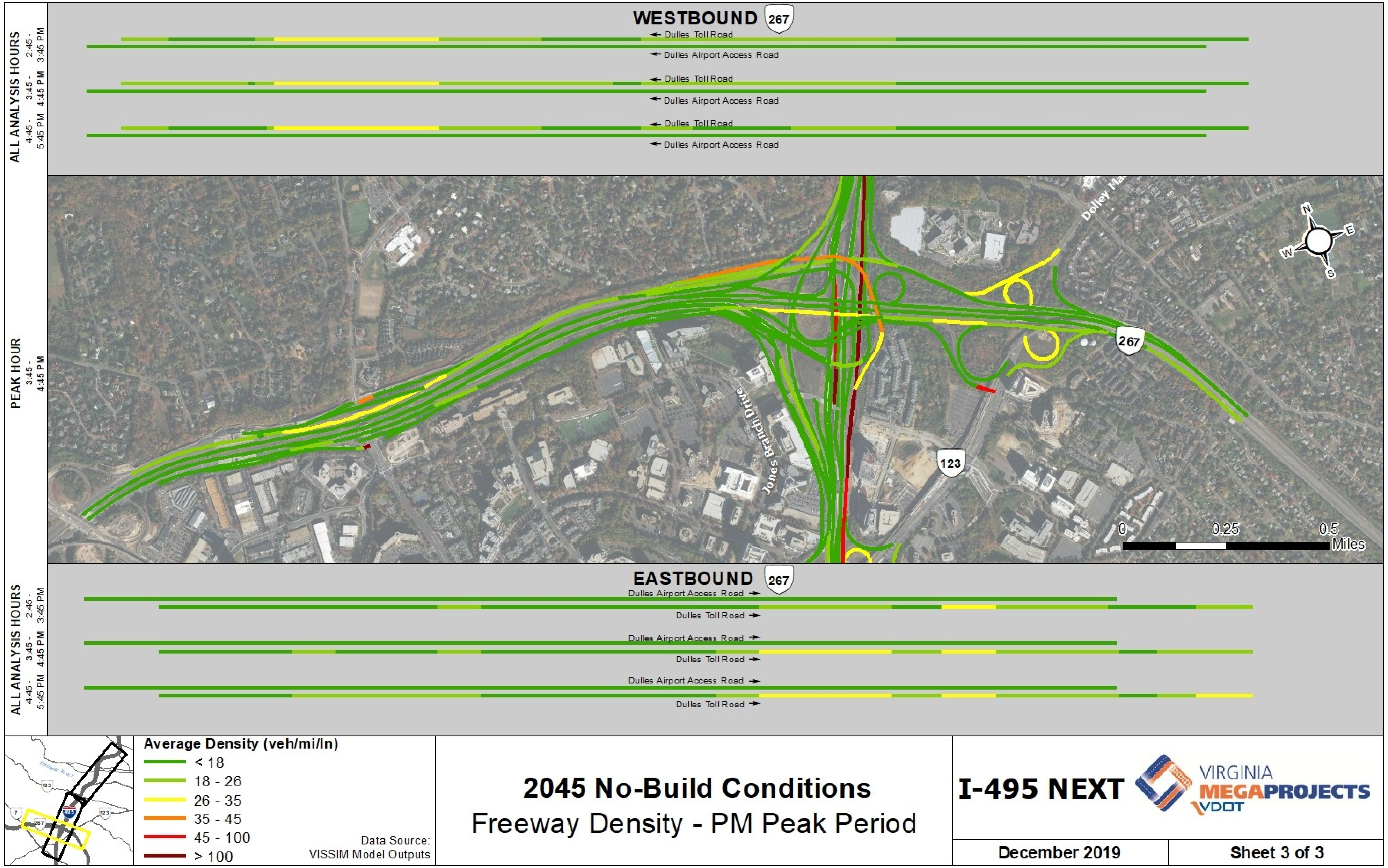


Exhibit 9-21c. 2045 No Build Route 267 PM Peak Period Average Densities

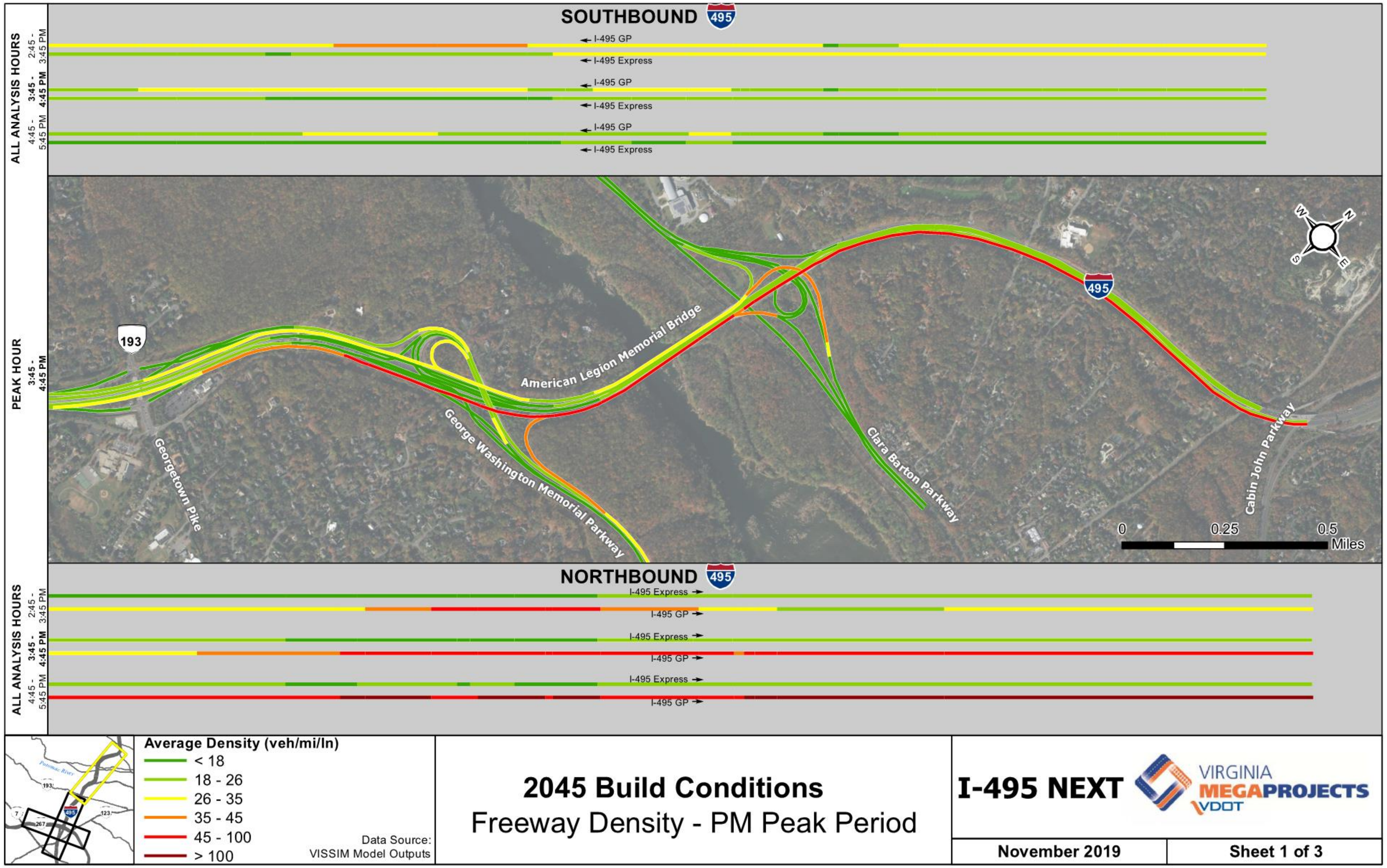


Exhibit 9-22a. 2045 Build I-495 PM Peak Period Average Densities – Georgetown Pike to Cabin John Parkway

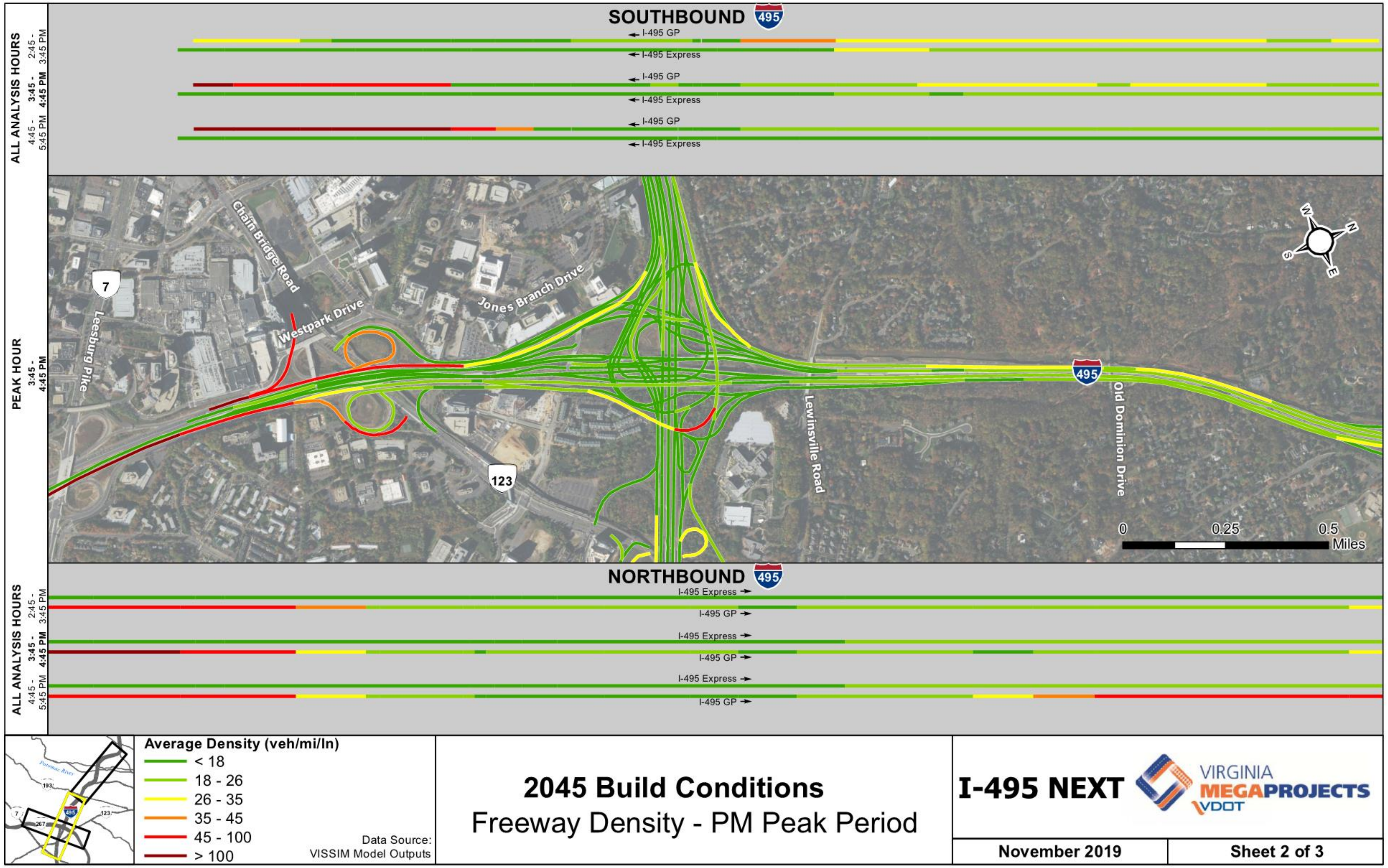


Exhibit 9-22b. 2045 Build I-495 PM Peak Period Average Densities – Route 123 through Old Dominion Drive

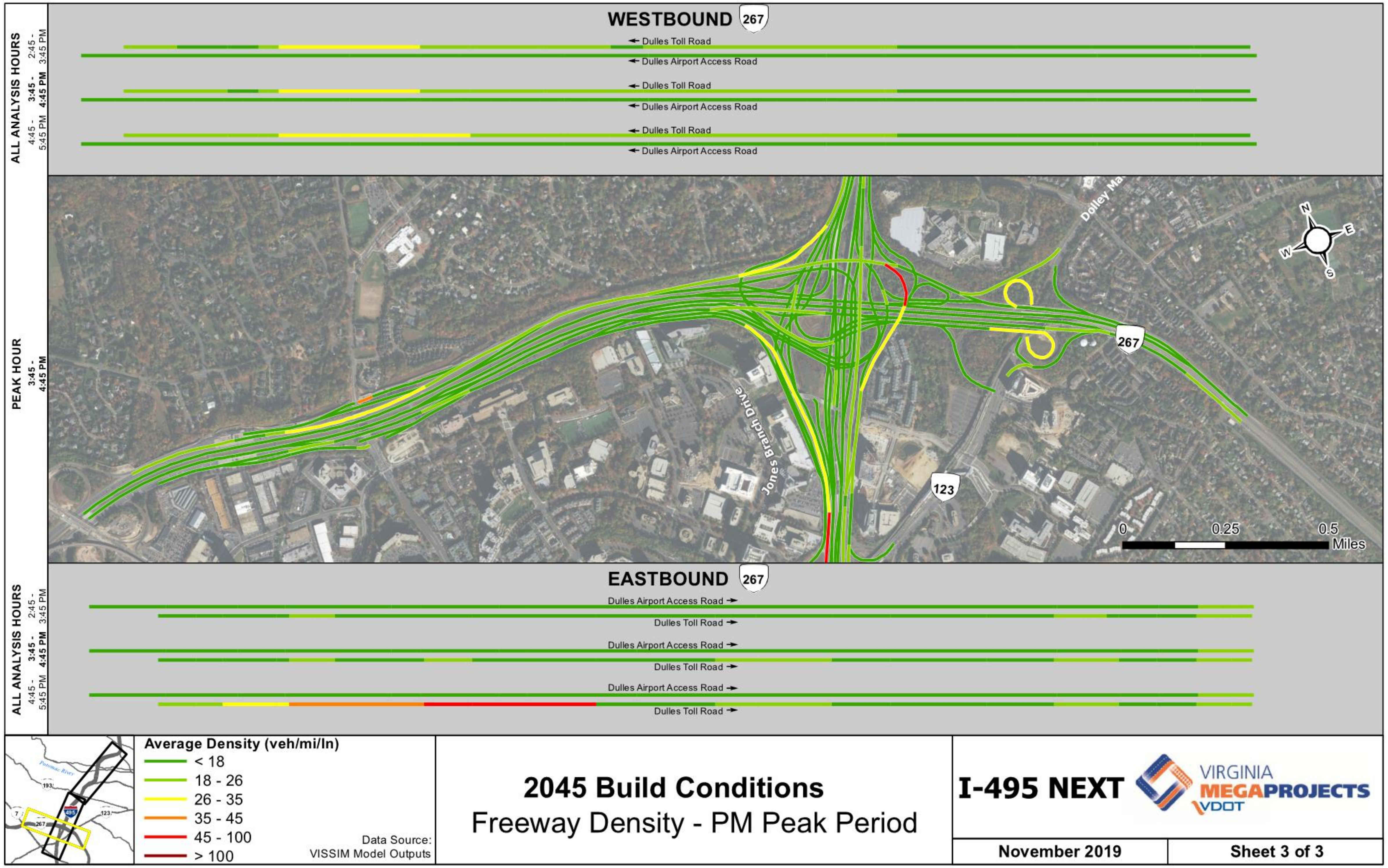


Exhibit 9-22c. 2045 Build Route 267 PM Peak Period Average Densities

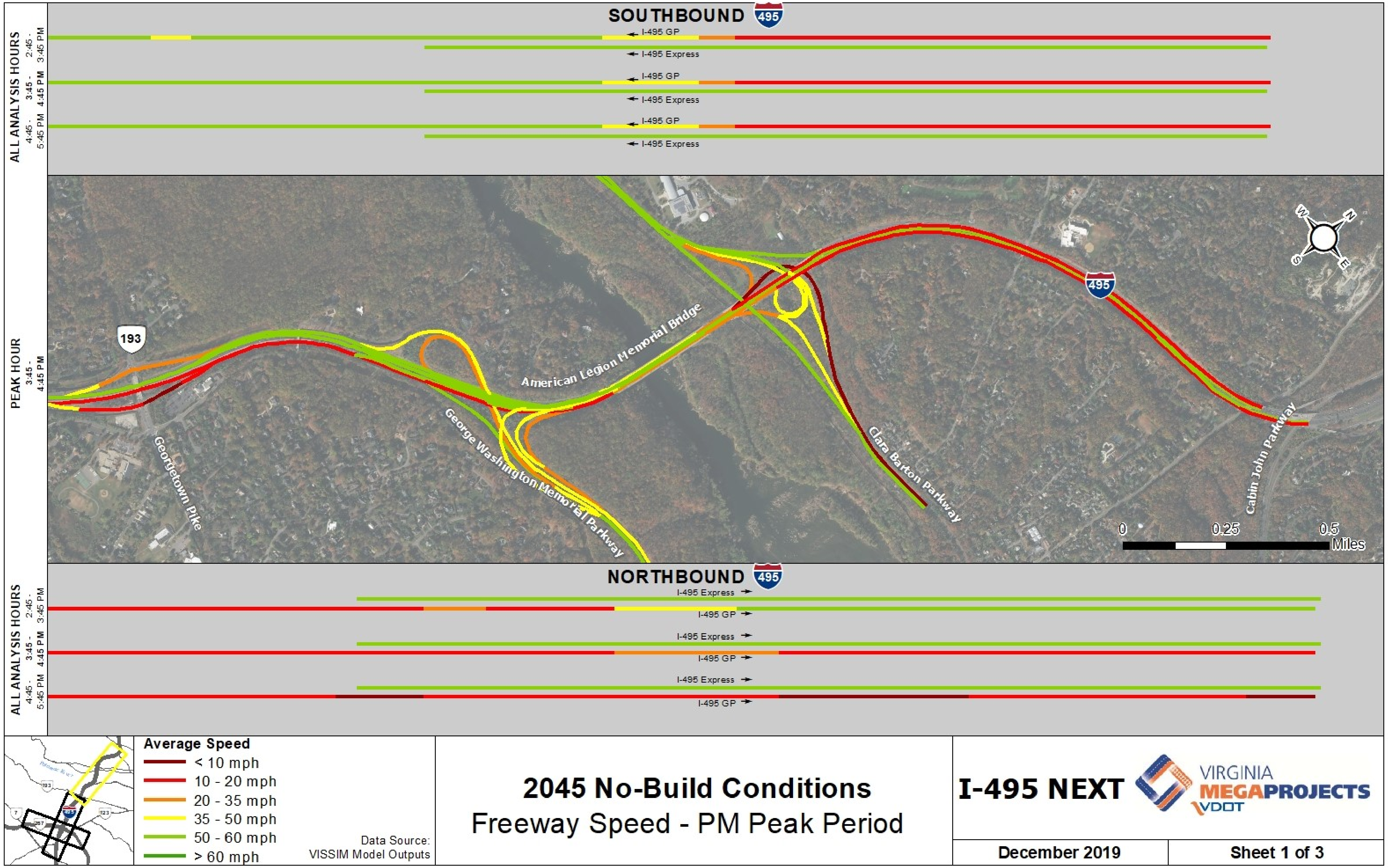


Exhibit 9-23a. 2045 No Build I-495 PM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

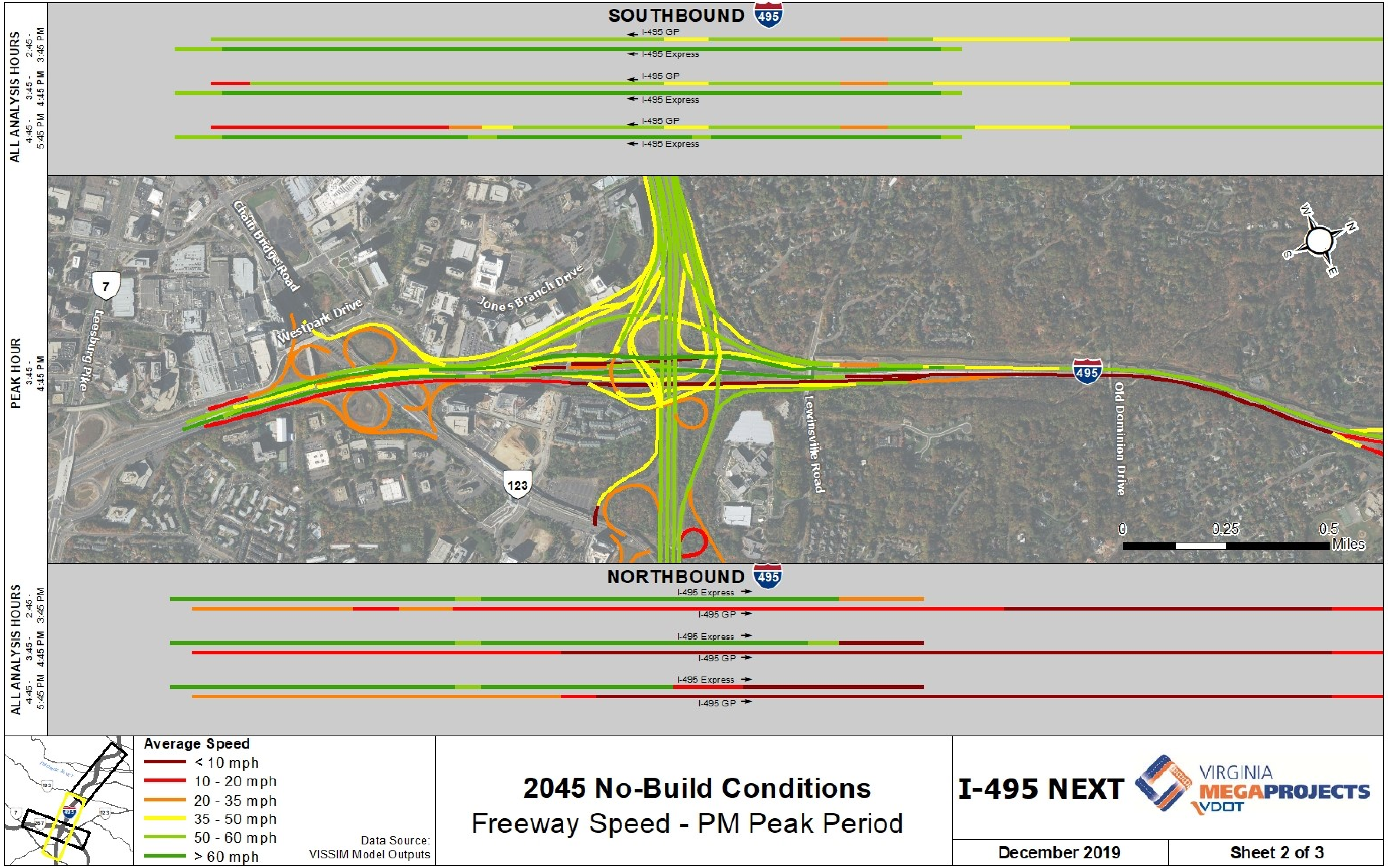


Exhibit 9-23b. 2045 No Build I-495 PM Peak Period Average Speeds – Route 123 through Old Dominion Drive

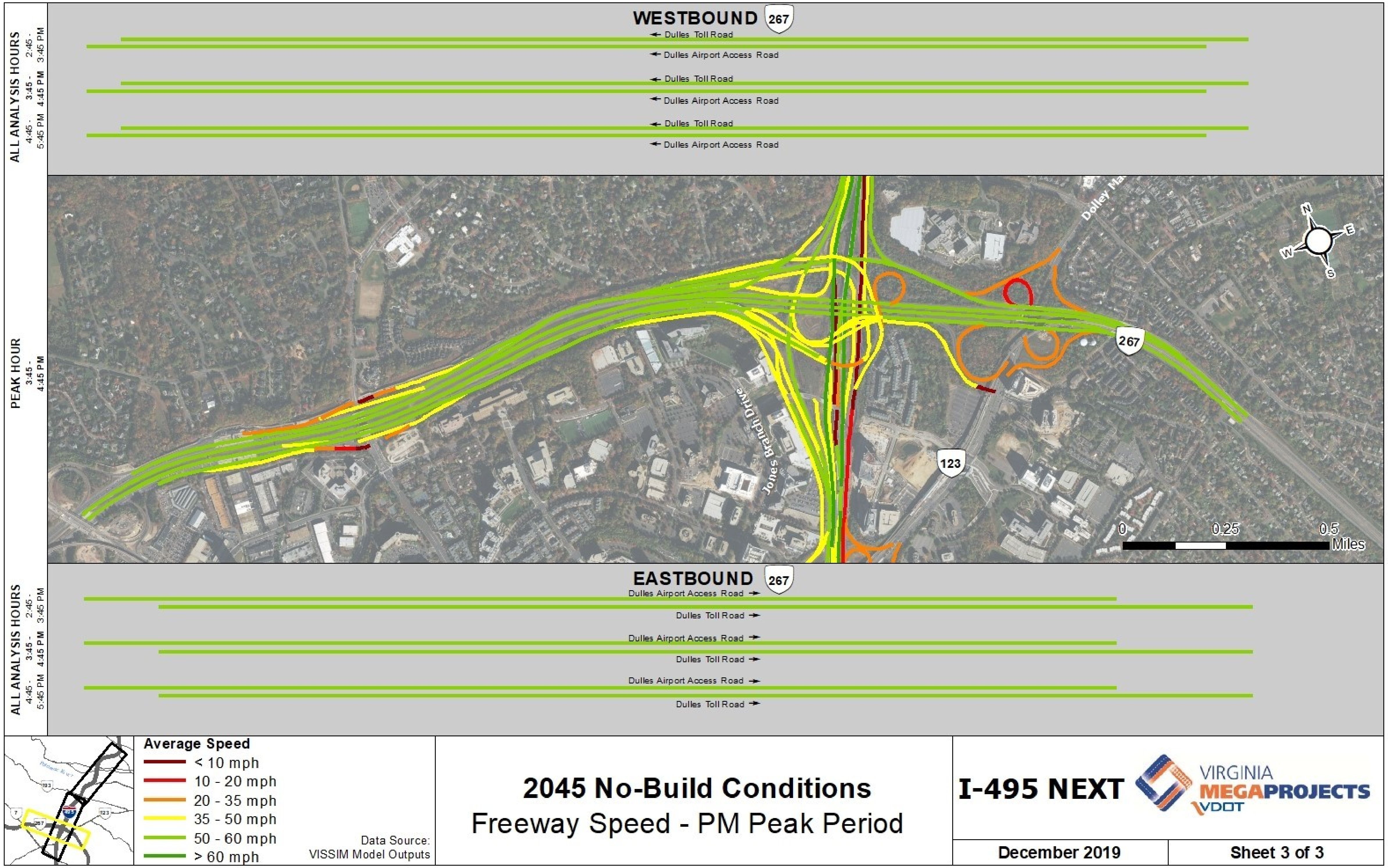


Exhibit 9-23c. 2045 No Build Route 267 PM Peak Period Average Speeds

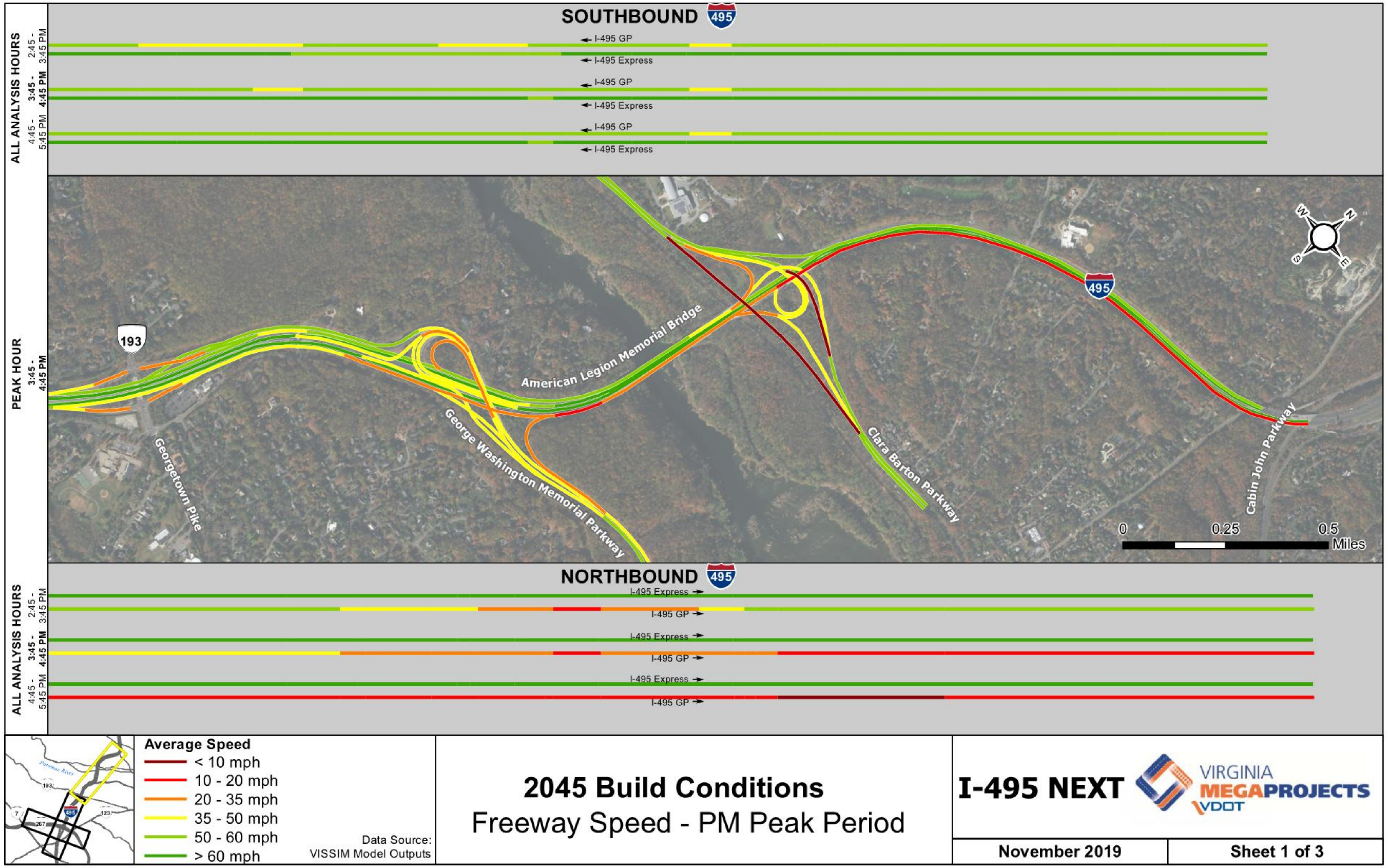


Exhibit 9-24a. 2045 Build I-495 PM Peak Period Average Speeds – Georgetown Pike to Cabin John Parkway

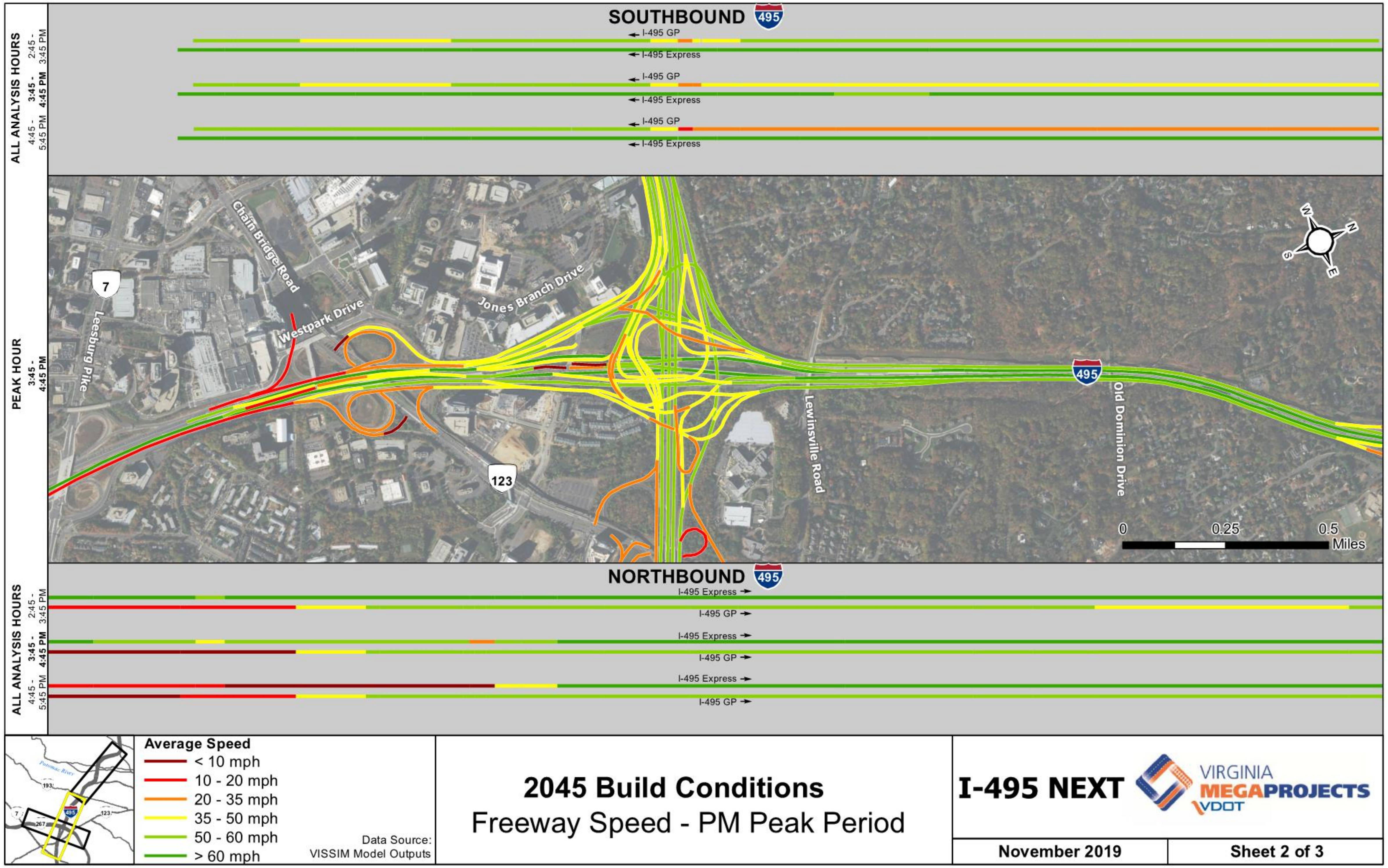


Exhibit 9-24b. 2045 Build I-495 PM Peak Period Average Speeds – Route 123 through Old Dominion Drive

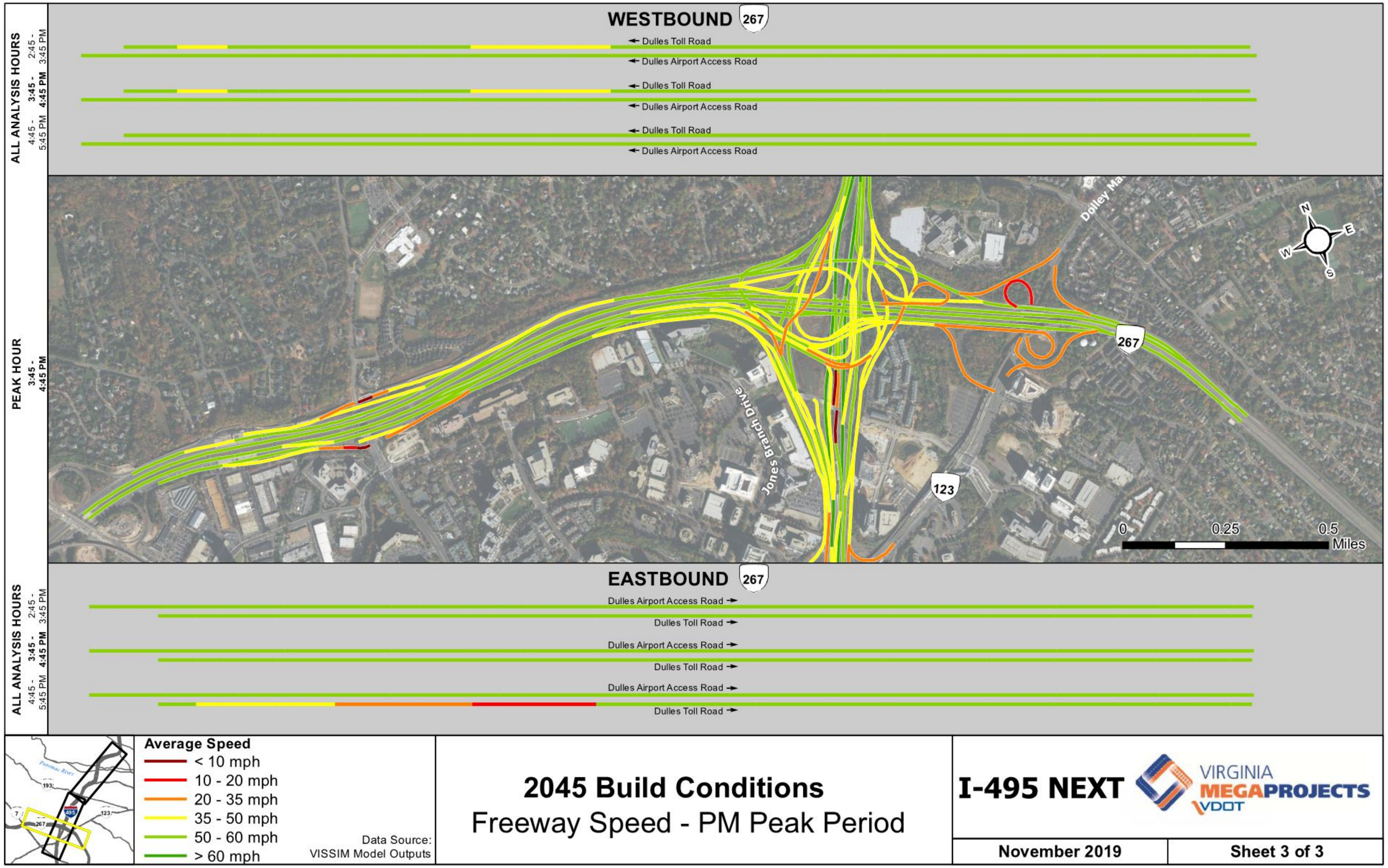


Exhibit 9-24c. 2045 Build Route 267 PM Peak Period Average Speeds

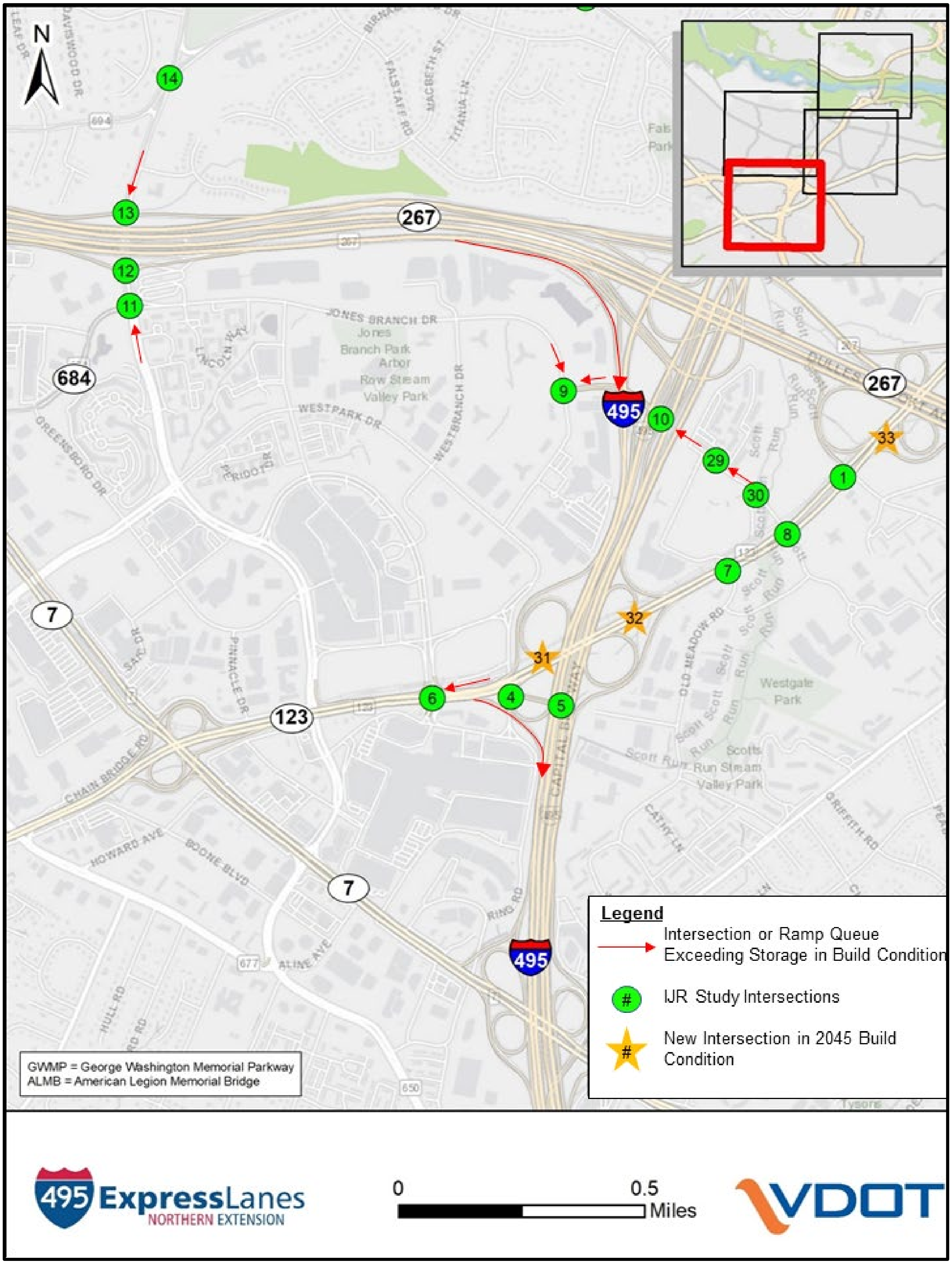


Exhibit 9-25a. Queues Exceeding Storage in 2045 Build PM Condition (Page 1 of 4)

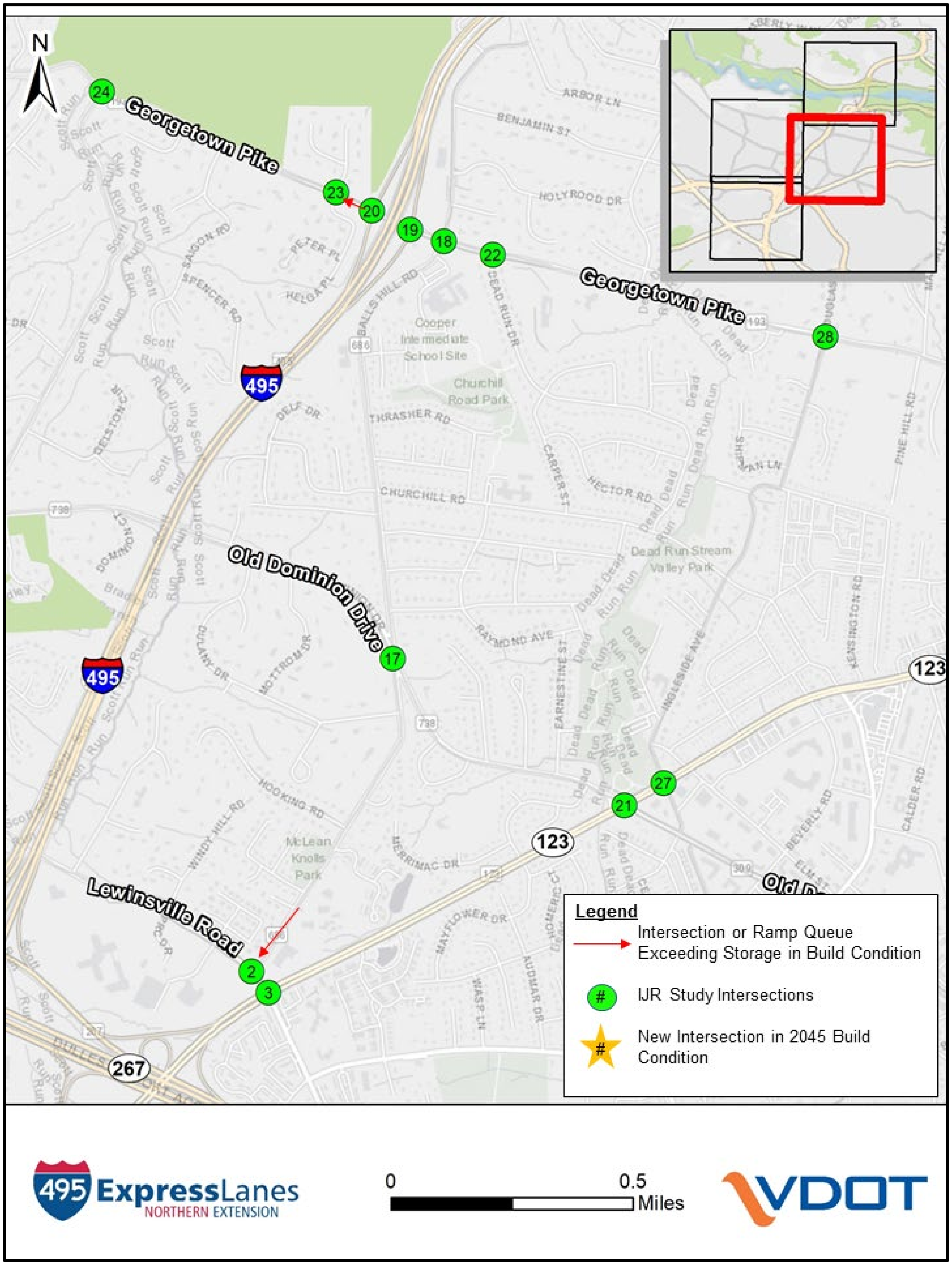


Exhibit 9-25b. Queues Exceeding Storage in 2045 Build PM Condition (Page 2 of 4)

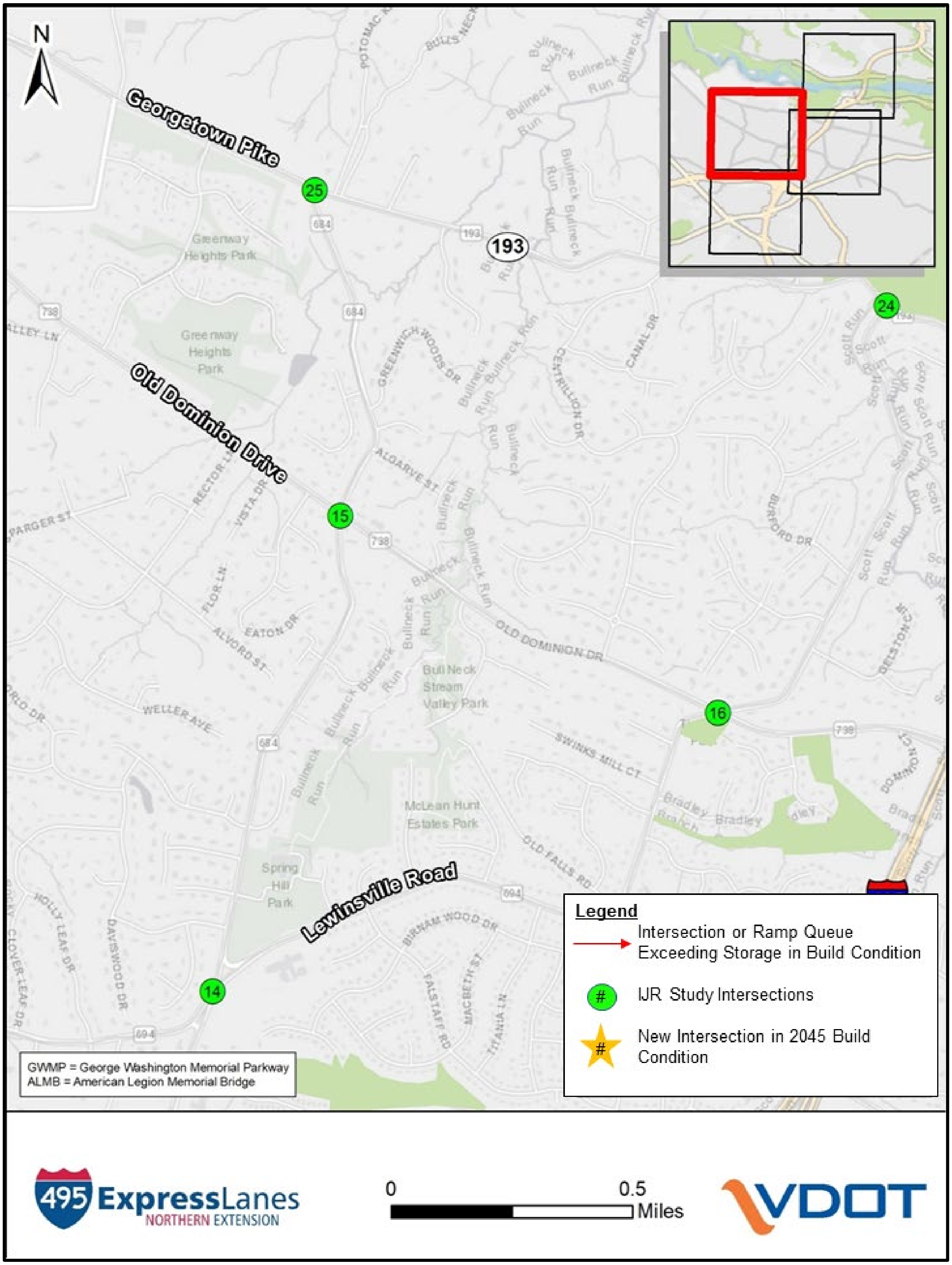


Exhibit 9-25c. Queues Exceeding Storage in 2045 Build PM Condition (Page 3 of 4)

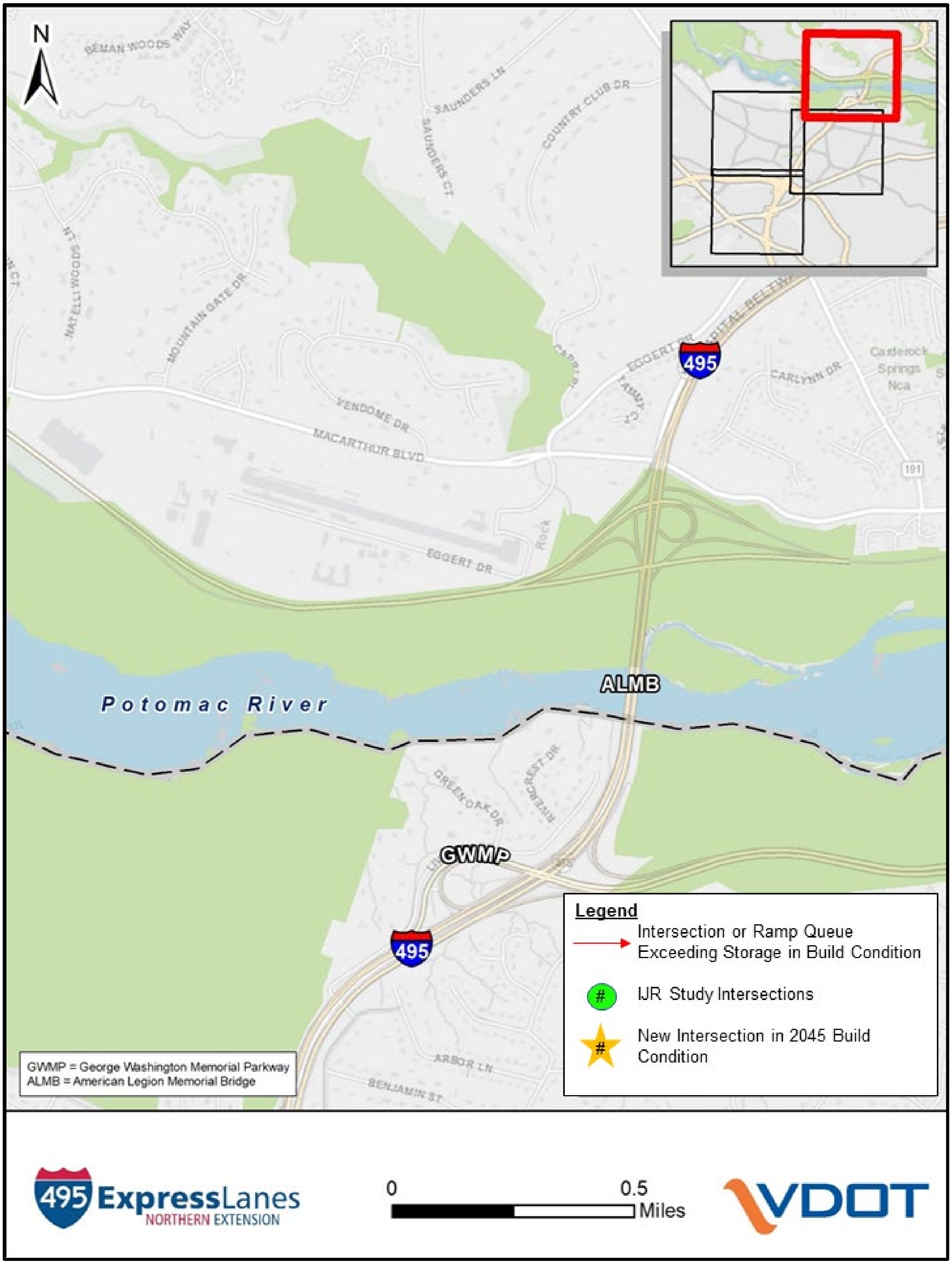


Exhibit 9-25d. Queues Exceeding Storage in 2045 Build PM Condition (Page 4 of 4)

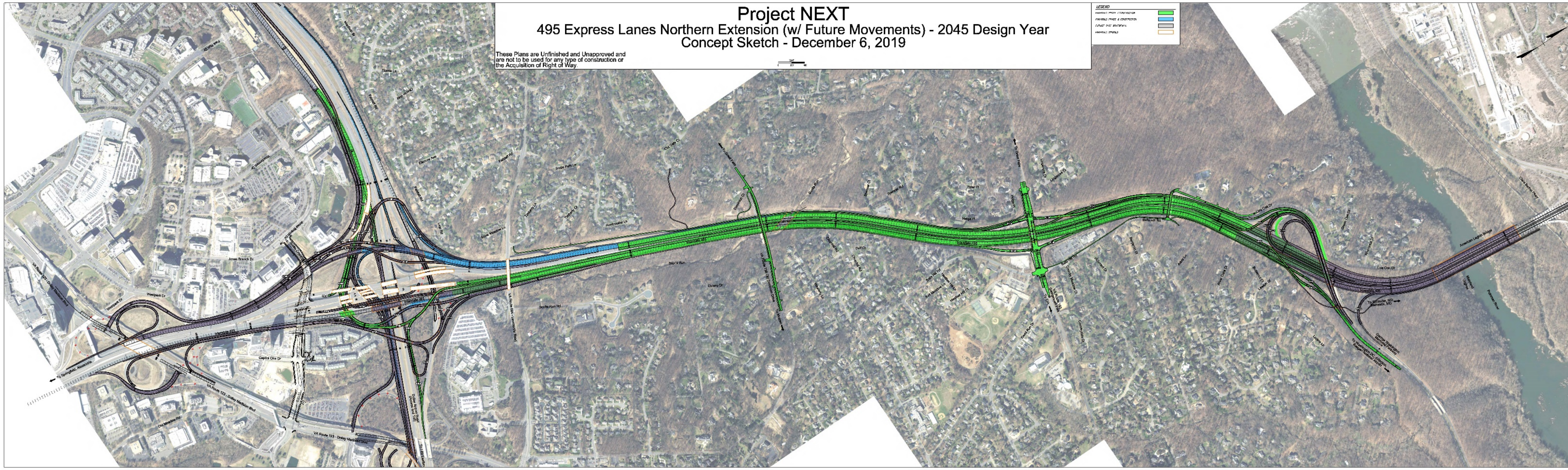


Exhibit 11-1. Phasing of Interchange Ramps in Build Alternative